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With Latest Questions & their Solutions

OBJECTIVE GENERAL STUDIES-4

IDEAL FOR - ONE DAY & ALL LEVEL COMPETITIVE EXAMS



HIGHLIGHTS

- MCQ's with Detailed Solutions
- Strictly Designed as per Latest Exam Pattern
- Time Saving Tips(TST) to solve MCQ's in short time



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Students are today enlightened and focused. They know what they are up to. They need just a ray of guidance. I feel I have accomplished the reason of my existence on this earth. Proud to be that faint ray of guidance, proud to be a reason of smile on certain lips, proud to be your teacher, friend and guide.

DR. ANSHU SURANA

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Physics

Physics is the branch of science which is concerned with the study of matter and energy and their inter-relationship. Numerous developments have taken place in the realm of physics, from the earlier stages of classical physics to the emergence of physics based on quantum theory. Classical physics included topics like optics, mechanics, electricity, magnetism and acoustics. In the twentieth century quantum physics has made much headway and it includes topics like atomic and nuclear particles, etc.

SI UNIT SYSTEM

Fundamental or base quantities

- The quantities which do not depend upon other quantities for their complete definition are known as fundamental or base quantities.
  e.g.: length, mass, time, etc.

Derived quantities

- The quantities which can be expressed in terms of the fundamental quantities are known as derived quantities.
  e.g.: Speed = (Distance/Time), volume, acceleration, force, pressure, etc.

Units of physical quantities

- The chosen reference standard of measurement in multiple of which, a physical quantity is expressed is called the unit of that quantity.
  Physical Quantity = Numerical Value × Unit

Quantity	Unit	Symbol	Definition
Length	metre	m	1983, 17th CGPM: The path travelled by light in vacuum during a time interval of 1/299792458 seconds. This fixes the speed of light to exactly 299,792,458 m/s.
Mass	kilogram	kg	1901, 3rd CGPM: Mass of the platinum-iridium prototype kept at BIPM in Sevres.
Time	second	s	1968, 13th CGPM: One second equals 9192631770 periods of the radiation due to the transition between the two hyperfine levels of the ground state of Cesium-133 atom.
Electric current	ampere	A	1948, 9th CGPM: Given two parallel, rectilinear conductors of negligible circular cross- section positioned 1 m apart in vaccum, one ampere is the electric current which, passing through both of them, makes them attract each other by the force of 2×10^{-7} newtons per every meter of length. This fixes the permeability of vaccum to exactly $2\pi\times10^{-7}$ H/m.
Temperature	kelvin	K	1968, 13th CGPM: One degree K

			equals 1/273.16 of the thermodynamic temperature of the triple point of water.
Quantity of substance	mole	mol	1971, 14th CGPM: The amount of a substance composed of as many specified elementary units (molecules, atoms) as there are atoms in 0.012 kg of Carbon-12.
Luminosity	candela	cd	1979, 16th CGPM: The candle (or candela) is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 × 10^{12} hertz and that has a radiant intensity in that direction of 1/683 W/sr.

Quantity	**Unit**	**Symbol**	**Equals**	**Definition/Dimensional Formula**
Plane angle	radian	rad		The plane angle which, when centered in a circle, cuts off an arc whose length is equal to the circle radius.
Solid angle	sterad ian	sr		The solid angle which, when centered in a sphere, cuts off a cap whose surface equals that of a square having the radius as side.
Frequency	hertz	Hz	1 s^{-1}	[number of events or cycles]/[time].
Mechanics				
Force	newton	N	1 kg.$m.s^{-2}$	MLT^{-2}
Pressure	pascal	Pa	1 $N.m^{-2}$	$ML^{-1}T^{-2}$
Energy	joule	J	1 N.m	ML^2T^{-2}
Power	watt	W	1 $J.s^{-1}$	ML^2T^{-3}
Electromagnetism				
Charge	coulomb	C	1 A.s	M^0L^0TA
Potential	volt	V	1 $W.A^{-1}$	$ML^2T^{-3}A^{-1}$
Resistance	ohm	Ω	1 $V-A^{-1}$	$ML^2T^{-3}A^{-2}$
Conductance	siemens	S	1 $A-V^{-1}$	$M^{-1}L^{-2}T^3A^2$
Capacitance	farad	F	1 $C.V^{-1}$	$M^{-1}L^{-2}T^4A^2$
Inductance	henry	H	1 $V-s.A^{-1}$	$ML^2T^{-2}A^{-2}$
Magnetic flux	weber	Wb	1 $J.A^{-1}$	$ML^2T^{-2}A^{-1}$
Magnetic flux density	tesla	T	1 $Wb.m^{-2}$	$ML^0T^{-2}A^{-1}$
Optics				
Luminous flux	lumen	Im	1 cd.sr	[luminosity]-[solid angle].
Illuminance	lux	Ix	1 $Im.m^2$	[luminous flux]/[area].
Power	dioptre	D	1 m^{-1}	Inverse of focal length
Radioactivity and radiation				
Activity	becquerel	Bq	1 s^{-1}	[number of decay events]/[time]

Absorbed dose	gray	Gy	1 $J.Kg^{-1}$	[energy]/[mass].
Dose equivalent	sievert	Sv	1 $J.kg^{-1}$	[energy]/[mass]. Absorbed dose re-normalized by biological effects.

REST AND MOTION

An object is said to be at rest if it does not change its position with respect to its surroundings with time and said to be in motion if it changes its position with respect to its surrounding with time.

- **Rectilinear motion:** moving car on horizontal road, motion under gravity etc.
- **Angular motion** such as particle going on a circle, projectile motion, rotation of machine shaft etc.
- **Rotational motion** such as motion of a fan.
- If an object travels equal distances in equal intervals of time, then it is said to be in **uniform motion**.
- If an object travels unequal distances in equal intervals of time, then it is said to be in **non-uniform motion**.

Speed

- The distance covered by a moving body in a unit time interval is called its speed.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

- It is a scalar quantity and its SI unit is ms^{-1}.
- When a body travels equal distances with speed v_1 and v_2, then average speed is the **harmonic mean** of the two speeds.

$$\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2} \Rightarrow v = \frac{2v_1v_2}{v_1 + v_2}$$

- When a body travels for equal times with speeds v_1 and v_2, then average speed is the arithmetic mean of the two speeds.

$$v = \frac{v_1 + v_2}{2}$$

- Speed cannot be negative.

Velocity

- The time rate of change of displacement of a body is called its velocity.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

- It is a vector quantity and its SI unit is ms^{-1}.
- An object is said to be moving with uniform velocity if it undergoes equal displacements in equal intervals of time.
- An object is said to be moving with non-uniform or variable velocity if it undergoes unequal displacement in equal intervals of time.
- $$\text{Average velocity} = \frac{\text{Time displacement}}{\text{Total time taken}}$$
- Velocity can be negative.

Acceleration

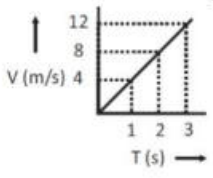
- The time rate of change of velocity of a body is called its acceleration.

$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time taken}}$$

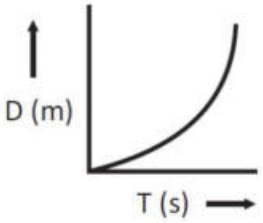
- It is a vector quantity and its SI unit is ms^{-2}.
- Acceleration at an instant of time is known as instantaneous acceleration.
- When the velocity of a body increases with time, then its acceleration is positive and if velocity decreases with time, then its acceleration is negative called deceleration or retardation.
- If acceleration does not change with time, it is said to be constant acceleration.

Equations of Uniformly Accelerated Motion (Along straight line)

- If a body starts its motion with initial velocity u and attains final velocity "v" in the interval "t". and the acceleration assumed to be uniform in motion is "a" and the distance travelled is "s", then equations of motion are given by:
  - $v = u + at$
  - $s = ut + \frac{1}{2}at^2$
  - $v^2 = u^2 + 2as$
- If a body is falling freely under gravity, then "a" is replaced by "g" in above equations.
- If an object is thrown vertically upward, then in above equations of motion "a" is replaced by (–g).
- For a body with zero acceleration (or constant speed) graph between velocity and time will be a line parallel to time axis.
- Velocity-Time Graph For accelerating or decelerating body the graph will be a straight line inclined to time axis and velocity axis.



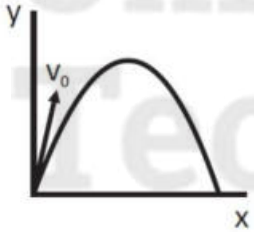
- Graph between position (distance) and time for an accelerating or decelerating body is a parabola.



- Acceleration-time graph for uniformly accelerating body is a line parallel to time axis.
- In case of uniform acceleration, the graph between position and velocity is always a parabola.
- In case of uniformly accelerated motion, the graph between velocity and time is always a straight line.
- Slope of displacement-time graph gives velocity and slope of velocity-time graph gives acceleration.
- Area under the velocity time graph gives displacement and area under the acceleration time graph gives velocity.

Projectile Motion

- When a body is thrown from a horizontal plane making an angle (θ) except 90°, then its motion under gravity is a curved parabolic path, called trajectory and its motion is called projectile motion.
- The motion of a bullet shot from the gun
- The motion of a rocket after burn-out
- The motion of a bomb dropped from an aeroplane etc.



Properties of Projectile Motion

- If we drop a ball from a height and at the same time throw another ball in a horizontal direction, then both the balls would strike the ground simultaneously at different places.

Circular Motion

- The motion of an object along a circular path is called circular motion.
- Circular motion with a constant speed is called uniform circular motion.



- The direction of motion at any point in circular motion is given by the tangent to the circle at that point.
- In uniform circular motion, the velocity and acceleration both changes.
- In case of non-uniform circular motion, the speed changes from point to point on the circular track.

Centripetal Acceleration

- During circular motion an acceleration acts on the body towards the centre, called centripetal acceleration.
- The direction of centripetal acceleration is always towards the centre of the circular path.

Force

- It is an external push or pull which can change or tries to change the state of rest or of uniform motion. SI unit is newton (N) and CGS unit is dyne. 1 N = 10^5 dyne.
- If sum of all the forces acting on a body is zero, then body is said to be in equilibrium.

Centripetal Force

- During circular motion a force always acts on the body towards the centre of the circular path, called centripetal force.

Centrifugal Force

- In circular motion we experience that a force is acting on us in opposite to the direction of centripetal force called centrifugal force.
- This is an apparent force or imaginary force and also called a pseudo force.

Applications of centripetal and centrifugal forces

- For revolution of the earth around the sun, gravitational force of attraction between the earth and the sun acts as centripetal force.
- Cream is separated from milk when it is rotated in a vessel about the same axis. During rotation lighter particles of cream experience a lesser force than the heavier particles of milk.
- Cyclist inclined itself from vertical to obtain required centripetal force. To take a safe turn cyclist slows down his speed and moves on a path of larger radius.
- Roads are banked at turns to provide required centripetal force for taking a turn.

- For taking turn on a curved road, the frictional force is acting between the tyres of the vehicle and the road acts as centripetal force.
- If a bucket containing water is revolved fast in a vertical plane, the water may not fall even when bucket is completely inverted because a centrifugal force equal or greater than the weight of water pushes the water to the bottom of the bucket.
- For orbital motion of electrons around the nucleus, electrostatic force of attraction is acting between the electrons and the nucleus as centripetal force.

NEWTON'S LAW OF MOTION

Newton's First Law

- A body continues in its state of rest or of uniform motion in a straight line unless an external force acts on it. It is based on law of inertia.
- Inertia is the property of a body by virtue of which it opposes any change in its state of rest or of uniform motion in a straight line.

Inertia of Rest

- When a bus or train at rest starts to move suddenly, the passengers sitting in it experiences a jerk in backward direction due to their inertia of rest.
- The dust particles come out from a carpet when it is beaten with a stick due to their inertia of rest.

Inertia of Motion

- When a running bus or train stops suddenly, the passengers sitting in it jerk in forward direction due to inertia of motion.
- A passenger jumping out from a rapidly moving bus or train is advised to jump in forward direction and run forward for a short mile due to inertia of motion.

Newton's Second Law

- The rate of change of momentum of a body is directly proportional to the force applied on it and change in momentum takes place in the direction of applied force.

$$F = \frac{\Delta P}{\Delta t} = \frac{m\Delta v}{\Delta t} = ma$$

Newton's Third Law

- For every action, there is an equal and opposite reaction and both act on two interacting objects.
- Rocket is propelled by the principle of Newton's third law of motion.

Impulse

- A large force which acts on a body for a very short interval of time and produces a large change in its momentum is called an impulsive force.
- Its unit is Newton-second.
- A fielder lowers its hand when catching a cricket ball because by lowering his hands, he increases the time of contact for stopping the ball and therefore fielder has to apply lesser force to stop the ball. The ball will also exert lesser force on the hands of the fielder and the fielder will not get hurt.
- Wagons of a train are provided with the buffers to increase the time of impact during jerks and therefore, decreases the damage. The vehicles like scooter, car, bus, truck etc. are provided with shockers.

Momentum

- The momentum of a moving body is equal to the product of its mass and its velocity.

$P = mv$

Conservation of Linear Momentum

- The linear momentum of a system of particles remains conserved if the external force acting on the system is zero.
- Rocket propulsion and engine of jet aeroplane works on principle of conservation of linear momentum. In rocket, ejecting gas exerts a forward force which helps in accelerating the rocket upward.

Friction

- Friction is a force which opposes the relative motion of the two bodies when one body actually moves or tries to move over the surface of another body.
- The cause of friction is the strong atomic or molecular forces of attraction acting on the two surfaces at the point of actual contact.

Application of Friction

- A ball bearing is a type of rolling-element that uses balls to maintain the separation between the bearing races.
- Friction is necessary for walking, to apply brakes in vehicles, for holding nuts and bolts in a machinery etc.
- Friction can be decreased by polishing the surfaces using lubricants or by using ball bearings.
- The purpose of a ball bearing is to reduce rotational friction and to support loads (weight).

- The tyres are treaded to increase the friction between the tyres and the road.
- Tyres are made of synthetic rubber so its coefficient of friction with road is larger and therefore, large force of friction acts on it, which stops sliding at turns.
- When pedal is applied to a bicycle, the force of friction on rear wheel is in forward direction and on front wheel is in the backward direction.

Losses due to Friction

- Too much Loss of Energy in machines and then ultimately the machines are damaged.

Machine Lever

- It is a simple machine in which a straight or inclined rod is made to turn or rotate at a point freely or independently. There are three points related to lever namely load, effort and fulcrum.
- **Load:** The weight carried by the lever is called load.
- **Effort:** To operate lever, the force applied externally is called effort.
- **Fulcrum:** The fixed point about which the rod of lever moves independently is called fulcrum.

OSCILLATIONS

Periodic Motion

- A motion which repeats itself identically after a fixed interval of time, is called a periodic motion.
- For example - Motion of arms of a clock, orbital motion of the earth around the sun, motion of a simple pendulum etc.

Oscillatory Motion

- A periodic motion taking place to and fro or back and forth about a fixed point, is called oscillatory motion.

  For example
  - Motion of a simple pendulum.
  - Motion of a loaded spring etc.
- If a particle oscillates with its own natural frequency without help of any external periodic force, the oscillation is then called damped oscillation.
- When a body oscillates with the help of an external periodic force with a frequency different from natural frequency of the body, then oscillation is called forced oscillation.

Simple Harmonic Motion (SHM)

- An oscillatory motion of constant amplitude and of single frequency under a restoring force whose magnitude is proportional to the displacement and which always acts towards mean position, is called Simple Harmonic Motion.

Characteristics of SHM

When a particle executing SHM passes through the mean position, then	When a particle executing SHM is at the extreme end, then
No force acts on the particle.	Acceleration of the particle is maximum.
Acceleration of the particle is zero.	Restoring force acting on the particle is maximum.
Velocity is maximum.	Velocity of the particle is zero.
Kinetic energy is maximum.	Kinetic energy of the particle is zero.
Potential energy is zero.	Potential energy is maximum.

Simple Pendulum

- A heavy point mass suspended from a rigid support by means of an elastic inextensible string, is called a simple pendulum.
- Time period of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$, where l is the length of string.
- The time period of a simple pendulum of infinite length is 84.6 min. The time period of a seconds pendulum is 2 s. Its length on the earth is nearly 100 cm.
- Acceleration due to gravity decreases with altitude (height) and therefore time period of a pendulum clock increases and clock becomes slow.
- If the bob of a simple pendulum is suspended from a metallic wire, then the length of the pendulum increases with increase in temperature and therefore its time period also increases.
- A girl is swinging over a swing. If she stands up over the swing, then the effective length of the swing decreases and therefore, the time period of oscillations decreases.
- A pendulum clock cannot be used in a space-ship.

Damped Harmonic Motion

- When there is friction or any other force acting within an oscillating system, the amplitudes of the oscillation decreases over time due to damping force and this motion is called damped harmonic motion.

Resonant Oscillations

- When a body oscillates with its own natural frequency (ν_0) with the help of an external periodic force then the motion is called forced harmonic motion.
- If the frequency (ν) provided by the external agent is equal to the natural frequency of the body, the oscillations of the body are called resonant oscillations.

WAVES

- A wave is a disturbance which propagates energy from one place to the other without the transport of matter.
- Waves are broadly of two types:
  - Mechanical Waves
  - Non-mechanical waves

Mechanical Waves

- The waves which require material medium (solid, liquid or gas) for their propagation are called mechanical wave or elastic waves. Mechanical waves are of two types.
  - **Longitudinal wave:** If the particles of the medium vibrate in the direction of propagation of wave, the wave is called longitudinal wave. e.g. Sound waves.
  - **Transverse Wave:** If the particles of the medium vibrate perpendicular to the direction of propagation of wave, the wave is called transverse wave. e.g. Waves on strings under tension, waves on the surface of water are examples of transverse waves.

Non-mechanical waves or electromagnetic waves

- The waves which do not require medium for their propagation i.e. which can propagate even through the vacuum are called non mechanical waves.
- Light and heat are the examples of non-mechanical wave. In fact all the electromagnetic waves are non-mechanical.
- All the electromagnetic waves consist of photons.
- The wavelength range of electromagnetic wave is 10^{-14} m to 10^{4} m.

Properties of electromagnetic waves

- They are neutral (uncharged).
- They propagate as transverse wave.
- They propagate with the velocity of light.
- They contains energy and momentum.
- Their concept was introduced by Maxwell.
- Electromagnetic waves of wavelength range 10^{-3} m to 10^{-2} m are called microwaves.
- Following waves are not electromagnetic:
  - Cathode rays
  - Canal rays
  - α rays
  - β rays
  - Sound wave
  - Ultrasonic wave

Some Important Electromagnetic Waves and their discoverer

Electromagnetic Waves	Discoverer
γ-Rays	Henry Becqueral
X-Rays	W. Rontgen
Ultra-violet rays	Ritter
Visible radiation	Newton
Infrared rays	Hershel
Short radio waves or Hertzian Waves	Heinrich Hertz
Long Radio Waves	Marconi

Amplitude

- Amplitude is defined as the maximum displacement of the vibrating particle on either side from the equilibrium position.

Wavelength

- Wavelength is the distance between any two nearest particle of the medium, vibrating in the same phase. It is denoted by the Greek letter lambda (λ).
- In transverse wave, distance between two consecutive crests or troughs and in longitudinal wave, distance between two consecutive compressions or rarefactions is equal to wavelength.
- Velocity of wave = frequency × wavelength.

SOUND

- Sound waves are mechanical longitudinal waves and require medium for their propagation. It cannot propagate through vacuum. When propagated speed and wavelength changes but frequency remains constant. It is of three types:

Sound waves	Ranges
Infrasonic waves	(0 to 20 Hz)
Audible waves	(20 to 20,000 Hz)
Ultrasonic waves	(> 20,000 Hz)

Properties of Sound Wave

Reflection

- The bouncing back of sound when it strikes a hard surface, is called reflection of sound.
- The laws of reflection of light are also obeyed during reflection of sound.
- The working of megaphone, sound boards and ear trumpet is based on reflection of sound.
- The repetition of sound due to reflection of sound waves, is called an echo.
- The persistence of hearing on human ear is $1/10^{th}$ of a second.
- The minimum distance from a sound reflecting surface to hear an echo is nearly is nearly 17 m.
- Sound proof rooms are made of two layers of walls having vacuum between them.
- Reverberation arises due to multiple reflection of sound.
- While designing an auditorium for speech or musical concerts, one has to take proper care for the absorption and reflection of sound.
- Time taken by reverberant sound to decrease its intensity by a factor of 10^6 is called reverberation time.

Refraction

- When a sound wave move from one mechanical medium to another mechanical medium, it shows deviation from the original path of the incident wave. The phenomenon is called refraction. It is due to difference in speed of sound in mediums.

Diffraction

- When sound waves originated by a vibrating source, spread in the medium and if the medium is homogeneous, this leads to bending of sound waves around the edges, which is known as diffraction.

Musical Scale

- In theory of music, a musical scale is a set of musical notes, the frequencies of which are in simple ratios to one another. sa, re, ga, ma, pa, dha, ni is one such scale called the diatonic scale.
- The frequencies of these notes are: sa (256 nm), re (288 nm), go (320 nm), ma (341.3 nm), pa (384 nm), dha (426.7 nm) and ni (480 nm). The next note denoted by sa has a frequency 512 nm, twice that of sa. The interval sa-sa is called an octave (8).

Noise Reduction in Recording Media

Five types of noise reduction system exists in recording media as discussed below:

- Dolby A noise reduction system, intended for use in professional recording studios. It provides about 10 dB of broadband noise reduction.
- Dolby B was developed to achieve about 9 dB noise reduction primarily for cassettes. It was much simpler than Dolby A and therefore less expensive to implement in consumer products.
- Dolby C provides about 15 dB noise reduction.
- Dolby SR (Spectral Recording) system is much more aggressive noise reduction approach than Dolby A. Dolby SR is much more expensive to implement than Dolby B or C, but it is capable of providing upto 25 dB noise reduction in the high frequency range.
- Dolby S is found on some Hi-Fi and semi-professional recording equipment. It is capable of 10 dB of noise reduction at low frequencies and upto 24 dB of noise reduction at high frequencies.

Doppler's Effect

The apparent change in the frequency of source due to relative motion between the source and observer is called Doppler's effect.

Applications of Doppler's Effect

The measurement of Doppler shift (based on Doppler's effect) has been used:

- By police to check over speeding of vehicles.
- At airports to guide the aircraft.
- To study heart and blood flow in different parts of the body.
- By astrophysicist to measure the velocities of planets and stars.

SONAR

- SONAR stands for Sound Navigation And Ranging.
- It is used to measure the depth of a sea, to locate the enemy submarines and shipwrecks.
- The transmitter of a sonar produces pulses of ultrasonic sound waves of frequency of about 50000 Hz. The reflected sound waves are received by the receiver.

Human Ear

- We are able to hear with the help of an extremely sensitive organ of our body called the ear. There are three parts of human ear:
- The outer ear is called pinna. It collects the sound from the surroundings.
- The middle ear transmits the amplified pressure variations received from the sound wave to the inner ear.

- In the inner ear, the pressure variations are turned into electrical signals by the cochlea. These electrical signals are sent to the brain via the auditory nerve and the brain interprets them as sound.

HEAT

- Heat is the form of energy which produces the sensation of warmth. Its SI unit is joule and other commonly used unit is calorie (1 cal = 4.2 Joule).
- The transfer of heat is always from hotter to colder body.

Temperature

- Temperature is a measure of hotness or coldness of a body.
- The heat flows from one body to another due to the difference in their body temperature.

Scale of Temperature

- To measure the temperature of a body following temperature scales are used.
- Celsius scale of temperature. Freezing point = 0°C and boiling point of water = 100°C.
- Fahrenheit scale of temperature. Ice point or freezing of water = 32° F and boiling point of water = 212° F
- Kelvin or absolute scale of temperature. Ice point of water = 273° K and boiling point of water = 373° K
- Reaumur scale of temperature. Ice point of water is 0° R and boiling point of water = 80° R

Relation between Different Scales of Temperature

Different scales of temperature are related as follows:

- $\frac{C}{100} = \frac{F-32}{180} = \frac{K-273}{100}$
- K = 273 + °C
- At temperature – 40°C = – 40°F, Clesius scale is equal to Fahrenheit
- The temperature at which the three phases of water remains at equilibrium is called triple point of water (273.16 K)

Thermometers

The instruments used to measure temperature of a body is called thermometer.

Thermometers are of following three types

Clinical thermometer

- It is used to measure human body temperatures and ranges from 96° F to 110°F or 35°C to 43°C.

Electronic thermometer

- Basic components of an electronic thermometer are thermistors or thermoresistors. Range of electronic thermometer is –40° to 450°F.

Other thermometers

- These include constant volume gas thermometer, platinum resistance thermometer etc.
- In thermometer, mercury is commonly used through a wide range from –30°C to 300°C.
- Thermometer was developed by Galileo who found that the gases expand on heating.

Thermal Expansion

The expansion of a body caused by heat is known as thermal expansion.

Thermal Expansion of Solids

Thermal expansion of solids is of three types:

- Expansion in length on heating, is called **linear expansion**. The increase in length of a rod of unit length of a substance due to increase in its temperature by 1°C is called the coefficient of linear expansion of the substance of that rod. It is represented by α.

$$\alpha = \frac{\text{Increase in length}}{\text{Initial length} \times \text{Rise in temperature}} = \frac{\Delta L}{L \times \Delta t}$$

Its unit is $°C^{-1}$.

- Expansion in area on heating, is called **superficial expansion**. Coefficient of superficial expansion is given as:

$$\beta = \frac{\text{Increase in area}}{\text{Initial area} \times \text{Rise in temperature}} = \frac{\Delta A}{A \times \Delta t}$$

Its unit is $°C^{-1}$.

- Expansion in volume on heating, is called **volume expansion or cubical expansion**.

Coefficient of volume or cubical expansion is given as

$$\chi = \frac{\text{Increase in volume}}{\text{Original volume} \times \text{Rise in temperature}}$$

$$= \frac{\Delta V}{V \times \Delta t}$$

Its unit is $°C^{-1}$.

Relation between Coefficients of Expansions

- Coefficients of thermal expansions are related as $\beta = 2\alpha$ & $\gamma = 3\alpha$ and $\alpha : \beta : \gamma = 1 : 2 : 3$
- In laying a railway line, a small gap is left in between two iron rails otherwise railway line will become curved on heating in summer.
- Telephone wires are not tightened on poles because in winter, wires contract and can break.

Thermal Expansion of Liquids

- In liquids, only expansion in volume takes place on heating.
- Expansion of liquids is of two types:
- When expansion of the container containing liquid, on heating, is not taken into account, then observed expansion is called apparent expansion of liquids.
- When expansion of the container, containing liquid, on heating, is also taken into account, then observed expansion is called real expansion of liquids.

  $\gamma_r = \gamma_a + \gamma_g$ where, γ_r and γ_a, are coefficients of real and apparent expansion of liquids and γ_g = coefficient of cubical expansion of the container.

Anomalous Expansion of Water

- When temperature of water is increased from 0°C, then its volume decreases up to 4°C, becomes minimum at 4° C and then increases. This behavior of water expansion around 4°C is called, anomalous expansion of water.

Thermal Expansion of Gases

- There are two types of coefficient of expansion in gases
- At constant pressure, the change in volume per unit volume, per degree celsius, is called volume coefficient (γ_v).
- At constant volume, the change in pressure per unit, pressure per degree celsius, is called pressure coefficient (γ_p).

Calorimetry

- Amount of heat required to raise the temperature of 1 g of water by 1°C is called 1 calorie.
- Calorimetry states that heat lost by hotter body equals the heat gained by colder body.

Specific Heat

- The amount of heat required to raise the temperature of unit mass (m) of a substance by 1°C, is called its specific heat (s).
- It is denoted by s and its unit is 'cal/g°C or Joule/g°C.
- The specific heat of water is 4200 J/kg°C or 1000 cal/g°C, which is high compared with most other substances. Therefore, water is used as coolant in radiator in vehicle and hot water is used for the fermentation.
- Heat energy given or taken to change the temperature of a body is given by $Q = ms\Delta\theta$ Where, m = mass of the body and $\Delta\theta$ = change in temperature.

Latent Heat

- The heat energy absorbed or released at constant temperature per unit mass for change of state, is called latent heat.
- It is denoted by L and its SI unit is cal/g or kcal/kg.
- Heat energy absorbed or released during change of state is given by Q = mL
- Where, m = mass of the substance.
- Latent heat of fusion of ice is 80 cal/g.
- Latent heat of vaporisation of steam is 536 cal/g.

Thermodynamics

- The branch of physics which deals with the study of relation of heat energy with different types of energy is called thermodynamics.

Zeroth Law

- Zeroth law of thermodynamics tells about thermal equilibrium.

First Law

- As per first law, heat given to a substance is equal to sum of change in internal energy and work done.

Second Law

- In second law, work can be converted into heat and vice-versa but conversion is not possible with 100% efficiency.
- It is impossible for a machine operating in a cyclic process to convert heat completely into work, it is kelvin's statement.
- Heat by itself can not transfer from a colder to a hotter body. It is Clausius statement. Refrigerator is based on this statement.
- Heat engine is a device which converts heat into mechanical work. Internal combustion and external combustion heat engine are two types of heat engines.
- Car engine uses coolant added with water to reduce harmful effects like corrosion, rusting etc. Such as ethylene glycol, potassium dichromate etc.
- Carnot's theorem tells about maximum efficiency of heat engine. It refers to carnot cycle.
- Entropy measures the molecular disorder of a system and is a thermodynamic function depending only on the temperature of the system.
- Evaporation is a process in which molecules escape slowly from the surface of a liquid.
- For a given liquid the rate of evaporation depends on the temperature and area of evaporating surface.
- A refrigerator is a device used for cooling things by the evaporation and compression of a volatile liquid inside a copper coil.

Humidity

- The presence of moisture in the atmosphere is called humidity.
- The amount of water vapour present in the per unit volume of atmosphere, is called absolute humidity.
- The relative humidity of air at a given temperature is, the ratio of mass of water vapour present in a certain volume of air to the mass of water vapour required to saturate the same volume of air at the same temperature multiplied by 100.
- Relative humidity is measured by hygrometer.
- Relative humidity of about 50% is considered comfortable at temperature 22° – 25° C.
- If the relative humidity is very low in air, then lips become dry and cracks appear in them.
- If relative humidity is very high in air then the sweat from our body does not evaporate readily and therefore we feel uncomfortable.
- Air conditioner provides comfortable conditions by regulating temperature and humidity.

Transmission of Heat

- Heat can be transferred from one place to another by process of transmission.
- There are three methods of transmission of heat.

Conduction

- The mode of transmission of heat in solids from higher temperature part to lower temperature part without actual movement of the particles, is called conduction.
- Transmission of heat in solids takes place mainly through conduction.
- Metals are good conductors of heat.
- Wood, cotton, wool, glass are bad conductors of heat. Dry air is also a bad conductor of heat.
- Woollen clothes do not allow the heat of our body to escape and therefore we feel warm.
- On a cold night two thin blankets give more warmth than a single thick blanket because the layer of air between the two blankets works as a better insulator.
- Refrigerators and ice-boxes have double walls having thermocol between them which minimises heat gain by conduction.

Convection

- The mode of transmission of heat in fluids (liquids and gases) due to actual movement of the particles, is called convection.
- When a liquid in a vessel is heated at the bottom, the liquid at bottom gets heated and expands.
- Due to its lower density, hot liquid rises and its place is taken by cold liquid from above. Convection currents are set up in the liquid until the temperature of the whole liquid becomes same.
- The cooling unit in a refrigerator is fitted near the top as cold air move downward and keeps the whole interior cool.
- Radiator in a motor car works on the principle of convection.

Newton's Law of Cooling

- The rate of loss of heat from a body is directly proportional to the difference in temperatures of the body and its surroundings.
- If we take hot water and fresh water and put it in a refrigerator, then rate of cooling of hot water will be faster than the fresh tap-water.
- Due to sea breeze during day time the seashore warms up much faster than sea water. Hot air over the seashore rises and cooler air from sea water moves towards seashore to take its place resulting in a sea breeze.
- Due to land breeze At night, land cools faster than sea water. Now hot air over sea water rises and cooler air from land moves towards sea to take its place and resulting in a land breeze.
- Cloudy nights are warmer than clear night because clouds reflect the radiations emitted by the earth at night and keep it warm.

Radiation

- The process of heat transmission in the form of electromagnetic waves, is called radiation.
- Radiation does not require any medium for propagation and it propagates without heating the intervening medium.

Black Body

- A body that absorbs all the radiation incident on it is called an ideal black body.
- Ratio of heat absorbed (radiation) to total incident radiation for a body is called absorptive power (a) of body. It has no unit.
- Amount of heat radiation per unit area of the surface at a given temperature is called emissive power of the surface. Its unit is J/m^2s.
- The ratio of emissive power and absorptive power of a body is always constant and is equal to emissive power of a black body. This is known as Kirchhoff's law.
- White colour is a bad absorber and good reflector of heat radiations while black colour is good absorber and bad reflector of heat. Therefore, clothes of light colours give better feeling in

summer and clothes of dark colours give better feeling in winter.

- Good absorbers are good emitters and poor absorbers are poor emitters.

Stefan's Law

- It states that "The amount of heat energy (E) radiated per second by unit area of perfectly black body is directly proportional to the fourth power of absolute temperature (T) of the body."
- E □ T^4

MATTER

- Matter is considered as anything which has mass and occupy space.
- It exists in three states: Solid, liquid and gas.
- In solid, molecules vibrate about fixed positions. In liquid, molecules also vibrate but simultaneously they move freely throughout the material. In gas, the molecules are much farther apart than in solids and liquids and move at high velocities.

Interatomic Forces

- The electrostatic force of interaction acting between the two or more atoms is called interatomic forces.
- The range of interatomic forces is equal to the order of atomic size, i.e. 10^{-10} m.

SOLID

- It is that state of matter which has a definite shape and a definite volume. In this state molecules are closely packed.

Properties of Solids

Elasticity

- The property of a body by virtue of which it regain its original configuration after the removal of deforming force, is called elasticity.
- Quartz and phosphor bronze are almost perfectly elastic bodies.
- The maximum deforming force upto which a body retains its property of elasticity is called the limit of elasticity of the material body.

Plasticity

- The property of a body by virtue of which it does not regain its original configuration after the removal of deforming force, is called plasticity.

Strain

- The fraction change in configuration i.e. length, volume and shape, is called strain. Strain has no unit.
- On the basis of change in configuration, strain is of three types
  - Longitudinal Strain $= \frac{\Delta l}{l}$
  - Volume strain $= \frac{\Delta V}{V}$
  - Shearing strain = $\tan\theta$

Stress

- The internal restoring force acting per unit area of cross-section of a deformed body, is called stress.
- Stress is of two types
  - Normal stress
  - Tangential stress
- The minimum stress required to break a wire is called breaking stress.

Modulus

- Ratio of stress and its corresponding strain is called modulus.
- Depending upon the strain, modulus is classified in 3 categories.
  - Young's Modulus or Modulus of Elasticity: Ratio of longitudinal stress and longitudinal strain.

  $Y = [Fl/A\Delta l]\ Nm^{-2}$ where F is the force applied on area A.
  - Modulus of rigidity or shear Modulus: Ratio of shearing stress and shearing strain.
  - Bulk Modulus or Volumetric Modulus: Ratio of Volumetric stress and volumetric strain.

  $B = [PV/\Delta V]\ Nm^{-2}$ where P is the pressure applied.
- Springs are made of steel, not of copper as Young's modulus of elasticity of steel is more than that of copper.

Elastic Limit

- It is the limit of stress and strain upto which a wire remains elastic.

Plastic Behaviour

- If the wire is stretched beyond the elastic limit, the strain increases much more rapidly. If the stretching force is removed, the wire does not comes back to its natural length.

Fracture Point

- If the deformation is increased further the plastic behaviour, the wire breaks at a point known as fracture point.

Ductile and Brittle Materials

- If large deformation takes place between the elastic limit and the fracture point, the material is called ductile.
- If the wire breaks soon after the elastic limit is crossed, it is called brittle.

Elastic Fatigue

- It is the property of an elastic body by virtue of which its behaviour becomes less elastic under the action of repeated alternating deforming force.
- Due to elastic fatigue, the bridges becomes less elastic after a use of long time and therefore are declared unsafe.

FLUID

- A substance which begins to flow or deform under an external force is called a fluid. Liquids and gases are fluids.

Fluid Density

- The ratio of mass to the volume of a body is called its density. (i.e. mass present in its unit volume). It is a scalar quantity having SI unit kg/m^3.
- The density of water is 1000 kg/m^3.
- The density of water is maximum at 4°C.
- Relative density is the ratio of density of a substance to the density of a standard fluid. It is a dimensionless quantity.

Hydrometer

- It is an instrument used to measure density or relative density of liquid. Its working is based on law of flotation.

Fluid Pressure

- Thrust (the normal force) exerted by a liquid per unit area of the surface in contact at rest, is called fluid pressure.
  - Fluid pressure (P) = F/A
  - Its unit is Nm^{-2} or Pascal (Pa).

Atmospheric Pressure

- The pressure exerted by the atmosphere, is called atmospheric pressure.
- Aneroid barometer is used to measure atmospheric pressure and height of a place.
- SI unit of atmospheric pressure is atm. Other units of atmospheric pressure are torr and bar.

Pascal's Law

- The pressure exerted anywhere at a point of confined fluid is transmitted equally and undiminished, in all directions throughout the liquid.
- Hydraulic lift, hydraulic press, hydraulic brakes work on the basis of Pascal's law.

Buoyancy

- When a body is partially or wholly immersed in a liquid, an upward force acts on it, which is called buoyant force or upthrust and this property of fluids is called buoyancy.
- Buoyant force is equal to the weight of the liquid displaced by the submerged part of the body.
- The buoyant force acts at the centre of gravity of the liquid displaced by the submerged part of the body, which is called 'centre of buoyancy'.

Archimedes Principle

- When a body is partially or completely immersed in a liquid, it loses some of its weight. The loss in weight is equal to the weight of the liquid displaced by the submerged part of the body.

Law of Flotation

- A body will float in a liquid if weight of the body is equal to the weight of the liquid displaced by the immersed part of the body.
- In floating condition, the centre of gravity (g) and the centre of buoyancy (B) of the floating body must lie on the same straight line.
- Ice and large icebergs float on water surface as its density (0.92 g/cm^3) is lesser than the density of water.
- When a piece of ice floats on water, its $\left(\frac{11}{12}\right)^{th}$ part is submerged in water and $\left(\frac{1}{12}\right)^{th}$ part is outside the water.
- In sea water, $\left(\frac{8}{9}\right)^{th}$ part of icebergs is submerged and $\left(\frac{1}{9}\right)^{th}$ part is outside the water during floating.
- It is easier to swim in sea water than in a river as density of sea water is greater than the density of river water. In sea water, buoyant force is greater than that in river water.
- The density of human body is less than the density of water but the density of human head is greater than the density of water. Therefore, during swimming, a person displaces the liquid with hands and legs and total weight of displaced liquid becomes equal to the weight of the body.

Surface Tension

- The property of a liquid by virtue of which it tries to minimise its free surface area is called surface tension.
- The minimum surface area of a given amount of liquid is for spherical shape. Therefore, rain drops are spherical.

Factors Affecting Surface Tension

- **Temperature:** The surface tension of a liquid decreases with increase in temperature.
- **Soluble Impurities:** If the impurities are less soluble in liquid, then its surface tension decreases. If impurities are highly soluble in liquid, then its surface tension increases.

Applications of Surface Tension

- Surface tension of a liquid becomes zero at critical temperature.
- When soap, detergent, dettol, phenyl etc., are mixed in water then its surface tension decreases.
- When salt is added in water, its surface tension increases.
- When oil spreads over the surface of water, its surface tension decreases.
- When kerosene oil is sprinkled on water, its surface tension decreases. As a result the larva of mosquitoes floating on the surface of water die due to sinking.
- Warm soup is tasty because at high temperature its surface tension is low and consequently the soup spreads on all parts of the tongue.
- Antiseptics like dettol have low surface tension and therefore it reaches in the tiny cracks of the wound and cleans the germs and bacteria.
- The surface tension of soap solution in water is less than the surface tension of pure water. Therefore, soap solution cleans greasy strains of clothes better than pure water.

Capillarity

- The phenomenon of rising or falling of liquid column in a capillary tube (glass tube of very fine bore) is called capillarity.
- Illustrations of capillarity
  - A piece of blotting paper soaks ink because the pores of the blotting paper serve as capillary tubes.
  - The oil in the wick of a lamp rises due to capillary action of threads in the wick.
  - The root hairs of plants draw water from the soil through capillary action.
  - To prevent loss of water due to capillary action, the soil is loosened and split into pieces by the farmers.
  - If a capillary tube is dipped in water in an artificial satellite, water rises up to other end of tube because of its zero apparent weight, irrespective of the length of the tube.
  - Action of towel in soaking up water from the body is due to capillary action of cotton in the towel.
  - Melted wax, in a candle rises up to wick by capillary action.

Cohesive and Adhesive Forces

- The intermolecular force of attraction acting between the molecules of same substance is called cohesive force. e.g., Intermolecular force of attraction acting between the molecules of water, mercury etc.
- The intermolecular force of attraction acting between the molecules of different substance is called adhesive force. e.g., Intermolecular force of attraction acting between the molecules of paper and gum, paper and ink, etc.

Viscous force

- The force which opposes the relative motion between different layers of liquid or gases is called viscous force.

Viscosity

- Viscosity is the property of liquids and gases both.
- The viscosity of a liquid is due to cohesive force between its molecules.
- The viscosity of a gas is due to diffusion of its molecules from one layer to another layer.
- Viscosity of gases is much less than that of liquids. There is no viscosity in solids.
- Viscosity of an ideal fluid is zero.
- With rise in temperature, viscosity of liquids decreases and that for gases increases.
- Viscosity of a fluid is measured by its coefficient of viscosity. Its SI unit is decapoise (kg/ms) or pascal second. It is generally denoted by η.

Stoke's Law

- According to this law, the viscous force depends upon the coefficient of viscosity, velocity of the moving object and its size.

Terminal Velocity

- When a small spherical body falls through a long liquid column its velocity increases gradually but later on it becomes constant, called terminal velocity.
- The radius of spherical rain drops is very small therefore their terminal velocity is also small with which they strike the earth's surface. When a liquid flows through a pipe, its speed is maximum at the centre of the pipe and minimum near the walls of the pipe.

Equation of Continuity

- When a non-viscous liquid flows through a pipe of non-uniform cross-sectional area in stream-lined flow, (i.e. velocity at every point in the fluid remains constant) then at each section of the tube, the product of area of cross-section of the pipe and velocity of liquid remains constant, i.e. $A \times v =$ constant.
- Therefore, speed (v) of fluid flow becomes faster in narrower pipe.

Bernoulli's Principle

- If a non-viscous and incompressible liquid is flowing in stream-lined flow then total energy, i.e., sum of pressure energy, kinetic energy and potential energy, per unit volume of the liquid remains constant.
- Venturi tube and aspirator pump work on Bernoulli's Principle.
- According to Bernoulli's theorem, with increase in velocity of liquid, its pressure decreases and with decreases in velocity, pressure increases.
- During storms or cyclones, the roofs of the huts or tinned roofs blown off because wind blows with very high speed over the top of the roof and therefore pressure of air decreases. Due to the pressure difference of air above and below the roof, a lifting force acts on the roof. If it is sufficient to balance the weight of the roof it start to fly off.

Magnus Effect : Motion of a Spinning Ball

- When swing bowlers deliver the ball, the ball changes its plane of motion in air.

OPTICS

Optics is the branch of physics which involves the behaviour and properties of light, including its interactions with matter and the construction of instruments that use or detect it.

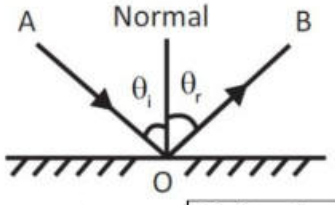
- Optics usually describes the behaviour of visible, ultraviolet, and infrared light.
- Light is electromagnetic radiation within a certain portion of the electromagnetic spectrum.
- Speed of Light: 3×10^8 ms^{-1}
- Time for light to reach on Earth from Sun: 8 minutes 20 seconds
- When light falls on the surface of an object it can either be Absorbed, Transmitted or Reflected.

Reflection of Light

- The process through which light rays falling on the surface of an object are sent back (reflected) is called as reflection of light.

Law of Reflection of Light

- The law of reflection states that the incident ray, the reflected ray, and the normal to the surface of the mirror all lie in the same plane.
- The angle of incidence is equal to the angle of reflection.



Refraction of light

Refraction is the change in direction of wave propagation due to a change in its transmission medium.

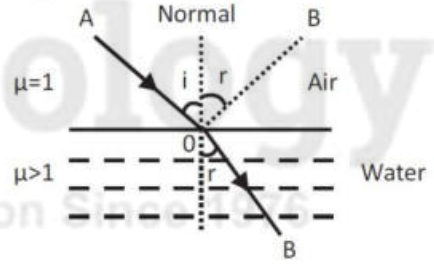
- The cause of refraction is due to the different light speed in different media.
- When a ray of light enters from one medium to another medium, its frequency and phase do not change, but wavelength and velocity changes.
- The stars appear to twinkle due to refraction.

Law of refraction (Snell's law)

The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given color and for the given pair of media.

$$\frac{\sin i}{\sin r} = \text{constant} = \frac{\mu_1}{\mu_2}$$

- The incident ray, the refracted ray and the normal at the point of incidence all three lie in the same plane.



Effects of Refraction

- When light travels through a denser medium towards a rarer medium it deviates away from the normal, therefore a pond appears shallower.
- A coin appears at lesser depth in water.
- Writing on a paper appears lifted when a glass slab is placed over the paper.
- The Sun is visible to us before actual sunrise and after actual sunset.

Critical Angle

- The angle of incidence in a denser medium for which the angle of refraction in rarer medium becomes 90°, is called the critical angle.

Total Internal Reflection (TIR)

- TIR is the phenomenon which occurs when a propagated wave strikes a medium boundary at an angle larger than a particular critical angle with respect to the normal to the surface.

Conditions for TIR

- Light should be incident from denser to rare medium.
- The angle of incidence should be greater than the critical angle.

Examples of TIR

Sparkling of diamond, mirage and looming, shining of air bubble in water or glass, optical fibre.

MIRRORS

Plane Mirror

- Images formed are laterally inverted, virtual and erect.
- The length of a plane mirror in which a person can see his/her full image is half the height of the person.
- Used in looking glasses, solar cooker, barber's shop, etc.
- If the object moves with a velocity 'v' towards or away from the mirror, its image appears to move with a velocity '2v'.

Spherical Mirrors (Concave, Convex)

Concave Mirrors	Convex Mirrors
If inner side of spherical mirror is reflecting, it is called as concave mirror.	If outer side of the spherical mirror is reflecting, it is called as convex mirror.
The images formed by the concave mirrors are magnified in size.	The images formed by the convex mirrors are diminished in size.
The object in the image formed by the concave mirror looks bigger than the original size of the object.	The object in the image formed by the convex mirror looks smaller than the original size of the object.
Concave mirrors form real and inverted images except when the object is between pole and focus.	Convex mirrors form virtual and erect images irrespective of the position of the object.
The examples of concave mirrors: The mirrors used in automobile head lights, reflecting telescopes, torch lights, etc.	The examples of convex mirrors: The mirrors used as rear view mirrors of vehicles, optical instruments, calling bell, etc.
Concave mirror is used in the solar furnace, the sun rays are focused at a point by the concave mirror. The concentrated beam of sunlight at a point increases the temperature at that point.	Convex mirror is used as the rear mirror of the vehicles because, the convex mirror enables a driver to view large area of traffic behind him by forming a small image of the vehicles.
Concave Mirrors Uses: Shaving Mirror, Headlights of vehicles, searchlight, opthalmoscope, solar cookers	Convex Mirrors Uses: Sodium Reflector Lamp

Important points related to the Spherical Mirrors

- **Centre of Curvature (C):** The center of hollow glass sphere of which the mirror is a part.
- **The radius of Curvature (R):** The radius of hollow sphere of which the mirror is a part.
- **Pole (P):** The mid point of a spherical mirror is called pole.
- **Focus (F):** When a beam of light rays parallel to the principal axis is incident on a spherical mirror then after reflection it meets or appears to meet at a point on the principal axis, called focus of the spherical mirror.
- **Focal length (f):** $f = R/2$

LENSES (CONCAVE, CONVEX)

- A lens is a uniform refractive medium bounded by two spherical surface or one plane.

Power of lenses (P)

$P = \frac{1}{f}$

- SI unit: Dioptre (D)
- A biconcave or biconvex lens has two centers of curvature and two foci (focus).

Image Formed by a Concave Lens

S. No.	Position of Object	Size of Image	Nature of Image
1.	At infinity	Highly diminished, Point sized	Virtual and erect
2.	Between the infinity and optical centre	Diminished	Virtual and erect

Image Formed by a Convex Lens

S. No.	Position of Object	Size of Image	Nature of Image
1.	At infinity	Highly diminished, Point sized	Real and inverted
2.	Beyond 2F	Diminished	Real and inverted
3.	At 2F	Same size	Real and inverted
4.	Between F and 2F	Enlarged	Real and inverted
5.	At the focus F	Highly enlarged	Real and inverted
6.	Between the focus F and optical centre C	Enlarged	Virtual and erect

Difference Between Convex lens and a concave lens

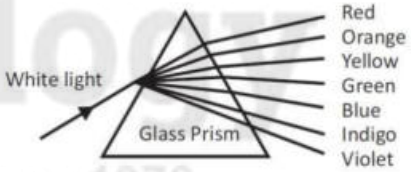
Convex Lens	Concave Lens
A convex lens is thick in the middle and thin at the edges.	A concave lens is thin in the middle and thick at the edges.
It is converging in nature.	It is diverging in nature.
A convex lens has a real focus.	A concave lens has a virtual image.
It is used for correction of hypermetropia and presbyopia.	It is used for correction of myopia.

Some Facts Regarding Lenses

- If a convex and a concave lens of the same focal length are put in contact the combination acts as a glass slab.
- If a convex and a concave lens of the same focal length are placed co-axially with a small separation between them, the combination acts as a convex lens.
- If a lens is cut into two equal halves with a plane perpendicular to the principal axis, the focal length of each part doubles.
- If a lens is cut into two equal halves with a plane along the principal axis, the focal length of each part remains unchanged.
- An air bubble in water behaves as a concave lens.
- When a lens is placed in a medium of density higher than the lens (higher refractive index), the nature of the lens reverses i.e. a converging lens behaves as a diverging lens & vice-versa.
- When a lens is placed in a medium of equal density as that of the lens, it acts as a glass slab. Its focal length becomes infinity and power becomes zero.

Prism

- Prism is a uniform transparent refracting medium bounded by plane surfaces, inclined at some angles forming a triangular shape.



- When a white light is incident on a glass prism, it disperses into its seven colour components in the sequence of VIBGYOR, and this is known as the dispersion of white light.
- The refractive index of glass is maximum for violet and minimum for red, therefore the violet colour of light deviated maximum and red colour of light deviated least.

Common Defects of Vision

Farsightedness (Hypermetropia)

- A person suffering from this defect can see objects far away but cannot see the nearer object clearly.

- Eye form the image of an object behind the retina.
- The defect can be corrected by using a convex lens of suitable focal length.

Shortsightedness (Myopia)

- A person suffering from this defect can see the nearer objects clearly but is unable to see objects far away clearly.
  - In this defect, the image is formed in front of retina.
  - This defect is corrected by using a concave lens of suitable focal length.

Atmospheric Refraction

- The air just above the fire becomes hotter than the air further up. The hotter air is lighter (less dense) than the cooler air above it, and has a refractive index slightly less than that of the cooler air.
- Since the physical conditions of the refracting medium (air) are not stationary, the apparent position of the object, as seen through the hot air, fluctuate. This wavering is thus an effect of atmospheric refraction (refraction of light by the earth's atmosphere) .

Twinkling of stars

- The twinkling of a star is due to atmospheric refraction of starlight.
- The starlight, on entering the earth's atmosphere, undergoes refraction continuously before it reaches the earth. The atmospheric refraction occurs in a medium of gradually changing refractive index. Since the atmosphere bends starlight towards the normal, the apparent position of the star is slightly different from its actual position. As the path of rays of light coming from the star goes on varying slightly, the starlight entering the eye flickers – the star sometimes appears brighter, and at some other time, fainter, which is the twinkling effect.

Advance sunrise and delayed sunset

- The Sun is visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction.

Scattering of Light

- The blue colour of the sky, colour of water in deep sea, the reddening of the sun at sunrise and the sunset.

Blue Sky

- The red light has a wavelength of about 1.8 times greater than blue light. Thus, when sunlight passes through the atmosphere, the fine particles in air scatter the blue colour (shorter wavelengths) more strongly than red. The scattered blue light enters our eyes. If the earth had no atmosphere, there would not have been any scattering. Then, the sky would have looked dark. The sky appears dark to passengers flying at very high altitudes, as scattering is not prominent at such heights.

Total Internal Reflection

- **Mirage – Desert :** Hotter air is less dense, and has smaller refractive index than the cooler air. On hot summer days, the air near the ground becomes hotter than the air at higher levels noticed that while moving in a bus or a car during a hot summer day, a distant patch of road, especially on a highway, appears to be wet. This is also due to mirage.
- **Diamonds** - Their brilliance is mainly due to the total internal reflection of light inside them.
- Optical fibres too make use of the phenomenon of total internal reflection. Light undergoes repeated total internal reflections along the length of the fibre. There is no appreciable loss in the intensity of the light signal.

Tyndall Effect

- The earth's atmosphere is a heterogeneous mixture of minute particles like smoke, tiny water droplets, suspended particles of dust and molecules of air. When a beam of light strikes such fine particles, the path of the beam becomes visible.
- When a fine beam of sunlight enters a smoke-filled room through a small hole. Tyndall effect can also be observed when sunlight passes through a canopy of a dense forest.
- The colour of the scattered light depends on the size of the scattering particles. Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths.

ELECTRICITY

- Flow of electrons is called electricity.
- The electricity produced by friction between two appropriate bodies, is called static electricity, it is also called frictional electricity.

Coulomb's law

- The electrostatic force of interaction acting between two stationary point charges (q_1, q_2) is directly proportional to the product of magnitude of charges and inversely proportional to the square of the distance 'r' between them.

- $F = \frac{Kq_1q_2}{r^2}$

Electric Field

- The space in the surrounding of any charge in which its influence can be experienced by another charge, is called electric field.

Electric field intensity

- Electric field intensity (E) at any point is defined as the electrostatic force (F) acting per unit positive test charge (q) at the point.
- $E = F/q$
- Its unit is newton/coulomb.
- Electric field intensity is inversely proportional to the square of the distance 'r' from the point charge.

Electric Field Lines

- An electric field line is an imaginary line, so that its tangent at any point is in the direction of the electric field vector at that point.
- Two lines can never intersect. Electric field lines always begin on a positive charge and end on a negative charge and do not start or stop in mid-space.

Electric Potential

- Electric potential at a point in an electric field is equal to the work done per unit charge in carrying a test charge from infinity to that point. Its unit is joule/coulomb.
- Electric potential, $v = w/q$
- Potential difference is that physical quantity which decides the direction of flow of charge between two points in electric field.
- Positive charge always tends to move from higher potential towards lower potential.

Electric Dipole and Capacitor

- An electric dipole consists of two equal and opposite point charges separated by a very small distance.
- Electric dipole moment of the dipole is product of charge and the separation between the charges.
- A capacitor or condenser is a device over which a large amount of charge can be stored without changing its dimensions.
- The capacitance of a conductor is equal to the ratio of the charge (q) given to the conductor to change in its potential (V) is given by $C = \frac{q}{V}$
- Its unit is coulomb/volt or farad. Farad (F) is a large unit of capacitance. Its practical unit is microfarad (μF).

$1\ \mu F = 10^{-6}\ F$

Type of Materials

- **Conductors** are those type of materials which have free electrons to conduct the electricity. The metals are good conductors of electricity.
- **Insulators** are that type of materials which do not have the free electrons in its volume and hence, it does not conduct the electricity at all.
- **Semiconductor** is that type of material which do not have free electrons at the normal temperature, but has the free electrons at the increased temperature and hence, behaves like a conductor. The materials such as silicon, germanium etc., are the semiconductor.

Electric Current

- An electric current whose magnitude and direction do not change with time is called direct current, and whose magnitude changes continuously and direction changes periodically is called alternating current.
- Inverter is a device which converts DC to AC.
- In solid conductors, electric current flows due to flow of electrons, in liquids due to flow of ions as well as electrons and in semiconductors due to flow of electrons and holes.
- Its S.I. unit is Ampere.

Resistance

- Resistance is the opposition that a substance offers to the flow of electric current.
- It is represented by R.
- Its S.I. unit is ohm.

Resistivity

- Resistivity of a material depends on the temperature and nature of the material. It is independent of dimensions of the conductor, i.e., length, area of cross-section etc.
- Resistivity of metals increases with increase in temperature.

Conductance

- Conductance and conductivity are the reciprocal of resistance and the resistivity of the material respectively. The SI unit of conductance is Ω^{-1} i.e., mho and that of conductivity is $\Omega^{-1}\ m^{-1}$.

Combination of Resistances

- If resistance R_1, R_2 and R_3 are connected in series, then their equivalent resistance is given by $R = R_1 + R_2 + R_3$.
- In series combination, equal current flows through each resistors but Voltage varies.

- If resistances R_1, R_2 and R_3 are connected in parallel, then their equivalent resistance is given by $\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$
- In parallel combination, potential difference across each resistor remains same but current varies.

Ohm's law

- It states that if physical conditions of any conductor such as temperature, pressure etc., remain unchanged, then electric current (I) flowing through it is directly proportional to the potential difference (V) applied across its ends, i.e., I □ V or V = IR
  where, R is the electrical resistance of the conductor.

Ammeter and Voltmeter

Ammeter	Voltmeter
An ammeter is an instrument used to measure electric current.	A voltmeter is a device used to measure potential difference between two points in an electric circuit.
It is always connected in series.	It is always connected in parallel.
The resistance of an ideal ammeter is zero.	The resistance of an ideal voltmeter is infinity.
A galvanometer can be converted into an ammeter by connecting a low resistance in parallel.	A galvanometer can be converted into a voltmeter by connecting a high resistance in series.
	A small resistance connected in parallel with the load resistance to reduce amount of electric current through the load resistor is called shunt.

Electric Cell

- An electric cell is a device which converts chemical energy into electrical energy.
- Electric cell are of two types
- Primary cell cannot be charged. Voltaic, Daniell and Leclanche cells are primary cells.
- Secondary cell can be charged again and again. Acid and alkali accumulators are secondary cells.
- Working of electric cells is based on chemical effect of electric current.

Emf of a Cell

- The work done by the cell to bring a (+)ve charge from its own terminal to the other is known as its emf (electromotive force). Electromotive force is work but not a force.

Joule's Law of Heating

- Current can produce three effects: heating effect, magnetic effect and chemical effect.
- Heat produced in conductor in time (t) is given by $H=I^2Rt=\frac{V^2}{R}t=VIt$
- This is known as Joule's law of heating.
- Electric bulb, electric kettle, heater etc., devices work on the basis of heating effect of electric current.
- To protect the domestic appliances from sudden change in electricity, fuses are used. It is made of tin + lead (63% + 37%) alloy.

Electric power

- The electrical energy produced or consumed per unit time is called electric power.
- Electric power, $P=VI=I^2R=\frac{V^2}{R}$
- 1 kWh = 3.6×10^6 J

Chemical Effect of Electric Current

- When an electric current is passed through an acidic or basic solution, it decomposes into its positive and negative ions. The positive ions collect at negative electrode (cathode) and the negative ions collect at positive electrode (anode).
- This phenomenon is called electrolysis. It is chemical effect of current. The process of coating of a base metal with a layer of more expensive metal, is called electroplating.

Domestic Electrification

- From the distribution, the two terminals are supplied to the houses named as live and neutral (neutral is earthed at local substation). The third terminal is introduced as the earth for the safety in the building.

Lightning Appliance

- The electric discharge occurring between two charged clouds or between a charged cloud and earth can damage the houses or buildings. To protect this, lightning conductors are used.

MAGNETISM

- A magnet is a material which can attract iron objects.
- A natural magnet is an ore of iron (Fe_3O_4) called magnetite or lodestone.
- A magnet which is prepared artificially, is called an **artificial magnet**.

- A freely suspended magnet always aligns itself into North-South direction. Like magnetic poles repel and unlike magnetic poles attract each other.
- A current-carrying coil containing a soft iron core, is called an electromagnet.
- An electromagnet is utilised in electric bell, telegraph receiver, telephone diaphragm, transformer, dynamo etc.
- Permanent magnets are made of steel and temporary magnet or electromagnets are made of soft iron because steel cannot be magnetised easily but when it is magnetised one time, it cannot be demagnetised easily. The soft iron can be magnetised or demagnetised easily.

Properties of Magnet

- **Attractive property** A magnet can attract small pieces of magnetic substances like iron, steel, cobalt, nickel etc. The attraction is maximum at poles. Unlike poles attract and like poles repel each other.
- **Directive property** A magnet, when suspended freely, aligns itself approximately along geographical N-S line.
- **Magnetic poles exist in pairs** If a magnet is cut into two equal parts transverse to its length, then N and S-poles of the magnet do not get separated.

Magnetic Field

- The space in the surrounding of a magnet or a current carrying conductor in which its magnetic effect can be experienced, is called magnetic field.
- **Magnetic lines of force** is an imaginary line drawn in magnetic field at which a magnetic North pole will move, if it is free to do so.
- A tangent drawn at any point of a magnetic line of force represents the direction of magnetic field at that point.
- The **magnetic flux** linked with a surface is equal to the total number of magnetic lines of force passing through that surface normally. Its unit is weber.

Earth's Magnetism

- The earth has its own magnetic field. The pole near the geographic North of the earth is called the magnetic North pole. Similarly, the pole near the geographic South pole is called the magnetic South pole.
- The Earth's magnetic field diverts charged particle coming from space towards its poles and saves living beings from being severely harmed.
- **Magnetic compass:** A magnetic needle which always direct in North-South (N-S) direction.

Magnetic storm

- Local disturbances in the earth's magnetic field which can damage telecommunication which are probably caused by lump of charged particles emanating from the sun is known as magnetic storm.
- **Example:** In the Arctic Circle, they are known as aurora borealis or the northern lights, while in the Antarctic Circle they are called aurora australis or the southern lights.
- **Moving Coil Galvanometer:** A moving coil galvanometer is used to detect the presence of current and the direction of current in any circuit.

Magnetic Substances

- There are three types of magnetic substances: Paramagnetic, Diamagnetic and Ferromagnetic.

Paramagnetic Substances

- Those substances which are feebly magnetised in the direction of magnetic field when placed in strong magnetic field, are called paramagnetic substances.
- For example – Aluminium, platinum, chromium, manganese, solutions of salts of iron, nickel, oxygen etc.
- These substances are attracted towards strong magnetic field in a non-uniform magnetic field.
- The magnetism of these substances decreases with increase in temperature.

Diamagnetic Substances

- Those substances which are feebly magnetised in the opposite direction of magnetic field when placed in strong magnetic field are called diamagnetic substances.
- For examples – Gold, silver, zinc, copper, mercury, water, alcohol, air, hydrogen etc.
- These substances are attracted towards weak magnetic field in a non-uniform magnetic field.
- The magnetism produced in these substances does not change with increase or decrease in temperature.

Ferromagnetic Substances

- Those substances which are strongly magnetised in the direction of magnetic field when placed in it, are called ferromagnetic substances.
- For examples – Iron, nickel, cobalt etc.
- The magnetism produced in these substances decreases with increase in temperature and at a particular temperature, called Curie temperature, substance becomes diamagnetic.

- Curie temperature for iron is 770°C and for nickel is 358°C.

Electromagnetic Induction (EMI)

- Whenever the magnetic flux linked with an electric circuit changes, an emf is induced in the circuit. This phenomenon is called electromagnetic induction.

Faraday's Laws of EMI

- Whenever the magnetic flux linked with a circuit changes, an induced emf is produced in it.
- The induced emf loses as long as the change in magnetic flux continues.

Lenz's Law

- The direction of induced emf or induced current is always in such a way that it opposes the cause due to which it is produced.

Eddy Current

- If a piece of metal is placed in a varying magnetic field or rotated with high speed in a uniform magnetic field, then induced current set up in the piece is like whirlpool of air, called eddy current, also known as foucault's current.

Uses

- Eddy currents are used in dead beat galvanometer, induction furnaces, induction motor, speedometers of automobiles etc.
- Eddy currents are used in diathermy for deep heat treatment of the human body.

Self and Mutual Induction

- The phenomenon of production of induced emf in a circuit due to change in current flowing on its own, is called self induction.
- The phenomenon of production of induced emf in a circuit due to change in magnetic flux in its neighbouring circuit, is called mutual induction.
- The unit of self induction and mutual induction is Henry (H).

Alternating Current (AC)

- An electric current whose magnitude and direction changes continuously is called alternating current.
- The frequency of alternating current in India is 50 Hz.
- **Mean or average value of AC** is zero for one complete cycle.
- **Root mean square value** of AC is given by : $I_{rms} = \frac{I_0}{\sqrt{2}}$, where I_0 is the maximum current.
- An AC ammeter and AC voltmeter read root mean square value of alternating current and alternating voltage respectively.

AC Generator or Dynamo

- It is a device which converts mechanical energy into alternating current.
- Its working is based on electromagnetic induction.

DC Motor

- It is a device which converts electrical energy into mechanical energy.
- Its working is based on the fact that when a current carrying coil is placed in uniform magnetic field, a torque acts on it.

Transformer

- It is a device which can change a low voltage current into a high voltage current and vice-versa.
- Its working is based on mutual induction.

Step-up Transformer

- It converts a low voltage current into a high voltage current.
- The main energy losses in a transformer are Iron loss, Flux loss, Hysteresis loss, Humming loss (ohmic loss).

Step–down Transformer

- It converts a high voltage current into a low voltage current.

NUCLEAR REACTOR

- A nuclear reactor is a device that contains and controls sustained nuclear chain reactions. In nuclear reactors, the nuclear fission is controlled by controlling the number of neutrons released during the fission. The energy liberated in a controlled manner is used to produce steam, which can run turbines and produce electricity.
- The fissionable material is used in the reactor along with a small neutron source. The solid fuel is made into rods and is called fuel rods.

Role of extra neutron

- These neutrons in turn can initiate fission processes, producing still more neutrons, and so on. This starts a chain reaction. Slow neutrons (thermal neutrons) are much more likely to cause fission in $^{235}U_{92}$ than fast neutrons. Fast neutrons liberated in fission would escape instead of causing another fission reaction.
- If the chain reaction is uncontrolled, it leads to explosive energy output, as in a nuclear bomb or Atom bomb. Each time an atom splits, it releases large amounts of energy in the form of heat.

Moderators

- Water, heavy water (D_2O) and graphite are used as moderator.
- Light nuclei called moderators are provided along with the fissionable nuclei for slowing down fast neutrons.

Core

- The core of the reactor is the site of nuclear fission.
- It contains the fuel elements in suitably fabricated form.

Reflector

- The core is surrounded by a reflector to reduce leakage.
- The energy (heat) released in fission is continuously removed by a suitable coolant.

Coolant

- Water, heavy-water, liquid sodium, helium, liquid oxygen are used as coolant.
- The coolant transfers heat produced during fission to a working fluid which in turn may produce steam. The steam drives turbines and generates electricity.

Control rods

- They are made of cadmium, boron.
- The reactor can be shut down by means of rods (made of, for example, cadmium or Boron) that have high absorption of capacity of neutrons. Cadmium and boron can absorb neutrons to form the corresponding isotopes, which are not radioactive.

Shield

- The whole assembly is shielded with heavy steel or concrete to check harmful radiation from coming out.

WORK, POWER AND ENERGY

Work

- Work is a scalar quantity given by $W = Fs \cos\theta$, where F is the force, s is the displacement and θ is the angle between force and displacement. Its SI unit is joule and CGS unit is erg. 1 joule = 10^7 erg.
- Work done by a force is zero when body is not displaced actually i.e. $s = 0$ or body is displaced perpendicular to the direction of force i.e. $\theta = 90°$.

Work done by a variable force

- If we throw a ball upward, work done against gravity is given by, $W = mgh$
- Where, m = mass of the body, g = acceleration due to gravity and h = height to which the ball is raised.
- The centripetal force acts on a body perpendicular to the direction of motion. Therefore, work done by or against centripetal force in circular motion is zero.
- If a coolie is carrying a load on his head and moving on a horizontal platform, then work done by force of gravity is zero as displacement is perpendicular to the direction of force of gravity.

Energy

- Energy of a body is its capacity of doing work. It is a scalar quantity and its SI unit is joule.
- Energy can be transformed into work and vice-versa with the help of some mechanical device.
- There are two types of Mechanical Energy, which are as follows

Kinetic Energy

- The energy possessed by a body by virtue of its motion is called its kinetic energy.
- Kinetic energy of the body of mass m moving with velocity v is given by $K = \frac{1}{2}mv^2$

Potential Energy

- The energy possessed by any object by virtue of its position or configuration is called its potential energy.
- Gravitational potential energy, $U = mgh$

Einstein's Mass-Energy Relation

- According to this relation, the mass can be transformed into energy and vice-versa.
- When Δm mass is disappeared, then produced energy. $E = \Delta mc^2$
  Where, c = speed of light in vacuum.

Conservative and Non-conservative forces

- Conservative forces are non-dissipative forces like gravitational force, electrostatic force etc.
- For the conservative forces, work done during a round trip is always zero.
- Non-conservative forces are dissipative in nature like frictional force, viscous force etc.

Law of Conservation of Energy

- Energy can neither be created nor be destroyed, only one type of energy can be transformed into other form of energy.
- Only for conservative forces, (Total mechanical energy) Initially = (Total mechanical energy) finally i.e. Mechanical energy is conserved.

Some Equipments used to Transform Energy

Equipment	Energy Transformed

Battery	Chemical energy into electrical energy.
Candle	Chemical energy into light and heat energy.
Dynamo	Mechanical energy into electrical energy
Electric Bulb	Electrical energy into light and heat energy.
Electric Motor	Electrical energy into mechanical energy.
Loud Speaker	Electrical energy into sound energy.
Microphone	Sound energy into electrical energy.
Sitar	Mechanical energy into sound energy.
Solar Cell	Solar energy into electrical energy.
Tube light	Electrical energy into light energy and heat energy.

Collision

- Collision between two or more particles is the interaction for a very short interval of time in which they apply relatively strong forces on each other. For a collision, physical contact of two bodies is not necessary.
- A collision in which momentum of the system as well as kinetic energy of the system remains conserved, is called an elastic collision. In an elastic collision, all involved forces are conservative forces.
- A collision in which only momentum remains conserved but kinetic energy of the system does not remain conserved, is called an inelastic collision.
- If after collision two colliding bodies gets sticked with each other and moves with a common velocity, then collision is said to be perfectly inelastic.
- In perfectly inelastic collision, the loss of kinetic energy during collision do not recover at all and two bodies stick together after collision.

Gravitation

- Every massive body attracts other by virtue of their masses. This phenomenon is called gravitation.

Newton's Law of Gravitation

- The gravitational force acting between two point objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.
- Gravitational force (F) $= \frac{Gm_1m_2}{r^2}$
- Where, G is universal gravitational constant and its value is 6.67×10^{-11} Nm^2kg^{-2}.
- Gravitational force is a central as well as conservative force.

Acceleration Due to Gravity of Earth

- The uniform acceleration produced in a freely falling body due to the earth's gravitational pull, is called acceleration due to gravity, $g = \frac{GM}{R^2}$
- Where, M = mass of the earth, R = radius of the earth.
- The value of g changes slightly from place to place but its value near the earth's surface is 9.8 ms^{-2} (approximately).
- Gravitational force is the weakest force in nature. It is 10^{36} times smaller than electrostatic force and 10^{38} times smaller than nuclear force.

Factors affecting acceleration due to Gravity

- **Shape of Earth:** Earth is not completely spherical. Its radius at equator is approximately 42 km greater than its radius at poles.
- The value of 'g' is maximum at poles (i.e. 9.8 ms^{-2}) and minimum (i.e. 9.78 ms^{-2}) at equator.
- There is no effect of rotation of the earth at poles and maximum at equator.
- **Effect of Altitude:** 'g' decreases with altitude.
- **Effect of Depth:** 'g' decreases with depth and becomes zero at centre of the earth.

Mass and Weight

- The mass of a body is the quantity of matter contained in it. It is a scalar quantity and its SI unit is kg.
- Mass is measured by an ordinary equal arm balance.
- Mass of a body does not change from place to place and remains constant.
- The weight of a body is the force with which it is attracted towards the centre of the earth. Weight of a body (w) = mg
- The centre of gravity of a body is that point at which the whole weight of the body appears to act.
- The centre of gravity of a body can be inside the material of the body or outside it.
- It is a vector quantity and its SI unit is newton (N). It is measured by a spring balance.
- Weight of a body is not constant, it changes from place to place.

Weight of a Body in a Lift

- When lift is at rest or in uniform motion, the weight recorded in spring balance (i.e. apparent weight) is equal to the real weight of the body w = mg.
- When lift is accelerating upward (acceleration = ams^{-2}) the weight recorded in spring balance is greater than the real weight of the body w' = m(g + a)
- When lift is accelerating downward, the weight recorded in spring balance is smaller than the real weight of the body w = m(g – a).
- When lift is falling freely under gravity, the apparent weight of the body becomes zero.

  $w = m(g-g)(\because a = g)$

  $w = 0$
- Therefore, body will experiences weightlessness.

Weight of a Body at the Moon

- As mass and radius of moon are lesser than the earth, so the force of gravity at the moon is also less than that of the earth. Its value at the moon's surface is g/6.

Satellite

- A heavenly body revolving around a planet in an orbit is called a satellite. Moon is a natural satellite of the earth. The satellite may be artificial. Artificial satellites are of two types.

Geostationary Satellites

- It revolves around the earth in equatorial orbits which is also called Geostationary or Geosynchronous orbit. The time period of these satellites is 24 hour.

Polar Satellites

- These satellites revolve around the earth in polar orbits at a height of approximately 800 km.
- Weather monitoring which is predicted on the basis of information about moisture present in air, atmospheric pressure etc, obtained through a polar satellite.
- We are able to see a live telecast of cricket world cup match or other programme with the help of a communication satellite which is a geostationary satellite.
- Launching vehicles – PSLV & GSLV

Time Period of a Satellite

- It is the time taken by a satellite to complete one revolution.
- If satellite is near the earth's surface, then
- $T = 2\pi\sqrt{\frac{R}{g}}$, Where R is radius of the earth.

Escape Velocity

- Escape velocity is that minimum velocity with which a body should be projected from the surface of earth so as it goes out of gravitational field of earth.
- Escape velocity is independent of the mass, shape and size of the body and its direction of projection.
- Escape velocity is also called second cosmic velocity.
- For earth, escape velocity = 11.2 km/s.
- For moon, escape velocity = 2.4 km/s.

Orbital Velocity

- Orbital velocity of a satellite is $V_0 = \sqrt{gR}$ and escape velocity $V_e = \sqrt{2gR}$ where R = Radius of earth. i.e. $V_e = \sqrt{2}\,V_0$ i.e. escape velocity is $\sqrt{2}$ times the orbital velocity.
- There if the orbital velocity of a satellite is increased to $\sqrt{2}$ times (increased by 41%), the satellite will leave the orbit and escape.

Exercise

1. _____are such substance which when placed in a magnetic field acquire a feeble magnetism in the direction of the field.
(A) Diamagnetic substance
(B) Paramagnetic substance
(C) Ferromagnetic substance
(D) All of the above

Ans.1(A) Those substance which when placed in a magnetic field are feebly magnetized in a direction opposite to the magnetizing field are called diamagnetic substances.

2. The force acting on an object does not produce which one of the following effects?
(A) Change in the size of the object
(B) Change in the shape of the object
(C) Change in the temperature of the object
(D) Change in the motion state of the object

Ans.2(A) A force can produce the following effects:
A force can move a stationary object.
A force can stop a moving object.
A force can change the speed of a moving object.
A force can change the direction of a moving object.
A force can change the shape and size of an object.

3. Which one of the following is not the fundamental international system quantity?
(A) Length
(B) Amount of substance
(C) Luminous intensity
(D) Torque

Ans.3(D) International System of Quantities. The International System of Quantities (ISQ) is a system based on seven base quantities: length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity.

4. The coil wire in the electric room heater or electric cooking heater is called _____.
(A) Circuit **(B)** Element
(C) Filament **(D)** Cells

Ans.4(B) The coil wire in the electric room heater or electric cooking heater is called element circuit.

5. The bending of light when it passes around a corner or a slit is due to _____.
(A) Reflection
(B) Refraction
(C) Diffraction
(D) Total internal reflection

Ans.5(C) Diffraction is the slight bending of light as it passes around the edge of an object. The amount of bending depends on the relative size of the wavelength of light to the size of the opening.

6. When an object revolves around its axis, then what is its speed called?
(A) Linear motion
(B) Circular motion
(C) Rotational motion
(D) Oscillation speed

Ans.6(C) Purely rotational motion occurs if every particle in the body moves in a circle about a single line. This line is called the axis of rotation. Then the radius vectors from the axis to all particles undergo the same angular displacement at the same time.

7. When an object moves on both sides of its mean position, then this type of motion is called?
(A) Oscillation speed **(B)** Circular motion
(C) Rotational motion **(D)** Linear motion

Ans.7(A) Oscillatory motion can be termed as the repeated motion in which an object repeats

the same movement over and over. In the absence of friction, the oscillatory motion would continue forever; but in the real world, the system eventually settles into equilibrium.

8. How many dynes in a Newton?
(A) 1000 **(B)** 10000
(C) 100000 **(D)** 1000000

Ans.8(C) Dyne, unit of force in the centimeter-gram-second system of physical units, equal to the force that would give a free mass of one gram an acceleration of one centimeter per second per second. One dyne equals 0.00001 newton.

9. A rotational motion rotates a particle with certain angle in a second, it is called the _____ of the particle.
(A) Angular velocity
(B) Linear velocity
(C) Centripetal Acceleration
(D) Centrifugal Force

Ans.9(A) Angular velocity is the rate of velocity at which an object or a particle is rotating around a center or a specific point in a given time period. It is also known as rotational velocity. Angular velocity is measured in angle per unit time or radians per second (rad/s).

10. When we tied a piece of stone with one end of the string, then we have to put a strain on the string, this strain work as?
(A) Centripetal force
(B) Centrifugal force
(C) Balanced force
(D) Unbalanced force

Ans.10(A) The tension in the string provides the necessary centripetal force when a piece of stone is tied to the rope. Now if we leave the end of the string by hand, the piece runs along the tangent of the circle, leaving the circular path.

11. Which one of the following materials is ferromagnetic?
(A) Gold **(B)** Nickel
(C) Wood **(D)** Manganese

Ans.11(B) Iron is ferromagnetic (attracted to magnets), but only within a certain temperature range and other specific conditions. Iron is magnetic in its α form. So, most magnetic materials are metals. Other magnetic elements include nickel and cobalt.

12. When a glass rod is rubbed with silk then which type of charge is created on it?
(A) Electric charge
(B) Positive charge
(C) Negative charge
(D) None of the above

Ans.12(A) This is because when rubbed with silk or wool, there is an electric charge in the comb. We can generate electric charge in many similar ways. After inflating a balloon, rub it with paper or woolen cloth.

13. The speed of sound is maximum in
(A) Air **(B)** Water
(C) Vacuum **(D)** Steel

Ans.13(D) The speed of sound will be highest in a solid. Sound (sound) is a type of vibrations or turbulence that is transmitted through a solid, liquid or gas. But mainly those vibrations are called sound

14. Momentum of a particle of mass m is p. Its kinetic energy will be
(A) mp **(B)** p^2m
(C) p^2/m **(D)** $p^2/2m$

Ans.14(D) The energy generated due to its motion in an object is called kinetic energy. If the object of mass m is at speed v. K.E = p2 / 2m where p = momentum = mv.

15. Which physical unit is obtained by the ratio of momentum and velocity of matter?
(A) Velocity **(B)** Acceleration
(C) Mass **(D)** Force

Ans.15(C) Matter of mass means that the mass.

16. An object at rest will remain at rest and an object in motion will remain in motion until and unless it is acted upon by an external force. This is Newton's.

(A) First law (B) Second law
(C) Third law (D) Fourth law

Ans.16(A) The First Law states, "A body at rest will remain at rest, and a body in motion will remain in motion unless it is acted upon by an external force." This simply means that things cannot start, stop or change direction all by themselves.

17. Two forces are called action and reaction forces it is which Newton's _____ law.
(A) First law (B) Second law
(C) Third law (D) Fourth law

Ans.17(C) Two forces are called action and reaction forces it is which Newton's third law law.

18. What is called comparing a given amount to its standard?
(A) Unit (B) Measurement
(C) Fundamental unit (D) None of these

Ans.18(B) Measurement is the process of comparing a given amount with its unit.

19. Rain gages are used-
(A) To measure the rainfall
(B) To measure air pressure
(C) Both
(D) None of these

Ans.19(A) rain gauge is an instrument used by meteorologists and hydrologists to measure precipitation (e.g. rain, snow, hail or sleet) in a certain amount of time.

20. 1 foot is equals-
(A) 26.48 cm (B) 28.48 cm
(C) 29.48 cm (D) 30.48 cm

Ans.20(D) 1 ft = 30.48 cm using an online calculator for metric conversion.

21. The working principle of a washing machine is.
(A) Reverse osmosis (B) Diffusion
(C) Centrifugation (D) Dialysis

Ans.21(C) The working principle of a washing machine is Centrifugation.

22. Which one of the following is a bad Thermal Conductor?
(A) Potassium (B) Sodium
(C) Glass (D) Silver

Ans.22(C) Glass, wood and plastic are all excellent insulators, but not good conductors. It doesn't allow the flow of electrons easily from atom to atom and are bad conductors

23. Who invented first working laser?
(A) Alhazen (B) Carl Anderson
(C) T. H. Maiman (D) Charles Barkla

Ans.23(C) The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". The first laser was built in 1960 by Theodore H. Maiman at Hughes Research Laboratories, based on theoretical work by Charles Hard Townes and Arthur Leonard Schawlow.

24. Which of the following is not a vector quantity?
(A) Acceleration (B) Electric current
(C) Pressure (D) Velocity

Ans.24(C) which the quantity and quantity along with the direction to express a physical amount is also described, it is called a vector quantity.

25. When a charged particle moves in a magnetic field, then what is called the force on the particle?
(A) Lorentz force (B) Faraday's force
(C) Coulomb's force (D) None of these

Ans.25(A) When a charged particle moves in a magnetic field, a force is applied on the particle. This force is called the force of Lorenz

26. The phonograph was invented by which of the following scientists?
(A) Hans Geiger (B) Hans Oersted
(C) Thomas Edison (D) Paul Cornu

Ans.26(C) On November 21,1877, Edison announced his invention of the phonograph, a hand-cranked, tinfoil covered cylinder that could reproduce recorded sound.

27. The distance-time graph for the motion of an object moving at a constant speed is a _____.
(A) Dot **(B)** Circle
(C) Straight Line **(D)** Curve

Ans.27(C) If we record distance and time for the motion of a body and a, we will obtain a distance-time graph corresponding to the ...

28. An image formed by a concave mirror on a screen is called _____?
(A) Virtual image **(B)** Real image
(C) Both A and B **(D)** Erect image

Ans.28(B) Concave mirrors can produce both real and virtual images; they can be upright or inverted (if real); they can be behind the mirror (if virtual) or in front of the mirror (if real); they can also be enlarged, reduced, or the same size as object.

29. The process of depositing a layer of any desired metal on another material by means of electricity is called_____.
(A) Electroplating **(B)** Galvanisation
(C) Rusting **(D)** Crystallisation

Ans.29(A) Electroplating: The process of depositing a layer of any desired metal on another material by means of electricity is called electroplating.

30. Who invented the waterproof raincoat?
(A) Robert Hooke **(B)** CaiLun
(C) Charles Macintosh **(D)** William Harvey

Ans.30(C) Charles Macintosh FRS (29 December 1766 – 25 July 1843) was a Scottish chemist and the inventor of waterproof fabric. The Mackintosh raincoat (the variant spelling is now standard) is named after him.

31. If the linear momentum is increased by 50%, then K.E. will be increased by

(A) 50% **(B)** 75%
(C) 100% **(D)** 125%

Ans.31(D) Kinetic energy K and linear momentum P are related as
$K=P^2/2m$ .....(1)
The new momentum is P+50% 0f P =(3/2)P.
If the new kinetic energy is K' then
$K'=(3/2)P^2 / 2m=9/4p^2 / 2m$.....(2)
Divide equation (2) by Equation (1) to get
$K'=(9/4)K$
Now the % change in K is 125%

32. Who describe first experimentally Interference of light rays?
(A) Snell **(B)** Thomas Young
(C) Albert Einstein **(D)** Lenz

Ans.32(B) Young's double slit interferometer in 1803 demonstrated interference fringes when two small holes were illuminated by light from another small hole which was illuminated by sunlight. Young was able to estimate the wavelength of different colours in the spectrum from the spacing of the fringes.

33. Which of the following was invented by Sir Humphry Davy?
(A) Safety Pin **(B)** Steam Engine
(C) Safety Lamp **(D)** X-Rays

Ans.33(C) Sir Humphry Davy, Baronet English chemist who discovered several chemical elements (including sodium and potassium) and compounds, invented the safety lamp.

34. Light Emitting diode (LED) converts.
(A) Light energy into electrical energy
(B) Electrical energy into light energy
(C) Thermal energy into light energy
(D) Mechanical energy into electrical energy

Ans.34(B) Ompared with conventional light sources that first convert electrical energy into heat, and then into light, LEDs (Light Emitting Diodes) convert electrical energy directly into light, delivering efficient light generation with little-wasted electricity.

35. For which of the following game, players must have knowledge of Pascal's law?
(A) Climbing **(B)** Paragliding
(C) Rafting **(D)** Scuba diving

Ans.35(D) Pascal's rule is used to design water to wers, but scuba divers must also understand this principle. At a depth of 10

meters under water, pressure is twice the atmospheric pressure at sea surface, and increases by about 100 kPa (about 1 atm) for each increase of 10 m depth.

36. Who invented the Centigrade scale?
(A) Anders Celsius
(B) Daniel Gabriel Fahrenheit
(C) William Thomson
(D) Thomas Edison

Ans.36(A) The Celsius scale, invented by Swedish Astronomer Anders Celsius (1701-1744), has 100 degrees between the freezing point (0^0 C) and boiling point (100^0 C) of pure water at sea level air pressure.

37. The bats can fly in the dark because -
(A) They can see the objects in darkness
(B) They have weak legs and are likely to be attacked by predators
(C) They generate flashes of light
(D) They generate ultrasonic sound waves

Ans.37(D) Bat echolocation is very much similar to a SONAR and is a perceptual system where ultrasonic sounds are emitted specifically to produce echoes.

38. The time between program input and output is called.
(A) Turnaround time **(B)** Waiting time
(C) Execution time **(D)** Delay time

Ans.38(C) The time between program input and output is called. A Execution time

39. A Stone is thrown vertically from an aircraft flying 2 Km above the Earth. The stone will fall with a.
(A) Constant speed
(B) Constant velocity
(C) Constant Acceleration
(D) Constant speed for some time, then with constant acceleration as it nears the earth
Ans.39(C) A Stone is thrown vertically from an aircraft flying 2 Km above the Earth. The stone will fall with a Constant Acceleration.

40. Which of the following is NOT correct about an inelastic collision?
(A) Linear momentum is conserved
(B) Kinetic energy is conserved
(C) Total energy
(D) Some or all the forces involved may be non-conservative in nature

Ans.40(B) Following are the basic characteristics of an inelastic collision:
1. Linear momentum is conserved
2. Kinetic energy is NOT conserved
3. Total energy is conserved
4. Some or all the forces involved may be non-conservative in nature

41. The dot product of two vectors A and B is equal to the product of magnitude of A and B and _____?
(A) Cosine of the largest angle between them
(B) Sine of the largest angle between them
(C) Cosine of the smallest angle between them
(D) Sine of the smallest angle between them

Ans.41(D) KE1: KE2 = 4:9
Both body's mass is equal
Lets mass is both body is x
$KE = ½ mv^2$
M= mass V = velocity
Then, $KE1 = ½ \times x \times v^2$
$4 = ½ \times x \times v^2$ ----------1
$KE2 = ½ \times x \times V^2$
$9 = ½ \times x \times V^2$ ---------- 2
Then, $2 / 3 = v^2 / V^2$
$v^2 / V^2 = \sqrt{2} / \sqrt{3}$

42. Kaleidoscope was invented by _____.
(A) Ray Tomlinson
(B) Tim Berners-Lee
(C) Alan Blumlein
(D) David Brewster

Ans.42(D) The name is derived from the Greek words kalos ("beautiful"), eïdos ("form"), and skopeïn ("to view"). The kaleidoscope was invented by Sir David Brewster about 1816.

43. What is the principle by which a cooling system (Radiator) in a motor car works?
(A) Conduction only
(B) Onvection only
(C) Adiation only
(D) Both conduction and radiation W

Ans.43(B) By convection a cooling system (Radiator) in a motor car works.

44. The instrument used to study the laws of vibrating string is _____.
(A) Hydrometer **(B)** Sonometer
(C) Sphygmomanometer **(D)** Electrometer

Ans.44(B) A Sonometer is a device for demonstrating the relationship between the frequency of the sound produced by a plucked string, and the tension, length and mass per unit length of the string.

45. Teach Text' is a text editor in which of the following operating systems?
(A) Windows **(B)** Google Chrome
(C) UC browser **(D)** Macintosh

Ans.45(D) Edit was included with early versions of the basic system software to demonstrate the use of the Macintosh user interface.

46. If there were no atmosphere the average temperature on the surface of the earth would be.
(A) Higher
(B) Lower
(C) Same as today
(D) Zero degrees Celsius

Ans.46(D) The greenhouse effect keeps the average surface temperature of the planet at around 15°**(C)** If this effect was absent, the average surface temperature would drop to below zero - like -20°C; with the result, all water on Earth would freeze, the oceans would turn into ice - and life on earth as we know it, would not exist.

47. The strength of a force is usually expressed by its-
(A) Acceleration **(B)** Direction
(C) Iteraction **(D)**Magnitude

Ans.47(D) The strength of a force is expressed by its magnitude. The magnitude of a force is expressed in the SI unit of force called Newton. 1 Newton is the force which can make an object of 1-kilogram mass to move at a speed of 1 meter per second.

48. Transfer of heat energy from the sun to the moon takes place by.
(A) Radiation only
(B) Radiation and conduction
(C) Radiation and convection
(D) Radiation, conduction, and convection

Ans.48(A) In space, heat gets transferred by radiation. This is mainly in the infrared band of electromagnetic waves. Earth, gets heated up due to earth's atmosphere and also due to greenhouse effect. Since the moon doesn't have an atmosphere, it won't heat or cool through conduction or convection.

49. The force of gravitation between two bodies does not depend on.
(A) Their separation
(B) The product of their masses
(C) The sum of their masses
(D) The gravitational constant

Ans.49(C) The attraction force acting between any two objects is proportional to the product of the mass of the objects and inversely proportional to the square of the distance between them.

50. When a ball is thrown vertically upwards, which of the following quantities remains constant during its motion?
(A) Energy **(B)** Displacement
(C) Velocity **(D)** Acceleration

Ans.50(D) When you throw an object upwards, it will eventually fall back to the ground under the earth's gravity. In fact, all objects near the earth's surface fall with a constant acceleration of about 9.8.

51. Which system is used by the Digital Computers to encode data and Programs?
(A) Decimal **(B)** Binary
(C) Hexa decimal **(D)** Octal

Ans.51(B) Computers use binary digits 0 and 1 to store data. A binary digit, or bit, is the smallest unit of data in computing. Binary numbers are made up of binary digits (bits), eg

the binary number 1001. The circuits in a computer's processor are made up of billions of transistors

52. 'Queensbury rules' is code of rules that directly influences which of the following sport?
(A) Cricket **(B)** Football
(C) Boxing **(D)** Hockey

Ans.52(C) The Marquess of Queensberry Rules, also known as Queensbury Rules, are a code of generally accepted rules in the sport of boxing

53. Which one of the following is not a property of electromagnetic waves?
(A) Electromagnetic waves do not show interference and diffraction.
(B) Oscillating electric field and magnetic field are perpendicular to each other.
(C) Electromagnetic waves are transverse waves
(D) Electromagnetic waves do not require a medium to propagate.

Ans.53(A) All types of waves cause diffraction (sound, water wave, electromagnetic wave etc.).

54. During _____ motion of an object along a straight line, the change in velocity of the object for any time interval is zero.
(A) Linear **(B)** Translational
(C) Equilibrium **(D)** Uniform

Ans.54(D) Uniform speed (same linear motion) - in this the velocity is unchanged,

55. Work done is defined as the dot product of which of the following vectors?
(A) Force and acceleration
(B) Force and area
(C) Force and instantaneous
(D) Force and displacement

Ans.55(D) Work done is equal to product of magnitude of force and magnitude of displacement and cosine of angle between them.

56. The action of a nib split at the top of the pen is explained by
(A) Gravity flow
(B) Diffusion of fluid
(C) Capillary action
(D) Osmosis of liquid

Ans.56(C) As the sides of the nib spread and flex, ink moves down the open split (Gravity) and is drawn onto the absorbent paper (Capillary).

57. Which of the following is not true about X-rays?
(A) Have low penetrating power
(B) Travel with the speed of light
(C) Can be reflected or refracted
(D) Can affect photographic plates

Ans.57(A) Wilhelm Rantgen demonstrated in 1895 that when the cathode ray collided with a substance present in the tube, the electrons produced rays that could produce fluorescence in the fluorescent material placed outside the cathode ray cell. Because Rantgen did not know the nature of these rays. Was. , So they named it X-ray. X-rays are not deflected in electrical and magnetic fields. Otherwise, these rays have high penetrating power, due to which they are used in the internal aggradation of objects. These rays have very low wavelength (0.1nm). They also exhibit magnetic behavior.

58. What type of vibrations is produced in a sitar wire?
(A) Longitudinal vibration
(B) Transverse vibration
(C) Both 1 and 2
(D) None of the above

Ans.58(A) The sitar wire produces longitudinal vibrations.

59. Which of these quantities is not scalar quantity?
(A) Mass **(B)** Density
(C) Momentum **(D)** Work

Ans.59(C) The physical quantities which are specified with the magnitude or size alone are

scalar quantities. For example, length, speed, work, mass, density, etc.
Vector Quantities: Vector quantities refer to the physical quantities characterized by the presence of both magnitude as well as direction. Some examples of vector quantities include force, velocity, acceleration, displacement and momentum.

60. The motion of the ceiling fan, the motion of the mill plates is what kind of motion?
(A) Linear motion
(B) Circular motion
(C) Rotational motion
(D) Oscillation motion

Ans.60(C) When an object revolves around its axis, its motion is called rotational motion. Such as the speed of ceiling fans,

61. Swinging children in seesaw is example of what kind of motion?
(A) Linear motion **(B)** Circular motion
(C) Rotational motion
(D) Oscillation motion

Ans.61(D) To move the equilibrium position of a body is called oscillatory motion or compound motion.

62. Which of the following is NOT a conservative force?
(A) Electrostatic force
(B) Magnetic force
(C) Force in an elastic spring
(D) Frictional force

Ans.62(D)

63. If a ball rolls on the floor, it stops at a distance. This is the example of which force?
(A) Frictional force **(B)** Muscular force
(C) Gravitational force **(D)** Magnetic force

Ans.63(A) When an object is rolled on a surface, the friction force between the object and the surface between the surface is called the lotonic friction force.

64. Rotation of moon around the sun is the example of which type of motion?
(A) Linear motion **(B)** Circular motion
(C) Rotational motion
(D) Oscillation motion

Ans.64(B) Satellites (Moon) move in circular orbit around the Earth.

65. The black board seems black because it ____.
(A) Reflects every colour
(B) Does not reflect any colour
(C) Absorbs black colour
(D) Reflects black colour

Ans.65(B) balckbord does not reflect any color.

66. What is the speed of light?
(A) 280,000 kilometers per second
(B) 299,792 kilometers per second
(C) 320,000 kilometers per second
(D) 380,000 kilometers per second

Ans.66(B) Trick of light (which is usually: C is denoted by) a physical constant is. Its exact value in vacuum is 299,792,458 meters per second

67. Two system are said to be in thermal equilibrium, if and only if
(A) There can be a heat flow between them even if they are at different temperature.
(B) There cannot be a heat flow between them even if they are at different temperature
(C) Their temperatures are slightly different
(D) There is no heat flow between them

Ans.67(D) Two system are said to be in thermal equilibrium, if there is no heat flow between them

68. A mobile phone charger is.
(A) An inverter
(B) An UPS
(C) A step-down transformer
(D) A step-up transformer

Ans.68(C) A mobile phone charger is step-down transformer

69. The power of a lens of focal length 40 cm is _____.

(A) 80 D **(B)** 40 D
(C) 2.5 D **(D)** 1.25 D

Ans.69(C) Power = 1 /Focal length
P = 100cm/40
P = 2.5D
P = 100cm/40
P = 2.5D

70. The focal length of convex lens is.
(A) The same for all colours
(B) Maximum for blue light
(C) Shorter for blue light than for red
(D) Shorter for red light than for blue

Ans.70(C) In case of a lens, large the value of refractive index shorter is the focal length. Since wavelenth of red light is more than that of blue light, focal length for red light will be more than that for blue light.

71. X-rays are not used for radar purpose because
(A) They are not reflected by the target
(B) They are completely absorbed by air
(C) They are not electromagnetic wave
(D) All of the above

Ans.71(D) X rays, having extremely high frequency and low wavelength, would not be suitable to use as RADAR because they would penetrate the obstacle instead of reflecting and coming back.

72. Which of the following is not a high-level programming language?
(A) FORTRAN **(B)** PHP
(C) COBOL **(D)** Lisp

Ans.72(B) PHP is a commonly used scripting language.

73. Who is the founder of you tube?
(A) Chad Hurley **(B)** Steve Chen
(C) Jawed Karim **(D)** All of the above

Ans.73(D) YouTube is an American video-sharing platform headquartered in San Bruno, California. Three former PayPal employees—Chad Hurley, Steve Chen, and Jawed Karim—created the service in February 2005. Google bought the site in November 2006 for US$1.65 billion; YouTube now operates as one of Google's subsidiaries.

74. Which frequency range of E.M. waves are used for commercial FM radio
(A) 99MHz to 108 MHz
(B) 88 KHz to 108 KHz
(C) 88 GHz to 108 GHz
(D) None of these

Ans.74(D) FM radio waves are also used for commercial radio transmission, but in the frequency range of 88 to 108 MHz.

75. Albert Einstein was awarded Nobel Prize for which of the following:
(A) Theory of Relativity
(B) Laws of Photo-Electric Effect
(C) Principle of Wave-Particle Duality
(D) None of the above

Ans.75(B) The Nobel Prize in Physics 1921 was awarded to Albert Einstein "for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect." Albert Einstein received his Nobel Prize one year later, in 1922.

76. Which of the following is not a vector?
(A) Energy **(B)** Force
(C) Momentum **(D)** Acceleration

Ans.76(A) Vector quantities are those physical quantities which are represented by their magnitude and direction. For example: acceleration, velocity, displacement, momentum, force, etc

77. "All planets move about the Sun in elliptical orbits, having the Sun is at the focus". This is known as-
(A) Newton's first law **(B)** Ohm's first law
(C) Kepler's first law **(D)** Lenz's first law

Ans.77(C) In Kepler's laws of planetary motion. …be stated as follows: (1) All planets move about the Sun in elliptical orbits, having the Sun as one of the foci. (2) A radius vector joining any planet to the Sun sweeps out equal areas in equal lengths of time.

78. Who given the name of Gamma rays based on their relatively strong penetration of matter?
(A) Ernest Rutherford **(B)** Henri Becquerel
(C) W Rontgen **(D)** none of these

Ans.78(A)

79. The temperature at which Fahrenheit and Celsius's scales are same –
(A) 40 **(B)** -40
(C) -34 **(D)** -140

Ans.79(B) To find the temperature when both are equal, we use an old algebra trick and just set $^{o}F = {}^{o}C$ and solve one of the equations. So, the temperature when both the Celsius and Fahrenheit scales are the same is -40 degrees.

80. Ram is not seen clearly above 15 meters. He is suffering from which eye decease?
(A) Hypermetropia **(B)** Myopia
(C) Presbyopia **(D)** Astigmatism

Ans.80(A) In this vision defect, a distant object is clearly visible to humans, but the nearest object is not clearly visible. When this defect occurs in the eyes, the same ray of light makes the posterior reflection of the retina after refraction by the beam.

81. Which of the following is not an Output device?
(A) Monitor **(B)** Projector
(C) Keyboard **(D)** Mother board

Ans.81(C) A computer keyboard is one of the primary input devices used with a computer.

82. Which one among the following given processes cannot be demonstrated with the sound wave?
(A) Refraction **(B)** Polarization
(C) Interference **(D)** Transmission

Ans.82(A) Three ways that waves may interact with matter are reflection, refraction, and diffraction.

83. Energy-mass relation is related to.
(A) Quantum theory
(B) Theory of relativity
(C) Law of motion
(D) Law of gravitation

Ans.83(B) General relativity theory or general relativity theory, which in English is called "General Theory of Relativity"

84. Sound of frequency greater than 20000 Hz known as .....
(A) Sonic **(B)** Infrasonic
(C) Ultrasonic
(D) None of the above

Ans.84(C) Ultrasonic sound, which bats use for introduction, is in-perceptible to people as it has frequencies higher than 20,000Hz. In like manner, sound lower than 20Hz can't be heard;

85. The unit to measure the speed of ships is-
(A) Mile **(B)** Meter
(C) Knot **(D)** Mph

Ans.85(C) Knot, in navigation, measure of speed at sea, equal to one nautical mile per hour.

86. The temperature of the stars can be estimated by.
(A) Wien's displacement law
(B) Rayleigh-Jeans law
(C) Faraday's law
(D) Coulomb's law

Ans.86(B) Rayleigh-Jeans law -Apart from the Sun, the temperature of a star can be approximated by considering the energy emitted from it as a black ray vi ray

87. In electric supply lines in India, which parameter is kept constant?
(A) Voltage **(B)** Current
(C) Frequency **(D)** Power

Ans.87(C) The frequency of a repeated event (a repeated event) that occurs in unit time is called the frequency of that event

88. Sun appears reddish during the rising and setting time, because.
(A) The atmosphere absorbs short wavelength more than long wavelengths.

(B) Red light is emitted in a huge amount by it
(C) The atmosphere absorbs long wavelength more than short wavelengths.
(D) Light of shorter wavelengths are scattered to a greater extent than the longer wavelengths by the atmosphere.

And.88(D) The light from the Sun travels through Earth's atmosphere it undergoes scattering before it reaches us. The extent of scattering is not uniform for all colours. Light of shorter wavelengths, such as violet, blue, green and yellow undergoes greater scattering than those of longer wavelengths, such as orange and red.

89. In RADAR we use-
(A) Ultrasonic waves
(B) Infra sonic waves
(C) Radio waves
(D) Audible waves

Ans.89(C) Radar (radar) is a device with the help of radio waves to detect distant objects and to determine their position, ie direction and distance.

90. If the distance between two objects is doubled, the force of attraction between them will,
(A) Become ¼ times **(B)** Become 2 times
(C) Become 1/8 times **(D)** Remains same

Ans.90(A) If the distance between two objects is doubled, the force of attraction between them will 1/4.

91. A body has a mass of 6 kg on the earth, when measured on the moon, its mass would be.
(A) Nearly 1 kg **(B)** Less than 1 kg
(C) Less than 6 kg **(D)** 6 kg

Ans.91(A) That the gravity force on the moon is 1/6 times the gravity of the Earth. ... If the mass of an object is 6 kg on the surface of the Earth, 1 Kg will it be on the Moon

92. The minority charge carriers in N-type semiconductor is?
(A) Electron **(B)** Hole
(C) Proton **(D)** Neutron

Ans.92(A) The less abundant charge carriers are called minority carriers; in n-type semiconductors they are holes, while in p-type semiconductors they are electrons. If an intrinsic semiconductor is doped with a donor impurity then the majority carriers are electrons.

93. During cold weather, touch the iron cube and the wooden cube in the morning, then the iron cube is colder because.
(A) The temperature of the iron cube is less than the wood cube.
(B) Iron is a good conductor of heat than wood cube.
(C) Iron cube is a poor conductor of heat compared to wood cube.
(D) The iron cube is heavier than the wood cube.

Ans.93(B) During cold weather, touch the iron cube and the wooden cube in the morning, then the iron cube is colder because. Iron is a good conductor of heat than wood cube.

94. What is a transformer?
(A) Converts DC into AC.
(B) Used to reduce and increase AC voltage.
(C) Converts AC voltage to DC voltage.
(D) Converts electrical energy into mechanical energy.

Ans.94(B) A transformer is a device that is used to either raise or lower voltages and currents in an electrical circuit. In modern electrical distribution systems, transformers are3used to boost voltage levels so as to decrease line losses during transmission.

95. Who invented Velcro?
(A) Thomas Edison **(B)** William Harvey
(C) George de Mestral **(D)** Robert Boyles

Ans.95(C) The VELCRO® brand of hook and loop was invented by a man named George de Mestral in the 1940's while hunting in the Jura mountains in Switzerland. Mr. de Mestral, a Swiss engineer, realized that the tiny hooks of the cockle-burs were stuck on his pants and in his dog's fur and wondered how they attached themselves.

96. In Microsoft Word, _____ allows us to move selected paragraphs to the right.
(A) Decrease Indent **(B)** Increase Indent
(C) Double Indent **(D)** Single Indent

Ans.96(B) In Microsoft Word, Increase Indent allows us to move selected paragraphs to the right.

97. The incident ray, the _____ at the point of incidence and the reflected ray all lie in the same plane.
(A) Surface **(B)** Tangent
(C) Normal
(D) Angle of reflection

Ans.97(C) The incident ray, the Normal at the point of incidence and the reflected ray all lie in the same plane.

98. What is the unit of Electric conductivity?
(A) Siemens per meter **(B)** Ohm per meter
(C) Kilogram per meter
(D) Newton per meter

Ans.98(A) Conductivity (or specific conductance) of an electrolyte solution is a measure of its ability to conduct electricity. The SI unit of conductivity is Siemens per meter (S/m).

99. Which of the following is the distance between Sun and Earth?
(A) 144.6Million km
(B) 14 3.6Million km
(C) 149 6.Million km
(D) 14 7.4Million km

Ans.99(C) Earth orbits the Sun at an average distance of 149.60 million km (92.96 million mi).

100. How many kilometers in one mile?
(A) 1.524534 **(B)** 1.609344
(C) 0.539478 **(D)** 2.035355

Ans.100(B) You can easily convert 1 mile into kilometers using each unit definition:
Mile
5280 ft = 1609.344 m
Kilometers
1 km = 1000 m
With this information, you can calculate the quantity of kilometers 1 mile is equal to.

101. The thickness of the ozone layer is measured?
(A) Dobson **(B)** Barrel
(C) Bar **(D)** Decibel

Ans.101(A) A dobson unit is the most basic measure used in ozone research. One Dobson Unit (DU) is defined to be 0.01 mm thickness at STP (standard temperature and pressure).

102. Nuclear reactor is a discovered by _____.
(A) K. Onnes **(B)** H. Devi
(C) Fermi **(D)** L. D Forest

Ans.102(C) Enrico Fermi was an Italian (later naturalized American) physicist and the creator of the world's first nuclear reactor, the Chicago Pile-1. He has been called the "architect of the nuclear age" and the "architect of the atomic bomb". He was one of very few physicists to excel in both theoretical physics and experimental physics. Fermi held several patents related to the use of nuclear power, and was awarded the 1938 Nobel Prize in Physics for his work on induced radioactivity by neutron bombardment and for the discovery of trans uranium elements.

103. Which of the following device converts chemical energy in to electrical energy?
(A) Battery **(B)** Loud Speaker
(C) Solar Cell **(D)** Electric Motor
Ans.103(A) Battery is a device that converts chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction.

104. Which lens are used to correct the Myopia (Near sightedness) defect?
(A) Concave Lens **(B)** Convex Lens
(C) Bipolar Lens
(D) None of the above

Ans.104(A) Concave Lens is used for the myopia.

105. Astronauts use radios to communicate, because _____.
(A) Sound travels at very high speed in vacuum
(B) Sound does not travel in vacuum
(C) Sound in the vacuum may burst
(D) Sound turns into light in vacuum

Ans.105(B) Space is a vacuum, Approximately there is one atom per cubic centimetre in space. With such low density, atoms are not close enough for the sound to travel or bounce and reach the eardrums. So, in simple terms – No Atoms, no waves and hence, no sound. Spaceship don't actually make noise in space unless they are in the atmosphere of planet. Also, sound cannot travel through vacuum!

106. A solar panel is in kept black surface so that it absorbs more _____.
(A) Heat **(B)** Water
(C) Air **(D)** Oxygen

Ans.106(A) Solar panels are blue due to the type of silicon (polycrystalline) that is used for a certain set of solar panels. ... Black solar panels (monocrystalline) are often more efficient as black surfaces more naturally absorb light

107. The Laser is a beam of radiations which are-
(A) Non-coherent and non-monochromatic
(B) Coherent and non-monochromatic
(C) Non-coherent and monochromatic
(D) Coherent and monochromatic
Ans.107(D) The Laser is a beam of radiations which are Coherent and monochromatic

108. Why is used earthing in the electrical equipment?
(A) To avoid any kind of damage
(B) To prevent from Current
(C) To stop short circuit
(D) All of the above

Ans.108(D) Earthing is used to protect you from an electric shock. It does this by providing a path (a protective conductor) for a fault current to flow to earth. It also causes the protective device (either a circuit-breaker or fuse) to switch off the electric current to the circuit that has the fault

109. When pressing the two pieces of ice together, the pieces stick together, because-
(A) With high pressure, the melting point of the ice decreases.
(B) With Higher pressure the melting point of ice increases.
(C) If the pressure is high, the melting point of the ice decreases first and then increases.
(D) There is no connection between pressure and melting point.

Ans.109(A) When the two ice cubes are pressed together, melting point of ice is lowered, so they melt to form a thin layer of water (between them).

110. What is a Noisy Intermediate Scale Quantum (NISQ) technology?
(A) A technology where a computer injects a noise in large scale for running algorithms for quantitative comparison
(B) A technology of the future where quantum computers with 50 to 100 qubits that perform tasks exceeding those of today's digital computers
(C) A technology in use in National Institute of Standard and Quality computer
(D) A technology for suppressing electromagnetic interference from all sources

Ans.110(B) It's an acronym which means Noisy Intermediate Scale Quantum. Intermediate scale indicates that we're talking about devices that are large enough, perhaps 50 qubits or more is enough, that we can't by brute force simulate the quantum system using our most powerful existing digital computers.

111. What is the goal of LOON project of Google X – an R&D facility founded by Google?
(A) Expanding coverage of Internet connectivity with stratospheric balloons
(B) To create kites that harness wind energy to generate electricity efficiently from wind
(C) An autonomous delivery drone service aiming to increase access to goods, reduce traffic congestion in cities, and help ease the CO2 emissions
(D) Transforming mobility with self-driving cars

Ans.111(A) Project Loon was a project of X that aims to bring internet access to everyone by creating an internet network of balloons flying through the stratosphere. It uses wireless routers in balloons that are above weather and plans to give access to the internet to those who can't reach it or are in need of help.

112. A popular form of activity for businesses and individuals to increase hits on their websites is SEO. What is the full form of SEO?
(A) Search Engine Optimization
(B) Security Embedded in Organization
(C) Search Embedded Optimization
(D) Site Engine Optimization

Ans.112(A) Search engine optimization (SEO) is the process of increasing the quality and quantity of website traffic by increasing the visibility of a website or a web page to users of a web search engine.

113. What is the unit of Magnetic flux density?
(A) Tesla **(B)** Weber
(C) Farad **(D)** None of these

Ans.113(A) Magnetic flux density is defined as the amount of magnetic flux in an area taken perpendicular to the magnetic flux's direction. Tesla is unit of it.

114. Name the physicist awarded Nobel Prize for Quantum Theory in 1918?
(A) Albert Einstein **(B)** Niels Bohr
(C) Max Planck **(D)** Burry

Ans.114(C) The Nobel Prize in Physics 1918 was awarded to Max Karl Ernst Ludwig Planck "in recognition of the services he rendered to the advancement of Physics by his discovery of energy quanta." Max Planck received his Nobel Prize one year later, in 1919.

115. Communication satellites are used to:
(A) To transmit communication signals
(B) To receive and redirect communication signals
(C) To only receive the communication signal
(D) To provide information on national sources only

Ans.115(B) Communications satellites are commonly used for mobile phone signals, weather tracking, or broadcasting television programs. Communications satellites are artificial satellites that relay receive signals from an earth station and then retransmits the signal to other earth stations.

116. Kinetics is the study of-
(A) The rate of chemical reaction
(B) How fast the reactions go
(C) The mechanisms and paths of the molecules take injoining from one reactant to products
(D) All of these are correct

Ans.116(A) Chemical kinetics. Chemical kinetics, also known as reaction kinetics, is the branch of physical chemistry that is concerned with understanding the rates of chemical reactions.

117. J. J. Thomson's proposed model of action is generally called ..... model.
(A) Cream and cake
(B) Plum and pudding
(C) Plum and cake
(D) Cream and pudding

Ans.117(B) Thomson in 1904 and is known as the Plum pudding model or the Thomson model of the atom.

118. When a motor boat in a sea travels faster than sound then waves just like shock- waves are produced on the surface of water. These waves are called -
(A) Bow Waves
(B) Constructive waves
(C) Destructive waves
(D) All of the above

Ans.118(A) When a motor boat in a sea travels faster than sound, then waves just like shock-waves are produced on the surface of water. These waves are called bow waves.

119. If Mach number is greater than 1 then the body (source) is said to be moving with –
(A) Hypersonic **(B)** Subsonic
(C) Supersonic **(D)** None of these

Ans.119(C) If Mach number is greater than 1 then the body (source) is said to be Supersonic

120. If Mach number is greater than 5 then the body (source) is said to be moving with –
(A) Hypersonic **(B)** Subsonic
(C) Supersonic **(D)** None of these

Ans.120(A) If Mach number is greater than 5 then the body (source) is said to be Hypersonic.

121. If Mach number is less than 1 then the body (source) is said to be moving with –
(A) Hypersonic **(B)** Subsonic
(C) Supersonic **(D)** None of these

Ans.121(B) If Mach number is greater than 5 then the body (source) is said to be Subsonic.

122. A body moving with supersonic speed in air leaves behind it a conical region of disturbance which spreads continuously. Such a disturbance is called –
(A) Infrasonic wave **(B)** Electric wave
(C) Sonic wave **(D)** Shock wave

Ans.122(D) In physics, a shock wave (also spelled shockwave), or shock, is a type of propagating disturbance that moves faster than the local speed of sound in the medium. Like an ordinary wave, a shock wave carries energy and can propagate through a medium but is characterized by an abrupt, nearly discontinuous, change in pressure, temperature, and density of the medium.

123. It is difficult to walk on ice than on road because.
(A) Ice is harder than road
(B) Road is harder than ice
(C) Ice does not offer any reaction, when we push it, with our foot
(D) Ice has a lesser friction than road

Ans.123(D) Ice has a lesser friction than road.

124. Which of the following is the slowest process of heat transfer?
(A) Conduction **(B)** Convection
(C) Radiation **(D)** Insolation

Ans.124(A) The slowest mode of transfer of heat is conduction because it takes place from particle to particle.

125. Why does the bottom of a lake not freeze in severe winter even when the surface is all frozen?
(A) The fish increases the temp of lake water
(B) The conductivity of ice is low
(C) Because of sublimation of water
(D) The temperature of the earth at the bottom of the lake is high

Ans.125(A) Ponds and lakes freeze from the top down, meaning that beneath the icy surface there is usually a layer of liquid water where fish swim.

126. A hot substance loses heat to its surroundings in the form of heat radiation. The rate of loss of heat depends on the-
(A) Pressure of the surroundings
(B) Temperature of the surroundings
(C) Temperature difference between the substance and its surroundings
(D) Average volume of the object and its surroundings

Ans.126(B) In a cold body to a hot body heat transit of heat transfer (heat transfer) says. When the temperature of an object is different from that of its surroundings or other object,

127. The capacity of a body to do work is known as:
(A) Energy **(B)** Power
(C) Momentum **(D)** Strength

Ans.127(A) Energy is the of a physical system to perform work. Energy exists in several forms such as heat energy, kinetic or mechanical energy, light energy, potential energy, electrical energy, or other forms. Joule is also the SI unit of work.

128. _____ is the transfer of heat due to bulk movement of molecules within fluids such as gases and liquids, including molten rock?
(A) Conduction only
(B) Convection only
(C) Radiation
(D) Both conduction and convection

Ans.128(B) Convection is the heat transfer due to the bulk movement of molecules within fluids such as gases and liquids, including molten rock.

129. By the use of photovoltaic cell while converting solar energy which of the following is produced?
(A) Light energy **(B)** Electric energy
(C) Chemical energy **(D)** Heat energy

Ans.129(B) Photovoltaics are best known as a method for generating electric power by using solar cells to convert energy from the sun into a flow of electrons by the photovoltaic effect.

130. Hydraulic brakes used in automatic vehicles is direct virtual application of which law?
(A) Pascal's law
(B) Archemedes' principle
(C) Charles law
(D) Boyle's law

Ans.130(A) Pascal's law basically states that any pressure applied to a fluid inside a closed system will transmit that pressure equally in all directions throughout the fluid. This law is the basic principle that causes hydraulic power in heavy construction machines to work.

131. Which among the following is a light sensitive device used for converting images to their digital form?
(A) Joystick **(B)** Monitor
(C) Scanner **(D)** ROM

Ans.131(C) Scanner is a light sensitive device used for converting images to their digital form.

132. When an object is kept between two parallel plane mirrors then what is the number of images formed?
(A) 1 **(B)** 2
(C) 4 **(D)** Infinite

Ans.132(D) When the object is placed between two parallel plane mirrors, Infinite images will be formed.

133. Who among the following first used and when the term Nanotechnology?
(A) Richard Feynman, 1959
(B) Norio Taniguichi, 1974
(C) Erie Drexler, 1986
(D) Sumiolima, 1991

Ans.133(C) When the term "nanotechnology" was independently coined and popularized by Eric Drexler (who at the time was unaware of an earlier usage by Norio Taniguchi) it referred to a future manufacturing technology based on molecular machine systems.

134. Which of the following is not a web browser?
(A) Opera **(B)** Google Apps
(C) Vivaldi **(D)** Mozilla firefox

Ans.134(B) The distinction therefore between Chrome Apps and Google Apps is that Chrome is a browser, while Google Apps is not;

135. DuckDuckGo is a-
(A) Search engine **(B)** Web browser
(C) Virus **(D)** News web site

Ans.135(A) protecting searchers' privacy and avoiding the filter bubble of personalized search results.

136. Heat given to a body which raises its temperature 1 degree Celsius is known as-
(A) Water equivalent
(B) Thermal Capacity
(C) Specific Heat
(D) Temperature gradient

Ans.136(B) Explanation: Heat required to raise the temperature of a body through 1°C is called thermal capacity.

137. Which of the following laws was formulated was Nernst?
(A) First law of thermodynamics
(B) Second law of thermodynamics
(C) Third law of thermodynamics
(D) All of the above

Ans.137(C) The Nernst heat theorem was formulated by Walther Nernst early in the twentieth century and was used in the

development of the third law of thermodynamics.

138. What is the S.I. unit of force?
(A) Kg m/sec2 **(B)** Kg m/sec
(C) Meter/sec **(D)** Kg sec/m2

Ans.138(A) The S.I. unit of force is newton(N). newton can also be denoted in fundamental units as kg. Kg m/sec2.

139. A/an _____ is used to measure the force and velocity of wind?
(A) Speedometer **(B)** Odometer
(C) Anemometer **(D)** Hygrometer

Ans.139(C) An anemometer is a device used for measuring wind speed and direction. It is also a common weather station instrument.

140. Which of the following effect cannot be produced by unbalanced force acting on a body?
(A) Change in speed of the body
(B) Change in shape of the body
(C) Change in direction of motion
(D) Change in state of rest

Ans.140(B) Change in shape of the body cannot be produced by unbalanced force acting on a body.

141. If we release a magnet held in our hands, it falls to the ground. The force which makes the magnet fall down is example of?
(A) Balance force
(B) Unbalance force
(C) Electrostatic force
(D) Van der wall force

Ans.141(B) Change in shape of the body cannot be produced by unbalanced force acting on a body?

142. A fielder pulls his hand backward after catching a cricket ball. This enables the fielder to-
(A) Extra large force on the ball
(B) Reduce the force exerted by the ball
(C) Increase the rate of change of momentum
(D) Keep the ball in hands firmly

Ans.142(B) Reduce the force exerted by the ball A fielder pulls his hand backward after catching a cricket ball.

143. Red light is used for signal because it has _____.
(A) Long wavelength
(B) High Intensity
(C) High Frequency
(D) Low refraction in the medium

Ans.143(A) Red colour has longest wavelength. Since it is visible from a long distance,

144. The sky appears blue because of -
(A) Atmospheric water vapour
(B) Scattering of light
(C) Reflection on sea water
(D) Emission of blue wavelength by the Sun

Ans.144(B) Light scattering is a type of elastic scattering, because the scattering that is to be done depends on the wavelength of the light. Therefore, blue light with shorter wavelengths collides with air molecules and disintegrates with the sky, making it blue.

145. Stars appear twinkling because of _____ light.
(A) Reflection **(B)** Refraction
(C) Dispersion **(D)** Scattering

Ans.145(B) In the night, we see the stars twinkling, we feel as if the stars do not stop flashing continuously, but the stars are constantly illuminated by their own light, various layers in our atmosphere, troposphere, The stratosphere, the middle, the temperature … there is a change in their density. Due to which the phenomenon of refraction occurs and the stars are seen flickering.

146. Optical Fiber work on the principle of -
(A) Dispersion of light
(B) Diffraction of light
(C) Total internal reflection
(D) Interference of light

Ans.146(C) Optical Fibre: Principle and Working. The optical fibre is a device which works on the principle of total internal

reflection by which light signals can be transmitted from one place to another with a negligible loss of energy.

147. Which one of the following instrument is used to study dispersion of light?
(A) Actinometer **(B)** Cathetometer
(C) Spectrometer **(D)** Densitometer

Ans.147(C) Spectrometer is used to study dispersion of light.

148. What is the coefficient of restitution for a perfectly elastic collision?
(A) 0 **(B)** 1
(C) -1 **(D)** 100

Ans.148(B) The coefficient of restitution is a number which indicates how much kinetic energy (energy of motion) remains after a collision of two objects. If the coefficient is high (very close to 1.00) it means that very little kinetic energy was lost during the collision.

149. The gravitational force of attraction between two bodies is _____ the distance between the two bodies.
(A) Inversely proportional to the
(B) Directly proportional to the square of
(C) Inversely proportional to the square of
(D) Directly proportional to the

Ans.149(C) gravitational forces are inversely proportional to the square of the distance between the two bodies.

150. A ray of white light strikes the surface of an object. If all the colours are reflected the surface would appear:
(A) Black **(B)** White
(C) Grey **(D)** Red

Ans.150(B) A ray of white light strikes the surface of an object. If all the colours are reflected the surface would appear white.

151. When a glass rod is rubbed with silk then which type of charge is created on it?
(A) Electric charge **(B)** Positive charge
(C) Negative charge
(D) None of the above

Ans.151(B) The core has positive charge, the electrons have negative charge. When you are rubbing the glass rod with the silk cloth, electrons are stripped away from the atoms in the glass and transferred to the silk cloth. This leaves the glass rod with more positive than negative charge, so you get a net positive charge.

152. When a body motion on a circular path, then one force works towards the center of the path, which is called?
(A) Centripetal force **(B)** Centrifugal force
(C) Both **(D)** None

Ans.152(A) Concept of Centripetal Force: A force that acts on a body that performs circular motion and acts along the radius of the circular path and is directed towards the center of the path known as the centripetal force.

153. What is the unit of electric current?
(A) Meter **(B)** Ampere
(C) Kelvin **(D)** Candela

Ans.153(B) The SI unit of electric current is ampere, which is the flow of electric charge across a surface at a rate of one coupling per second.

154. The burn caused by steam is more severe than, boiling water because-
(A) Steam has latent heat.
(B) Steam enters the body.
(C) Steam is light
(D) All of the above

Ans.154(A) Steam produces more severe burns than boiling water because the LATENT HEAT of steam is greater than water. It means that steam has greater heat energy than boiling water which causes more severe burns.

155. Which of the following has the longest wavelength?
(A) Blue light **(B)** Gamma ray
(C) X-ray **(D)** Red light

Ans.155(D) As the full spectrum of visible light travels through a prism, the wavelengths

separate into the colors of the rainbow because each color is a different wavelength. Violet has the shortest wavelength, at around 380 nanometers, and red has the longest wavelength, at around 700 nanometers.

156. FM radio broadcasts are a popular mode of communication today. What does FM stand for?
(A) Frequency Modulation
(B) Flexible Module
(C) Frequency mixing
(D) Flexible Multidimensional

Ans.156(A) Frequency modulation or FM is a form of modulation which conveys information by varying the frequency of a carrier wave.

157. India entered into space age by launching the satellite Aryabhata in the year?
(A) 1932 **(B)** 1965
(C) 1975 **(D)** 1990

Ans.157(C) Aryabhata was India's first satellite, named after the famous Indian astronomer of the same name. It was launched on 19 April 1975 from Kapustin Yar, a Russian rocket launch and development site in Astrakhan Oblast using a Kosmos-3M launch vehicle. It was built by the ISRO.

158. What is the distance between the poles of the mirror and the focus?
(A) Principal axis **(B)** Focal length
(C) Radius of curvature
(D) Center of curvature

Ans.158(B) The distance between Pole and focus is also known as focal length.

159. Which physical amount is obtained from the ratio of momentum and the velocity?
(A) Velocity **(B)** Acceleration
(C) Mass **(D)** Angular velocity

Ans.159(C) We know, Momentum = mass * velocity; So Momentum / Velocity = Mass

160. Rocket works on which principle?
(A) Energy Conservation
(B) Bernoulli theorem
(C) Conservation of Momentum
(D) Law of thermodynamics

Ans.160(C) Rocket works on the conservation of momentum. In a rocket, the fuel burns and produces gas at high temperature.

161. What is the measure by Cusec?
(A) Water drift **(B)** Depth of water
(C) Volume of water **(D)** Purity of water

Ans.161(A) It is not possible to measure a cusec in liters, because cusec is not a measurement of water, but a unit of water flow.

162. Soldering of two metals is possible due to the property of-
(A) Diffusion **(B)** Viscosity
(C) Surface tension **(D)** Cohesion

Ans.162(D) Soldering is the process of joining two metals by the use of a solder alloy, and it is one of the oldest known joining techniques. It is possible because of the property of cohesion,

163. Why boiling point of water decreases with altitude?
(A) Low pressure **(B)** Low temperature
(C) High temperature **(D)** High pressure

Ans.163(A) As elevation increases, atmospheric pressure decreases because air is less dense at higher altitudes. Because the atmospheric pressure is lower, the vapour pressure of the liquid needs to be lower to reach boiling point. The boiling point is lower at higher altitude.

164. When a piece of stone is immersed in water, it displaces water of equal-
(A) Density **(B)** Specific Gravity
(C) Mass **(D)** Volume

Ans.164(C) Archimedes' Principle states that upward buoyant force exerted on a body immersed in a fluid is equal to the weight of the fluid the body displaces.

165. First law of thermodynamics is normally related to-

(A) Charles's law
(B) Boyle's law
(C) Newton's law of cooling
(D) Law of conservation of Energy

Ans.165(D) The First Law of Thermodynamics states that heat is a form of energy, and thermodynamic processes are therefore subject to the principle of conservation of energy. This means that heat energy cannot be created or destroyed.

166. What is the standard unit of the mass?
(A) Quintal **(B)** Kg
(C) Gram **(D)** Newton

Ans.166(B) The standard International System of Units (SI) unit of mass is the kilogram (kg). first defined in 1795 as one cubic decimetre of water at the melting point of ice.

167. Which is the force that takes place between two magnetic poles?
(A) Electrostatic force **(B)** Magnetic force
(C) Gravitational force **(D)** All of the above

Ans.167(B) The force between two magnetic poles is called magnetic force.

168. What is the S.I. unit of concentration?
(A) Cubic meter per kilogram
(B) Ampere per meter
(C) Mole per cubic meter
(D) Kilogram meter per second

Ans.168(C) Molar concentration The SI unit is mol/m3.

169. What is the speed of light in a vacuum?
(A) 3×10^{8} m/s **(B)** 3×10^{5} m/s
(C) 3×10^{3} m/s **(D)** 3×10^{4} m/s

Ans.169(A) Speed of light in a vacuum 3.00×10^{8} m/s.

170. "The value of an electric current flowing in a conductor is directly proportional to its potential difference at its ends." Whose rule is it?
(A) Faraday's law **(B)** Ohm's law
(C) Lenz's law **(D)** Coulomb's law

Ans.170(B) Ohm's laws: The value of an electric current flowing in a conductor is directly proportional to its potential difference at its ends:

171. By the use of Solar panel while converting solar energy which of the following is produced?
(A) Light energy **(B)** Electric energy
(C) Chemical energy **(D)** Heat energy

Ans.171(B) Photovoltaics are best known as a method for generating electric power by using solar cells to convert energy from the sun into a flow of electrons by the photovoltaic effect. Solar cells produce direct current electricity from sunlight which can be used to power equipment or to recharge a battery.

172. Wy are impurities added to a semiconductor?
(A) To increase its life
(B) To enable it to withstand higher voltages
(C) To increase its electrical conductivity
(D) To increase its electrical resistivity

Ans.172(C) Here are two types of charge carriers in semiconductors. They are electrons and holes. Since conductivity depends on the no of charge carriers per unit volume, the conductivity increases. So, impurity is added to increase the carrier concentration.

173. What is the SI unit of resistance?
(A) Volt **(B)** Coulomb
(C) Ampere **(D)** ohm

Ans.173(D) The ohm (symbol: Ω) is the SI unit of electrical resistance, named after German physicist Georg Simon Ohm.

174. Raman effect involves
(A) Scattering of light
(B) Diffraction of light
(C) Interference of light
(D) All the above

Ans.174(A) Compton scattering is the scattering of a photon from an independently charged particle. If the charged particle is a bound electron then the energy of the photon must be much higher than the binding energy of the electron.

175. DC current can be controlled by which one of the following components?
(A) Impedance **(B)** Resistance
(C) Capacitance **(D)** Inductance

Ans.175(B) DC current be controlled by Resistance.

176. Ball pen works on the principles of-
(A) Viscosity
(B) Gravitational force
(C) Boyle's law
(D) Capilliarity and surface tension

Ans.176(D) The ball pen works on the principle of capillary action and surface tension. Explanation: Capillary action means that an ink is pulled due to the thin length of the capillary as a part of fluid moves out.

177. TV waves are otherwise known as
(A) Radio waves **(B)** Cosmic rays
(C) Micro waves **(D)** UV rays

Ans.177(A) TV waves are otherwise known as radio waves.

178. In a reactor, cadmium rods are used for ____.
(A) Absorping neutrons
(B) Speeding neutrons
(C) Slowing fast neutrons
(D) Dispersing neutrons

Ans.178(A) A slow-moving neutron is readily absorbed in the form of cadmium or boron. Therefore, they are used to control the fission rate in a nuclear reactor. When the cadmium rod is pushed into the reactor, the fission rate decreases and the fission rate increases when it is ejected.

179. Filament of an electric bulb is made of which element?
(A) Copper **(B)** Silver
(C) Iron **(D)** Tungsten

Ans.179(D) Filament of an electric bulb is made of Tungsten element.

180. Oil or soap film when in daylight appears coloured because of _____.
(A) Reflection **(B)** Refraction
(C) Interference **(D)** Surface energy

Ans.180(A) Oil or soap film when in daylight appears coloured because of Reflection.

181. A falling drop of rain water acquires the spherical shape due to which force?
(A) Viscosity
(B) Gravitational force
(C) Surface tension
(D) Atmospheric pressure

Ans.181(C) A falling drop of rain water acquires the spherical shape due to Surface tension force.

182. The principle of Dynamo was discovered by
(A) Max Planck
(B) Michael Faraday
(C) Albert Einstein
(D) Sir Humphrey Davy

Ans.182(B) The operating principle of electromagnetic generators was discovered in the years 1831–1832 by Michael Faraday.

183. In a sitar wire which one of the following types of vibration is produced?
(A) Progressive longitudinal
(B) Stationary longitudinal
(C) Progressive transverse
(D) Stationary transverse

Ans.183(D) Vibration occurs due to static transverse.

184. Recoil of a gun is an example of-
(A) Conservation of mass
(B) Conservation of energy
(C) Conservation into Kinetic Energy
(D) Conservation of linear momentum

Ans.184(D) The recoiling of gun is an example of the Law of Conservation of Linear Momentum.

185. Who of the following recognized that large quantity of energy is released as a result of the fusion of hydrogen nuclei to form deuterium?

(A) Enrico Fermi
(B) Glenn Seaborg
(C) Hans Bethe
(D) Werner Heisenberg

Ans.185(C) In the late 1930s Hans Bethe first recognized that the fusion of hydrogen nuclei to form deuterium is exoergic (i.e., there is a net release of energy) and, together with subsequent nuclear reactions, leads to the synthesis of helium.

186. Aviation fuel for Jet aero planes consists of purified
(A) Petrol (B) Kerosene
(C) Gasoline (D) Diesel

Ans.186(B) Kerosene purifies aviation fuel for jet aero aircraft.

187. The period of revolution of an earth's satellite close to the surface of the earth is_____.
(A) 50 minute (B) 65 minute
(C) 55 minute (D) 6 0minute

Ans.187(D) The period of revolution of an earth's satellite close to the surface of the earth is 60 minutes.

188. Which one of the following common devices works on the basis of the principle of mutual induction?
(A) Tube light (B) Transformer
(C) Photodiode (D) Led

Ans.188(B) The transformer is based on the principle of mutual induction.

189. Intensity of sound at a point is _____ its distance from the source.
(A) Directly proportional to
(B) Inversely proportional to
(C) Directly proportional to square of
(D) Inversely proportional to square of

Ans.189(D) Intensity of sound at a point is inversely proportional to square of its distance from the source.

190. What is the name of the nuclear reactor at trombay?
(A) Bhaba (B) Venus
(C) Aryabhatta (D) Apsara

Ans.190(D) Trombay was the nymph name of nuclear blocker.

191. Light from the star, Alpha Centauri, which is nearest to the earth after the sun, reaches the earth in_____.
(A) 4.2 seconds (B) 42 seconds
(C) 4.2 years (D) 42 years

Ans.191(C) Light from the star, Alpha Centauri, which is nearest to the earth after the sun, reaches the earth in 4.2 years.

192. Mirage is due to-
(A) Unequal heating of different parts of the atmosphere.
(B) Magnetic disturbances in the atmosphere.
(C) Depletion of ozone layer in the atmosphere.
(D) Equal heating of different parts of the atmosphere.

Ans.192(A) Mirage is an optical illusion caused by atmospheric conditions, especially the appearance of a sheet of water in a desert or on a hot road caused by the refraction of light from the sky by heated air.

193. Metals are good conductors of electricity because-
(A) They contain free electrons
(B) The atoms are lightly packed
(C) They have high melting point
(D) All of the above

Ans.193(A) Metals are good conductors of electricity because They contain free electrons.

194. Magnetism at the Centre of a bar magnet is _____.
(A) Maximum (B) Minimum
(C) Zero (D) All The above

Ans.194(C) Magnetism at the Centre of a bar magnet is zero.

195. out of the following, which is not emitted by radioactive substance?

(A) Electrons
(B) Electromagnetic radiations
(C) Alpha particles
(D) Neutrons

Ans.195(D) Neutrons Out of the which is not emitted by radioactive substance.

196. Lux is the SI unit of-
(A) Intensity of illumination
(B) luminous efficiency
(C) luminous flux
(D) luminous intensity

Ans.196(A) The SI unit of intensity of illumination (illuminance) is the lux.

197. Point A is at a lower electrical potential than point B. An electron between them on the line joining them will
(A) Move towards A
(B) Move towards B
(C) Move at right angles to the line joining A and B
(D) Remain at rest

Ans.197(B) Point A is at a lower electrical potential than point B. An electron between them on the line joining them will Move towards B.

198. What is the unit of measure of a magnetic field?
(A) Tesla (B) Mole
(C) Henry (D) siemens

Ans.198(A) The SI unit for magnetic field is the Tesla, which can be seen from the magnetic part of the Lorentz force law Fmagnetic = qvB to be composed of (Newton x second)/ (Coulomb x meter). A smaller magnetic field unit is the Gauss (1 Tesla = 10,000 Gauss).

199. Who was the first person to create a vacuum and to discover the principle of the barometer?
(A) Lord Kelvin
(B) Evangelista Torricelli
(C) Benjamin Franklin
(D) Alessandro Volta

Ans.199(B) Evangelista Torricelli is the first scientist to make vacuum and discover the principle of barometer.

200. The energy derived from the heat of Earth is called _____.
(A) Biomass Energy
(B) Tidal Energy
(C) Hydrogen Energy
(D) Geothermal Energy

Ans.200(D) Geothermal energy is heat derived within the sub-surface of the earth. Water and/or steam carry the geothermal energy to the Earth's surface.

201. What is that celestial object that is of very small radius and very high density?
(A) White Dwarf Star (B) Neutron Star
(C) Supergiant Star (D) Red Giant Star

Ans.201(D) A neutron star is a celestial object with very small radius (typically 18 miles/30 km) and very high density, composed mostly of closely packed neutrons.

202. Who received the very first Nobel Prize in Physics in 1901 for his discovery of X-rays?
(A) Luis Alvarez (B) Pierre Curie
(C) Wilhelm Röntgen (D) Henry Moseley

Ans.202(C) Wilhelm Conrad Röntgen, referred to as the father of diagnostic radiography, was a German physicist who first discovered the X-ray in 1895 and received the very first Noble Prize in physics in 1901.

203. The working of quartz crystal in the watch is based on which effect?
(A) Eliza effect
(B) Piezoelectric effect
(C) Electrocaloric effect
(D) Electro-optic effect

Ans.203(B) Inside a quartz clock or watch, the battery sends electricity to the quartz crystal through an electronic circuit. The quartz crystal oscillates (vibrates back and forth) at a precise frequency: exactly 32768 times each second. This is due to Piezoelectric Effect.

204. The force applied towards the center of the path in the vertical direction of the instantaneous velocity of a body is called ___?
(A) Centripetal force **(B)** Magnetic Force
(C) Gravitational Force
(D) Centrifugal force

Ans.204(A) Any net force causing uniform circular motion is called a centripetal force. The direction of a centripetal force is toward the center of curvature, the same as the direction of centripetal acceleration. According to Newton's second law of motion, net force is mass times acceleration.

205. If the temperature of a place Increases suddenly the relative humidity_____.
(A) Increases **(B)** Decreases
(C) Remains constant **(D)** Fluctuates

Ans.205(B) Hot air has the capacity to hold more water than cooler air. So, if the temperature rises and there's no extra moisture added to the air, the relative humidity will go down.

206. Which of the following is used to split white light into different colours?
(A) Water **(B)** Diamond
(C) Glass **(D)** Glass Prisms

Ans.206(D) Glass Prism is the device used to split white light into seven colour. 'Dispersion of Light' can be defined as the splitting of white light when it passes through a glass prism into its constituent spectrum of colors (i.e. violet, indigo, blue, green, yellow, orange and red).

207. The work of _____ is based on the principle of total internal reflection.
(A) Internet **(B)** Optical fibers
(C) Radiography **(D)** X - ray

Ans.207(B) The optical fibre is a device which works on the principle of total internal reflection by which light signals can be transmitted from one place to another with a negligible loss of energy.

208. Remote sensing device has an Inbuilt source of _____.
(A) Radio waves **(B)** Gamma Ray
(C) Ultraviolet Ray **(D)** Infrared Ray

Ans.208(D) The Remote Sensing Device (RSD) is a unique system that enables to measure individually the emissions of vehicles in motion, it has an inbuilt source of Infrared Ray.

209. A device which is used to limit the current in an electrical circuit is called_____.
(A) Fuse **(B)** Invertor
(C) Resistor **(D)** Capacitor

Ans.209(C) The charge passing through the circuit always passes through an appliance (which acts as a resistor) or through another resistor, which limits the amount of current that can flow through a circuit. Appliances are designed to keep current at a relatively low level for safety purposes.

210. When the wire is stretched to double the length, the area of cross section gets reduced to _____.
(A) Double **(B)** Half
(C) Three times **(D)** Four times

Ans.210(B) When the wire is stretched to double the length, the area of cross section gets reduced to half. So, when the wire is stretched, the resistance multiplies by four times.

211. Why is it difficult to breathe at higher altitudes?
(A) Air pressure decreases
(B) Decreased hemoglobin
(C) Decreased hemoglobin
(D) Excess of air pressure

Ans.211(A) At higher elevations, the outside pressure is lower than the pressure in your lungs, making it more difficult for the thin air to pull in and for your veins to pump oxygen throughout the body.

212. The prescribed highest limit of noise levels for residential localities is _____ decibels.
(A) 70 dB **(B)** 60 dB
(C) 45 dB **(D)** 30 dB

Ans.212(C) In industrial areas, the permissible limit is 75 dB for daytime and 70 dB at night. In commercial areas, it is 65 dB and 55 dB while in residential areas it is 55 dB and 45 dB during daytime and night respectively.

213. _____ is a common vision condition in which you can clearly see objects near you, but distant objects appear blurred.
(A) Hyperopia **(B)** Myopia
(C) Cataract **(D)** Astigmatism

Ans.213(B) Myopia occurs when the eyeball is too long, relative to the focusing power of the cornea and lens of the eye. This causes light rays to focus at a point in front of the retina, rather than directly on its surface.

214. When any wave travels through different medium the _____ always remains constant.
(A) Frequency **(B)** Length
(C) Wavelength **(D)** Speed

Ans.214(A) When the air slows down, its frequency remains the same, due to the fact that its wavelength is shorter. When waves travel from one medium to another the frequency never changes. As waves travel into the denser medium, they slow down and wavelength decreases.

215. If you spray perfume at one end of a room eventually the gas particles will be all over the room. It is example of _____.
(A) Capillarity **(B)** Diffusion
(C) Surface tension **(D)** Adhesive force

Ans.215(B) Diffusion is the net movement of anything (for example, atom, ions, molecules) from a region of higher concentration to a region of lower concentration. Diffusion is driven by a gradient in concentration.

216. Due to _____ small pieces of camphor dance on the surface of water.
(A) Surface tension **(B)** Diffusion
(C) Capillarity **(D)** Adhesive force

Ans.216(A) The camphor slowly dissolves in water, reducing the surrounding surface tension. The strong stretch exerted by the uncontrolled part of the water increases the speed of the surface and with it the camphor particles start dancing on the surface of the water.

217. Sodium is immersed in kerosene oil because:
(A) Sodium is a positive metal.
(B) Sodium reacts with oxygen to form sodium oxide.
(C) Sodium is a less active metal
(D) Sodium does not react with kerosene.

Ans.217(B) Sodium is more reactive. If it is kept open, it will start burning in contact with oxygen.

218. The rate of change of linear momentum of a body falling freely under gravity is equal to it's _____.
(A) Weight **(B)** Mass
(C) Acceleration **(D)** Impulse

Ans.218(A) The rate of change of impulse is equal to the force. In the case of a body falling freely under gravity it is equal to the weight.

219. Which of the following is not true about X--rays?
(A) They have a shorter wavelength of the electromagnetic spectrum.
(B) They travel in a straight line and do not carry an electric charge with them.
(C) They are capable of travelling in a vacuum.
(D) Requires low voltage to produce X-Rays.

Ans.219(D) The X-Rays properties are given below:
They have a shorter wavelength of the electromagnetic spectrum.
Requires high voltage to produce X-Rays.
They are used to capture the human skeleton defects. They travel in a straight line and do not carry electric charge with them.
They are capable of travelling in a vacuum.

220. Fuse wire is made of an alloy of _____.
(A) Tin and Lead **(B)** Tin and Copper
(C) Lead and Copper
(D) Copper and Silver

Ans.220(A) The materials used to make the fuse element have low melting points, such as

tin, lead, or zinc. The main materials used for the fuse element are tin, lead, silver, copper, zinc, aluminum and lead and tin.

221. What is the unit of measure of a Electric Conductance?
(A) Tesla **(B)** Mole
(C) Henry **(D)** siemens

Ans.221(D) Conductivity (or specific conductance) of an electrolyte solution is a measure of its ability to conduct electricity. The SI unit of conductivity is Siemens per meter (S/m).

222. A device used for measuring small currents due to changing magnetic field is known as _____.
(A) Voltmeter **(B)** Ammeter
(C) Galvanometer **(D)** Potentiometer

Ans.222(C) Galvanometer is used to detect small current changes. By adding resistors, it can be converted into an ammeter or a voltmeter.

223. Who introduced the first scientific theory of atomic structure?
(A) Henry Moseley **(B)** John Dalton
(C) Ernest Rutherford **(D)** Marie Curie

Ans.223(B) The concept of the atom dates back to the ideas of Democritus, the English meteorologist and chemist John Dalton formulated the first modern description of it as the fundamental building block of chemical structures.

224. The direction of heat flow in a solid only depends on the _____ of its neighboring elements.
(A) Weight **(B)** Volume
(C) Temperature **(D)** Mass

Ans.224(C) Heat always flows from a warm place to a cold place when it flows automatically (you can force the heat to flow in the opposite way using energy - such as in a refrigerator). Until both the objects reach the same temperature, the heat will continue to flow, which is called thermal equilibrium. The direction of heat flow in a solid only depends on the temperature.

225. If the star's remaining mass is greater than three times the mass of the Sun, the star contracts tremendously and becomes a _____.
(A) Red giant star **(B)** Black hole
(C) Neutron star
(D) White Dwarf star

Ans.225(B) A black hole is a region of spacetime exhibiting gravitational acceleration so strong that nothing—no particles or even electromagnetic radiation such as light—can escape from it. The theory of general relativity predicts that a sufficiently compact mass can deform spacetime to form a black hole. The star whose mass will be three times the mass of the Sun will have the end of that star as a black hole star.

226. Why do birds not have respiratory trouble at the time of flying at high altitude?
(A) They use less oxygen
(B) They fly Inactively
(C) They have extra air sacs
(D) Their lungs are very large

Ans.226(C) Because flying takes a tremendous amount of energy, birds need to get lots of oxygen. The air sacs in their lungs help them to keep fresh air flowing in, unlike mammals, where the "old" air within the trachea and mouth (which has low oxygen content and high CO_2 levels) in inhaled each time.

227. Water boils at a lower temperature on top of mountain because:
(A) There is less air pressure on the molecules
(B) There is less Oxygen
(C) There is high Carbon dioxide
(D) There is high air pressure on the molecules

Ans.227(A) Water boils at a lower temperature on top of a mountain because there is less air pressure on the molecules. Water boils when the vapor pressure of water exceeds atmospheric pressure.

228. Which of the following has the highest value of specific heat?

(A) Iron **(B)** Alcohol
(C) Hydrogen **(D)** Water

Ans.228(D) The specific heat capacity of a substance is the heat capacity of a sample of the substance divided by the mass of the sample. The SI unit of specific heat is joule/kelvin. The specific heat often varies with temperature, and is different for each state of matter. Water has one of the highest specific heats among common substances, about 4182 J/K/kg at 20°C.

229. The surface tension of water on adding detergent to it:
(A) Increases **(B)** Dicreases
(C) No Change **(D)** Becomes Zero

Ans.229(B) When detergent is added to water, it decreases the surface tension of the water. Compounds that lower water's surface tension are called surfactants, which work by separating the water molecules from one another.

230. Waves that are required for long distance wireless communication are _____.
(A) Microwaves **(B)** Ultraviolet rays
(C) Infrared rays **(D)** Radio waves

Ans.230(A) Generally microwaves (frequency in MHz) used for wireless tele-communication. For satellite communication waves in GHz frequency range are used. The distance of operation is dependent on the channel of propagation.

231. The nature of fuse wire is:
(A) A fuse wire has high resistance and low melting point.
(B) A fuse wire has low resistance and high melting point.
(C) A fuse wire has high resistance and high melting point.
(D) A fuse wire has low resistance and low melting point.

Ans.231(D) A fuse wire has low resistance and low melting point. Fuse is a wire with a very low melting point. When a high current flow through the circuit due to Overloading or a Short circuit, the wires gets heated and melts. As a result, the circuit is broken and current stops flowing.

232. What is the period of rotation of a geostationary satellite?
(A) 365 days **(B)** 24 hours
(C) 30 days **(D)** 48 hours

Ans.232(B) Geostationary orbit, a circular orbit 35,785 km (22,236 miles) above Earth's Equator in which a satellite's orbital period is equal to Earth's rotation period of 23 hours and 56 minutes (24 Hours approx.).

233. Which of the following statements is correct with respect to the Curie point?
(A) certain materials lose their permanent magnetic properties on curie point.
(B) certain materials lose their properties on curie point.
(C) certain materials lose their power on curie point.
(D) certain materials change their magnetic properties on curie point.

Ans.233(B) Curie point, is the temperature above which certain materials lose their permanent magnetic properties. Below the Curie temperature, the atoms are aligned and parallel, causing spontaneous magnetism, the material is ferromagnetic. Above the Curie temperature the material is paramagnetic, as the atoms lose their ordered magnetic moments when the material undergoes a phase transition.

234. If the mass of an object is 60 kgs, what will be its weight on the moon?
(A) 90 N **(B)** 60 N
(C) 98 N **(D)** 120 N

Ans.234(C) mass = 60 kg
As we know,
Weight= mass × acceleration due to gravity
On moon the gravity is approx. 1/6 as compared to earth that is 9.8/m/s2
Weight of that object on moon
= 60 × 9.8/6 = 98 N
A mass of 60kg on the Moon will still be 60Kg as mass is independent of gravity. The Moon's gravity (its gravitational constant) is about

1/6th that of the Earth's. Your weight on the Moon is 16.5% what you would experience on Earth.

235. Which of the following is not an example of the Pascal law?
(A) Hydraulic Jack **(B)** Hydraulic bus
(C) Hydraulic brake **(D)** Hydraulic lift

Ans.235(B) Pascal's law basically states that any pressure applied to a fluid inside a closed system will transmit that pressure equally in all directions throughout the fluid. Hydraulic Jack, press, brake and lift are example of pascal law.

236. Gravitational force is maximum at which of the following places?
(A) The poles **(B)** The north pole
(C) Equator
(D) Northern Hemisphere

Ans.236(A) Gravitational force is maximum at Poles. The gravitational force is almost equal in every where in the earth. The resultant force is maximum in pole. Since earth is rotating there is centrifugal force and due to this force is maximum at poles.

237. The different colours of different stars are due to the variation of _____.
(A) Pressure **(B)** Density
(C) Temperature
(D) Radiation from them

Ans.237(C) As the light from the stars comes through the earth's atmosphere, they appear to be twinkling. This makes the cooler stars appear red and the stars with the higher temperatures appear blue or white. For instance, the color of a star – which varies from bluish-white and yellow to orange and red – is primarily due to its temperature.

238. Which layer of the sun can be seen with the naked eye during a total solar eclipse?
(A) Transition Region **(B)** Chromosphere
(C) Photosphere **(D)** Corona

Ans.238(D) The only time that the Sun can be viewed safely with the naked eye is during a total eclipse, when the Moon completely covers the disk of the Sun. It is never safe to look at a partial or annular eclipse, or the partial phases of a total solar eclipse, without the proper equipment and techniques.

239. Clear nights are colder than cloudy nights because of _____.
(A) Conduction **(B)** Condensation
(C) Radiation **(D)** Insolation

Ans.239(C) Cloudless nights are colder because the nights that have clouds provide a blanket for the earth and trap some of the hot day air where as the cloudless nights have no protection so all the hot air rises up into the sky. radiation is a process in which energetic particles or energetic waves travel through vacuum, or through matter-containing media that are not required for their propagation.

240. cryogenics is a science dealing with _____.
(A) High temperature **(B)** Low temperature
(C) Friction
(D) Growth of Crystals

Ans.240(B) cryogenics is the production and behaviour of materials at very low temperatures. The cryogenic temperature range has been defined as from −150 °C (−238 °F) to absolute zero (−273 °C or −460 °F).

241. Which one of the following instruments is used to study dispersion of light?
(A) Spectrometer **(B)** Gyroscope
(C) Pyrometer **(D)** Speedometer

Ans.241(A) A spectrometer is an instrument used to measure properties of light over a specific portion of the electromagnetic spectrum, typically used in spectroscopic analysis to identify materials.

242. Which one of the following lenses should be used to correct the defect of astigmatism?
(A) Convex lens **(B)** Concave lens
(C) Cylindrical lens **(D)** Bifocal lens

Ans.242(C) Astigmatism is a common vision condition that causes blurred vision. It occurs when the cornea (the clear front cover of the eye) is irregularly shaped or sometimes

because of the curvature of the lens inside the eye. In Astigmatism, cylindrical lens is used.

243. In a Laser all the atoms emit the light waves of _____.
(A) Same frequency **(B)** Same amplitude
(C) Same phase **(D)** All of the above

Ans.243(D) In a Laser all the atoms emit the light waves of same frequency, amplitude and phase. A laser is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the stimulated emission of photons.

244. Which type of mirrors used in the headlamp of cars?
(A) Parabolic concave **(B)** Plane mirrors
(C) Cylindrical convex
(D) Cylindrical concave

Ans.244(A) Only a parabolic concave mirror has a true, single-point principal focus for parallel rays. For this reason, parabolic mirrors are used to gather light in reflecting telescopes and solar furnaces, and project a beam of light in flashlights, searchlights, stage spotlights, and car headlights.

245. The swimming pool to appear less deep than the actual depth is because:
(A) Refraction **(B)** Light scattering
(C) Reflection
(D) Total internal reflection

Ans.245(A) It is caused by refraction of light. When the sunlight collides with the lower point of the pool and returns, it becomes slower than its normal speed due to the density of the water. On coming back, it gives us the same image of the lower point, which is slightly above its actual position.

246. which of the following is not a scalar quantity?
(A) Mass **(B)** Force
(C) Temperature **(D)** Volume

Ans.246(B) The quantity is either a vector or a scalar. These two categories can be distinguished from one another by their distinct definitions: Scalars are quantities that are fully described by a magnitude (or numerical value) alone. Vectors are quantities that are fully described by both a magnitude and a direction. Examples of scalar quantities include time, volume, speed, mass, temperature, distance, energy, work. Example of vector quantities include acceleration, velocity, momentum, force.

247. Which of the following examples are not true about Newton's Third Law?
(A) Rock climbers pulling their vertical rope downwards so as to push themselves upwards.
(B) A swimmer pushes against the water, while the water pushes back on the swimmer.
(C) The flight of the bird
(D) Riding a bicycle

Ans.247(D) Examples of Newton's Third Law:
1. A propulsion of fish through water is an example of action-reaction pair. A fish makes use of its fins to push water backwards. This push serves to accelerate the fish forwards. The size of the force on the water equals the size of the force on the fish; the direction of the force on the water (backwards) is opposite the direction of the force on the fish (forwards).
2. The flight of the bird is an example of action-reaction pair. The wings of the bird push the air downwards. The air pushes the air upwards.
3. A swimmer pushes against the water, while the water pushes back on the swimmer.
4. Lift is created by helicopters by pushing the air down, thereby creating an upward reaction force.
5. Rock climbers pulling their vertical rope downwards so as to push themselves upwards.

248. Which of the following units is NOT used for measuring length?
(A) Astronomical Unit **(B)** Light year
(C) Parsec **(D)** slug

Ans.248(D) A slug is defined as the mass that is accelerated by 1 ft/s^2 when a force of one pound (lbf) is exerted on it.
Astronomical units are usually used to measure distances within our Solar System.
The light-year is a unit of length used to express astronomical distances and measures about 9.46 trillion kilometres or 5.88 trillion miles.

Parsec is a unit of length used to measure the large distances to astronomical objects outside the Solar System. One parsec is approximately equal to 31 trillion kilometres, equates to about 3.3 light-years.

249. 1 nautical mile is equivalent to which of the following?
(A) 1.44 x 1000 m **(B)** 1.852 x 100 m
(C) 1.852 x 1000 m **(D)** 1.44 x 100 m

Ans.249(C) Today the international nautical mile is defined as exactly 1852 metres (about 1.15 miles).

250. Knots is a unit of _____?
(A) Speed **(B)** Distance
(C) Depth **(D)** Acceleration

Ans.250(A) The knot is a unit of speed equal to one nautical mile per hour (1.852 km/h). The ISO standard symbol for the knot is kn. The knot is a non-SI unit. The knot is used in meteorology, and in maritime and air navigation. A vessel travelling at 1 knot along a meridian travel approximately one minute of geographic latitude in one hour.

251. Charles's law is based on
(A) Solid **(B)** Liquid
(C) Gas
(D) None of the above

Ans.251(C) The physical principle known as Charles' law states that the volume of a gas equals a constant value multiplied by its temperature as measured on the Kelvin scale (zero Kelvin corresponds to -273.15 degrees Celsius).

252. Which of the following is part of the Classical Physics?
(A) Optics **(B)** Thermodynamic
(C) Both A and B **(D)** None of these

Ans.252(C) In classical physics, energy and matter are considered separate entities. Acoustics, optics, classical mechanics, and electromagnetics are traditionally branches within classical physics.

Optics is the branch of physics that studies the behaviour and properties of light, including its interactions with matter and the construction of instruments that use or detect it. Optics usually describes the behaviour of visible, ultraviolet, and infrared light.
Thermodynamics is a branch of physics that deals with heat, work, and temperature, and their relation to energy, radiation, and properties of matter.

253. The Atomic clock is based on the periodic vibrations produced in the atom of which element?
(A) Hydrogen **(B)** Rubidium
(C) Cesium **(D)** Barium

Ans.253(C) The Atomic clock is based on the periodic vibrations produced in cesium atom. The atomic clock is also called as Cesium clock. Caesium is a chemical element with the symbol Cs and atomic number 55. It is liquid at or near room temperature. Caesium has physical and chemical properties similar to those of rubidium and potassium. It is the least electronegative element, with a value of 0.79 on the Pauling scale.

254. An atom with more neutrons than protons is called?
(A) Compound **(B)** Element
(C) Isotope
(D) None of the above

Ans.254(C) Isotopes are atoms of the same element that have different numbers of neutrons but the same number of protons and electrons.
example, carbon-12, carbon-13, and carbon-14 are three isotopes of the element carbon with mass numbers 12, 13, and 14, respectively.

255. When all the forces and torques are balanced in a mechanical body it is said to be in.
(A) Equilibrium **(B)** Static
(C) Buoyancy
(D) None of the above

Ans.255(A) A torque is a vector quantity which means that it has both a magnitude (size) and a direction associated with it. If the size

and direction of the torques acting on an object are exactly balanced, then there is no net torque acting on the object and the object is said to be in equilibrium.

256. The tidal waves on sea is mainly due to.
(A) Gravitational Effect of Moon on Earth.
(B) Gravitational Effect of Sun on Earth
(C) Gravitational Effect of Earth on Moon
(D) None of the above

Ans.256(A) The rise & fall of sea water due to gravity is termed as tide. It is combined effect of gravitational forces of moon and sun. As moon is closer to Earth than Sun its gravitational pull is more as compared to that of Sun.

257. Which of the following are Polar vectors?
(A) Displacement **(B)** Force
(C) Both A and B **(D)** None

Ans.257(C) Polar vectors describe translation motion and have starting point. The direction of polar vector remains unchanged irrespective of the coordinate system chosen. Displacement, force, etc are polar vectors

258. A ball pen function on the principle of
(A) Viscosity **(B)** Capillarity
(C) Gravity
(D) Atmospheric pressure

Ans.258(B) The ball pen works on the principle of capillary action and surface tension. Pen is fitted with a tiny ball bearing in its tip. Explanation: Capillary action means that an ink is pulled due to the thin length of the capillary as a part of fluid moves out. When we move the pen on a piece of paper.

259. Work done is defined as the dot product of which of the following vectors?
(A) Force and instantaneous velocity
(B) Force and displacement
(C) Force and acceleration
(D) Force and area

Ans.259(B) Work done is defined as the dot product of Force vector and displacement vector. W = F.S Work done is a scalar quantity.

Note: Instantaneous power is defined as the dot product of Force vector and instantaneous velocity.

260. Which of the following is not an example of conservation of mechanical energy?
(A) Vibrations of a simple pendulum)
(B) Motion of a small spherical ball over a watch glass
(C) Vibrations of an elastic spring
(D) None of the above

Ans.260(D) According to the principle of conservation of mechanical energy, the mechanical energy of an isolated system remains constant in time, as long as the system is free of friction and other non-conservative forces. In any real situation, frictional forces and other non-conservative forces are present, but in many cases their effects on the system are so small that the principle of conservation of mechanical energy can be used as a fair approximation. Though energy cannot be created or destroyed in an isolated system, it can be converted to another form of energy.

261. The acceleration due to gravity on any planet does not depend on which of the following?
(A) Radius of the planet
(B) Mass of the planet
(C) Density of the planet
(D) Mass of the object

Ans.261(D) The acceleration which is gained by an object because of gravitational force is called its acceleration due to gravity. Its SI unit is m/s2. Acceleration due to gravity is a vector, which means it has both a magnitude and a direction. The acceleration due to gravity at the surface of Earth is represented by the letter g. It has a standard value defined as 9.80665 m/s2 (32.1740 ft/s2). However, the actual acceleration of a body in free fall varies with location.

262. The three famous law of Kepler is related to
(A) Optics
(B) Speed
(C) Oscillations
(D) Planetary Motion

Ans.262(D) In astronomy, Kepler's laws of planetary motion are three scientific laws describing the motion of planets around the Sun, published by Johannes Kepler between 1609 and 1619. These improved the heliocentric theory of Nicolaus Copernicus, replacing its circular orbits and epicycles with elliptical trajectories, and explaining how planetary velocities vary.
The orbit of a planet is an ellipse with the Sun at one of the two foci.
A line segment joining a planet and the Sun sweeps out equal areas during equal intervals of time.
The square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit.

263. For a freely falling body, the sum of kinetic energy and potential energy is always?
(A) Zero **(B)** Unity
(C) Same **(D)** Variable

Ans.263(C) In physics, potential energy is the energy held by an object because of its position relative to other objects, stresses within itself, its electric charge, or other factors.
Common types of potential energy include the gravitational potential energy of an object that depends on its mass and its distance from the center of mass of another object, the elastic potential energy of an extended spring.

264. The angular momentum of a satellite depends on which of the following?
(A) Mass of the satellite
(B) Mass of the planet
(C) Radius of orbit of satellite
(D) All of the above

Ans.264(D) The angular momentum of a satellite depends on: 1. Mass of the satellite 2. Mass of the planet 3. Radius of orbit of satellite it is denoted by L.
$L = (m^2GMr)^{1/2}$

265. What is the unit of Magnetic Induction?
(A) Tesla **(B)** Farad
(C) Volt **(D)** Henry

Ans.265(A) Electromagnetic or magnetic induction is the production of an electromotive force (i.e., voltage) across an electrical conductor in a changing magnetic field.
Michael Faraday is generally credited with the discovery of induction in 1831, and James Clerk Maxwell mathematically described it as Faraday's law of induction.
Electromagnetic induction has found many applications, including electrical components such as inductors and transformers, and devices such as electric motors and generators.
The unit of magnetic induction is the tesla (T).

266. Water does not fall out of a glass when it is inverted inside a satellite, which is orbiting very close to the earth's surface. Which of the following is the best reason for this?
(A) The earth does not exert any force on the water.
(B) The earth's force of attraction on the water is exactly balanced by the force created by the satellites.
(C) The water and the glass have the same acceleration due to gravity.
(D) The gravitational attraction between the glass and the water balances the earth's attraction on the.

Ans.266(C) Water does not fall out of a glass when it is inverted inside a satellite, which is orbiting very close to the earth's surface. The reason for this is that the water and the glass have the same acceleration due to gravity, equal to g, towards the centre of the earth. Hence there is no relative motion between them.

267. What is the relation between the orbital velocity and the radius of the orbit for a given planet?
(A) Greater the radius of orbit, lesser will be the orbital velocity.
(B) Greater the radius of orbit, greater will be the orbital velocity.
(C) Orbital velocity is independent of radius of orbit.
(D) None of the above.

Ans.267(A) Greater the radius of orbit, lesser will be the orbital velocity

I understand that there is the equation $V=\sqrt{\frac{GM}{R}}$, where V is the orbital velocity, G is the gravitational constant, and R is the orbital radius.

268. Which phenomena shows the particle nature of light?
(A) Diffraction **(B)** Interferenc
(C) Photoelectric effect **(D)** Polarisation

Ans.268(C) The photoelectric effect is a phenomenon in which the emission of electrons occurs when a beam of light strikes a metal or a cathode surface. For emissions of electrons frequency of incident light is required to be greater than a minimum value called Threshold Frequency. Thus, show particle nature of light.
The photoelectric effect is the emission of electrons or other free carriers when electromagnetic radiation, like light, hits a material. Electrons emitted in this manner can be called photoelectrons. This phenomenon is commonly studied in electronic physics and in fields of chemistry such as quantum chemistry and electrochemistry.

269. The laws which govern the motion of planets are called?
(A) Newton's Laws **(B)** Kepler's Laws
(C) Avogadro's Laws
(D) De Morgan's Laws

Ans.269(B) Kepler's laws of planetary motion are three scientific laws describing the motion of planets around the Sun, published by Johannes Kepler between 1609 and 1619. These improved the heliocentric theory of Nicolaus Copernicus, replacing its circular orbits and epicycles with elliptical trajectories, and explaining how planetary velocities vary. The laws state that:

270. The temperature at which a solid melt to become a liquid at the atmospheric pressure is called its _____.
(A) Crystallization **(B)** Melting point
(C) Evaporation **(D)** Galvanization

Ans.270(B) Pure, crystalline solids have a characteristic melting point, the temperature at which the solid melts to become a liquid. The transition between the solid and the liquid is so sharp for small samples of a pure substance that melting points can be measured to 0.1°C.

271. Who invented the thermos flask?
(A) Ray Tomlinson
(B) Tim Berners-Lee
(C) William Cullen
(D) James Dewar

Ans.271(D) Invented in 1892 by Sir James Dewar, a scientist at Oxford University, the "vacuum flask" was not manufactured for commercial use until 1904, when two German glass blowers formed Thermos GmbH. They held a contest to name the "vacuum flask" and a resident of Munich submitted "Thermos", which came from the Greek word "Therme" meaning "hot".

272. An electron and a proton are circulating with same speed in circular paths of equal radius. Which one among the following will happen, if the mass of a proton is about 2,000 times that of an electron?
(a) The centripetal force required by the electron is about 2,000 times more than that required by the proton.
(b) The centripetal force required by the proton is about 2,000 times more than that required by the electron.
(c) No centripetal force is required for any charged particle.
(d) Equal centripetal force acts on both the particles as they rotate in the same circular path.

Ans.272(B) Mass of proton = 2000 × mass of electron radius and speed is the same for both, proton and electron. Centripetal force a mass. Since mass of proton is 2000 times that of mass of electron, hence the centripetal force required by proton is about 2000 times more than that required by the electron.

273. Sodium is the sixth most abundant element in the Earth's crust and exists in numerous

minerals such as feldspars, sodalite, and rock salt (NaCl). Sodium metal should be stored in
(A) Alcohol **(B)** Kerosene oil
(C) Water
(D) Hydrochloric acid

Ans.273(B) Sodium metals are kept in kerosene oil. Sodium is a very reactive metal. It is kept in kerosene to prevent it from coming in contact with oxygen and moisture. If this happens, it will react with the moisture present in air and form sodium hydroxide which is a highly exothermic reaction.

274. The upper and lower portions in common type of bi-focal lenses are respectively _____.
(A) concave and convex
(B) convex and concave
(C) both concave of different focal lengths
(D) both convex of different focal lengths

Ans.274(A) Concave lens are used to see the distant objects while convex lens are used to see nearby object, thus upper portion is concave lens while lower portion is convex lens in bi-focal lenses.

275. Tungsten is used for the construction of filament in electric bulb because of its _____.
(A) High melting point
(B) Low specific resistance
(C) High light emitting power
(D) High specific resistance

Ans.275(A) Tungsten has the highest melting point. Tungsten, or wolfram, is a chemical element with the symbol W and atomic number 74. The name tungsten comes from the former Swedish name for the tungstate mineral scheelite, tungsten which means "heavy stone". Tungsten is a rare metal found naturally on Earth almost exclusively combined with other elements in chemical compounds rather than alone.

276. In the phenomenon of dispersion of light, the light wave of shortest wavelength is
(A) accelerated and refracted the most
(B) slowed down and refracted the most
(C) accelerate d and refracted the least
(D) slowed down and refracted the least

Ans.276(B) Short wavelengths are slowed more sharply upon entering glass from air than are long wavelengths. Red light has the longest wavelength and is bent the least. Violet light has the shortest wavelength and is bent the most.

277. A moderator is a material with a mass not too much more than the mass of a neutron such that, when a neutron collides with it, the neutron will lose energy (slow down). Carbon or Graphite rods are used in atomic reactors as moderators for sustained nuclear chain reaction through nuclear fission process.
In this process
(A) The neutrons are made fast
(B) The protons are made fast
(C) The neutrons are made slow
(D) The protons are made slow

Ans.277(C) Moderators like carbon and Graphite are used for slowing down the neutrons from fission have very high speeds and must be slowed greatly by "moderation" to maintain the chain
Graphite is used as a neutron moderator in nuclear reactors. That is, the carbon nuclides in the graphite absorb the relatively high kinetic energy that most neutrons have when they are emitted from nuclear fission. This slows the neutrons down so they have a higher probability of being absorbed by nuclides which they can cause to undergo fission rather than speeding out of the reactor.

278. For a harmonic oscillator, the graph between momentum p and displacement q would come out as.
(A) A straight line **(B)** A parabola
(C) A circle **(D)** An ellipse

Ans.278(D) an ellipse is a plane curve surrounding two focal points, such that for all points on the curve, the sum of the two distances to the focal points is a constant. As such, it generalizes a circle, which is the special type of ellipse in which the two focal points are the same.

279. In step-down transformer, the AC output gives the-

(A) Current more than the input current
(B) Current less than the input current
(C) Current equal to the input current
(D) Voltage more than the input voltage

Ans.279(D) Transformers change the voltage of an alternating current (ac) electrical supply. Sometimes transformers make the output voltage smaller than the input voltage

280. A rectifier is an electronic device used to convert.
(A) AC voltage into DC voltage
(B) DC voltage into AC voltage
(C) Sinusoidal pulse into square pulse
(D) None of the above

Ans.280(A) A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification, since it "straightens" the direction of current.

281. A device, which is used in our TV set, computer, radio set for storing the electric charge, is.
(A) Resistor **(B)** Inductor
(C) Conductor **(D)** Capacitor

Ans.281(D) A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.
The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as a condenser or condensator. The physical form and construction of practical capacitors vary widely and many types of capacitor are in common use. Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium.

282. The material used in the fabrication of a transistor is –
(A) Aluminum **(B)** Copper
(C) Silicon **(D)** Silver

Ans.282(C) The fabrication of the transistor is the process of creating the transistor that is used in electrical and electronics circuit. Transistors are made from very pure silicon or germanium, but certain other semiconductor materials can also be used.

283. In which of the following processes is energy released?
(A) Respiration **(B)** Photosynthesis
(C) Ingestion **(D)** Absorption

Ans.283(A) During cellular respiration, glucose is broken down in the presence of oxygen to produce carbon dioxide and water. The energy released during the reaction is captured by the energy-carrying molecule ATP.

284. "Curie" is the unit of –
(A) Radioactivity **(B)** Temperature
(C) Heat **(D)** Energy

Ans.284(A) The curie is a unit of ionizing radiation (radioactivity), symbolized Ci and equal to 3.7 x 10 10 disintegrations or nuclear transformations per second. This is approximately the amount of radioactivity emitted by one gram (1 g) of radium-226. The unit is named after Pierre Curie a French physicist.
Temperature is a measure of average kinetic energy per molecule in a substance. It is different from heat, although the two quantities are intimately related. Heat is the energy transferred between two objects at different temperatures. The SI unit of temperature as per the International System of Units is Kelvin which is represented by the symbol K
Heat has the unit joule (J) in the International System of Units (SI). However, in many applied fields in engineering the British thermal unit (BTU) and the calorie are often used. The standard unit for the rate of heat transferred is the watt (W), defined as one joule per second.

285. Electric current in a metal wire is due to the flow of –

(A) Electrons **(B)** Protons
(C) Ions **(D)** Holes

Ans.285(A) where the charge carriers (electrons) are negative, conventional current is in the opposite direction to the overall electron movement. In other conductive materials, the electric current is due to the flow of both positively and negatively charged particles at the same time.

286. When a running car stops suddenly, the passengers tends to lean forward because of –
(A) Centrifugal force **(B)** Inertia of rest
(C) Inertia of motion **(D)** Gravitation force

Ans.286(C) While sitting in the passenger's position on a motorcycle, the sudden application of brakes by the driver causes the passenger to experience a push in the forward direction. This is because the passenger is in a state of motion in the forward direction and the inertia of motion always opposes the change in the state of motion.
When the passenger of a bus attempts to jump out of the moving bus, the inertia of motion causes him or her to fall down or temporarily lose his/her balance. This is because when the passenger jumps, the inertia of motion of the body tends to oppose the change in state of the body (it wants to continue in the state of motion of the bus rather than coming to a state of rest).

287. A person is hurt on kicking a stone due to –
(A) Inertia **(B)** Velocity
(C) Reaction **(D)** Momentum

Ans.287(C) Newton's third law is: For every action, there is an equal and opposite reaction. The statement means that in every interaction, there is a pair of forces acting on the two interacting objects.

288. The spoon dropped by an astronaut in a satellite will –
(A) Fall to the floor
(B) Remain stationar
(C) Continue to follow the motion of the satellite
(D) Move tangentially away

Ans.288(C) The spoon dropped by an astronaut in a satellite will continue to follow the motion of the satellite. In the context of spaceflight, a satellite is an object that has been intentionally placed into orbit. These objects are called artificial satellites to distinguish them from natural satellites such as Earth's Moon.
On 4 October 1957 the Soviet Union launched the world's first artificial satellite, Sputnik 1. Since then, about 8,900 satellites from more than 40 countries have been launched.

289. The sensation of weightlessness in a spacecraft in an orbit is due to the –
(A) Absence of gravity outside.
(B) Acceleration in the orbit which is equal to the acceleration due to gravity outside.
(C) Presence of gravity outside but not inside the spacecraft.
(D) Fact that spacecraft in the orbit has no energy.

Ans.289(B) The sensation of weightlessness in a spacecraft in an orbit is due to the acceleration in the orbit which is equal to the acceleration due to gravity outside.

290. In a nuclear reactor, one of the following is used as a fuel?
(A) Coal **(B)** Uranium
(C) Radium **(D)** Diesel

Ans.290(B) The fuel that is used in a nuclear reactor to maintain a nuclear concatenation response is known as Nuclear fuel. These fuels are fissionable, and the most popular nuclear combustibles are radioactive elements such as uranium-235 and plutonium-239.

291. It is difficult to walk on any oily floor because
(A) Floor gets spoiled
(B) There is more resistance
(C) Force of friction is high
(D) Force of friction is very less

Ans.291(D) You will find friction everywhere that objects come into contact with each other. The force acts in the opposite direction to the way an object wants to slide. Friction is still there, but the liquid makes the surfaces

smoother and the friction a lot less. Less friction means it is harder to stop. It is difficult to walk on oily surface because the surface has less friction. We can walk only if there is more friction. So, we slip easily thus it is hard to walk on an oily floor.

292. The coefficient of static friction is.
(A) Less than the coefficient of kinetic friction.
(B) Greater than the coefficient of limiting friction.
(C) Equal to coefficient of kinetic friction.
(D) Equal to the tangent of the angle of friction.

Ans.292(D) It is the "The maximum ratio of applied force to normal force with no motion" we all know Frictional force is a force which opposes motion. If we keenly observe, once you apply force to move a body from rest, there exist a point upto which the body resist to move. To move the body the applied force should be greater to overcome this resistance. This maximum resistive force offered by the body against the applied force to continue its state of motion is called Coefficient of Static Friction.
Magnitude of frictional force depends on two factors.
How heavy is the material.
How rough is the surface.
It is a unit less quantity. As it is the ratio of two forces. The respective S.I units get cancelled. This also implies that it is a dimensionless quantity.

293. A compass needle cannot be used to detect
(A) Magnetic North-South direction
(B) Polarity of a magnet
(C) Strength of a magnet
(D) Direction of magnetic field

Ans.293(C) A compass is an instrument used for navigation and orientation that shows direction relative to the geographic cardinal directions (or points). Usually, a diagram called a compass rose shows the directions north, south, east, and west on the compass face as abbreviated initials.

294. Indicate the false statement about the resistance of a wire.
(A) It depends on material of wire
(B) It is unrectly proportional to the length of wire
(C) It is directly proportional to the area of cross-section of wire
(D) Resistance of metallic wire increases with increase in temperature.

Ans.294(C) The resistance of a current carrying conductor is inversely proportional to the area of cross section of the conductor. The reason is because the resistance occurs due to the collision of electrons/charged particles. So, resistance is inversely proportional to area of cross section of the conductor.

295. The ratio of intensity of magnetisation to the magnetisation force is known as.
(A) flux density **(B)** susceptibility
(C) relative permeability
(D) none of the above

Ans.295(B) This ratio, strictly speaking is the volume susceptibility, because magnetization essentially involves a certain measure of magnetism per unit volume.

296. In electromagnetic induction, the induced charge does not depend on –
(A) Change in flux
(B) time of change of magnetic flux
(C) Resistance of Coil
(D) None of the above

Ans.296(B) Prove that induced charge does not depend on rate of change of flux.

297. White light is made up of seven colors. What is the method of separating the colors?
(A) By passing it through a prism
(B) By filtration
(C) Can't be separated
(D) Both (A) and (B)

Ans.297(A) Different colors of different wavelength experience different degree of deviation and hence when put through refraction, white light splits into its constituent colors. This is how when passing through a prism, dispersion of light (white light) happens

wherein it splits into its seven-constituent colour.

298. Which of the following is not a vector quantity?
(A) speed **(B)** velocity
(C) torque **(D)** displacement

Ans.298(A) A vector quantity is a quantity which has both magnitude and direction. Here in the given options, speed is a scalar quantity but not the vector quantity.

299. The temperature which has the same reading on both Fahrenheit and Celsius scales is
(A) 0° **(B)** -40°
(C) 4° **(D)** 140°

Ans.299(B) Negative forty degrees is the temperature where the Fahrenheit and Celsius scales correspond with one another (-40°F = -40°C).

300. Kilowatt hour is the unit of-
(A) Energy **(B)** Power
(C) Force **(D)** Momentum

Ans.300(A) The kilowatt-hour is a unit of energy equal to 3600 kilojoules. The kilowatt-hour is commonly used as a billing unit for energy delivered to consumers by electric utilities. The kilowatt-hour is a composite unit of energy equal to one kilowatt (kW) of power sustained for one hour. Expressed in the standard unit of energy in the International System of Units (SI), the joule (symbol J), it is equal to 3600 kilojoules.

301. The which part of the eye having the larges refractive index is :
(A) Cornea **(B)** Aqueous humor
(C) Lens **(D)** Vitreous humor

Ans.301(C) The part of the eye having the largest refractive index is lens. The lens is a transparent, biconvex structure. It is located directly behind the iris (the colored part of the eye) and the pupil. Its function is to focuses light on the retina.

302. Conversion of heat into electrical is achieved by using:
(A) Ammeter **(B)** Hydrometer
(C) Voltmeter **(D)** Thermocouple

Ans.302(D) A thermocouple is a temperature-measuring device consisting of two dissimilar conductors that contact each other at one or more spots, where a temperature differential is experienced by the different conductors (or semiconductors).

303. Ball pen functions on the principle of-
(A) Viscosity **(B)** Boyles Law
(C) Gravitational force **(D)** Surface tension

Ans.303(D) Ball pen functions on the principle of surface tension. Pen is fitted with a tiny ball bearing in its tip. As the pen moves along the paper, the ball rotates picking up ink from the ink cartridge and leaving it on the paper.

304. A man cannot see clearly beyond 10meters. The disease he suffers from:
(A) Far sight **(B)** Myopia
(C) Cataract **(D)** Hyper metopic

Ans.304(B) Near sightedness (myopia) is a common vision condition in which you can see objects near to you clearly, but objects farther away are blurry. It occurs when the shape of your eye causes light rays to bend (refract) incorrectly, focusing images in front of your retina instead of on your retina.

305. When milk is churned the cream separates from it due to which doctrine:
(A) Frictional force **(B)** Centrifugal force
(C) Gravitational force **(D)** Viscous forces

Ans.305(B) Centrifugal force, a fictitious force, peculiar to a particle moving on a circular path, that has the same magnitude and dimensions as the force that keeps the particle on its circular path (the centripetal force) but points in the opposite direction. A stone whirling in a horizontal plane on the end of a string tied to a post on the ground is continuously changing the direction of its velocity and, therefore, has an acceleration toward the post.

306. Moving electric charge produces:
(A) magnetic field **(B)** Sound waves
(C) Light rays **(D)** Heat waves

Ans.306(A) A charged particle moving without acceleration produces an electric as well as a magnetic field. It produces an electric field because it's a charge particle. All of a sudden when it starts moving, it starts producing a magnetic field.

307. The S.I. Unit of electric charge is:
(A) ampere **(B)** Coulomb
(C) e.s.u **(D)** Kelvin

Ans.307(B) Coulomb, unit of electric charge in the metre-kilogram-second-ampere system, the basis of the SI system of physical units. It is abbreviated as C. The coulomb is defined as the quantity of electricity transported in one second by a current of one ampere. Named for the 18th–19th-century French physicist Charles-Augustin de Coulomb, it is approximately equivalent to 6.24 × 10 18 electrons.

308. Light beam which is highly directional is called:
(A) eraser **(B)** Grazer
(C) Maser **(D)** laser

Ans.308(D) Laser, a device that stimulates atoms or molecules to emit light at particular wavelengths and amplifies that light, typically producing a very narrow beam of radiation. The emission generally covers an extremely limited range of visible, infrared, or ultraviolet wavelengths. Many different types of lasers have been developed, with highly varied characteristics. Laser is an acronym for "light amplification by the stimulated emission of radiation."
The laser is an outgrowth of a suggestion made by Albert Einstein in 1916 that under the proper circumstances atoms could release excess energy as light—either spontaneously or when stimulated by light.

309. What is the fuel in the Sun?
(A) Helium **(B)** Hydrogen
(C) Oxygen **(D)** Carbon dioxide

Ans.309(B) The Sun currently fuses about 600 million tons of hydrogen into helium every second, converting 4 million tons of matter into energy every second as a result. This energy, which can take between 10,000 and 170,000 years to escape from its core, is the source of the Sun's light and heat.

310. What are the nuclei of different atoms containing same number of neutrons known as?
(A) Isobars **(B)** Isotopes
(C) Isotones **(D)** Isomers

Ans.310(C) Isotone, any of two or more species of atoms or nuclei that have the same number of neutrons. Thus, chlorine-37 and potassium-39 are isotones, because the nucleus of this species of chlorine consists of 17 protons and 20 neutrons, whereas the nucleus of this species of potassium contains 19 protons and 20 neutrons.

311. What is the ratio of the change in collector current to the change in base current at a constant collector-emitter voltage, when the common emitter transistor is in active state, known as?
(A) Input resistance
(B) Output resistance
(C) Current amplification factor
(D) None of the above

Ans.311(C) The ratio of change in collector current (ΔIC) to the change in emitter current (ΔIE) when collector voltage VCB is kept constant, is called as Current amplification factor. It is denoted by α.
$\alpha = \Delta IC / \Delta IE$ at constant VCB

312. Which of these diodes is used to detect optical signals?
(A) Photodiode
(B) Light emitting diode
(C) Photovoltaic diode
(D) None of the above

Ans.312(A) A photodiode is a semiconductor device that converts light into an electrical current. The current is generated when photons are absorbed in the photodiode. Photodiodes

may contain optical filters, built-in lenses, and may have large or small surface areas. Photodiodes usually have a slower response time as their surface area increases. The common, traditional solar cell used to generate electric solar power is a large area photodiode. Photodiodes are used in consumer electronics devices such as compact disc players, smoke detectors, medical devices and the receivers for infrared remote-control devices used to control equipment from televisions to air conditioners.

313. Sound of frequency below 20 Hz are called—
(A) Audio sounds **(B)** Infrasonic
(C) Ultrasonic **(D)** Supersonics

Ans.313(B) The term "infrasonic" applied to sound refers to sound waves below the frequencies of audible sound, and nominally includes anything under 20 Hz. Sources of infrasound in nature include volcanoes, avalanches, earthquakes and meteorites.

314. A man wearing spectacles, when working with a microscope—
(A) Cannot see anything through the microscope.
(B) Should keep on wearing spectacles.
(C) Should take off his spectacles.
(D) May work with or without spectacles.

Ans.314(C) If you wear eyeglasses, you may wonder whether you should keep them on or take them off while viewing samples through the microscope. If the glasses merely adjust for near-sightedness or farsightedness, or old age, then there is no need to wear glasses. You may find it more comfortable to do this if the eyepieces have rubber eye shields which help block out light from your peripheral vision.

315. The spread in colors in a rainbow on sky is primarily due to-
(A) Dispersion of sunlight
(B) Reflection of sunlight
(C) Refraction of sunlight
(D) Total internal reflection of sunlight

Ans.315(A) The sunlight splits into seven colors namely violet, indigo, blue, green, orange, and red. The prism splits the white light into seven different colors. This splitting of white light into many colors is called as a dispersion of light. This shows that the sunlight consists of several colors.

316. Ability of the eye to see objects at all distances is called—
(A) Binocular vision **(B)** Myopia
(C) Hypermetropia **(D)** Accommodation

Ans.316(D) Accommodation of an eye: While seeing at distant object, eye lens is thinner and its focal length is more (about 2.5 cm). While looking at near objects, eye lens assumes a more round shape, and its focal length decreases and nearby objects are clearly focused at the retina.

317. Mach number is used in connection with the speed of—
(A) Sound **(B)** Aircraft
(C) Spacecraft **(D)** Ships

Ans.317(B) The Mach number is the ratio of flow velocity after a certain limit of the sounds speed. In simple words it is the ratio of the speed of a body to the speed of sound in the surrounding medium. The formula of Mach Number is:
$M = u/c$
Where,
The Mach number is M
Based on the limits the local flow velocity is u
The speed of sound in that medium is c
To explain it simply, the speed of sound can be equated to Mach 1 speed. Thus, Mach 0.75 will be 75% of the speed of sound that is also called subsonic and Mach 1.65 will be 65% faster than the speed of light which is also called supersonic.

318. The layer of atmosphere used for radio wave transmission is-
(A) Chromospheres **(B)** Troposphere
(C) Ionosphere **(D)** Stratosphere

Ans.318(C) The ionosphere is the ionized part of Earth's upper atmosphere, from about 60 km to 1,000 km altitude, a region that includes the thermosphere and parts of the mesosphere and exosphere. The ionosphere is ionized by solar

radiation. It plays an important role in atmospheric electricity and forms the inner edge of the magnetosphere. It has practical importance because, among other functions, it influences radio propagation to distant places on the Earth. The region below the ionosphere is called neutral atmosphere, or neutrosphere. Geophysical, the state of the ionosphere plasma may be described by four parameters: electron density, electron and ion temperature and, since several species of ions are present, ionic composition. Radio propagation depends uniquely on electron density.

319. Negative feedback in amplifiers
(A) Increases bandwidth and decreases noise
(B) Decreases bandwidth and decreases noise
(C) increases bandwidth and increases noise
(D) Decreases bandwidth and increases noise

Ans.319(A) Advantages and disadvantages of negative feedback amplifier.
The negative feedback reduces noise.
It has highly stabilized gain.
It can control step response of amplifier.
It has less harmonic distortion.
It has less amplitude distortion.
It has less phase distortion.
Input and output impedances can be modified as desired.
It can increase or decrease output impedances.

320. Water cannot be used to extinguish fire caused by electric current because.
(A) It may cause electrocution
(B) It may cause hydrolysis
(C) It may cause electrolysis
(D) It may spoil the wiring

Ans.320(A) Water is not used for extinguishing fires caused due to electrical faults because water is good conductor of electricity. If water is poured on an electrical fire, the water could conduct electricity causing the person trying to extinguish the fire to experience an electric shock.

321. A periscope works on the principle of-
(A) Refraction
(B) Total internal reflection
(C) Diffraction
(D) Reflection

Ans.321(D) A periscope works on the Laws of Reflection of light which states that the light from the object falls on one mirror at a 45o angle from the object and is reflected. This reflected light then falls on another mirror and is again reflected until it reaches the human eye.

322. A copper disc has a hole. If the disc is heated the size of the hole
(A) Increases
(B) Decreases
(C) No change
(D) First increases and then decreases

Ans.322(A) When a metal plate with a circular hole at its centre is heated, definitely along with the areal expansion of the plate the diameter of the circular hole also increases.

323. A rear-view mirror for driving is
(A) plain **(B)** concave
(C) convex **(D)** inverted

Ans.323(C) Convex mirrors are curved mirrors that give a "compressed" view rather than a flat view. As a result, they cover a wider field of view and objects in the mirror appear smaller. This minimizes blind spots but also creates the illusion that things in the mirror are further away.

324. The important unit of a microprocessor Is-
(A) ALU
(B) Array of registers
(C) Control unit
(D) All of the above

Ans.324(D) The control unit (CU) is a component of a computer's central processing unit (CPU) that directs the operation of the processor. It tells the computer's memory, arithmetic/logic unit and input and output devices on how to respond to a program's instructions.
The basic functionality of the Microprocessor is to do processing. Microprocessor performs two type of operations called Arithmetic and Logic. So, the basic functionality unit which

consists of Arithmetic (Addition, Subtraction, Multiplication & Division) and Logic (AND, OR, NOT) is called Arithmetic Logic Unit.
The Central Processing Unit (CPU) is also known as the microprocessor or processor. The processor contains three sections called the Arithmetic Logic Unit (ALU), the Control Unit and Registers. Control unit: The Control Unit makes decisions and sends the appropriate signal down its lines to other parts of the computer.

325. Which one of the following has the highest value of specific heat?
(A) Glass **(B)** Copper
(C) Lead **(D)** Water

Ans.325(B) Copper is a chemical element with the symbol Cu and atomic number 29. It is a soft, malleable, and ductile metal with very high thermal and electrical conductivity. A freshly exposed surface of pure copper has a pinkish-orange color. Copper is used as a conductor of heat and electricity, as a building material, and as a constituent of various metal alloys, such as sterling silver used in jewelry, cupronickel used to make marine hardware and coins, and constantan used in strain gauges and thermocouples for temperature measurement. Electrical wiring is the most important market for the copper industry.

326. The device used for locating submerged objects under sea is.
(A) sonar **(B)** radar
(C) laser **(D)** maser

Ans.326(A) Sonar is a technique that uses sound propagation (usually underwater, as in submarine navigation) to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels. Two types of technology share the name "sonar": passive sonar is essentially listening for the sound made by vessels; active sonar is emitting pulses of sounds and listening for echoes. The first recorded use of the technique was by Leonardo da Vinci in 1490 who used a tube inserted into the water to detect vessels by ear.

327. The metal whose electrical conductivity is more is-
(A) copper **(B)** aluminium
(C) silver **(D)** lead

Ans.327(C) Silver is a chemical element with the symbol Ag and atomic number 47. A soft, white, lustrous transition metal, it exhibits the highest electrical conductivity, thermal conductivity, and reflectivity of any metal. Silver has long been valued as a precious metal. Silver metal is used in many bullion coins, sometimes alongside gold: while it is more abundant than gold, it is much less abundant as a native metal. Silver is very important in electronics for conductors and electrodes on account of its high electrical conductivity even when tarnished. Bulk silver and silver foils were used to make vacuum tubes, and continue to be used today in the manufacture of semiconductor devices, circuits, and their components.

328. In a photocell light energy is converted into.
(A) Potential energy
(B) Chemical energy
(C) Heat energy
(D) Electrical energy

Ans.328(D) In a photocell when light strikes a semiconductor material, the semiconductor causes the electrons to flow which creates electricity. Solar power generating systems uses this concept of converting light energy into electrical energy. Thus, a photocell converts light energy into electrical energy.
Electrical energy is a form of energy resulting from the flow of electric charge. Energy is the ability to do work or apply force to move an object. In the case of electrical energy, the force is electrical attraction or repulsion between charged particles. Electrical energy may be either potential energy or kinetic energy, but it's usually encountered as potential energy, which is energy stored due to the relative positions of charged particles or electric fields.

329. A storm is predicted if atmospheric pressure
(A) Rises suddenly **(B)** Rises gradually
(C) Falls suddenly **(D)** Falls gradually

Ans.329(C) Atmospheric pressure is basically the weight of air in the atmosphere above the reservoir, so the level of mercury continues to change until the weight of mercury in the glass tube is exactly equal to the weight of air above the reservoir. In areas of low pressure, air is rising away from the surface of the earth more quickly than it can be replaced by air flowing in from surrounding areas. This reduces the weight of air above the reservoir so the mercury level drops to a lower level. A sudden drop in atmospheric pressure over a few hours often forecasts an approaching storm, with heavy rain and strong winds.

330. What should a person on a freely rotating turn table do to decrease his (angular) speed?
(A) Bring his hands together
(B) Raise his hands up
(C) Spread his hands outwards
(D) Sit down with raised hands

Ans.330(C) When a person on a turn table will raise his hands, there will be increase in the momentum of inertia. Hence, the angular velocity of the turntable will decrease.

331. Which of the following celestial bodies contains abundant quantities of helium-3 a potential source of energy?
(A) Earth **(B)** Moon
(C) Venus **(D)** Saturn

Ans.331(B) The Moon and other celestial bodies contain a vast amount of natural resources. One, and in abundance, is helium-3. It is estimated that forty tons of it can meet twenty five percent of the global energy demand for one year. This clean, nonradioactive and safe source of energy scarcely exists on Earth. Helium-3 derives from the dismantlement of old and outdated nuclear warheads. Helium-3 is used within medicine, scientific research, and well logging operations in the oil and gas industry, and for homeland security. Major space nations such as Russia, China, India, and Japan appear to have integrated within their space programmers to commercially exploit the Moon for helium-3 in the future.

332. Smog is a combination of-
(A) Air and water vapors
(B) Water and smoke
(C) Fire and water
(D) Smoke and fog

Ans.332(D) Smog is a type of air pollutant; the word "smog" is a combination of smoke and fog. Classic smog results from large amounts of coal burning in an area and is caused by a mixture of smoke and sulfur dioxide. Smog is a kind of air pollution that is produced by the photochemical reaction of sunlight with nitrogen oxides and hydrocarbons which have been released into the atmosphere, specifically by automotive emissions.

333. Which of the following circuit elements is used to block DC in an electronic circuit?
(A) Resistances **(B)** Capacitance
(C) Inductance **(D)** Diode

Ans.333(B) Capacitance is the ratio of the change in electric charge of a system, to the corresponding change in its electric potential. There are two closely related notions of capacitance: self capacitance and mutual capacitance. Any object that can be electrically charged exhibits self capacitance. A material with a large self capacitance holds more electric charge at a given voltage than one with low capacitance. The notion of mutual capacitance is particularly important for understanding the operations of the capacitor, one of the three elementary linear electronic components (along with resistors and inductors).

334. Spectacles used for viewing 3D films have.
(A) Bifocal lens **(B)** Convex lens
(C) Concave lens **(D)** Polaroid's

Ans.334(D) Polarised sunglasses have been popular for years the most common approach to the production of 3D films is derived from stereoscopic photography. Polaroids are circularly polarized 3D glasses which uses polarization glasses to create the illusion of three-dimensional images by restricting the light that reaches each eye.

335. A boy sitting in an open car moving with the constant speed throws a ball straight up into the air. The ball falls.
(A) Behind him **(B)** in front of him
(C) Into his hand **(D)** By his side

Ans.335(A) The moment ball is thrown; it is moving with the velocity of the car. According to the inertia of motion it will continue to move in the same direction with the same velocity. As the ball is moving up and the down it will maintain its forward motion but practically it is not possible to neglect the resistance caused by air friction. So, the ball will fall behind him. Inertia is the resistance of any physical object to a change in its state of motion or rest, or the tendency of an object to resist any change in its motion.

336. The process involved in making soap is.
(A) Saponification **(B)** Hydrolysis
(C) Condensation **(D)** Polymerization

Ans.336(A) Saponification is a process by which triglycerides are reacted with sodium or potassium hydroxide (lye) to produce glycerol and a fatty acid salt called "soap." The triglycerides are most often animal fats or vegetable oils. When sodium hydroxide is used, a hard soap is produced. Using potassium hydroxide results in a soft soap.

337. A kilowatt-hour is unit of-
(A) Energy **(B)** Power
(C) Electric charge **(D)** Electric current

Ans.337(A) The kilowatt-hour is a unit of energy equal to 3600 kilojoules (3.6 megajoules). The kilowatt-hour is commonly used as a billing unit for energy delivered to consumers by electric utilities. A watt is a unit of power already. A kilowatt (kW) is just a thousand watts. It's also a unit of power. Power is a measure of how fast you are using energy. In engineering and science, we use joule as the unit of energy.

338. Ventilators are provided near the ceiling of the room because.
(A) The exhaled warmer air rises up and goes out.
(B) These provide cross ventilation in the room
(C) These provide some sunlight in the room.
(D) These do not look nice in the lower part.

Ans.338(C) Ventilators are provided near ceilings in the rooms of our houses because the air we breathe out is warm and rises out of the room through the ventilators. Cool fresh air rushes into the room through the doors and windows.

339. The hair of shaving brush clings together when removed from water due to.
(A) Surface tension **(B)** Viscosity
(C) Elasticity **(D)** Friction

Ans.339(A) Surface tension is the tendency of liquid surfaces to shrink into the minimum surface area possible. Surface tension allows insects (e.g. water striders), usually denser than water, to float and slide on a water surface. At liquid–air interfaces, surface tension results from the greater attraction of liquid molecules to each other (due to cohesion) than to the molecules in the air (due to adhesion). The net effect is an inward force at its surface that causes the liquid to behave as if its surface were covered with a stretched elastic membrane.

340. In severe winter in cold countries water pipes burs because.
(A) Water expands on freezing
(B) Contraction of water pipes
(C) High atmospheric pressure
(D) Combined effect of all the above three

Ans.340(A) When liquid water is cooled, it contracts like one would expect until a temperature of approximately 4 degrees Celsius is reached. After that, it expands slightly until it reaches the freezing point, and then when it freezes it expands by approximately 9%.

341. In the process of magnetization of a bar
(A) The entire bulk of the bar gets magnetized
(B) Only the surface of the bar gets magnetized.
(C) Only the ends of the bar get magnetized
(D) Only some parts of the outer layers of the bar get magnetized.

Ans.341(A) The Magnetic behavior of a magnet is characterized by the alignment of the atoms inside a substance. When a ferromagnetic substance is brought under the application of a strong external magnetic field, then they experience a torque wherein the substance aligns themselves in the direction of the magnetic field applied and hence gets strongly magnetized in the direction of the magnetic field.

342. A falling drop of rain water acquires the spherical shape due to.
(A) Viscosity
(B) Surface Tension
(C) Atmospheric pressure
(D) Gravitational force

Ans.342(B) Surface tension, property of a liquid surface displayed by its acting as if it were a stretched elastic membrane. This phenomenon can be observed in the nearly spherical shape of small drops of liquids and of soap bubbles. Because of this property, certain insects can stand on the surface of water. A razor blade also can be supported by the surface tension of water. The razor blade is not floating: if pushed through the surface, it sinks through the water.

343. The weakest of all fundamental forces is.
(A) Gravitational force
(B) Electrostatic force
(C) Magnetic force
(D) Nuclear force

Ans.343(A) Gravitation is the force of attraction between any two bodies. All the objects in the universe attract each other with a certain amount of force, but in most of the cases, the force is too weak to be observed due to the very large distance of separation. This force of attraction was first observed by Sir Isaac Newton and was presented as Newton's law of gravitation in the year 1680. Gravitation may be the attraction of objects by the earth.
Each body in this universe attracts other bodies towards itself with a force known as Gravitational Force, thus gravitation is a study of the interaction between two masses. Out of the two masses, the heavier one is called source mass and the lighter one is called test mass.
Gravitational force is a central force which depends only on the position of test mass from the source mass and always acts along the line joining the centers of the two.

344. Velocity of sound in air does not change with the change of-
(A) Temperature of air
(B) Pressure of air
(C) Moisture content in air
(D) Wind in the direction of propagation of sound.

Ans.344(B) The speed of sound depends on temperature. The formula relating speed of sound and temperature is as follows:
$v=331+0.6\times T$, where T is temperature in absolute scale and v is in m/s.
Humidity has little effect on the speed of sound.
Air pressure has no effect at all in an ideal gas approximation. This is because pressure and density both contribute to sound velocity equally, and in an ideal gas the two effects cancel out each other, leaving only the effect of temperature.
Composition of air has also almost no effect on the speed of sound.

345. The density of gas is maximum at-
(A) Low temperature low pressure
(B) Low temperature high pressure
(C) High temperature low pressure
(D) High temperature high pressure

Ans.345(B) The density of gases depends upon the temperature. The higher the temperature, the more the molecules are spread out and the lower the density. The result is that warm gases rise and cool gases sink. The same concept helps to explain the weather resulting in high and low pressures.

346. Why is it difficult to breathe at higher altitudes?
(A) Due to low air pressure
(B) Due to low temperature
(C) Due to ozone
(D) Due to high humidity

Ans.346(A) In order for your lungs to breathe air in without duress, the pressure has to be higher outside your body. But at high altitudes, the outside air pressure is lower than it is inside your lungs, making it more difficult to pull in the thinner air and for your veins to pump oxygen throughout the body.

347. On the basis of electrical resistance, all the substances can be divided into:
(A) Good conductors **(B)** Resistors
(C) Insulators **(D)** All of the above

Ans.347(D) Electrical resistance is opposition to the flow of current in an electric circuit: resistance converts electrical energy to thermal energy, and in this regard is similar to mechanical friction. Resistances are said to dissipate electrical energy as heat.

348. Which one of the following is not correctly matched?
(A) Voltmeter –Potential difference
(B) Potentiometer- EMF
(C) Ammeter – Electric current
(D) Meter bridge – Electrical resistance

Ans.348(B) A potentiometer is an electrical device used to measure the voltage between two points of a circuit.

349. Which of the following is not matched correctly?
(A) Amount of substance - mole
(B) Luminous intensity - candela
(C) Mass - kilogram
(D) Thermodynamic temperature - secon

Ans.349(D) Like other energy, its unit is also joules but it is also expressed in calories.

350. Which of the following matches is incorrect?

Invention	Inventor
(A) Thermometer	Galileo Galilei
(B) Cosmic Rays	Victor Hess
(C) Transformer	Michael Faraday
(D) Lift	Igor Sikorsky

Ans.350(D) Elisha Graves Otis was an American industrialist, founder of the Otis Elevator Company, and inventor of a safety device elevators.

351. Which of the following matches is incorrect?

Unit	SI unit
(A) Magnetic flux density	Weber
(B) Electric Capacitance	Farad
(C) Electrical conductance	Siemens
(D) Electric charge	Coulomb

Ans.351(A) The SI unit for magnetic flux density is the tesla which is equivalent to Weber's per square meter.

352. Which of the following matches is incorrect?

Invention	Inventor
(A) Dynamite	Alfred Nobel
(B) Atomic bomb	Edward Teller
(C) Laser	Robert Alexander Watson
(D) Transistor	John Bardeen

Ans.352(C) The first laser was built in 1960 by Theodore H. Maiman at Hughes Research Laboratories, based on theoretical work by Charles Hard Townes and Arthur Leonard Schawlow.

353. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I	List-II
a. Aluminum	**1.** the highest electrical conductivity, thermal conductivity
b. Copper	**2.** non-magnetic and ductile metal
c. Glass	**3.** a non-crystalline, often transparent amorphous solid
d. Silver	**4.** a soft, malleable, and ductile

Codes:

	A	B	C	D
(A)	1	2	4	3
(B)	1	4	2	3
(C)	2	4	3	1
(D)	2	1	4	3

Ans.353(C) Aluminium is a chemical element with the symbol Al and atomic number 13. It is a silvery-white, soft, non-magnetic and ductile metal in the boron group. By mass, aluminium makes up about 8% of the Earth's crust, where it is the third most abundant element (after

oxygen and silicon) and also the most abundant metal. Occurrence of aluminium decreases in the Earth's mantle below, however. The chief ore of aluminium is bauxite.

Copper is a chemical element with the symbol Cu (from Latin: cuprum) and atomic number 29. It is a soft, malleable, and ductile metal with very high thermal and electrical conductivity. A freshly exposed surface of pure copper has a pinkish-orange color.

Glass is a non-crystalline, often transparent amorphous solid, that has widespread practical, technological, and decorative use in, for example, window panes, tableware, and optics. Glass is most often formed by rapid cooling (quenching) of the molten form; some glasses such as volcanic glass are naturally occurring.

Silver is a chemical element with the symbol Ag and atomic number 47. A soft, white, lustrous transition metal, it exhibits the highest electrical conductivity, thermal conductivity, and reflectivity of any metal. The metal is found in the Earth's crust in the pure, free elemental form, as an alloy with gold and other metals, and in minerals such as argentite and chlorargyrite. Most silver is produced as a byproduct of copper, gold, lead, and zinc refining.

354. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I	**List-II**
a. SI unit of Force	1. Pascal
b. SI unit of pressure	2. Newton
c. SI unit of volume	3. Watt
d. SI unit of Power	4. Meter 3

Codes:

	A	**B**	**C**	**D**
(A)	1	2	4	3
(B)	1	4	2	3
(C)	2	4	3	1
(D)	2	1	4	3

Ans.354(D) The Newton is the SI unit of force. Strictly defined: the force that will give a mass of 1 kilogram an acceleration of 1 meter per second per second.

The pascal is the SI derived unit of pressure used to quantify internal pressure, stress, Young's modulus and ultimate tensile strength. The unit, named after Blaise Pascal, is defined as one newton per square metre. The unit of measurement called standard atmosphere is defined as 101325 Pa.

The SI unit of volume is, of course, meters3. Thus pV has units of newton meters, which is the unit of energy, the joule.

The watt (symbol: W) is a unit of power. In the International System of Units (SI) it is defined as a derived unit of 1 joule per second, and is used to quantify the rate of energy transfer. In SI base units, the watt is described as kg m2 s-3, which can be demonstrated to be coherent by dimensional analysis.

355. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I	**List-II**
a. Speedometer	**1.** a gauge that measures and displays the instantaneous speed of a vehicle.
b. Thermometer	**2.** measure your core body temperature
c. Odometer	**3.** is a unit of length in the metric system,
d. Kilometer	**4.** is an instrument used for measuring the distance

Codes:

	A	**B**	**C**	**D**
(A)	1	2	4	3
(B)	1	4	2	3
(C)	2	4	3	1
(D)	2	1	4	3

Ans.355(A) A speedometer or a speed meter is a gauge that measures and displays the instantaneous speed of a vehicle. Now universally fitted to motor vehicles, they started to be available as options in the 1900s, and as standard equipment from about 1910 onwards. Speedometers for other vehicles have specific names and use other means of sensing speed. For a boat, this is a pit log. For an aircraft, this is an airspeed indicator.

A thermometer should measure your core body temperature, which is the temperature of your heart, brain and other organs. This is usually measured in your ear because your eardrum temperature, which provides an accurate reflection of how warm your body is.

An odometer or odograph is an instrument used for measuring the distance traveled by a

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