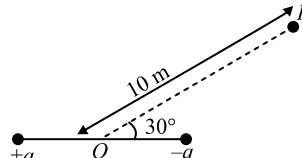




PHYSICS

SECTION-A

1. The interference pattern is obtained with two coherent light sources of intensity ratio 4:1. In the interference pattern, ratio $\frac{I_{\max} - I_{\min}}{I_{\max}}$ will be
- (1) 4 : 3
(2) 1 : 9
(3) 8 : 9
(4) 5 : 4
2. For the travelling harmonic wave $y(x, t) = 2.0 \cos 2\pi(10t - 0.0080x + 0.35)$ where x and y are in cm and t is in second. The phase difference between oscillatory motion of two points separated by a distance 4 m will be;
- (1) 9.4π rad
(2) 2.4π rad
(3) 6.4π rad
(4) 7.4π rad
3. The capacity of a parallel plate capacitor depends on;
- (1) the material used to make the plate.
(2) the thickness of the plates.
(3) the potential applied across the plates.
(4) the separation between the plates.
4. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A , is;
- (1) independent of the distance between the plates.
(2) linearly proportional to the distance between the plates.
(3) inversely proportional to the distance between the plates.
(4) proportional to the square root of the distance between the plates.
5. An inductor 20 mH, a capacitor $100 \mu F$ and a resistor 50Ω are connected in series across a source of emf, $V = 10 \sin 314 t$. The power loss in the circuit is;
- (1) 0.79 W
(2) 0.43 W
(3) 1.13 W
(4) 2.74 W
6. A short electric dipole of dipole moment $\sqrt{13} \times 10^{-6} \text{ C-m}$ is placed horizontally as shown and a point P is situated at distance 10 m from the centre of the dipole. The magnitude of electric field at point P due to dipole is;
- 
- (1) 90.5 N/C
(2) 50.5 N/C
(3) 58.5 N/C
(4) 78.5 N/C
7. The gravitational field at some point in space is $(g = 4\hat{i} + 5\hat{j}) \text{ N/Kg}$. The force exerted on a 5 kg mass placed at a point in the space is approximately.
- (1) 52 N
(2) 45 N
(3) 32 N
(4) 125 N
8. An emf wave is propagating in a medium with a velocity $\vec{V} = V\hat{i}$. The instantaneous oscillating electric field of this emf wave is along +y axis. Then the direction of oscillating magnetic field of the emf wave will be along;
- (1) -z direction
(2) +z direction
(3) -x direction
(4) -y direction
9. Which of the following quantities increases when wavelength of light incident on optical system increased? (Consider only magnitudes);
- (1) Power of a converging lens
(2) Focal length of a converging lens
(3) Focal length of a diverging lens
(4) Both (2) and (3)
10. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be;
- (1) 30 cm away from the mirror.
(2) 36 cm away from the mirror.
(3) 36 cm towards the mirror.
(4) 30 cm towards the mirror.



11. The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance;

(1) 0.138 H (2) 138.88 H
(3) 13.89 H (4) 1.389 H

12. Read the following statements and choose the correct option.

Statement (A): Output of NAND gate is inverse of AND gate.

Statement (B): The Boolean expression for two input NAND gate is $Y = \overline{A \cdot B}$

(1) (A) is true, (B) is false
(2) (A) is false, (B) is true
(3) (A) and (B), both are true
(4) (A) and (B), both are false

13. A satellite in a circular orbit around the earth has kinetic energy E_k . What is the minimum amount of energy to be added so that it escapes from the earth?

(1) $\frac{E_k}{4}$ (2) $\frac{E_k}{2}$
(3) E_k (4) $2E_k$

14. A solid sphere is in rolling motion. In rolling motion, a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$ for the sphere is;

(1) 7 : 10 (2) 5 : 7
(3) 2 : 5 (4) 10 : 7

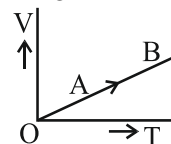
15. Water is filled in a vessel upto a height of 20 cm. The bottom of vessel is circular with radius 10 cm. If atmospheric pressure is 1.01×10^5 Pa, what is force exerted by water on the bottom? (density of water = 1000 kg m^{-3});

(1) 1620 N (2) 2820 N
(3) 3230 N (4) 4115 N

16. Two wires are made of same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area $3A$. If the length of the first wire is increased by $\Delta \ell$ on applying a force F , then how much force is needed to stretch the second wire by the same amount?

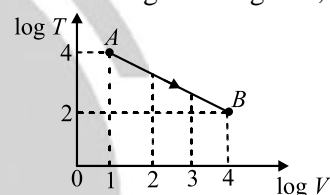
(1) $9F$ (2) $6F$
(3) F (4) $4F$

17. The volume (V) of a monatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B , is;



(1) $\frac{2}{5}$
(2) $\frac{2}{3}$
(3) $\frac{2}{7}$
(4) $\frac{1}{3}$

18. Figure shows the adiabatic on $\log T$ and $\log V$ scale performed on ideal gas. The gas is;



(1) Monatomic
(2) Diatomic
(3) Triatomic
(4) Mixture of monatomic and diatomic

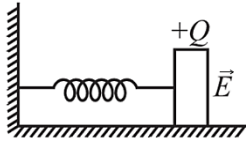
19. On the horizontal surface of truck a block of mass 5 kg is placed and coefficient of friction between the block and surface is $\mu = 0.4$. Maximum acceleration of truck for which the block will **not** move over the surface of truck is?

(1) 6 ms^{-2} (2) 5 ms^{-2}
(3) 4 ms^{-2} (4) 8 ms^{-2}

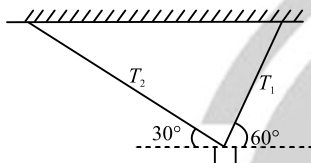
20. Three objects, A (a solid sphere), B (a thin circular disk) and C (a circular ring), each have the same mass M and radius R . They all spin with the same angular speed about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation.

(1) $W_C > W_B > W_A$
(2) $W_A > W_B > W_C$
(3) $W_A > W_C > W_B$
(4) $W_B > W_A > W_C$

21. A spring-block system undergoes simple harmonic motion on smooth horizontal surface. The block is now given some positive charge and a uniform horizontal electric field to the right is switched on as a result;



- (1) the time period of oscillation will increase.
 - (2) the time period of oscillation will remain unaffected.
 - (3) the mean position of simple harmonic motion will shift to the right.
 - (4) both (2) and (3).
22. A block of mass $m = 6 \text{ kg}$ is suspended by two strings making angle 30° and 60° with the horizontal. The tensions T_1 and T_2 are respectively.



- (1) $30 \text{ N}, 30 \text{ N}$
 - (2) $30\sqrt{3} \text{ N}, 30\sqrt{3} \text{ N}$
 - (3) $30\sqrt{3} \text{ N}, 30 \text{ N}$
 - (4) $30 \text{ N}, 30\sqrt{3} \text{ N}$
23. What percentage of total kinetic energy of a rolling spherical shell is rotational?
- (1) 50%
 - (2) 100%
 - (3) 40%
 - (4) 60%

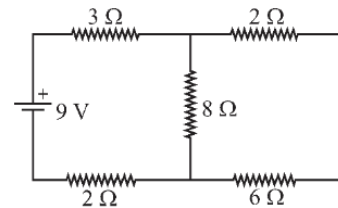
24. Rain is falling vertically downwards with speed of 30 m/s . A woman rides a bicycle with speed of $10\sqrt{3} \text{ m/s}$ in west to east direction. What is the direction in which she should hold the umbrella to save herself from rain?
- (1) at $\tan^{-1}(3)$ with vertical
 - (2) 30° with vertical
 - (3) 60° with vertical
 - (4) at $\tan^{-1}(1/3)$ with vertical

25. The coefficient of thermal conductivity depends upon;
- (1) temperature difference of two surfaces.
 - (2) area of the plate.
 - (3) thickness of the plate.
 - (4) material of the plate.

26. When a large bubble rises from the bottom of a lake to the surface. Its radius doubles. If atmospheric pressure is equal to that of column of water height H , then the depth of lake is;

- (1) H
- (2) $2H$
- (3) $7H$
- (4) $8H$

27. In the circuit shown in diagram the current through 6Ω resistor is;



- (1) 1 A
- (2) 0.1 A
- (3) 0.5 A
- (4) 1.2 A

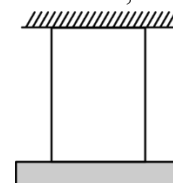
28. A cricket bat is cut at the location of its centre of mass as shown. Then;



- (1) the two pieces will have the same mass.
- (2) the bottom piece will have larger mass.
- (3) the handle piece will have larger mass.
- (4) mass of handle piece is double the mass of bottom piece.

29. On forward biasing the $p-n$ junction it;
- (1) reduces the majority carrier current to zero.
 - (2) raises the potential barrier.
 - (3) lowers the potential barrier.
 - (4) increases the electric field in depletion.

30. Two wires of equal length and cross-section are suspended as shown in figure. Their Young's modulus are Y_1 and Y_2 respectively. The equivalent Young's modulus will be;



- (1) $Y_1 + Y_2$
- (2) $\frac{Y_1 + Y_2}{2}$
- (3) $\frac{Y_1 Y_2}{Y_1 + Y_2}$
- (4) $\sqrt{Y_1 + Y_2}$



31. For an opaque body coefficient of transmission is;
(1) Zero (2) 1
(3) 0.5 (4) ∞
32. A capillary tube is attached horizontally to a constant pressure head arrangement. If the radius of the capillary tube is increased by 10% then the rate of flow of liquid will change nearly by;
(1) + 10%
(2) + 46%
(3) - 10%
(4) - 40%
33. An observer, at origin, is observing a force acting on a body at (5, 4). If no angular acceleration is observed, then the force acting on body can be;
(1) $8\hat{i} + 10\hat{j}$ (2) $10\hat{i} + 8\hat{j}$
(3) $8\hat{i} - 10\hat{j}$ (4) $10\hat{i} - 8\hat{j}$
34. Which of the following is **true** for nuclear force?
(1) nuclear forces are charge independent
(2) nuclear force are spin independent
(3) nuclear force are central forces
(4) nuclear forces are long range forces
35. A charged particle is released from rest in a region of uniform electric and magnetic fields, which are parallel to each other. The locus of the particle will be;
(1) helix of constant pitch.
(2) straight line.
(3) helix of varying pitch.
(4) cycloid.
- SECTION-B**
36. A radioactive nucleus splits into two nuclei of mass number 27 and 64 respectively. The ratio of their radius is;
(1) 4 : 3 (2) 9 : 8
(3) 3 : 4 (4) 8 : 9
37. Magnetic field due to the motion of the electron in n^{th} energy state of hydrogen atom is proportional to;
(1) $\frac{1}{n}$ (2) $\frac{1}{n^2}$
(3) $\frac{1}{n^5}$ (4) $\frac{1}{n^3}$
38. In an AC circuit, voltage $V = V_0 \sin \omega t$ and an inductor of inductance L are connected in series. The instantaneous power will be;
(1) $\frac{V_0^2}{\omega L} \sin 2\omega t$
(2) $\frac{V_0^2}{2\omega L} \sin(2\omega t)$
(3) $\frac{V_0^2}{2\omega L} \cos(2\omega t)$
(4) Zero
39. A gas is filled in a vessel at 27°C . To what temperature should it be heated in order that $1/3^{\text{rd}}$ of mass of the gas may escape out?
(1) 350 K (2) 400 K
(3) 450 K (4) 200 K
40. An electron of a stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be;
(1) $\frac{25m}{24hR}$ (2) $\frac{24m}{25hR}$
(3) $\frac{24hR}{25m}$ (4) $\frac{25hR}{24m}$
41. A cyclist turns around a curve at 15 miles/hour. If he turns at double the speed, the tendency to overturn is;
(1) Doubled (2) Quadrupled
(3) Halved (4) Unchanged
42. In the half wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be;
(1) 25 Hz (2) 50 Hz
(3) 70.7 Hz (4) 100 Hz
43. Which of the following can **not** be the angular momentum of an electron orbiting in a hydrogen atom?
(1) $\frac{2h}{\pi}$ (2) $\frac{h}{\pi}$
(3) $\frac{3h}{2\pi}$ (4) $\frac{5h}{4\pi}$



44. The electric field in an electromagnetic wave was found to oscillate with an amplitude of 36 Vm^{-1} . The amplitude of the oscillating magnetic field is;

- (1) $6 \times 10^{-8} \text{ T}$ (2) $12 \times 10^{-8} \text{ T}$
(3) $18 \times 10^{-8} \text{ T}$ (4) $20 \times 10^{-8} \text{ T}$

45. Consider the following two statements.

- A. Electrostatic field lines do not form any closed loops.
B. Gauss's law is very useful in calculation of the electrostatic field when the system doesn't have any symmetry.

Which of the following options is **correct**?

- (1) Statement A is correct while statement B is incorrect.
(2) Statement B is correct while statement A is incorrect.
(3) Both statement A and B are correct.
(4) Both statement A and B are incorrect.

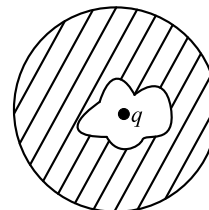
46. Magnetic permeability is maximum for;

- (1) ferromagnetic substances.
(2) diamagnetic substances.
(3) paramagnetic substances.
(4) same for all materials.

47. Molecules in which the centres of positive and negative charges do **not** coincide are called?

- (1) non-polar molecules
(2) conductor molecules
(3) polar molecules
(4) semiconductors

48. A metallic sphere has an irregular cavity inside it as shown. A point charge q is placed in the cavity, then the charge distribution on the inner surface of the cavity and on the outer surface of the sphere will be respectively;



- (1) Uniform, Uniform
(2) Uniform, non-uniform
(3) Non-Uniform, Uniform
(4) Non-Uniform, Non-uniform

49. A photoelectric cell is illuminated by a point source of light 2 m away. When the source is shifted to 1 m, then;

- (1) each emitted electron carries two times of initial energy
(2) number of electrons emitted is two times of the initial number
(3) each emitted electron carries four times of the initial energy
(4) number of electrons emitted is four times of the initial number

50. A space shuttle is launched in a circular orbit near the earth's surface. The additional velocity to be given to the space-shuttle to get free from the influence of gravitational force, will be;

- (1) 1.52 km/s (2) 2.75 km/s
(3) 3.28 km/s (4) 5.18 km/s

