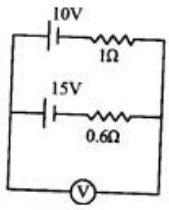
VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

PHYSICS	BITSAT 2018

1. A capillary tube of radius R is immersed in water and water rises in it to a height H. Mass of water in the capillary tube is M. If the radius of the tube is doubled, mass of water that will rise in the capillary tube will now be:

(a) M
(b) 2M
(c) M/2
(d) 4M

2. A 10V battery with internal resistance 1Ω and a 15V battery with internal resistance 0.6Ω are connected in parallel to a voltmeter (see figure). The reading in the voltmeter will be close to :

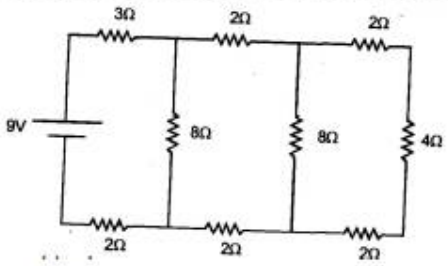


(a) 12.5 V
(b) 24.5V
(c) 13.1 V
(d) 11.9 V

3. If the edge lengths of a cuboid are measured to be 1.2 cm, 1.5 cm and 1.8 cm, then the volume of the cuboid is

(a) $3.240\ \mathrm{cm}^3$
(b) $3.24\ \mathrm{cm}^3$
(c) $3.2\ \mathrm{cm}^3$
(d) $3.0\ \mathrm{cm}^3$

4. In the circuit shown in the figure, find the current through



(a) the 3Ω is 0.50 A
(b) the 3Ω is 0.25 A
(c) the 4Ω is 0.50 A
(d) the 4Ω is 0.25 A

5. The resistance of the wire at 20°C is 20 Ω and 500°C is 60 Ω. At which temperature its resistance will be 25 Ω ?

(a) 50°C

(b) 60°C

(c) 70°C

(d) 80°C

6. A particle moving along x-axis has acceleration f, at time t, given by f = $f_0\left(1-\frac{t}{T}\right)$, where f_0, and T are constants. The particle at t = 0 has zero velocity. In the time interval between t = 0 and the instant when f = 0, the particle's velocity (v_x) is

(a) $\frac{1}{2}f_0T^2$

(b) $\mathrm{f_0T^2}$

(c) $\frac{1}{2}f_0T$

(d) f_0T

7. A charged particle enters in a uniform magnetic field with a certain velocity. The power delivered to the particle by the magnetic field depends on

(a) force exerted by magnetic field and velocity of the particle.

(b) angular speed ω and radius r of the circular path.

(c) angular speed ω and acceleration of the particle.

(d) None of these

8. Given $\vec{P} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\vec{Q} = \hat{j} - 2\hat{k}$. The magnitude of their resultant is

(a) $\sqrt{3}$

(b) $2\sqrt{3}$

(c) $3\sqrt{3}$

(d) $4\sqrt{3}$

9. Two projectiles A and B thrown with speeds in the ratio $1 : \sqrt{2}$ acquired the same heights. If A is thrown at an angle of 45° with the horizontal, the angle of projection of B will be

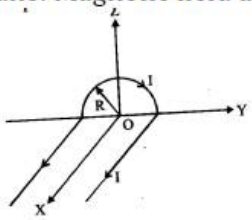
(a) 0°

(b) 60°

(c) 30°

(d) 450

10. A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane. Magnetic field at point O is:



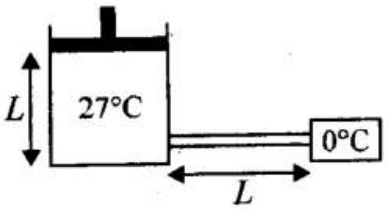
(a) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{1}{R}(\mu\hat{i} \times 2\hat{k})$

(b) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{1}{R}(\hat{n}\hat{i} + 2\hat{k})$

(c) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}(\pi\hat{i} - 2\hat{k})$

(d) $\vec{B} = \frac{\mu_0}{4\pi}\frac{1}{R}(ni + 2\hat{k})$

11. 0.5 mole of an ideal gas at constant temperature 27°C kept inside a cylinder of length L and cross section area A closed by a massless piston.



The cylinder is attached with a conducting rod of length I, cross-section area (1/9) m2 and thermal conductivity k, whose other end is maintained at 0°C. If piston is moved such that rate of heat flow through the conducing rod is constant then velocity of piston when it is at height L/2 from the bottom of cylinder is : (Neglect any kind of heat loss from system)

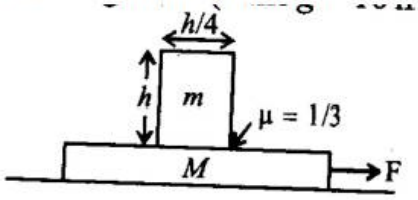
(a) $\left(\frac{k}{R}\right) m/sec$

(b) $\left(\frac{k}{10R}\right)$ m/sec

(c) $\left(\frac{k}{100R}\right)$ m/sec

(d) $\left(\frac{k}{1000R}\right)$ m/sec

12. A block of mass m= 2 kg is placed on a plank of mass M = 10 kg which is placed on a smooth horizontal plane. The coefficient of friction between the block and the plank is $\mu = \frac{1}{3}$. If a horizontal force F is applied on the plank, then find the maximum value of F for which the block and the plank move together. (Take g= $10 m/s^2$)



(a) 30 N
(b) 40 N
(c) 120 N
(d) None of these

13. The susceptibility of a magnetism at 300 K is 1.2×10^{-5}. The temperature at which the susceptibility increases to 1.8×10^{-5}

(a) 150K

(b) 200K

(c) 250K

(d) 20K

14. Magnetic moment of bar magnet is M. The work done to turn the magnet by 90° of magnet in direction of magnetic field B will be

(a) zero

(b) $\frac{1}{2}MB$

(c) 2MB

(d) MB

15. If M is magnetic moment and B is the magnetic field, then the torque is given by

(a) $\overrightarrow{\mathrm{M}}.\vec{\mathrm{B}}$

(b) $\frac{|\overrightarrow{\mathrm{M}}|}{|\vec{\mathrm{B}}|}$

(c) $\vec{\mathrm{M}} \times \vec{\mathrm{B}}$

(d) $|\vec{M}|\vec{B}|$

16. A copper rod of length l rotates about its end with angular velocity ω in uniform magnetic field B. The emf developed between the ends of the rod if the field is normal to the plane of rotation is

(a) $B\omega\ell^2$

(b) $\frac{1}{2}B\omega\ell^2$

(c) $2B\omega\ell^2$

(d) $\frac{1}{4}B\omega\ell^2$

17. Consider elastic collision of a particle of mass m moving with a velocity u with another particle of the same mass at rest. After the collision the projectile and the struck particle move in directions making angles , and , respectively with the initial direction of motion. The sum of the angles $\theta_1 + \theta_2$, is:

(a) 45°

(b) 90°

(c) 135°

(d) 180°

18. A particle of mass m executes simple harmonic motion with amplitude a and frequency v. The average kinetic energy during its motion from the position of equilibrium to the end is

(a) $2\pi^2 ma^2v^2$

(b) $\pi^2 ma^2v^2$

(c) $\frac{1}{4}mu^2v^2$

(d) $4\pi^2 ma^2v^2$

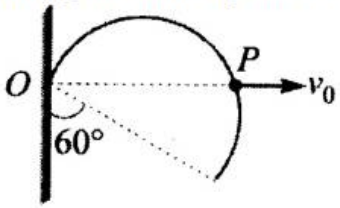
19. An elastic string of unstretched length L and force constant k is stretched by a small length x. It is further stretched by another small length y. The work done in the second stretching is

(a) $1/2Ky^2$
(b) $1/2Ky(2x + y)$
(c) $1/2K\left(x^2 + y^2\right)$
(d) $1/2k(x + y)^2$

20. A coil 10 turns and a resistance of 20Ω is connected in series with B.G of resistance 30Ω. The coil is placed with its plane perpendicular to the direction of a uniform magnetic field of induction $10^{-2}\mathrm{T}$. If it is now turned through an angle of 60° about an axis in its plane. Find the charge in duced in the coil. (Area of a coil $= 10^{-2}\mathrm{m}^2$))

(a) $2 \times 10^{-5}\mathrm{C}$
(b) $3.2 \times 10^{-5}\mathrm{C}$
(c) $1 \times 10^{-5}\mathrm{C}$
(d) $5.5 \times 10^{-5}\mathrm{C}$

21. A thin but rigid semicircular wire frame of radius r is hinged at O and can rotate in its own vertical plane. A smooth peg P starts from O and moves horizontally with constant speed v_0, lifting the frame upwards as shown in the figure.



Find the angular velocity of the frame when its diameter makes an angle of 60° with the vertical:

(a) v_0/r

(b) $v_0/2r$

(c) $2v_0/r$

(d) $v_0 r$

22. A resistor and an inductor are connected to an ac supply of 120 V and 50 Hz. The current in the circuit is 3 A. If the power consumed in the circuit is 108 W, then the resistance in the circuit is

(a) 12Ω

(b) 40Ω

(c) $\sqrt{(52 \times 25)}\Omega$

(d) 360Ω

23. Infinite number of masses, each 1 kg are placed along the x-axis at $x = \pm 1m, \pm 2m, \pm 4m, \pm 8m \pm 16m$ ..... the magnitude of the resultant gravitational potential in terms of gravitational constant G at the origin (x=0) is

(a) $G/2$

(b) G

(c) 2G

(d) 4G

24. A resistor of resistance R, capacitor of capacitance C and inductor of inductance L are connected in parallel to AC power source of voltage ε_0, sin ωt. The maximum current through the resistance is half of the maximum current through the power source. The value of R is

(a) $\frac{\sqrt{3}}{\left|\omega C - \frac{1}{\omega L}\right|}$

(b) $\sqrt{3}\left|\frac{1}{\omega C} - \omega L\right|$

(c) $\sqrt{5}\left|\frac{1}{\omega C} - \omega L\right.$

(d) None of these

25. A direct current of 5A is superposed on an alternating current I = 10sinωt flowing through the wire. The effective value of the resulting current will be

(a) (15A/2)

(b) $5\sqrt{3}$A

(c) $5\sqrt{5}$A

(d) 15A

26. The electric and the magnetic field associated with an E.M. wave, propagating along the+z-axis, can be represented by

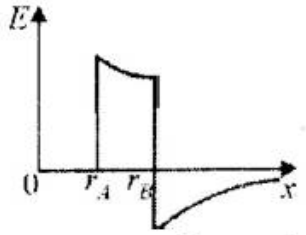
(a) $\left[\vec{\mathbf{E}} = \mathbf{E}_0\hat{\mathbf{i}} \cdot \vec{\mathbf{B}} = \mathbf{B}_0\hat{\mathbf{j}}\right]$

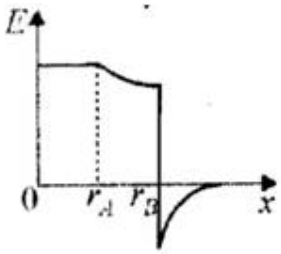
(b) $\left[\vec{\mathbf{E}} = \mathbf{E}_0\vec{\mathbf{k}}, \overline{\mathbf{B}} = \mathbf{B}_0\hat{\mathbf{i}}\right]$

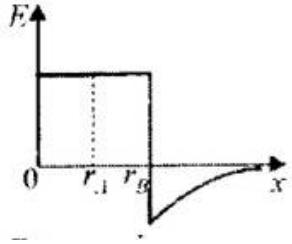
(c) $\left[\vec{\mathrm{E}} = \mathrm{E}_0\hat{\mathrm{i}}, \vec{\mathrm{B}} = \mathrm{B}_0\mathrm{i}\right]$

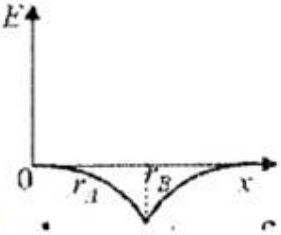
(d) $\left[\vec{\mathbf{E}} = \mathbf{E}_0\hat{\mathbf{j}}, \vec{\mathbf{B}} = \mathbf{B}_0\hat{\mathbf{k}}\right]$

27. Two concentric conducting thin spherical shells A, and B having radii r_A and r_B $((r_B > r_A)$ are charged to Q_A and $-Q_B (Q_B| > |Q_A]$. The electric field along a line passing through the centre is

(a) 

(c) 

(b) 

(d) 

28. An electromagnetic wave passes through space and its equation is given by $E = E_0 \sin(\omega t - kx)$ where E is electric field. Energy density of electromagnetic wave in space is

(a) $\frac{1}{2}\varepsilon_0 \mathbf{E}_0^2$

(b) $\frac{1}{4}\varepsilon_0 \mathbf{E}_0^2$

(c) $\varepsilon_0 \mathbf{E}_0^2$

(d) $2\varepsilon_0 \mathbf{E}_0^2$

29. The magnetic field in a travelling electromagnetic wave has a peak value of 20 nT. The peak value of electric field strength is

(a) 3V/m

(6) 6V/m

(c) 9V/m

(d) 12V/m

30. Four point charges -Q, -q, 2q and 2Q are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is :

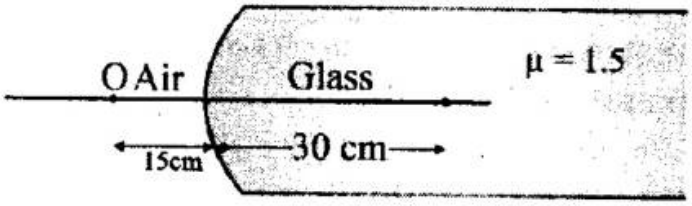
(a) Q = -q

(b) $Q = -\frac{1}{q}$

(c) Q = q

(d) $Q = \frac{1}{q}$

31. A point object O is placed in front of a glass rod having spherical end of radius of curvature 30 cm. The image would be formed at



(a) 30 cm left
(b) ∞
(c) 1 cm to the right
(d) 18 cm to the left

32. A cube is subjected to a uniform volume compression. If the side of the cube decreases by 2% the bulk strain is

(a) 0.02

(b) 0.03

(c) 0.04

(d) 0.06

33. The focal length of thin convex lens for blue rays are 100 cm and 96.8 cm respectively. Then, the dispersive power of the material of the lens is

(a) 0.968

(b) 0.98

(c) 0.0325

(d) 0.325

34. A biconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options best describe the image formed of an object of height 2 cm placed 30 cm from the lens?

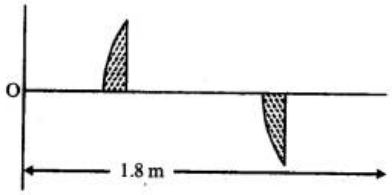
(a) Virtual, upright, height=1 cm

(b) Virtual, upright, height=0.5 cm

(c) Real, inverted, height=4 cm

(d) Real, inverted, height = 1cm

35. A thin plano-convex lens of focal length f is split into two halves: one of the halves is shifted along the optical axis. The separation between object and image planes is 1.8 m. The magnification of the image formed by one of the half-lenses is 2. If f and d be the focal length of the lens and separation between the two halves respectively then,



(a) f=0.4 m
(b) f=0.6 m
(c) d=0.5 m
(d) d=0.9 m

36. In Young's double slit experiment, $\lambda = 500\text{nm}$, d=1mm, D=1m. Minimum distance from the central maximum for which intensity is half of the maximum intensity is

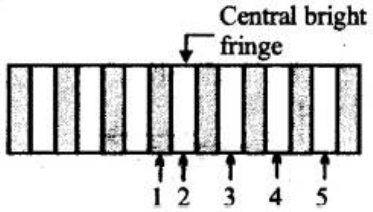
(a) $2.5 \times 10^{-4}\text{m}$

(b) $1.25 \times 10^{-4}\text{m}$

(c) $0.625 \times 10^{-4}\text{m}$

(d) $0.3125 \times 10^{-4}\text{m}$

37. The figure shows the interference pattern obtained in a double-slit experiment using light of wavelength 600 nm. 1, 2, 3, 4 and 5 are marked on five fringes. The third order bright fringe is



(a) 2
(b) 3
(c) 4
(d) 5

38. What is the minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of 2R?

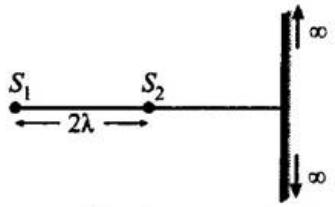
(a) $\frac{5GmM}{6R}$

(b) $\frac{2GmM}{3R}$

(c) $\frac{GmM}{2R}$

(d) $\frac{GmM}{2R}$

39. There are two sources kept at distances 2λ. A large screen is perpendicular to line joining the sources. Number of maximas on the screen in this case is (\lambda \) = wavelength of light)



(a) 1
(b) 3
(c) 5
(d) 7

40. An interference pattern the position of zeroth order maxima is 4.8 mm from a certain point P on the screen. The fringe width is 0.2 mm. The position of second order minima from point P is

(a) 5.1 mm

(b) 5 mm

(c) 40 mm

(d) 5.2 mm