MHT-CET PHYSICS PAPER - 2021

20TH SEPTEMBER (SHIFT - 2)

Time : 45 Minutes **No. of Questions : 50** **Marks : 50**

1. A particle at rest starts moving with a constant angular acceleration of 4 rad/s^2 in a circular path. At what time the magnitude of its centripetal acceleration and tangential acceleration will be equal ?

(a) $\frac{1}{4}$ s **(b)** $\frac{2}{3}$ s

(c) $\frac{1}{2}$ s **(d)** $\frac{1}{3}$ s

2. A disc of radius 0.4 metre and mass 1 kg rotates about an axis passing through its centre and perpendicular to its plane. The angular acceleration is 10 rad/s^2. The tangential force applied to the rim of the disc is

(a) 2N **(b)** 3N

(c) 4N **(d)** 5N

3. A parallel plate air capacitor is charged upto 100 V. A plate 2 mm thick is inserted between the plates. Then to maintain the same potential difference, the distance between the plates is increased by 1.6 mm. The dielectric constant of the thick plate is

(a) 4 **(b)** 5

(c) 2 **(d)** 3

4. A perfect gas of volume 10 litre and compressed isothermally to a volume of 1 litre. The rms speed of the molecules will

(a) decrease 5 times **(b)** remain unchanged

(c) increase 5 times **(d)** increase 10 times

5. A rectifier is used to

(a) convert a.c. to d.c.

(b) amplify a weak signal

(c) generate intermittent voltage

(d) convert d.c. to a.c.

6. In Young's double slit experiment, with a source of light having wavelength 6300 Å, the first maxima will occur when the

(a) path difference is 9200 Å

(b) phase difference is n radian

(c) phase difference is $\frac{\pi}{2}$ radian

(d) path difference is 6300 Å

7. In the case of insulators, a band gap and conduction band is respectively

(a) very high empty

(b) very low, partially filled

(c) very high, completely filled

(d) very low, empty

8. A series LCR circuit with resistance (R) 500 ohm is connected to an a.c. source of 250 V. When only the capacitance is removed, the current lags behind the voltage by 60º. When only the inductance is removed, the current leads the voltage by 60º. The impedance of the circuit is $\left(\tan\frac{\pi}{3} = \sqrt{3}\right)$

(a) $\frac{500}{\sqrt{3}}\ \Omega$ **(b)** $500\sqrt{3}\ \Omega$

(c) 250 Ω **(d)** 500 Ω

9. A black rectangular surface of area 'A' emits energy 'E' per second at 27ºC. If length and breadth is reduced to (1/3)rd of its initial value and temperature is raised to 327ºC then energy emitted per second becomes

(a) $\frac{20E}{9}$ **(b)** $\frac{8E}{9}$

(c) $\frac{16E}{9}$ **(d)** $\frac{4E}{9}$

10. A particle is suspended from a vertical spring which is executing S.H.M. of frequency 5 Hz. The spring is unstretched at the highest point of oscillation. Maximum speed of the particle is ($g = 10\ m/s^2$)

(a) $\frac{1}{\pi}$ m/s **(b)** $\frac{1}{4\pi}$ m/s

(c) $\frac{1}{2\pi}$ m/s **(d)** π m/s

11. The relation obeyed by a perfect gas during an adiabatic process is $PV^{3/2}$. The initial temperature of the gas is 'T'. When the gas is compressed to half of its initial volume, the final temperature of the gas is

(a) $2\sqrt{2}T$ **(b)** 4T

(c) $\sqrt{2}T$ **(d)** 2T

12. A conducting rod of length 1 m has area of cross-section $10^{-3}\ m^2$. One end is immersed in boiling water (100ºC) and the other end in ice (0ºC). If coefficient of thermal conductivity of rod is 96 cal/smºC and latent heat for ice is 8×10^{-4} cal/kg then the amount of ice which will melt in one minute is

(a) 5.4×10^{-3} kg **(b)** 7.2×10^{-3} kg

(c) 1.8×10^{-3} kg **(d)** 3.6×10^{-3} kg

13. A body is projected from earth's surface with thrice the escape velocity from the surface of the earth. What will be its velocity when it will escape the gravitational pull ?

(a) $2V_e$ **(b)** $4V_e$

(c) $2\sqrt{2}\ V_e$ **(d)** $\frac{V_e}{2}$

14. A monoatomic gas is suddenly compressed to (1/8)th of its initial volume adiabatically. The ratio of the final pressure to initial pressure of the gas is ($\gamma = 5/3$)

(a) 32 **(b)** 8

(c) $\frac{40}{3}$ **(d)** $\frac{24}{5}$

15. What is the additional energy that should be supplied to a moving electron to reduce its de Broglie wavelength from 1 nm to 0.5 nm ?

(a) Four times its initial energy

(b) Five times its initial energy

(c) Two times its initial energy

(d) Three times its initial energy

16. An inducive coil has a resistance of 100 Ω. When an a.c. signal of frequency 1000 Hz is applied to the coil the voltage leads the current by 45º. The inductance of the coil is (tan 45º = 1)

(a) $\frac{0.25}{2\pi}$ H **(b)** $\frac{0.05}{\pi}$ H

(c) $\frac{0.25}{\pi}$ H **(d)** $\frac{0.5}{\pi}$ H

17. A convex lens of focal length T is used to form an image whose size is one fourth that of size of the object. Then the object distance is

(a) 2f **(b)** 5f

(c) 4f **(d)** 3f

18. In an ideal step down transformer, out of the following quantities, which quantity increases in the secondary coil ?

(a) Power **(b)** Voltage

(c) Current **(d)** Frequency

19. A hollow charged metal sphere has radius 'R'. If the potential difference between its surface and a point at a distance '5R' from the centre is V, then magnitude of electric field intensity at a distance '5R' from the centre of sphere is

(a) $\frac{V}{2R}$ **(b)** $\frac{V}{20R}$

(c) 10 VR **(d)** 20 VR

20. A metal conductor of length 1 m rotates vertically about one of its end at an angular velocity of 5 rad/s. If horizontal component of earth's magnetic field is 0.2×10^{-4} T, then the e.m.f. developed between the two ends of the conductor is

(a) 5 μV **(b)** 50 mV

(c) 5 mV **(d)** 50 μV

21. The gyromagnetic ratio of an electron in an hydrogen atom, according to Bohr model is

(a) decreases with the quantum number 'n'

(b) independent of which orbit it is in

(c) negative

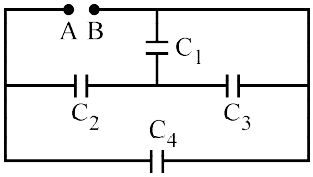
(d) positive

22. An air column in a pipe, which is closed at one end will be in resonance with a vibrating tuning fork of frequency 264 Hz for various lengths. Which one of the following lengths is not possible ? (V = 330 m/s)

(a) 62.50 cm **(b)** 93.75 cm

(c) 156.25 cm **(d)** 31.25 cm

23. In the arrangement of the capacitors as shown in figure, each capacitor is of 6 μF, then equivalent capacity between points A and B is



(a) 12 μF **(b)** 6 μF

(c) 4 μF **(d)** 10 μF

24. The output of an 'OR' gate is 'one'

(a) only when both inputs are 'one'

(b) only when both inputs are 'zero'

(c) only when either input is 'zero'

(d) if either or both inputs are 'one'

25. What should be the radius of water drop so that excess pressure inside it is 72 Nm^{-2} ?

(a) 1 mm **(b)** 2 mm

(c) 8 mm **(d)** 4 mm

26. In potentiometer experiment, null point is obtained at a particular point for a cell on potentiometer wire 'x' cm long. If length of potentiometer wire is increased by few centimeter without changing the cell, the balancing length will [Driving source is not changed]

(a) will net change **(b)** increase

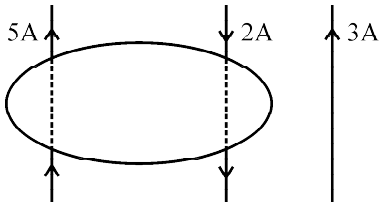
(c) decrease **(d)** becomes zero

27. In a single slit diffraction pattern, the distance between the first minimum on the left and the first minimum on the right is 5 mm. The screen on which the diffraction pattern is obtained is at a distance of 80 cm from the slit. The wavelength used is 6000 Å. The width of the slit is

(a) 0.096 mm **(b)** 0.576 mm

(c) 0.192 mm **(d)** 0.384 mm

28. Two wires carrying currents 5A and 2A are enclosed in a circular loop as shown in the figure. Another wire carrying a current of 3A is situated outside the loop. The value of $\oint \vec{B}\,d\vec{l}$ around the loop is (μ_0 = permeability of free space, $\vec{dl}$ is the length of the element on the Amperion loop)



(a) $4\mu_0$ **(b)** $2\mu_0$

(c) $3\mu_0$ **(d)** μ_0

29. Which one of the following statements is true ?

(a) The sound waves in air are longitudinal while the light waves in air are transverse

(b) Both light and sound waves in air are transverse

(c) Both light and sound waves in air are longitudinal

(d) The sound waves are transverse and light waves are longitudinal

30. A cricket player hit a ball like a projectile but the fielder caught the ball after 2 second. The maximum height reached by the ball is ($g = 10\ m/s^2$)

(a) 2m **(b)** 5m

(c) 4 m **(d)** 3 m

31. The magnetic field at the centre of a current carrying circular coil of area 'A' is 'B'. The magnetic moment of the coil is (μ_0 = permeability of free space)

(a) $\dfrac{2BA^{3/2}}{\mu_0\sqrt{\pi}}$ **(b)** $\dfrac{BA^{3/2}}{\mu_0\pi}$

(c) $\dfrac{\mu_0\sqrt{\pi}}{2BA^2}$ **(d)** $\dfrac{2BA^2}{\mu_0\sqrt{\pi}}$

32. A metal wire of length 2500 m is kept in east-west direction, at a height of 10 m from the ground. If it falls freely on the ground then the current induced in the wire is (Resistance of wire = $25\sqrt{2}\ \Omega$, $g = 10\ m/s^2$ and Earth's horizontal component of magnetic field $B_H = 2 \times 10^{-5}T$)

(a) 0.2 A **(b)** 0.02 A

(c) 0.01 A **(d)** 2 A

33. A particle executes S.U.M. of period $\frac{2\pi}{\sqrt{3}}$ second along a straight line 4 cm long. The displacement of the particle at which the velocity is numerically equal to the acceleration is

(a) 2 cm **(b)** 1 cm

(c) 4 cm **(d)** 3 cm

34. Photoelectrons are emitted when photons of energy 4.2 eV are incident on a photosensitive metallic sphere of radius 10 cm and work function 2.4 eV. The number of photoelectrons emitted before the emission is stopped is

$\left[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ SI unit; } e = 1.6 \times 10^{-19} \text{ C}\right]$

(a) 1.25×10^6 **(b)** 1.25×10^8

(c) 1.25×10^2 **(d)** 1.25×10^4

35. The depth at which acceleration due to gravity becomes $\frac{g}{n}$ is [R = radius of earth, g = acceleration due to gravity, n = integer]

(a) $\frac{R(n-1)}{n}$ **(b)** $\frac{(n-1)}{nR}$

(c) $\frac{Rn}{(n-1)}$ **(d)** $\frac{n}{R(n-1)}$

36. Two consecutive harmonics of an air column in a pipe closed at one end are of frequencies 150 Hz and 250 Hz. The fundamental frequency of an air column is

(a) 25 Hz **(b)** 75 Hz

(c) 100 Hz **(d)** 50 Hz

37. A galvanometer has resistance 'G' Ω and 'I_g' is current flowing through it which produces full scale deflection. 'S_1' is the value of shunt which converts it into an ammeter of range 0 to '3I' and 'S_2' is the shunt value which converts it into an ammeter of range 0 to '4I', the ratio $S_2 : S_1$ is

(a) $\frac{4}{3}$ **(b)** $\frac{3I - I_g}{4I - I_g}$

(c) $\frac{3}{4}$ **(d)** $\frac{4I - I_g}{3I - I_g}$

38. The ratio of radii of gyration of a circular ring and circular disc of the same mass and radius, about an axis passing through their centres and perpendicular to their planes is

(a) $1 : \sqrt{2}$ **(b)** 2 : 1

(c) $\sqrt{2} : 1$ **(d)** 3 : 2

39. The surface energy of a liquid drop is 'U'. It splits up into 512 equal droplets. The surface energy becomes

(a) 8U **(b)** 6U

(c) 4U **(d)** 2U

40. A body performs S.H.M. under the action of force 'F_1' with period 'T_1' second. If the force is changed to 'F_2' it performs S.H.M. with period 'T_2' second. If both forces 'F_1' and 'F_2' act simultaneously in the same direction on the body, the period in second will be

(a) $\frac{T_1 + T_2}{T_1 T_2}$ **(b)** $\frac{T_1^2 + T_2^2}{T_1 T_2}$

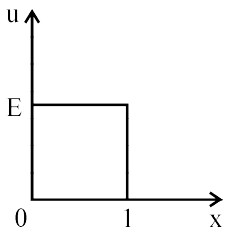
(c) $\frac{T_1 T_2}{\sqrt{T_1^2 + T_2^2}}$ **(d)** $\frac{T_1 T_2}{T_1 + T_2}$

41. Two masses 'm_a' and 'm_b' moving with velocities 'v_a' and 'v_b' opposite directions collide elastically. Alter the collision 'm_a' and 'm_b' move with velocities and 'v_b' and 'v_a' respectively, then the ratio $m_a : m_b$ is

(a) $\frac{v_a + v_b}{v_a - v_b}$ **(b)** $\frac{1}{2}$

(c) 1 **(d)** $\frac{v_a - v_b}{v_a + v_b}$

42. The P.E. 'U' of a moving particle of mass 'm' varies with 'x'-axis as shown in figure. The de Broglie wavelength or the particle in the region $0 \le x \le 1$ and $x > 1$ and λ_1 and λ_2 respectively. If the total energy of the particle is 'nE', then the ratio of λ_1/λ_2 is



(a) $\sqrt{\frac{n^2}{n-1}}$ **(b)** $\sqrt{\frac{n-1}{n}}$

(c) $\sqrt{\frac{n}{n-1}}$ **(d)** $\sqrt{\frac{n(n-1)}{n}}$

43. The relation between magnetic moment 'M' of revolving electron and principle quantum number 'n' is

(a) $M \propto \frac{1}{n}$ **(b)** $M \propto n$

(c) $M \propto n^2$ **(d)** $M \propto n^3$

44. A sample of radioactive element contains 8×10^{16} active nuclei. The half-life of the element is 15 days. The number of nuclei decayed after 60 days is

(a) 7.5×10^{16} **(b)** 2.0×10^{16}

(c) 0.5×10^{16} **(d)** 4.0×10^{16}

45. A body of density V is dropped from (at rest) height 'h' into a lake of density 'δ' ($\delta > \rho$). The maximum depth to which the body sinks before returning to float on the surface is [Neglect all dissipative forces]

(a) $\frac{(\delta - \rho)}{2h\rho}$ **(b)** $\frac{2h\rho}{(\delta - \rho)}$

(c) $\frac{h\rho}{2(\delta - \rho)}$ **(d)** $\frac{h\rho}{(\delta - \rho)}$

46. Beats are produced by waves $y_1 = a \sin 2000\pi t$ and $y_2 = a \sin 2008\pi t$. The number of beats heard per second is

(a) 4 **(b)** 1

(c) zero **(d)** 8

47. A uniformly charged semicircular arc of radius 'r' has linear charge density (λ), is the electric field at its centre ?

(ε_0 = permittivity of free space)

(a) $\frac{\lambda}{4\varepsilon_0 r}$ **(b)** $\frac{2\pi\varepsilon_0}{\lambda}$

(c) $\frac{\lambda}{4\varepsilon_0}$ **(d)** $\frac{2\varepsilon_0}{\lambda}$

48. Two stars 'P' and 'Q' emit yellow and blue light respectively. The relation between their temperatures (T_P and T_Q) is

(a) $T_P = T_Q$ **(b)** $T_P = \frac{T_Q}{2}$

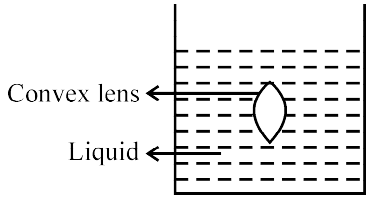
(c) $T_P > T_Q$ **(d)** $T_P < T_Q$

49. In Young's double slit experiment, the intensity at a point where the path difference is $\frac{\lambda}{4}$ [λ is wavelength of light used] is 'I'. If 'I_0' is the maximum intensity then $\frac{I}{I_0}$ is equal to $\left[\cos\frac{\pi}{4} = \sin\frac{\pi}{4} = \frac{1}{\sqrt{2}}\right]$

(a) 3 : 2 **(b)** 2 : 3

(c) 3 : 4 **(d)** 1 : 2

50. Inside a vessel filled with liquid a converging lens is placed as shown in figure. The lens has focal length 15 cm when in air and has refractive index $\frac{3}{2}$. If the liquid has refractive index $\frac{9}{5}$, the focal length of lens in liquid is



(a) 15 cm **(b)** –60 cm

(c) 90 cm **(d)** –45 cm

ANSWERS

1. c	**2.** a	**3.** b	**4.** b	**5.** a
6. d	**7.** a	**8.** d	**9.** c	**10.** a
11. c	**12.** b	**13.** c	**14.** a	**15.** d
16. b	**17.** b	**18.** c	**19.** b	**20.** d
21. b	**22.** a	**23.** d	**24.** d	**25.** b
26. b	**27.** c	**28.** c	**29.** a	**30.** b
31. a	**32.** b	**33.** b	**34.** b	**35.** a
36. d	**37.** b	**38.** c	**39.** a	**40.** c
41. c	**42.** c	**43.** b	**44.** a	**45.** d
46. a	**47.** a	**48.** d	**49.** d	**50.** d

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24TH SEPTEMBER (SHIFT - 2)

Time : 45 Minutes **No. of Questions : 50** **Marks : 50**

1. A current I = 10 sin (100 πt) ampere, is passed in a coil which induces a maximum emf 5π volt in neighbouring coil. The mutual inductance of two coils is

(a) 5 mH **(b)** 10 mH

(c) 15 mH **(d)** 25 mH

2. The displacement of a particle performing S.H.M. is given by x = 5 sin (3t + 3), where x is in cm and t is in second. The maximum acceleration of the particle will be

(a) 15 cm s^{-2} **(b)** 30 cm s^{-2}

(c) 45 cm s^{-2} **(d)** 90 cm s^{-2}

3. 'n' small drops of same size fall through air with constant velocity 5 cm/s. They coalesce to form a big drop. The terminal velocity of the big drop is

(a) $7n^{2/3}$ cm/s **(b)** $5n^{2/3}$ cm/s

(c) $3n^{2/3}$ cm/s **(d)** $9n^{2/3}$ cm/s

4. Three point masses, each of mass 'm' are kept at the corners of an equilateral triangle of side 'L'. The system rotates about the centre of the triangle without any change in the separation of masses during rotation. The period of rotation is directly proportional to $\left(\cos 30° = \frac{\sqrt{3}}{2}\right)$

(a) L **(b)** $L^{1/2}$

(c) $L^{3/2}$ **(d)** L^{-2}

5. The length of the seconds pendulum is 1 m on earth. If the mass and diameter of the planet is 1.5 times that of the earth, the length of the seconds pendulum on the planet will be nearly

(a) 0.67 m **(b)** 0.45 m

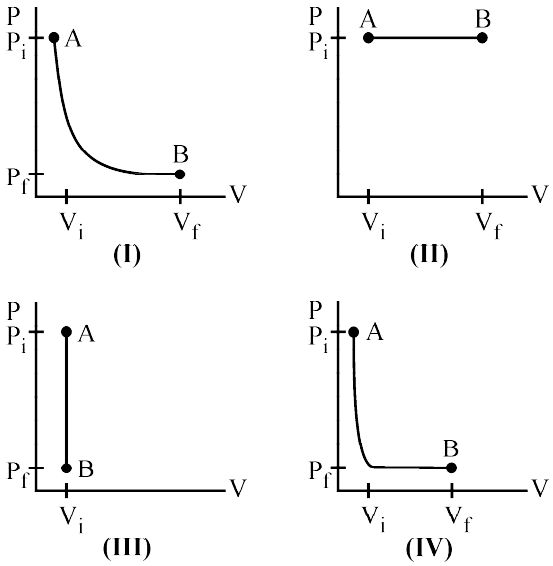
(c) 0.60 m **(d)** 0.76 m

6. A current 'I' produces a magnetic flux 'ϕ' per turn in a coil of 'n' turns. Self inductance of the coil is 'L'. The relation between them is

(a) $nLI = \phi$ **(b)** $\frac{nL}{I} = \phi$

(c) $\frac{LI}{n^2} = \phi$ **(d)** $\frac{LI}{n} = \phi$

7. Which one of the following P-V diagram is correct for an isochoric process ?



(a) IV **(b)** II

(c) III **(d)** I

8. Velocity of sound waves in air is 'v' m/s. For a particular sound wave in air, path difference of 'x' cm is equivalent to phase difference nπ. The frequency of this wave is

(a) $\frac{vn}{x}$ **(b)** $\frac{v}{nx}$

(c) $\frac{vn}{2x}$ **(d)** $\frac{2x}{v}$

9. A ray of light is incident on one face of an equilateral glass prism having refractive index $\sqrt{2}$. It produces the emergent ray which just grazes along the adjacent face. The value of angle of incidence is

$\left(\sin 45° - \cos 45° - \frac{1}{\sqrt{2}}\right)$

(a) $\sin^{-1}\left(\frac{1}{\sqrt{2}}\sin 15°\right)$ **(b)** $\sin^{-1}(\sqrt{2}\sin 30°)$

(c) $\sin^{-1}\left(\frac{1}{\sqrt{2}}\sin 45°\right)$ **(d)** $\sin^{-1}(\sqrt{2}\sin 15°)$

10. The ratio of energies of photons produced due to transition of electron of hydrogen atom from its (i) second to first energy level and (ii) highest energy level to second energy level is

(a) 6 : 1 **(b)** 3 : 1

(c) 12 : 1 **(d)** 8 : 1

11. A rejector circuit is the resonant circuit in which

(a) L – C – R are connected in parallel

(b) L – C – R are connected in series

(c) C – R are connected in series

(d) L – R are connected in series

12. Choose the correct statement. In conductors

(a) valence band and conduction band overlap each other

(b) valence band and conduction band are separated by large energy gap

(c) valence band and conduction band are separated by a small energy gap

(d) a very small number of electrons are available for electrical conduction

13. The input a.c. voltage of frequency 60 Hz is applied to half-wave rectifier and also to full-wave rectifier. The output frequency in case of half-wave rectifier and that in case of full wave rectifier is respectively.

(a) 120 Hz, 60 Hz **(b)** 60 Hz, 120 Hz

(c) 60 Hz, 60 Hz **(d)** 120 Hz, 120 Hz

14. A light of wavelength 'λ' and intensity 'I' falls on photosensitive material. If 'N' photo electrons are emitted, each with kinetic energy 'E', then

(a) $E \propto I, N \propto \lambda$ **(b)** $E \propto I, N \propto I$

(c) $E \propto I, N \propto \frac{1}{\lambda}$ **(d)** $E \propto \frac{1}{\lambda}, N \propto I$

15. Which one of the following is NOT a correct expression for an ideal gas ?

[C_P = Molar specific heat of a gas at constant pressure,

C_V = Molar specific heat of a gas at constant volume,

Y = Ratio of two specific heats of a gas,

R = Universal gas constant.]

(a) $C_V = C_P + R$ **(b)** $R = C_V(\gamma - 1)$

(c) $\frac{C_V}{C_P} = \frac{1}{\gamma}$ **(d)** $R = \frac{C_P(\gamma - 1)}{\gamma}$

16. A cylindrical tube open at both ends has fundamental frequency 'n' in air. The tube is dipped vertically in water so that one-fourth of it is in water. The fundamental frequency of the air column becomes

(a) $\frac{3n}{4}$ **(b)** $\frac{n}{2}$

(c) n **(d)** $\frac{2n}{3}$

17. For a transistor, the current ratio $\alpha_{dc} = \frac{69}{70}$, the current gain β_{dc} is

(a) 67 **(b)** 69

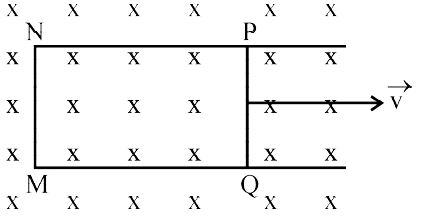
(c) 71 **(d)** 66

18. The length and diameter of a metal were used in sonometer is doubled. The fundamental frequency will change from 'n' to

(a) $\frac{n}{4}$ **(b)** 2n

(c) 4n **(d)** $\frac{n}{2}$

19. A rectangular loop PQMN with movable arm PQ of length 12 cm and resistance 2 Ω is placed in a uniform magnetic field of 0.1 T acting perpendicular to the plane of the loop as shown in figure. The resistances of the arms MN, NP and MQ are negligible. The current induced in the loop when arm PQ is moved with velocity 20 ms^{-1} is



(a) 0.12 A **(b)** 0.06 A

(c) 0.24 A **(d)** 0.18 A

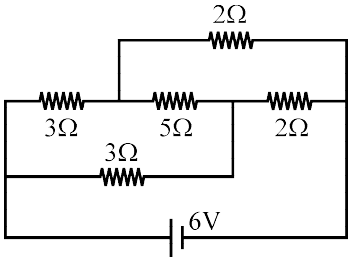
20. A metal sphere cools at the rate of 1.5 ºC/min when its temperature is 80ºC. At what rate will it cool when its temperature falls to 50ºC.

[Temperature of surrounding is 30ºC]

(a) 0.9 ºC/min **(b)** 0.6 ºC/min

(c) 1.5 ºC/min **(d)** 1.2 ºC/min

21. A current drawn from the battery in the given network is (Internal resistance of the battery is negligible)



(a) 2.4 A **(b)** 1.6 A

(c) 2.0 A **(d)** 3.0 A

22. In a photoelectric experiment, a graph of maximum kinetic energy ($K.E._{max}$) against the frequency of incident radiation (ν) is plotted. If A and B are the intercepts on the X and Y axis respectively then the Planck's constant is given by

(a) A + B **(b)** $\frac{B}{A}$

(c) A × B **(d)** $\frac{A}{B}$

23. A particle is moving along the circular path with constant speed and centripetal acceleration 'a'. If the speed is doubled, the ratio of its acceleration after and before the change is

(a) 3 : 1 **(b)** 1 : 4

(c) 2 : 1 **(d)** 4 : 1

24. Pressure inside two soap bubbles are 1.01 atm and 1.03 atm. The ratio between their volumes is (Pressure outside the soap bubble is 1 atmosphere)

(a) 9 : 1 **(b)** 27 : 1

(c) 81 : 1 **(d)** 3 : 1

25. The kinetic energy of a light body and a heavy body is same. Which one of them has greater momentum ?

(a) A body having high velocity

(b) Heavy body

(c) Light body

(d) A body having large displacement

26. The moment of inertia of a thin uniform rod of mass 'M' and length 'L' about an axis passing through a point at a distance $\frac{L}{4}$ from one of its ends and perpendicular to the length of the rod is

(a) $\frac{ML^2}{48}$ **(b)** $\frac{7ML^2}{48}$

(c) $\frac{5ML^2}{48}$ **(d)** $\frac{9ML^2}{48}$

27. A monoatomic gas is suddenly compressed to (1/8)th of its initial volume adiabatically. The ratio of the final pressure to initial pressure of the gas is ($\gamma = 5/3$)

(a) 32 **(b)** 8

(c) $\frac{40}{3}$ **(d)** $\frac{24}{5}$

28. Assume that for solar radiation, surface temperature of the sun is 6000 K. If Wien's constant 'b' is 2.897×10^{-3} mK, the value of maximum wavelength will be

(a) 4828 Å **(b)** 3648 Å

(c) 6400 Å **(d)** 5890 Å

29. A body of mass 'm' is moving with speed 'v' along a circular path of radius 'r'. Now the speed is reduced to $\frac{v}{2}$ and radius is increased to '3r'. For this change, initial centripetal force needs to be

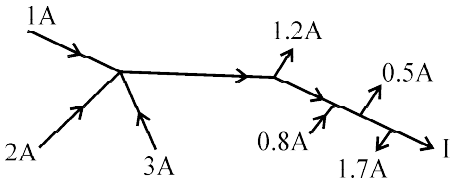
(a) increased by $\frac{7}{12}$ times

(b) increased by $\frac{10}{12}$ times

(c) decreased by $\frac{11}{12}$ times

(d) decreased by $\frac{1}{12}$ times

30. In the following electrical network, the value of I is



(a) 1.5 A **(b)** 3.0 A

(c) 3.4 A **(d)** 2.5 A

31. The average density of the earth is
[g is acceleration due to gravity]
(a) inversely proportional to g^2
(b) directly proportional to g
(c) inversely proportional to g
(d) directly proportional to g^2

32. The half life of a radioactive substance is 30 minute. The time taken between 40% decay and 85% decay of the same radioactive substance is
(a) 15 minute **(b)** 90 minute
(c) 60 minute **(d)** 30 minute

33. The path difference between two interfering light waves meeting at a point on the screen is $\left(\frac{57}{2}\right)\lambda$. The band obtained at that point is
(a) 29th bright band **(b)** 57th dark band
(c) 57th bright band **(d)** 29th dark band

34. White light consists of wavelengths from 480 nm to 672 nm. What will be the wavelength range when white light is passed through glass of refractive index 1.6 ?
(a) 420 nm - 672 nm **(b)** 300 nm - 480 nm
(c) 300 nm - 420 nm **(d)** 300 nm - 672 nm

35. A particle of charge 'q' and mass 'm' moves in a circular orbit of radius 'r' with angular speed 'ω'. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on
(a) ω and q **(b)** ω and m
(c) q and m **(d)** ω, q and m

36. In series LCR circuit, at resonance the peak value of current will be [E_0 is peak emf, R is resistance, ωL is inductive reactance and ωC is capacitive]
(a) $\frac{E_0}{R}$
(b) $\frac{E_0}{\sqrt{2}R}$
(c) $\frac{E_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$
(d) $\frac{E_0}{\sqrt{2}\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$

37. Two bar magnets 'P' and 'Q' are kept in uniform magnetic field 'B' with magnetic moments 'M_P' and 'M_Q' respectively. Magnet 'P' is oscillating with frequency twice that of magnet 'Q'. If the moment of inertia of the magnet 'P' is twice that of magnet 'Q' then
(a) $M_Q = 2M_P$ **(b)** $M_P = 2M_Q$
(c) $M_P = 8M_Q$ **(d)** $M_Q = 8M_P$

38. Capacitors of capacities C_1, C_2 and C_3 are connected in series. If the combination is connected to a supply of 'V' volt, then potential difference across capacitor 'C_1' is
(a) $\frac{C_2C_3 + C_1C_3 + C_1C_2}{C_1C_2V}$
(b) $\frac{C_2C_3 + C_1C_3 + C_1C_2}{C_1C_2C_3V}$
(c) $\frac{C_2C_3V}{C_2C_3 + C_1C_3 + C_1C_2}$
(d) $\frac{C_1C_2C_3V}{C_2C_3 + C_1C_3 + C_1C_2}$

39. An alternating e.m.f. is $e = e_0 \sin \omega t$. In what time the e.m.f. will have half its maximum value, if 'e' starts from zero ? (T = Time period, $\sin 30^\circ = 0.5$)
(a) $\frac{T}{12}$ **(b)** $\frac{T}{16}$
(c) $\frac{T}{4}$ **(d)** $\frac{T}{8}$

40. Three charges each of +1μC are placed at the corners of an equilateral triangle. If the repulsive force between any two charges is F, then the net force on either charge will be [$\cos 60^\circ = 0.5$]
(a) 2F **(b)** 3F
(c) $\sqrt{2}F$ **(d)** $\sqrt{3}F$

41. If the work done in blowing a soap bubble of volume 'V' is 'W', then the work done in blowing a soap bubble of volume '2V' will be
(a) 2W **(b)** $(4)^{1/3}W$
(c) W **(d)** $\sqrt{2}$ W

42. The molecular masses of helium and oxygen are 4 and 32 respectively. The ratio of r.m.s. speed of helium at 327°C to r.m.s. speed of oxygen at 27°C will be
(a) 1 : 6 **(b)** 8 : 1
(c) 1 : 8 **(d)** 4 : 1

43. Two monochromatic beams of intensities I and 4I respectively are superposed to form a steady interference pattern. The maximum and minimum intensities in the pattern are

(a) 4I and I **(b)** 9I and 3I

(c) 5I and 3I **(d)** 9I and I

44. A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the e.m.f. of the battery. The ratio of the energy stored in the capacitor to the work done by the battery will be

(a) 2 **(b)** $\frac{1}{2}$

(c) 1 **(d)** $\frac{1}{4}$

45. A magnetic dipole of magnetic moment M, is freely suspended in a magnetic field of induction B. The minimum and maximum values of potential energy of the dipole, respectively are

(a) –MB, +MB **(b)** 0, MB

(c) 0, 2MB **(d)** MB, 0

46. The depth from the surface of the earth of radius R, at which acceleration due to gravity will be 60% of the value of the earth surface is

(a) $\frac{2R}{3}$ **(b)** $\frac{2R}{5}$

(c) $\frac{3R}{5}$ **(d)** $\frac{5R}{3}$

47. A solenoid 2 m long and 4 cm in diameter has 4 layers of windings of 1000 turns each and carries a current of 5A. What is the magnetic field at its centre along the axis ?

$[\mu_0 = 4\pi \times 10^{-7}$ Wb/Am]

(a) 10^{-3} T **(b)** $2\pi \times 10^{-3}$ T

(c) $4\pi \times 10^{-3}$ T **(d)** $8\pi \times 10^{-3}$ T

48. Four electric charges +q, +q, –q and –q are placed in order at the corners of a square of side 2L. The electric potential at point midway between the two positive charges is

(a) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}(1 - \sqrt{5})$ **(b)** zero

(c) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1 + \frac{1}{\sqrt{5}}\right)$ **(d)** $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1 - \frac{1}{\sqrt{5}}\right)$

49. A closed organ pipe and an open organ pipe of same length produce 2 beats per second when they are set into vibrations together in fundamental mode. The length of open pipe is now halved and that of closed pipe is doubled. The number of beats produced per second will be

(a) 4 **(b)** 3

(c) 8 **(d)** 7

50. A monochromatic ray of light travels through glass slab and water column. The number of waves in glass slab of thickness 4 cm is the same as in water column of height 5 cm. If refractive index of glass is $\frac{5}{3}$ then refractive index of water is

(a) 1.33 **(b)** 1.30

(c) 1.25 **(d)** 1.10

ANSWERS

1. a	**2.** c	**3.** b	**4.** c	**5.** a
6. d	**7.** c	**8.** c	**9.** d	**10.** b
11. a	**12.** a	**13.** b	**14.** d	**15.** a
16. d	**17.** b	**18.** a	**19.** a	**20.** b
21. a	**22.** b	**23.** d	**24.** b	**25.** b
26. b	**27.** a	**28.** a	**29.** c	**30.** c
31. b	**32.** c	**33.** d	**34.** c	**35.** c
36. a	**37.** c	**38.** c	**39.** a	**40.** d
41. b	**42.** d	**43.** d	**44.** b	**45.** a
46. b	**47.** c	**48.** d	**49.** d	**50.** a