Physics

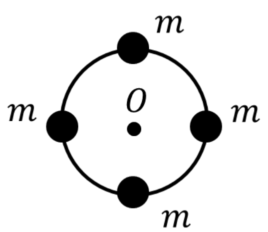
SECTION – A

1. When a resistance of 2 ohm is connected across the terminals of a cell, the current is 0.5 A. When the resistance is increases to 5 ohms, the current becomes $0.25\,A$ The e.m.f. of the cell is.
(1) $1.0\,V$
(2) $1.5\,V$
(3) $2.0\,V$
(4) $2.5\,V$

2. An earth's satellite is moving in a circular orbit with a uniform speed v. If the gravitational force of the earth suddenly disappears, the satellite will
(1) Vanish into outer space
(2) Continue to move with velocity v in original orbit
(3) Fall down with increasing velocity
(4) Fly off tangentially from the orbit with velocity v

3. **Statement I:** Microwaves have more energy than the radio waves.
Statement II: Energy of electromagnetic waves is shared equally by the electric and magnetic fields.
Choose the correct option.
(1) Both statement I and II are correct.
(2) Both statement I and II are incorrect.
(3) Statement I is correct but statement II is incorrect.
(4) Statement II is correct but statement I is incorrect.

4. Four similar point masses (each of mass m) are placed on the circumference of a ring of mass M and radius R. The M.I. of the system about the normal axis passing through the centre O will be.



(1) $MR^2 + 4mR^2$
(2) $\frac{1}{2}MR^2 + 4mR^2$
(3) $\frac{8}{5}MR^2 + 4mR^2$
(4) None of these

5. A box contains N molecules of a gas. If the number of molecules is doubled, then the pressure will.
(1) Decrease
(2) Be same
(3) Be doubled
(4) Get tripled

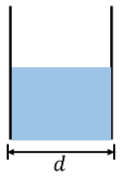
6. A resistant of 300 Ω and an inductance of $\frac{1}{\pi}$ henry are connected in series to a A.C. voltage of 20 volts and 200 Hz frequency. The phase angle between the voltage and current is.
(1) $\tan^{-1}\left(\frac{4}{3}\right)$
(2) $\tan^{-1}\left(\frac{3}{4}\right)$
(3) $\tan^{-1}\left(\frac{3}{2}\right)$
(4) $\tan^{-1}\left(\frac{2}{3}\right)$

7. A 110 V, 60 W lamp is run from a $220\,V$ AC mains using a capacitor in series with the lamp, instead of a resistor then the voltage across the capacitor is about.
(1) $110\,V$
(2) $190\,V$
(3) $220\,V$
(4) $311\,V$

8. The wavelength of the most energetic X-ray emitted when a metal target is bombarded by electrons having kinetic energy 100 keV approximately.
(1) 12 Å
(2) 4 Å
(3) 0.31 Å
(4) 0.124 Å

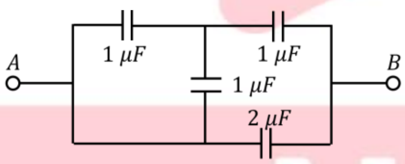
9. A parallel plate capacitor has rectangular plates of 400 cm^2 area and are separated by a distance of 2 mm with air as the medium. What charge will appear on the plates if a 200-volt potential difference is applied across the capacitor?
(1) $3.54 \times 10^{-6}\ C$
(2) $3.54 \times 10^{-8}\ C$
(3) $3.54 \times 10^{-10}\ C$
(4) $1771.8 \times 10^{-13}\ C$

10. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be.



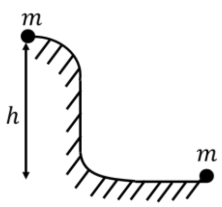
(1) 400%
(2) 66.6%
(3) 33.3%
(4) 200%

11. The equivalent capacitance between points A and B of the circuit shown will be:



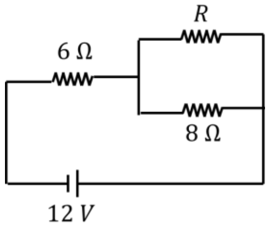
(1) $\frac{2}{3}\mu F$
(2) $\frac{5}{3}\mu F$
(3) $\frac{8}{3}\mu F$
(4) $\frac{7}{3}\mu F$

12. An object of mas m is sliding down a hill of arbitrary shape and after traveling a certain horizontal path stops because of friction. The work done that a force must perform to return the object to its initial position along the same path would be.



(1) 0
(2) mgh
(3) 2 mgh
(4) None of these

13. In the circuit shown in figure, the power which is dissipated as heat in the 6 Ω resistor is 6 W. What is the value of resistance R in the circuit?

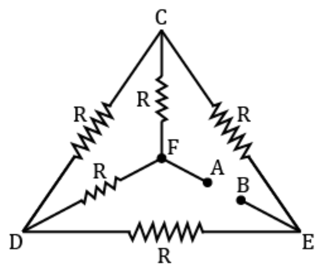


(1) 6 Ω
(2) 10 Ω
(3) 13 Ω
(4) 24 Ω

14. If fore $F = 50 - 20t$, then impulse in interval $[0, t]$.
(1) $50t - 10t^2$
(2) $50t - 10$
(3) $50 - t^2$
(4) $25\ t^2$

15. The potential difference between the terminals of a cell is found to be 3 volts when it is connected to a resistance of value equal its internal resistance. The e.m.f of the cell is.
(1) 3 V
(2) 6 V
(3) 1.5 V
(4) 4.5 V

16. Five equal resistance each of resistance R are connected as shown in the Figure. A battery of voltage V is connected between A and B. The current flowing in AFCEB will be.



(1) $\frac{V}{R}$

(2) $\frac{V}{2R}$

(3) $\frac{2V}{R}$

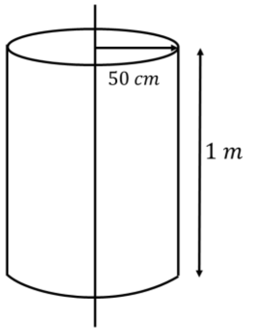
(4) $\frac{3V}{R}$

17. If intensity of each wave in the observed interference pattern in Young's double slit experiment is I_0. Then for some point P where the phase difference is ϕ, intensity I will be.
(1) $I = I_0 \cos\phi$
(2) $I = I_0 \cos^2\phi$
(3) $I = I_0(1 + \cos\phi)$
(4) $I = 2I_0(1 + \cos\phi)$

18. A photon of energy $4\ eV$ is incident on a metal surface whose work function is $2\ eV$. The minimum reverse potential to be applied for stopping the current is.
(1) $2\ V$
(2) $4\ V$
(3) $6\ V$
(4) $8\ V$

19. If the mass of a microscopic particle as well as its speed are halved, the de Broglie wavelength associated with the particle will.
(1) Increased by a factor more than 2
(2) Increase by a factor of 2
(3) Decrease by a factor of 2
(4) Decrease by a factor more than 2

20. Electric charge is uniformly distributed over a long straight wire of radius 1 mm. The charge per cm length of the wire is Q coulombs. A cylindrical surface of radius 50 cm and length 1 m encloses the wire symmetrically as shown in fig. The total flux passing through the cylindrical surface is.



(1) $\frac{Q}{\epsilon_0}$
(2) $\frac{100\ Q}{\epsilon_0}$
(3) $\frac{10\ Q}{\pi\ \epsilon_0}$
(4) $\frac{100\ Q}{\pi\epsilon_0}$

21. **Assertion:** Only microwaves are used in radar.
Reason: Because microwaves have very small wavelength.
(1) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
(2) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
(3) If the assertion is true but the reason is false
(4) If both the assertion and reason are false

22. Water drops fall at regular intervals from a tap 6 m above the ground. The third drop is leaving the tap at the instant the first drop touches the ground. How far above the ground is the second drop at that instant?
(1) $1.25\ m$
(2) $2.50\ m$
(3) $3.75\ m$
(4) $4.5\ m$

23. Linear density of a string is $1.5 \times 10^{-4} kg/m$ and wave equation is $y = 0.021 \sin(x + 30\ t)$. Find the tension in the string where x in meter, t in sec.
(1) $1.35 \times 10^{-2}\ N$
(2) $1.35 \times 10^{-1}\ N$
(3) $1.35 \times 10^{-3}\ N$
(4) None

24. **Statement I:** When two coils wound on each other, the mutual induction between the coils is maximum.
Statement II: Acceleration of a magnet falling through a copper ring decreases.
Choose the correct option.
(1) Both statement I and II are correct.
(2) Both statement I and II are incorrect.
(3) Statement I is correct but statement II is incorrect.
(4) Statement II is correct but statement I is incorrect.

25. 25 W, 200 V and 100 W, 200 V bulbs are connected in series to a source of 400 Voltas. Which bulb will fuse?
(1) 25 W
(2) 100 W
(3) Both will fuse at the same time
(4) None of the bulbs fuse

26. A force F is given by $F = at + bt^2$, where t is time. The dimensions of a and b are.
(1) $[M\,L\,T^{-3}]$ and $[M\,L\,T^{-4}]$
(2) $[M\,L\,T^{-4}]$ and $[M\,L\,T^{-3}]$
(3) $[M\,L\,T^{-1}]$ and $[M\,L\,T^{-2}]$
(4) $[M\,L\,T^{-2}]$ and $[M\,L\,T^{0}]$

27. The length of a rod is $(11.05 \pm 0.05)\,cm$. What is the sum of length of two such rods.
(1) $(22.1 \pm 0.05)cm$
(2) $(22.10 \pm 0.05)cm$
(3) $(22.1 \pm 0.15)cm$
(4) $(22.10 \pm 0.10)cm$

28. If a car covers $2/5^{th}$ of total distance with v_1 speed and $3/5^{th}$ distance with v_2 speed then the average speed is.
(1) $\frac{1}{2}\sqrt{v_1 v_2}$
(2) $\frac{v_1+v_2}{2}$
(3) $\frac{2v_1+v_2}{v_1+v_2}$
(4) $\frac{5v_1 v_2}{3v_1+2v_2}$

29. The resistance R of a wire is given by the relation $R = \frac{\rho \ell}{\pi r^2}$. Percentage error in the measurement of ρ, ℓ and r is 1%, 3% and 2% respectively. Then the percentage error in the measurement of R is.
(1) 6%
(2) 9%
(3) 8%
(4) 10%

30. One centimeter on the main scale of vernier calipers is divided onto ten equal parts. If 20 division of vernier scale coincide with 16 small division of the main scale, the least count of the calipers is.
(1) $0.01\ cm$
(2) $0.02\ cm$
(3) $0.05\ cm$
(4) $0.005\ cm$

31. Two elastic bodies P and Q having equal masses are moving along the same line with velocities of 20 m/s and 15 m/s respectively. Their respective velocities after the elastic collision will be in m/s.
(1) 15 and 20
(2) 5 and 20
(3) 20 and 15
(4) 20 and 5

32. When the angle of incident on a material is 60°, the reflected light is completely polarized. The velocity of the refracted ray inside the material is (in ms^{-1}).
(1) 3×10^8
(2) $\sqrt{2} \times 10^8$
(3) $\sqrt{3} \times 10^8$
(4) 0.5×10^8

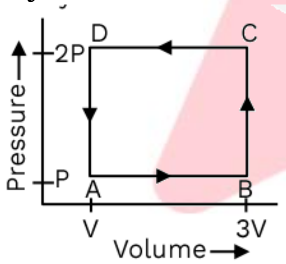
33. The magnifying power of a simple microscope is 6. The focal length of its lens in meters will be, if least distance of distinct vision is 25 cm.
(1) 0.05
(2) 0.06
(3) 0.25
(4) 0.12

34. The angle of a glass prism is 4.50° and its refractive index is 1.52. The angle of minimum deviation will be.
(1) 1.5
(2) 2.3
(3) 4.5
(4) 2

35. An arrow is shot into the air. Its range is 100 meters and its time of flight is 5 s. If the value of g is assumed to be 10 m/s^2, then the horizontal component of the velocity of arrow is.
(1) 40 m/s
(2) 20 m/s
(3) 31.25 m/s
(4) 12.5 m/s

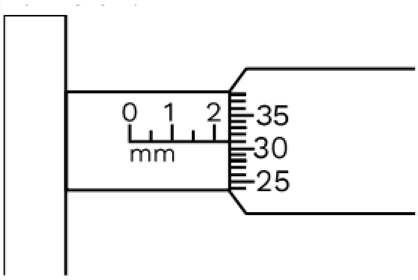
SECTION – B

36. A thermodynamic system is taken through the cyclic process ABCDA as shown in figure. Heat rejected by the gas during the cycle is:



(1) 2 PV
(2) -2 PV
(3) $\frac{1}{2}PV$
(4) PV

37. What is the reading of micrometer screw gauge shown in figure. Circular scale has 100 division:



(1) 2.31 mm
(2) 2.29 mm
(3) 2.36 mm
(4) 2.41 mm

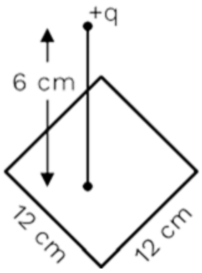
38. When light of frequency twice the threshold is incident on the metal plate, the maximum velocity of emitted electron is V_1. When the frequency of incident radiation is increased to 5 times the threshold value, the maximum velocity of emitted electron becomes V_2. If $V_2 = X\,V_1$, the value of x will be____:
(1) 0.2
(2) 4.0
(3) 2
(4) 0.4

39. A chain of mass m and length ℓ is held on a frictionless table in such a way that its $\frac{2\ell}{5}$ part is hanging below the edge of table. Find work done to pull the hanging part of chain:
(1) $\frac{2mg\ell}{25}$
(2) $\frac{mg\ell}{50}$
(3) $\frac{mg\ell}{25}$
(4) $\frac{4mg\ell}{25}$

40. A sphere of mass M rolls without slipping on an inclined plane of inclination θ. What should be the minimum coefficient of friction, so that the sphere rolls down without slipping?
(1) $\frac{2}{5}\tan\theta$
(2) $\frac{2}{7}\tan\theta$
(3) $\frac{5}{7}\tan\theta$
(4) $\tan\theta$

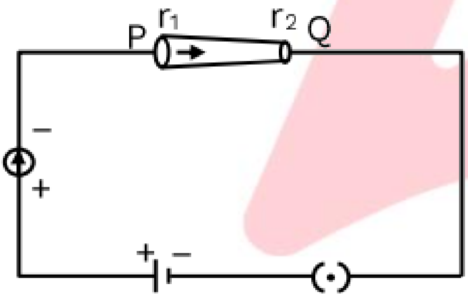
41. Ship A is moving at a speed of 3 m/s towards East and ship B towards North with a speed of 4m/s. If ship A is chosen as frame of reference, the direction and magnitude of velocity of ship B will be:
(1) 5 m/s; 53° Noarth of West
(2) 5 m/s; 37° Noarth of East
(3) 5 m/s; 37° East of Sout
(4) 5 m/s; 53° Sout of West

42. A point charge of $+12\mu C$ is at a distance 6 cm vertically above the center of a square of side 12 cm as shown in figure. The magnitude of the electric flux through the square will be ____ x $10^3 Nm^2/C$:



(1) 200
(2) 226
(3) 144
(4) 720

43. In the given figure, a battery of emf E is connected across a conductor PQ of length 'l' and different area of cross-sections having radii r_1 and $r_2 (r_2 < r_1)$:



Choose the correct option as one moves from P to Q:
(1) Drift velocity of electron increases.
(2) Electric field decreases.
(3) Electron current decreases.
(4) All of these

44. Hydrogen atom from excited state comes to the ground by emitting a photon of wavelength λ. The value of principal quantum number 'n' of the excited state will be: (R: Rydberg constant)-

(1) $\sqrt{\frac{\lambda R}{\lambda - 1}}$

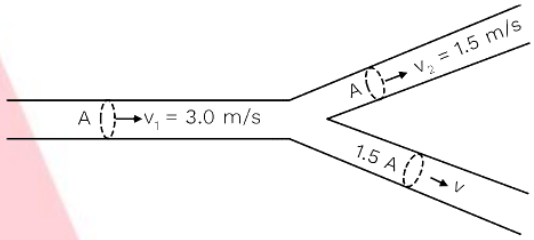
(2) $\sqrt{\frac{\lambda R}{\lambda R - 1}}$

(3) $\sqrt{\frac{\lambda}{\lambda R - 1}}$

(4) $\sqrt{\frac{\lambda R^2}{\lambda R - 1}}$

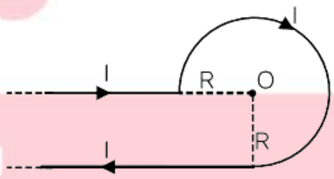
45. A parallel plate capacitor has plate area 100 m^2 and plate separation of 10m. The space between the plates is filled up to a thickness 5m with a material of dielectric constant of 10. The resultant capacitance of the system is x pF.
The value of $\varepsilon_0 = 8.85 \times 10^{-12} Fm^{-1}$.
The value of x to the nearest integer is:
(1) 441
(2) 161
(3) 108
(4) 532

46. An incompressible liquid flow through a horizontal tube as shown in the figure. Then the velocity 'v' of the fluid is:



(1) 3.0 m/s
(2) 1.5 m/s
(3) 1.0 m/s
(4) 2.25 m/s

47. Magnetic field at the center O due to the given structure is:



(1) $\frac{\mu_0 I}{4R}\left[\frac{3}{2} + \frac{1}{\pi}\right] \odot$

(2) $\frac{\mu_0 I}{2R}\left[3 + \frac{1}{\pi}\right] \otimes$

(3) $\frac{\mu_0 I}{4R}\left[\frac{3}{2} + \frac{1}{\pi}\right] \otimes$

(4) $\frac{\mu_0 I}{4R}\left[3 + \frac{2}{\pi}\right] \odot$

48. The amplitude of electric field, at a distance r from a point source of power P, is (Source efficiency is 100%):

(1) $\sqrt{\frac{P}{3\pi r^2 C \varepsilon_0}}$

(2) $\sqrt{\frac{P}{4\pi r^2 C \varepsilon_0}}$

(3) $\sqrt{\frac{P}{2\pi r^2 C \varepsilon_0}}$

(4) $\frac{P}{2\pi r^2 C\varepsilon_0}$

49. 10,000 electrons are passing per minute through a tube of radius 1 cm. The resulting current is:

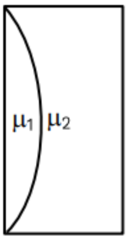
(1) 10000 A

(2) $0.26 \times 10^{-16} A$

(3) $10^{-9} A$

(4) $0.5 \times 10^{-19} A$

50. Curved surfaces of a plano-convex lens of refractive index μ_1 and a Plano-concave lens of refractive index μ_2 have equal, radius of curvature as shown in figure. Find the ratio of radius of curvature to the focal length of the combined lenses:



(1) $\frac{1}{\mu_2-\mu_1}$

(2) $\mu_1 - \mu_2$

(3) $\frac{1}{\mu_1-\mu_2}$

(4) $\mu_2 - \mu_1$