# Top 100+ Physics Questions for NDA Exam

1. Ans. C.

For a telescope, the angular magnification MA produced by the combination of a particular eyepiece and objective can be given by

$MA=f_o/f_E$; where, $f_0$ is focal length of objective and $f_E$ is focal length of eyepiece

$25=50/f_E$. So, $f_E=50/25=$ 2 cm

Hence, option (C) is the correct answer.

2. Ans. A.

Light Year is a unit of long distances. It is calculated by the distance travelled by light in one year which is given as 9.5 trillion kilometers. Light moves at a velocity of about 300,000 km each second. So, light year is the distance covered by light in one Julian year.

3. Ans. D.

Magnetic field strength of Solenoid depends upon the following factors-

- Strength of the magnetic field in ampere-turns/meter
- Current flowing through the solenoid
- Number of turns of the coil
- Length of the solenoid in meters

It does not depend upon the diameter of solenoid.

4. Ans. A.

The Power dissipation is given by, P=I*V and Resistance of any wire is given by $R=\rho L/A$

Since, $P=I^2R$, then we have

$P=I^2\rho l/A$

Power dissipation by First Wire is given by $P= I^2\rho l/\pi r^2$

Power dissipation by second wire is given by $P_1=I^2\rho 2l/\pi(2r)^2$

$P_1=I^2\rho l/2\pi r^2=P/2 \Rightarrow P=2P_1$

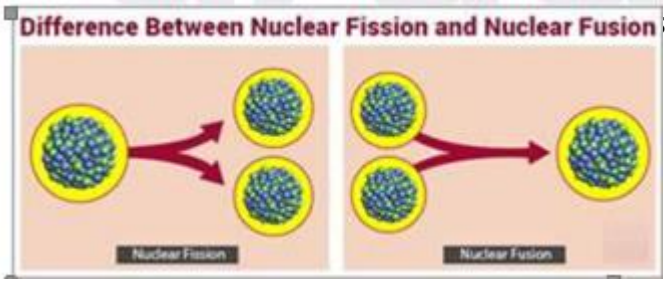
Hence, option (A) is the correct answer.

5. Ans. B.

Albert Einstein proposed the Laws of Photoelectric effect. Einstein won the Nobel Prize in Physics in 1921. As Einstein described, all the characteristics of the Photoelectric effect are due to the interaction of individual photons with individual electrons. Photoelectric effect is simply the phenomenon of release of electrons when a photon hits an electron on a metal surface. Wave-particle duality concept owes its origin to the photoelectric effect.

6. Ans. D.

The basic principle behind a nuclear reactor is Controlled Nuclear Fission. Nuclear fission and nuclear fusion are both the techniques that produces nuclear energy. In Nuclear Fission, radioactive materials are bombarded with neutrons which split nucleus into smaller nuclei. Whereas, Nuclear fusion is the technique for joining nuclei of light electrons to form a heavy energy is released.




7. Ans. D.

Resistance formula, $R=\rho L/A$;

Resistance of first copper wire; $R=\rho l/\pi r^2$ (Area of copper wire is given by $A=\pi r^2$)

Resistance of second copper wire having radius=2r and Length =l/2;

$R_2=\rho(l/2)/\pi(2r)^2$

So, $R_2=\rho l/(2*4\pi r^2)=\rho l/8A= R/8$

Hence, option (D) is the correct answer.

8. Ans. D.

Different metals have different melting point. Melting point for Iron is approx. $1500^0$C ($1538^0$C). Iron's boiling point is $2,862^0$C.

Gallium is the metal that melts when you take it in your hands.

9. Ans. C.

Sound is a longitudinal wave which needs a medium to propagate and does not travel through vacuum. Speed of sound is determined by density and compressibility of the medium. It is given by the equation,

$V=(K\rho)^{-1/2}$

V: speed of sound; K is compressibility and rho is the density.

Speed is also affected by temperature. Sound waves travel faster at high temperature. Speed is usually 1450 to 1498 meters per second in distilled water and 1531 mps in sea at room temperature of (20 to $25^0$C).

10. Ans. B.

Static charge only develops to insulators. These are the materials that do not allow the flow of charged electrons through them. They hold on to electrons very strongly. Static Electricity can charge insulators. They can build conductors, only when they are isolated.

11. Ans. C.

When an apple hangs to the tree, it stores Gravitational Potential Energy. When it falls, it comes in motion and the stored energy is converted to Kinetic Energy. When apple hits the ground, kinetic energy is transformed into heat energy and when it finally hits the ground it produces sound energy.

12. Ans. A.

Sunlight is a mixture of different colors. When it passes through a shower of rain which acts like a prism, it gets bent or refracted. Light leaving the prism spreads into continuous bands of color known as spectrum forming VIBGYOR.

A combination of Convex and Concave lens having same refractive indexes will behave as a plane mirror and light will simply pass through it.

13. Ans. C.

Potential energy is present between the links of the atom. When two atoms come closer, the potential energy decreases as the repulsive force increases. when a bond is formed. The energy of the system will decrease.

14. Ans. A.

Spring tide: At the time of new and full moon, the gravitational pull of Sun and Gravitational pull of the moon on Earth are supplementary. This results into high tide more than usual. This increase is called as Spring tide. In this, there is greatest difference in the sea level at high and low tides.

15. Ans. A.

Fuse is a piece of wire of a material with a very low melting point. When a high current flows through the circuit due to overloading or short circuit, at that time wire gets over heated and melts. As result of it, the circuit got broken and current stops flowing. They should have high conductivity than all other conductor present in the circuit otherwise an accidental fuse will blow somewhere else.

16. Ans. B.

- When a beam of white light passes through a glass prism, the emergent ray is deviated from its original direction by a certain angle.
- This angle is called the angle of deviation.
- During the dispersion of white light, **red colour has the least deviation.**

17. Ans. A.

to convert temperatures into degrees Celsius to Fahrenheit, we use the formula in which value in degree Celsius multiplied by 1.8 and then added to 32.

$^{o}F = 32 + (1.8 \times {}^{o}C)$

18. Ans. C.

Black hole is a place in space-time which is having strong gravitational acceleration. No particle even electromagnetic radiation can escape it. According to theory of relativity prediction has been made that sufficiently compacted mass can transform to form Black hole.

19. Ans. C.

The thermos flasks were invented by Reinhold Berger and Albert Aschenbrenner.

Thermos flask is super insulated jug. It consist of inner chamber and outer plastic or metal case separated by two layers of glass with vacuum in between. The glass is usually lined with reflective metal layer means having shiny surface. The vacuum prevents conduction. When infrared tries to leave the liquid, the reflective inner chamber reflects it straight back in again. So there is no way for heat to go outside and outer wall can absorb it.

20. Ans. C.

CD is representing accelerated motion because velocity is increasing with time. And we know that positive change in velocity with time is acceleration.

AB representing decelerated motion because velocity keeps decreasing with increase of time. And negative change in velocity with time is known as decelerated motion.

21. Ans. D.

A dyne is derived unit of force specified in the centimeter gram second (CGS) system. One dyne is equal to $10^{-5}$ kg m/$s^2$ or $10^{-5}$ N. Further a dyne can be defined as force required to accelerate a mass of one gram at a rate of one centimeter per second squared.

22. Ans. B.

The velocity of object A is highest because it is covering more distance in less time. As we know speed is the ratio of distance and time. Object C is having less distance in more time than the speed will be less.

So the correct relation will be $V_A > V_B$

$> V_C$ 23. Ans. B.

It is because of refraction of light in the atmosphere. Light enters from rarer to denser medium when it enters from vacuum to earth's surface. It bends towards Horizon. At the time of Sunrise, we see sun early because sun is just below the horizon and our atmosphere causes the light rays to bend. Also the time of sunset, because of same bending of rays we see only apparent position of sun not the actual position.

24. Ans. A.

we know that $g=\frac{GM}{R^2}$

Mass of planet M1=density × volume

$M1= d\times\frac{4}{3}\times\pi\times r1^3$

$M2= d\times\frac{4}{3}\times\pi\times r2^3$

Now $g1=\frac{G\times d\times\frac{4}{3}\times\pi\times r1^3}{R^2}$

$g2=\frac{G\times d\times\frac{4}{3}\times\pi\times r2^3}{R^2}$

We get ratio of gravity is $\frac{g1}{g2}=\frac{r1}{r2}$

Given that r1>r2 then g1>g2

25. Ans. A.

The MOI of ring and disc of same weight and mass is given by

$\frac{1}{2}MR^2$ *and* $\frac{1}{4}MR^2$ .

The kinetic energy is given by $I\omega^2$ .The ring has higher kinetic energy than the disc. This is because the kinetic energy of the ring is $\frac{1}{2}\omega^2MR^2$ while that of the ring is $\frac{1}{4}\omega^2MR^2$ .

Hence, the kinetic energy of ring > kinetic energy of disc.

26. Ans. C.

-During the process of thermal radiation, the heat waves travel along straight lines with the speed of light. Thermal radiation is emitted by matter as a result of vibrational and rotational movement of the molecule. It includes ultraviolet radiation, all visible and infrared radiation. It does not require any medium and energy is transported by electromagnetic waves; hence it is also the fastest method.

27. Ans. B.

The sudden change will be in momentum (P=mv) of the ball as the velocity will change suddenly after the bouncing off the ground. The **kinetic energy** (KE) of an object is the energy that it possesses due to its **motion**.

**Potential energy** (PE) is defined as mechanical energy, stored energy, or energy caused by its **position**.

28. Ans. A.

– if an object is moving with a non zero acceleration with initial velocity 'u'. According to the newtons law of motion, the distance covered in time 't' is given by $S = ut + \frac{1}{2}at^2$ .

Here, we can see that the distance is dependent on initial velocity 'u' and the square of time 't'.

29. Ans. A.

If the mass and radius of disc and a solid sphere is M and R respectively. then the moment of inertial of disc and solid sphere is given by $\frac{1}{2}MR^2$ and $\frac{2}{5}MR^2$ respectively. So Disc has a higher moment of inertia.

According to the principles of inertia, bodies that have more mass at the centre have lower levels of the moment of inertia, which is directly related to the rate at which an object can spin.

30. Ans. A.

- The density of substances are $P_1$ and $P_2$. Let V volume of both the substances is mixed, now the masses (density x volume)of the substances are $VP_1$ and $VP_2$.

Now, the density of the mixture

$$= \frac{mass}{volume} = \frac{VP_1 + VP_2}{V + V} = 4(given) = \frac{P_1 + P_2}{2} = 4 \Rightarrow P_1 + P_2 = 8 \quad \text{...i}$$

Let M mass of both substances are mixed, now the volume $\left(\frac{mass}{density}\right)$ of the substances are $\frac{M}{P_1}$ and $\frac{M}{P_2}$ .

Now, the

$$density\ of\ mixture = \frac{mass}{volume} = \frac{M+M}{\frac{M}{P_1}+\frac{M}{P_2}} = 3(given)$$

$$\Rightarrow \frac{2P_1P_2}{P_1+P_2} = 3$$

$$\Rightarrow \frac{2P_1P_2}{8} = 3$$

$$\Rightarrow P_1P_2 = 12 \qquad ...ii$$

On solving equation (i) and (ii) we get…….

$\rho_1 = 6; \rho_2 = 2$

31. Ans. D.

According to the conservation of energy**,** the energy of interacting bodies or particles in a closed system remains constant; in other words, energy can neither be created nor destroyed.

Ohm's law states that "The current through a conductor between two points is directly proportional to the voltage across the two points."

Conservation of momentum, according to this law of the total momentum of an isolated system of interacting particles is conserved.

32. Ans. C.

– The smallest value which can be measured by the measuring instrument is called its **least count**.

A) $0.50\ mm$ , the minimum possible measurement is 0.01 mm, $LC = 0.01mm$

B) $29.07\ cm$, the minimum possible measurement is 0.01 cm, $LC = 0.01cm = 0.1mm$

C) $0.925m$, the minimum possible measurement is 0.001 m, $LC = 0.001m = 1\ mm$

D) $910mm$ , the minimum possible measurement is 10 mm, $LC = 10mm$

33. Ans. A.

If the work done on the system or by the system is zero, $\Delta W = 0$ According to the law of thermodynamics, the change in internal energy is given by $\Delta U = \Delta Q + \Delta W$ , where $\Delta W$ is work done and $\Delta Q$ is the heat change.

If $\Delta W = 0$ then $\Delta U = \Delta Q$ or Change in internal energy of the system is equal to the flow of heat in or out of the system.

34. Ans. C.

Mass of water, $m_1$ = 10g

Mass of ice, $m_2$ = 10 g

Specific heat of water, $s_1 = 1 cal/g - ^oC$

Specific heat of ice, $s_2 = 1\ cal/g - ^oC$

Latent heat of fusion, $L = 80\ cal/g$

Now total required heat $= m_1 s_1 \Delta T + \left(m_2 s_2 \Delta T + m_2 L + m_2 s_1 \Delta T\right)$

$= 10 \times 1 \times 10 + 10 \times .5 \times \left(0 - (-10)\right) + 10 \times 80 + 10 \times 1 \times 10$

$= 100 + 50 + 800 + 100$

$= 1050\ cal$

35. Ans. A.

The heat generated by the coil = $i^2 Rt = \frac{v^2}{R} t$ , where i = current,

V = voltage, R is resistance of the coil and t is the time.

Temperature is not directly related to current and voltage, but an increase in current flow through a resistive material causes heating effect and current increases, so voltage must be increased. Therefore, the temperature is a function of resistance, i.e. R{T}. Also, voltage is directly proportional to current via Ohm's Law. So going by this we can say that as the voltage is increased, current increases through the load and the load shows the heating effect.

36. Ans. B.

The loudness of a sound depends on the amplitude of the sound wave. The sound is loud if the amplitude of the sound wave is large. It is directly proportional to the square of the amplitude of vibration. If the amplitude of the sound wave becomes double, then the loudness of the sound will be quadrupled. It is expressed in decibel (dB). Sounds above 80 dB becomes noise to human ears.

37. Ans. A.

- The force of gravitational attraction is directly dependent upon the masses of both objects and inversely proportional to the square of the distance that separates their centres. Newton's conclusion about the magnitude of gravitational forces is summarised symbolically as $F \propto \frac{m_1 m_2}{R^2}$

where *m*1 and *m*2 are masses of the object and R is the distance of separation between them.

Now the gravitational force in first system is given as

$$F = k\frac{M \times M}{R^2} = k\left(\frac{M}{R}\right)^2$$

And the gravitational force of 2nd system $= k\frac{(2M)\times(2M)}{\left(\frac{R}{2}\right)^2} = 16k\left(\frac{M}{R}\right)^2 = 16F$

Hence, the magnitude of the gravitational force between them will increase by 16 times.

38. Ans. B.

The cathode rays start from the cathode and move towards the anode. These rays glow, when they strike on the fluorescent screen. In the absence of electrical or magnetic field, these rays travel in straight lines. In the presence of the electrical or magnetic field, the behaviour of cathode rays is similar to negatively charged particles, suggesting that the cathode rays consist of negatively charged particles, called electrons. The characteristics of cathode rays (electrons) do not depend upon the material of electrodes and the nature of the gas present in the cathode ray tube.

39. Ans. C.

**The radiation given off by the Sun includes both infrared rays, visible light and ultraviolet rays (short-wavelength).** All of these

types of radiation are part of the electromagnetic spectrum. Sunlight is the visible and most common type of radiation that is given off by the Sun.

40. Ans. C.

Electromagnetic waves are non elastic waves in the sense that they don't really need a material medium for their propagation like sound waves do. They also can move in vacuum

Electromagnetic waves are the waves that are created as a result of vibrations between an electric field and a magnetic field when they are perpendicular to each other. They are also transverse waves which can polarise without any medium, and they do not get deflected, nor they show interference and diffraction.

The speed of EM waves is nearly the speed of light.

41. Ans. D.

- Ohm's law states that the current through a conductor between two points is directly proportional to the voltage difference across the two points. It also states that in a conducting device, ohms law is not dependent on magnitude and polarity of applied voltage as well as the direction of the applied electric field.

42. Ans. A.

- The average velocity of an object is its total displacement divided by the total time taken, since the displacement is zero, the average Velocity is also zero.

43. Ans. B.

- For parallel combination resistance is

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$$

$$\frac{1}{R}=\frac{1}{2}+\frac{1}{4}+\frac{1}{8}$$

$$\Rightarrow \frac{1}{R}=\frac{7}{8}\Rightarrow R=\frac{8}{7}$$ ohm

Now, for series combination resistance is

$R = R_1 + R_2$

$\Rightarrow R = \frac{8}{7} + 1$

$\Rightarrow R = \frac{15}{7}$ ohm

Hence, option B is the correct answer.

44. Ans. A.

- The time period of a pendulum is $2\pi\sqrt{\frac{l}{g}}$, here T is directly proportional to the length and is inversely proportional to $\sqrt{g}$ and independent on mass.

If the length of the first pendulum is l and gravity is g, then the time period of the first pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$

Now, it is given that the length of 2nd pendulum is same but the gravity is $\frac{g}{2}$. Hence the time period

45. Ans. D.

An optical fibre is a cylindrical dielectric waveguide that transmits light along its axis, by the process known as total internal reflection. The refractive index of the core is high in comparison to the refractive index of cladding in an optical fibre so that that total internal reflection can take place here. Optical fibre works on the principle of Total Internal Reflection of light. It has its applications in the field of Communication, Broadband Internet, Computer Networking etc.

46. Ans. D.

- Given that, mass of a body = 2kg

Balloon kept at a height = 50 m

Now, the total energy = mgh

= 2X9.8X50

= 980J

Speed of the body calculated as , $v^2 = u^2 + 2as$

$v^2 = 0 + 2 \times 9.8 \times 50$

$v^2 = 980$

$v = \sqrt{980}$ m/s

47. Ans. B.

If an object having some chemicals inside it and it starts moving with a uniform velocity than chemical reactions happening in the system cannot change the kinetic energy of the particles inside with respect to the centre of mass of an object.

48. Ans. A.

$\frac{C}{5} = \frac{F-32}{9}$

$\frac{C}{5}$ = 113-32/9

C = $45^0$ C

NOW, To change in kelvin,

= 45 + 273.15 K

= 318.15 K

49. Ans. D.

The types of electromagnetic radiation are broadly classified into the following classes (regions, bands or types):[5]

1. Gamma radiation

2. X-ray radiation

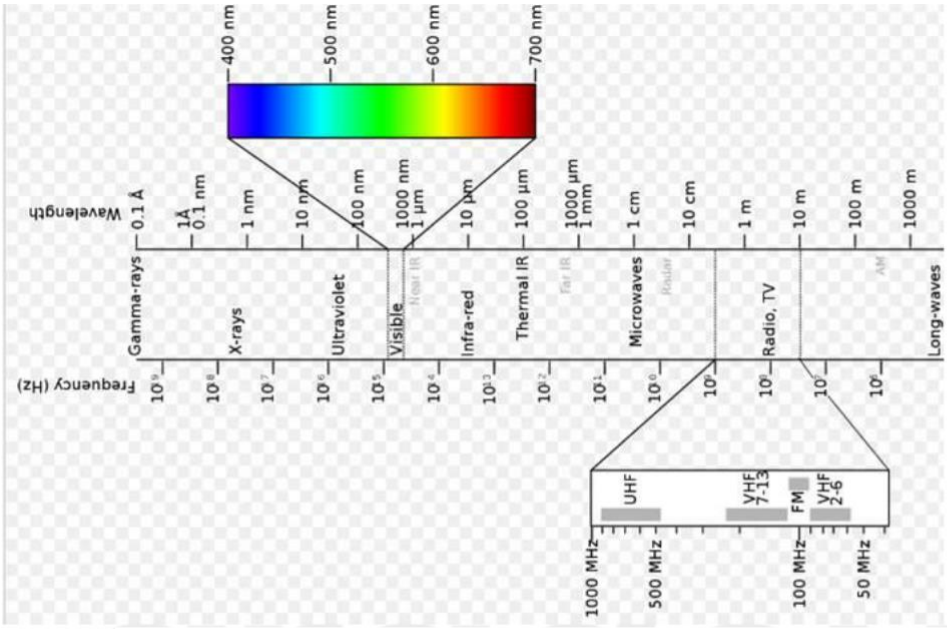
3. Ultraviolet radiation

4. Visible light

5. Infrared radiation

6. Microwave radiation

7. Radio waves




As we can see from the figure the frequency of ultrasound waves is greater than the sound waves and the wavelength is lower than the sound waves.

The speed id also depend on the frequency $(v \propto \upsilon)$.

50. Ans. B.

Time of flight T = 2 sec

Maximum height above the point of projection:

h = $\frac{u^2 \sin^2\theta}{2g} = T^2 \times \frac{g}{8}$

= $\frac{2 \times 2 \times 10}{8} = 5$ m

So, option B is correct.

51. Ans. C.

$$\vec{a}_{av} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$$

$\Delta\vec{v} = 5\sqrt{2}$ m/sec$^2$

$\vec{a} = \frac{5\sqrt{2}}{10} = \frac{1}{\sqrt{2}}$ m/sec$^2$ (in north-west direction).

So, option C is correct.

52. Ans. B.

Here, m = 12 kg and M = 18 kg and $v_M$ = 6 m/s and $v_m$ = ?

By the Law of Conservation of Momentum , we can find $v_m$

$V_m = \frac{Mv_M}{m} = \frac{18\times 6}{12} = 9$ m/s

Now,

K.E of 18 kg mass is = $\frac{1}{2}mv_m^2 = \frac{1}{2}\times 12\times 9^2 = 486$ J

So, option B is correct.

53. Ans. D.

Rotational K.E -

$K_R = \frac{1}{2}I\omega^2 = \frac{1}{2}L.\omega$

$\Rightarrow L = \frac{2k_R}{\omega}$

As the frequency is doubled, angular velocity is also doubled, and $k_R$ is halved ($k_R' = \frac{1}{2}k_R$)

Hence, $L' = \frac{2k_R'}{\omega'} = \frac{2.\frac{k_R}{2}}{2\omega} = \frac{L}{4}$

So. Option D is correct.

54. Ans. C.

g = $\frac{GM}{R^2}$

Hence, $\frac{\Delta g}{g} = -2\frac{\Delta R}{R}$

As, $\frac{\Delta R}{R} = -1\%$

Hence, $\frac{\Delta g}{g} = -2(-1\%) = +2\%$

So, option C is correct.

55. Ans. C.

Range R is same for angles of projection $\theta$ and ($90^\circ$ - $\theta$) and $R = \frac{u^2}{g}\sin 2\theta$ .

$T_1 = \frac{2u\sin\theta}{g}$ and $T_2 = \frac{2u}{g}\sin(90^\circ - \theta) = \frac{2u}{g}\cos\theta$

$\therefore T_1T_2 = \frac{2u\sin\theta}{g}.\frac{2u\cos\theta}{g}$

$\frac{2u^2\sin 2\theta}{g^2} = \frac{2}{g}R$

Or, $T_1T_2 \alpha R$

So, option C is correct.

56. Ans. D.

Here, $\vec{u} = 10 m/\sec$ then $\vec{v} = -\vec{u} = 10$ m/s in opposite direction ,time t = 0.01 s.

$\therefore |\vec{a}| = \frac{\vec{v}-\vec{u}}{t} = \frac{2u}{t}$

$= \frac{2\times 10}{0.01} = 2\times 10^3$

Force $|\vec{F}| = ma$

$= \frac{250}{1000} \times 2 \times 10^3$

=500N

So, option D is correct.

57. Ans. C.

We can directly use the result of the acceleration of the system.

a = $\frac{(m_1 - m_2)}{(m_1 + m_2)} g = \left(\frac{4-3}{4+3}\right) \times 9.8 = 1.4 m/\sec^2$

# So, option C is correct.

58. Ans. D.

When a body rolls down without slipping along an inclined plane of inclination θ, it rotates about a horizontal axis through its centre of mass and also it's centre of mass moves. Therefore, the rolling motion may be regarded as a rotational motion about an axis through its centre of mass plus a translational motion of the centre of mass. As it rolls down, it suffers a loss in gravitational potential energy provided translational energy due to frictional force is converted into rotational motion.

So, option D is correct.

59. Ans. C.

As per 'Law of Conservation of Mechanical Energy' -

$k = \frac{1}{2} M v^2 = \frac{1}{2} k l^2$

$\Rightarrow v = \sqrt{\frac{k}{M}} l$

Momentum, p = Mv = $\sqrt{kM}\, l$

So, option C is correct.

60. Ans. B.

If a body falls from height h, then from eq. of motion we know that it will hit the ground with a velocity say u = $\sqrt{2gh}$ which is also the velocity of approach here . Now, if after the collision it gains a height $h_1$ then again by eq. of motion v = $\sqrt{2gh_1}$ , which is also the velocity of separation. so, by definition of e.

e = $\sqrt{\frac{2gh_1}{2gh}}$ or $h_1 = e^2 h$

here, h =20 m , e = 0.9

$h_1 = (0.9)^{2\times 20}$

= 16.2 m

So, option B is correct.

61. Ans. B.

We will apply 'Energy Conservation' to calculate the speed at the bottom point.

$$\frac{1}{2}mv^2+\frac{1}{2}I\omega^2=mgh$$ .....eq 1st

Now, we know that for a solid cylinder M.O.I = $\frac{1}{2}MR^2$

And $v=\omega R$ then eq. 1st became

$$\Rightarrow \frac{1}{2}mv^2+\frac{1}{2}\left(\frac{1}{2}mR^2\right)\left(\frac{v}{R}\right)^2=mgh$$
$$\Rightarrow \frac{1}{2}v^2\left(1+\frac{1}{2}\right)=gh$$
$$\Rightarrow v=\sqrt{\frac{4}{3}gh}$$

So, option B is correct.

62. Ans. C.

Copernicus gave 'Heliocentric Theory' of our planetary system.

The Heliocentric Theory argues that the sun is the central body of the solar system and perhaps of the universe. Everything else (planets and their

satellites, asteroids, comets, etc.) revolves around it.

So, option D is correct.

63. Ans. B.

From Kepler's Third Law:

$T^2 \alpha r^3$ or $T \alpha (r)^{3/2}$

$$\frac{T_2}{T_1} = \left(\frac{r_2}{r_1}\right)^{3/2}$$

$$\Rightarrow T_2 = T_1\left(\frac{r_2}{r_1}\right)^{3/2}$$

$$= 365\left(\frac{1}{2}\right)^{3/2}$$

=129 days

So, option B is correct

64. Ans. D.

Breaking Stress = Y (Breaking Strain)

= $3\times10^{10}$ N/m$^2$

So, option D is correct.

65. Ans. C.

Volume remains constant after coalescing.

Thus, $\frac{4}{3}\pi R^3 = 2\times\frac{4}{3}\pi r^3$

where R is the radius of bigger drop and r is the radius of each smaller drop.

R = $2^{1/3}$r

Now, Surface Energy per unit surface area is the Surface Tension. So,

Surface Energy, w =

Or W =

Therefore, Surface Energy of the bigger drop:

$W_1 = 4\pi\left(2^{1/3}r\right)^2 T$

$= (2^{2/3})\ 4\pi r^2 T$

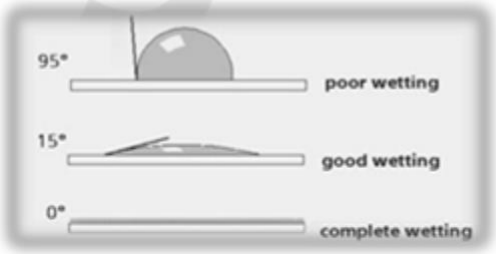
Surface Energy of Smaller drop: $W_2 = 4\pi r^2 T$

Hence, $\frac{W_1}{W_2} = 2^{2/3} : 1$

So, option C is correct.

66. Ans. B.

A liquid will not wet the sides of the solid container if its angle of contact is obtuse.




So option B is correct.

67. Ans. A.

As the liquid film has two surfaces hence,

F = S.2l

$\Rightarrow S = \frac{F}{2l} = \frac{2\times10^{-2}}{2\times(10\times10^{-2})}$

$= 10^{-1}$ N/m = 0.1 N/m

Hence, option A is correct.

68. Ans. D.

Here, $\gamma = 1.5$ and $v_2 = \frac{v_1}{4}$, Sudden compression means that the change is adiabatic change. Hence:

$$p_2 = p_1\left(\frac{v_1}{v_2}\right)^{\gamma} = p_1(4)^{1.5} = 8p_1$$

So, option D is correct.

69. Ans. A.

For the Adiabatic Process , $\Delta Q = 0$

$$\Delta U = -\Delta W$$
$$\Rightarrow nC_v dT = +146\times10^3 J$$

So, $\frac{nfR}{2}\times 7 = 146\times10^3$

Where f is the degree of freedom

$$\Rightarrow \frac{10^3 \times f \times 8.3 \times 7}{2} = 146\times10^3$$
$$\Rightarrow f \cong 5$$

So, it is a Diatomic gas.

Option A is correct.

70. Ans. B.

An ideal black body absorbs all the radiations incident upon it and has an emissivity equal to 1. If a black body and an identical another body arc kept at the same temperature, then the black body will radiate maximum power. Hence, the black object at a temperature of 2000◦C will glow brightest.

So, option B is correct.

71. Ans. A.

Under identical pressure and temperature condition, speed of sound in moist air is more than that in dry air, i.e., $V_m > v_d$

So, option A is correct.

72. Ans. C.

When heat is given to a gas in an isobaric process, then

$$\Delta Q = \Delta U + \Delta W$$
$$\Rightarrow \Delta Q = \Delta U + p\Delta V$$

Hence, $\Delta U = +ve$, i.e., internal energy of gas increases and in isobaric process work is done by gas, which is $\Delta W = p\Delta V$

So, option C is correct.

73. Ans. A.

The maximum velocity of a particle performing SHM is given by $v = A\omega$, where A is the amplitude and $\omega$ is the angular frequency of oscillation.

$$\therefore 4.4 = (7\times10^{-3})\times\frac{2\pi}{T}$$
$$\Rightarrow T = \frac{7\times10^{-3}}{4.4}\times\frac{2\times22}{7} = 0.01$$

= 0.01 s

So, option A is correct.

74. Ans. C.

If no external torque act on the system then angular momentum will remain to conserve i.e.;

$$\tau = 0$$
$$\Rightarrow \left(\frac{dL}{dt}\right) = 0$$
$$L = cons\tan t$$

Hence, $m\ v_{max}\ r_{min} = m\ v_{min}\ r_{max}$

$$r_{min} = \frac{v_{min}\times r_{max}}{v_{max}}$$

$$= \frac{1\times10^3\times4\times10^4}{3\times10^4}$$

$$= \frac{4}{3}\times10^3 \text{ km}$$

So, option C is correct.

75. Ans. C.

We know, Acceleration due to gravity is given by,

$g=GM/R^2$ Where, g: acceleration due to gravity

G: universal gravity constant

M: mass of the body

R: distance from the centre of the mass of large

body $M_1=M$, $M_2=2M$

$R_1=RR_2=2R$

$g_2/g_1=(GM/R^2)_2/(GM/R)_1=GM_2/R_2^2\times R_1^2/M_1$

$g_2/g_1=2M/(2R)^2\times R/M$

hence, $g_2=g_1/2$

76. Ans. D.

| Microscope | Telescope |
|---|---|
| To see smaller objects | To see large and distant objects |
| Focal length of eyepiece lens is greater than the focal length of the objective lens. | Focal length of the objective is greater than the eyepiece. |
| The aperture of the objective is small. | The aperture of the objective is large. |
| For higher magnification, focal length of the object should be small. | For higher magnification, focal length of the objective should be large. |

77. Ans. B.

Ohm's Law states that the current (I) is inversely proportional to the resistance R. so, when the current increases, the resistance will decrease.

As per the Ohm's law, correct sequence of resistances will be-

$R_1<R_3<R_2$

78. Ans. C.

Electrical wires follow standard coding. In India, wires are RGB mode- Red-Green-Black. Each of these RGB have different functions.

Red- It signifies the phase in electric circuit. It indicates live wire.

Black- It signifies neutral wire. It is connected to neutral bus bar inside an electric panel. It does not carry charge or current.

Green- it stands for grounding/earthing in electric circuit. These wires are usually not meant for lights and fans purposes; they are chiefly used for AC, geyser, TV, microwave, etc.

79. Ans. B.

We know,

Time Period= $2^{\pi\sqrt{l}/g}$

New time period $T_2/T_1=\sqrt{L2/L1}$

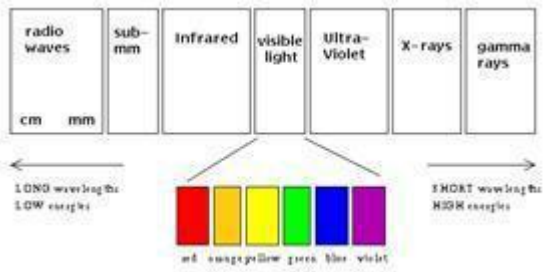
$T_2=T\sqrt{4L/L}$

Hence, $T_2=2T$

80. Ans. B.

Statement 3 is incorrect, as energy of UV light photon is more than that of visible light photon.

Wavelength of visible light is more than that of X-rays and the energy of X-rays photon is higher than that of UV photons.




81. Ans. B.

To calculate $R_{AB}$;

As we know, $1/R_1=1/R+1/R =2/R$

$R_1=R/2$

Since, $R_1$ and $R_2$ are series connected, so

$\Rightarrow R_1=R_1+R$
$\Rightarrow R/2+R$
$\Rightarrow 3R/2$

Now, $1/R_{AB}=1/R_2+R$

$\Rightarrow 2R/3+R$
$\Rightarrow 5R/3$

Hence, $R_{AB}=3/5R$

82. Ans. B.

A reflex arc is a neural pathway which controls a reflex. Most reflex arcs have 5 major components viz. receptors, sensory neurons, interneurons, motor neurons and muscles.

The correct circuit of reflex arc is:

Receptor, Sensory neurons, Spinal cord, motor neurons, effector

For example, a pain in receptor in the fingertip which ends with a motor neuron at an effector that is a skeletal muscle.

83. Ans. B.

Potential Energy is given by,

$\Rightarrow PE = q \times \Delta V$

$= 1.6 \times 10^{-1}$ Joule

Hence, (B) is the correct answer.

84. Ans. A.

- Light Emitting Diode (LED) is a semiconductor light source.
- LED is made up of millions of diode fabricated electronically to create screen for visualization.

85. Ans. B.

Angstrom to Nanometer conversion Table-

| Angstrom (A) | Nanometer (nm) |
|---|---|
| 0.01 | 0.001 |
| 0.1 | 0.01 |
| 1 | 0.1 |
| 2 | 0.2 |
| 10 | 1 |
| 100 | 10 |

86. Ans. A.

According to Ampere's Law, Current (I) in the wire induces a magnetic field (B) which is proportional to the current.

Hence, magnetic field strength of a current carrying wire depends upon the current in the wire.

87. Ans. D.

The frequency of ultrasound wave is greater than 20kHz. Human hearing is in the range of about 20Hz to 20,000Hz. The ultrasound waves are above normal human hearing. So, we can not hear ultrasound.

88. Ans. A.

Sound does not travel through vacuum. In vacuum, the region is marked by the absence of air. Space is such an area. So, sound waves require a medium to propagate and hence can not travel in space. Both the

statements are correct with statement 2 as the correct explanation of statement 1.

89. Ans. B.

Pitch of the sound depends on its frequency. A high pitch indicates high frequency sound wave whereas low frequency corresponds to a low frequency sound wave. Also, loudness of sound depends on its amplitude. Both statements are correct, but second statement is not he correct explanation of first statement.

90. Ans. C.

At the center of the current carrying coil, the magnetic field intensity is directly proportional to current and number of turns in the coil and inversely proportional to radius of the coil. The formula for magnetic induction is,

$B1= \frac{\mu_0 I}{2a} xN$

If the number of turns got doubled and radius got halved then

$B2= \frac{\mu_0 I}{a} x2N$

B2=4xB1

B2=4x0.1=0.4 tesla

91. Ans. A.

When a object placed in front of convex mirror image is always formed behind the mirror. The image formed by convex mirror is always virtual. When object starts moving towards mirror then the image starts moving away from focus. Only when the object is at infinity the image is at focus. The image formed by the convex mirror is always smaller the object.

92. Ans. C.

A plane mirror is a flat refractive surface. In the plane mirror angle of reflection is equal to angle of incidence. The image formed in the plane mirror is always virtual, upright and having same shape and size. Focal length of plane mirror is infinite because focal length of mirror is R/2 and radius of a mirror is infinite.

93. Ans. A.

Refractive index of a medium is inversely proportional to

velocity. Given that $n_2/n_1$ is 1.5

So $v_1 / v_2 = 1.5$

94. Ans. B.

The relationship between areal and volume expansion is,

$\beta/2=\gamma/3$

$\gamma=3x\beta/2$

$\gamma=3x\ 1.6 \times 10^{-5} /2$

$\gamma=2.4 \times 10^{-5}\ K^{-1}$

95. Ans. C.

$S=ut+1/2at^2$

$100=0+1/2xax4^2$

$a= 12.5\ cm/s^2$

Acceleration= g sin

g sin = 12.5

$\sin\theta = 12.5/1000=1/80$

$\theta = \sin^{-1}\frac{1}{80}$

96. Ans. A.

The power of a lens is defined as the reciprocal of its focal length.

D=1/f, where D is in dioptre and f is in meters.

D=1/0.5 = 2 dioptre

97. Ans. D.

Acceleration is change in velocity with reapect to time. Above time and velocity graph acceleration during 8s to 12 second is

Acceleration = 4-8/12-8= -1 $m/s^2$

98. Ans. A.

X-rays have wavelength of around 1 A (1 angstrom is 1×10^-10 meters). And in nanometers it is around 0.1 to 10 nanometers.

99. Ans. D.

The Step-Up Transformer increases the voltage from primary to secondary. Secondary Winding has more windings than the primary winding. Step-up transformers are used in transmission lines to replace the high voltage produced by the alternator. The power loss of a transmission line is directly proportional to the square of the current flow through it.

100. Ans. C.

Energy can neither be created nor destroyed. This statement is stated in the 'First Law of Thermodynamics' which is also known as Law of Conservation of Energy. Energy can only be transferred from one form to another form.

The 'Second Law of Thermodynamics' states that disorder always increases in the universe. After cleaning your room, it always has a tendency to get messy again. This is a consequence of the second law. As the disorder increases in the universe, energy changes to less useful forms. Thus, the efficiency of any process will always be less than 100%.

The 'ThirdLlaw of Thermodynamics' tells us that all molecular movements stop at a temperature we call absolute zero, or 0 Kelvin (-273$^oC$). Since temperature is a measure of molecular movement, there cannot be a temperature less than absolute zero. At this temperature, there is no disorder in a complete crystal.

101. Ans. B.

According to the International Astronomical Union (IAU), a light-year is a distance that light travels in a vacuum in one Julian year (365.25 days). Because it includes the word "year", the term light-year can be misinterpreted as a unit of time.

Astronomical units: 63241 au; 0.3066 pc. It is about 9.47 quadrillion metres or 5.9 trillion miles.

102. Ans. B.

Weight of the object will decrease as compared to its weight in the air. This is because by Archimedes' Principle if an object is immersed in a fluid, it experiences an apparent loss of weight which is equal to the weight of the fluid displaced. All objects are immersed in the buoyancy or high force of water experience. Even if the object is too heavy (denser than water) to float, it will still experience a force.

103. Ans. B.

When a lighted bulb is placed at the focus of the Concave Mirror Reflector, then Reflector of the mirror turns the incoming rays from the source in the parallel direction.

That's why it is used in vehicle headlights to send parallel rays because it allows light to be focused as a single beam.

104. Ans. A.

High-Altitude cooking is the opposite of Pressure Cooking in that the boiling point of water is lower at higher altitudes due to the decreased atmospheric pressure. This often requires an increase in cooking times or temperature and alterations of recipe ingredients.

105. Ans. B.

The ionization energy of the hydrogen atom in the ground state is 13.6 eV. Ionization energy is the amount of energy required to remove the most relaxed electron or valence electron from an atom.

Ionization energy, also known as Ionization Potential, IE, IP, $\Delta H°$, is the energy required to extract an electron from a gaseous atom or ion. The first or initial ionization energy or $E_i$ of an atom or molecule is the energy required to remove one mole of electrons from one mole of individual gaseous atoms or ions. The higher the ionization energy, the more difficult it is to remove an electron. Therefore, ionization is an indicator of energy reactivity. Ionization energy is important because it can be used to help estimate the strength of chemical bonds. Ionization energy is reported in units of kilojoule per mole (kJ/mole) or electron volts (eV).

106. Ans. D.

The charge carriers that are present in large quantities are called **'Majority Charge Carriers'**. The majority of charge carriers carry most of the electric charge or electric current into the semiconductor. Therefore, the majority of charge carriers are mainly responsible for the electric current in the semiconductor. When a trivalent atom such as boron or gallium is added to the inner semiconductor, a p-type

semiconductor is formed. In P-type semiconductor, a large number of holes are present. Therefore, **holes** are the majority charge carriers in P-type semiconductors.

107. Ans. A.

**Ultraviolet waves or UV rays are used to detect fake currency. The paper currency consists of a strip that is embedded in a note. This bandage cannot be forged like the original pose. So, to detect a forgery in currency notes, UV rays are used.**

**Radio waves have the longest wavelength of all electromagnetic waves. They range in length from about one foot to several miles. Radio waves are often used to transmit data and are used for all types of applications, including radio, satellite, radar, and computer networks.**

**Microwave waves are accompanied by radio waves that are measured in centimetres. We use microwaves in cooking, disseminating information and radar, which helps in forecasting the weather. Microwaves are useful in communication because they can penetrate clouds, smoke and light rain.**

**Infrared waves have waves that are close to visible light at wavelengths. These are infrared waves used to change channels in your TV remote. Far-infrared waves are far from visible light in wavelengths. Far-infrared waves are thermal and give heat. Anything that gives heat transmits infrared waves.**

**Ultraviolet light is used by powerful telescopes such as the Hubble Space Telescope to visualize distant stars. Some insects, such as the bumblebee, may see ultraviolet light.**

108. Ans. B.

**Convex mirrors are commonly used as rear-view mirrors in vehicles because they give an erect, virtual, full size diminished image of distant objects with a wider field of view.**

- **Plane Mirrors - These are flat mirrors that represent images in their normal proportions, reversed from left to right. It is the most common type of mirror used in bedrooms and bathrooms.**

- **Concave Mirrors - Concave mirrors are spherical mirrors that tilt inward like a spoon. They cause confusion of largeness and are usually found in bathrooms and bedrooms.**

**• Convex Mirrors - Convex mirrors are also spherical mirrors. However, unlike concave mirrors, they magnify and distort the reflected image, making it smaller.**

**• Cylindrical lenses can be used in single axial convergence or divergence of beams and can be found in optical measurements, laser scanning, spectroscopy, laser diode output beam shaping, X-ray light microscopic imaging, etc.**

109. Ans. A.

**A Geiger Counter is a device used to detect and measure radiation. Also known as the Geiger-Mueller counter, it is widely used in applications such as radiation dosimetry, radiological protection, experimental physics, and the nuclear industry.**

**A Polarimeter is a scientific instrument used to measure the angle of rotation, which alternately passes polarized light through an active substance.**

**A Calorimeter is a device used to measure the heat flow of a chemical reaction or physical change. The process of measuring this heat is called Calorimetry.**

**A basic Calorimeter consists of a metal container of water above a combustion chamber, in which a thermometer is used to measure changes in water temperature. A colorimeter is a photosensitive device that is used to measure the transmittance and absorption of light passing through a liquid sample. The device measures the intensity or concentration of the colour that develops upon introducing a specific reagent into a solution.**

110. Ans. B.

**About 8 minutes. Sunlight travels at the speed of light, photons emitted from the surface of the sun need to travel in the vacuum of space to reach our eyes. The short answer is that it takes 8 minutes and 20 seconds of sunlight to travel from the Sun to the Earth.**

111. Ans. B.

**Emission refers to a process by which any object is liberated. In the same way, the process by which free electrons are released from the metal and enter a vacuum is called electron emission and when it absorbs light energy, free electrons are released from the**

**metal. Photoelectric emission is also called photoemission or photoelectron emission or photoelectric effect.**

- **Thermionic emission occurs when a large amount of external energy in the form of heat is supplied to the free electrons in the metals.**

- **Field emission, also called Cold Emission, discharge of electrons from the surface of a material subjected to a strong electric field.**

- **Due to the creation of the electric field intensity needed for obtaining the auto electronic emission sufficient for excitation of the magnetron, provides for the possibility of the instant start of the magnetron without the need for first heating the cathode.**

112. Ans. D.

If the objects are dropped from the same height, they will reach the bottom simultaneously. Gravitational force is independent of the mass of the body. The acceleration due to gravity is same for all the objects, so $t_1 = t_2 = t_3$.

113. Ans. C.

The Henry (H) is the SI unit of inductance. Reduced to base SI units, one henry is the equivalent of a one-kilogram meter squared per second squared per ampere squared (kg $m^2$ $s^{-2}$ $A^{-2}$ ). The Hertz is a unit derived from time which measures the frequency in the International System of Units (SI). Symbol: Hz, definition: 1/s.

114. Ans. A.

When an Ultrasonic Wave transmits from one material/medium to another having different indices of refraction, then due to the different velocities of the waves within the two materials/medium both reflected and refracted waves are produced.

Certain Gases (like $CO_2$, $N_2$, $H_2$) and liquid absorb the Ultrasound Energy which as a result increases their temperature.

115. Ans. D.

Micro wave, Visible light, Infrared, Ultraviolet, Gamma Rays, X-ray and Radio Waves are Electromagnetic Waves. They don't need a medium to propagate and can travel through a vacuum.

However, Sound Wave is a longitudinal, mechanical wave needs a medium to propagate and cannot travel through a vacuum.

116. Ans. C.

There are 4 basic laws of Thermodynamics.

The state that- "heat transfer occurs spontaneously only from a body at higher temperature towards lower temperature". It states that the final entropy of the system must be greater than or identical to the initial entropy. Entropy is a measure of the amount of disorder within a system.

117. Ans. B.

Ultrasonic Waves are sound waves having a frequency above 20,000 Hz. They are inaudible to human ears.

They are widely used in Communication devices, Medical application, in Defense equipment and other industries.

Bats use Ultrasonic Waves to navigate and catch prey. They emit Ultrasonic Waves while moving at high speed and in pitch darkness. When the sounds are reflected back, bats sense it and can trace the prey.

118. Ans. A.

The magnitude of the Centripetal Acceleration ($a_c$) of an object moving in a circle of radius "r" at a speed "v" = $v^2$ / r

Now since $a_c$ is inversely proportional to a radius so the centripetal acceleration of the object is smaller for a gentle curve (i.e., the curve of larger radius) than that for a sharp curve (i.e., the curve of smaller radius).

119. Ans. A.

Each of the two semicircles between the two ends of the diameter has a resistance of 20/2=10.

These two resistors are in parallel between the two ends of the diameter. Thus the effective

resistance is

R= R1*R2 / R1+R2

= 10*10/10+10

= 5

120. Ans. C.

• Phase of oscillating particle at any instant is a physical quantity which completely expresses the position and direction of motion of particle at that instant with respect to its mean position. Phase of the oscillating particle is equal at t=3s and t=7s.

• By the figure, we can see that the time period of the oscillation is 4 sec. its mean after 4 sec. the position and the phase of the particle will be same.

121. Ans. B.

The electrical field due to sphere

122. Ans. D.

Let the speed of light in a medium of refractive index ( n )is v.

Then n = c/v or

Now the ratio of the velocity of light in glass and water:

$$\frac{v_1}{v_2}=\frac{n_2}{n_1}=\frac{4/3}{3/2}=\frac{8}{9}$$

123. Ans. D.

Whenever any liquid is heated it expand and its container also expand so it is more complicated to measure the coefficient due to expansion of both liquid and the container.

124. Ans. D.

We know that,

$$F = G\frac{m_1 m_2}{r^2}$$

Here:

G is universal Gravitational Constant and independent to other factors, $G = 6.67 \times 10^{-11}$

F is directly proportional to $m_1 m_2$

F is indirectly proportional to

The Gravitational Acceleration 'g' is maximum at the surface of the earth.

125. Ans. C.

Cut off wavelength is given by -

$$E = \frac{hc}{\lambda}$$

$$\lambda = \frac{hc}{E} = \frac{hc}{eV}$$

$$\lambda \text{ proportional to } \frac{1}{V}$$

Cut off wavelength doesn't depend on the separation between the filament & the target.

Thus, the cut off wavelength will be halved if the potential difference applied to the tube is doubled.

126. Ans. B.

(K-273)/5 = (F - 32)/9.

As it is given that K = F, we have

9k - 2457 = 5K - 160 or

4k = 2297 or

K = 574 or 574-273 = 301

Hence option, "B" is correct.

127. Ans. B.

In physics, angular frequency, i.e. ω (also considered by the terms angular speed, circular frequency, radial frequency, radian frequency, orbital frequency & pulsatance) is a scalar calculating quantity of rotation rate.

It is even known as to the angular displacement per unit time (for e.g. in rotation) or we can say that the rate of change of the phase of a sinusoidal waveform (for e.g. in oscillations and waves) or we can also say that as the changing rate of the argument of the sine function.

Angular Frequency / Angular Speed is the magnitude of the vector quantity angular velocity.

1 revolution is equal to 2π radians, hence

$$\omega = \frac{2\pi}{T}$$

$$\omega = 2\pi f$$

where:

ω is the angular frequency or angular speed (calculated in radians per second),

T is the period (calculated in seconds),

f is the ordinary frequency (calculated in hertz) (sometimes symbolised with v).

128. Ans. D.

When a rod is rubbed by wool, the rod becomes negatively charged while the wool becomes positively charged. This is because the electron in wool are less tightly bounded than electron in rod. So the friction between during rubbing makes the rod to gain electron from wool to rod.