

## TEST-03

Ultimate KCET Crash Course 2026

## PHYSICS

**Q1** If a current of 2.33 A is passed through a resistance of  $10.485 \Omega$ , the potential is 24.43005, its value in proper significant figures would be

- (A) 24.43 V  
 (B) 24.4 V  
 (C) 24.430 V  
 (D) 24.43005 V

**Q2** Two ice skaters A and B approach each other at right angles. Skater A has a mass 30 kg and velocity 1 m/s and skater B has a mass 20 kg and velocity 2m/s. They meet and cling together. The final velocity of the couple is

- (A) 2 m/s  
 (B) 1.5 m/s  
 (C) 1 m/s  
 (D) 2.5 m/s

**Q3** A copper wire with a cross-sectional area of  $2 \times 10^{-6} \text{ m}^2$  has a free electron density equal to  $5 \times 10^{22} \text{ cm}^{-3}$ . If this wire carries a current of 16 A the drift velocity of the electron is

- (A)  $1 \text{ ms}^{-1}$   
 (B)  $0.1 \text{ ms}^{-1}$   
 (C)  $0.01 \text{ ms}^{-1}$   
 (D)  $0.001 \text{ ms}^{-1}$

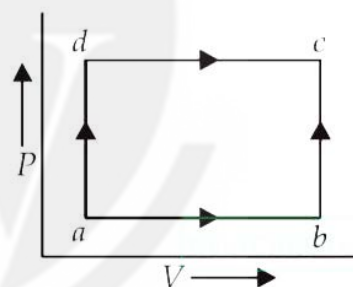
**Q4** For a metallic wire, the ratio of voltage to corresponding current is

- (A) independent of temperature  
 (B) increases with rise in temperature  
 (C) increases or decreases with rise in temperature depending upon the metal  
 (D) decreases with rise in temperature.

**Q5** Two bulbs consume the same power when operated at 200 V and 300 V respectively. When these bulbs are connected in series across a D.C. source of 500 V then the ratio of potential difference across them is

- (A)  $\frac{2}{3}$  (B)  $\frac{4}{9}$   
 (C)  $\frac{6}{27}$  (D)  $\frac{8}{24}$

**Q6** A system is taken from state  $a$  to state  $c$  by two paths and as shown in the figure. The internal energy at  $a$  is  $U_a = 10 \text{ J}$ . Along the path  $adc$  the amount of absorbed  $8Q_1 = 50 \text{ J}$  and the work obtained  $\delta W_1 = 20 \text{ J}$  whereas along the path  $abc$  the heat absorbed  $\delta Q_2 = 36 \text{ J}$ . The amount of work along the path  $abc$  is



- (A) 10 J  
 (B) 12 J  
 (C) 36 J  
 (D) 6 J

**Q7** The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of  $10 \Omega$  is

- (A)  $0.8 \Omega$  (B)  $1.0 \Omega$   
 (C)  $0.2 \Omega$  (D)  $0.5 \Omega$

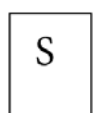


- Q8** If the frequency of a incident light is  $6 \times 10^{14}$  Hz, then what will be the wavelength of this light and lies in which region.  
 (A) 500 nm , Visible region  
 (B) 600 nm , Visible region  
 (C) 500 nm , Infrared region  
 (D) 600 nm , Infrared region
- Q9** An object is 8cm high. It is desired to form a real image 4cm high at 60cm from the mirror. The type of mirror needed with the focal length is  
 (A) convex mirror with focal length  $f = 40$  cm  
 (B) convex mirror with focal length  $f = 20$  cm  
 (C) concave mirror with focal length  $f = -40$  cm  
 (D) concave mirror with focal length  $f = -20$  cm
- Q10** A ray of light is incident normally on a glass slab of thickness 5 cm and refractive index 1.6 . The time taken to travel by a ray from source to surface of slab is same as to travel through glass slab. The distance of source from the surface is  
 (A) 4 cm (B) 8 cm  
 (C) 12 cm (D) 16 cm
- Q11** Pick out the WRONG statement from the following.  
 (A) Lateral shift increases as the angle of incidence increases.  
 (B) Lateral shift increases as the value of refractive index increases.  
 (C) Normal shift decreases as the value of refractive index increases.  
 (D) Both normal shift and lateral shift are directly proportional to the thickness of the medium.
- Q12** The position  $x$  of a particle varies with time as  $x = at^2 - bt^3$ . The acceleration of the particle is zero at time  $t$  which will be equal to  
 (A)  $\frac{2a}{3b}$  (B)  $\frac{b}{a}$   
 (C)  $\frac{a}{3b}$  (D) Zero
- Q13** A glass convex lens is of refractive index 1.55 with both face of same radius of curvature. What is the radius of curvature required if focal length is to be 20 cm?  
 (A) 18 cm  
 (B) 21 cm  
 (C) 20 cm  
 (D) 22 cm
- Q14** A prism is made up of material of refractive index  $\sqrt{2}$ . The angle of the prism is  $A$ . If the angle of minimum deviation is equal to the angle of the prism, the value of  $A$  is  
 (A)  $30^\circ$   
 (B)  $45^\circ$   
 (C)  $60^\circ$   
 (D)  $90^\circ$
- Q15** Two interfering wave have intensities  $I_1$  and  $I_2$ . The contrast between maximum and minimum intensities will be maximum when  
 (A)  $I_1 = I_2$   
 (B)  $I_1 \gg I_2$   
 (C)  $I_1 < I_2$   
 (D)  $I_1$  or  $I_2$  is zero
- Q16** Increase in temperature of a gas filled in a container would lead to  
 (A) decrease in intermolecular distance  
 (B) increase in its mass  
 (C) increase in its kinetic energy  
 (D) decrease in its pressure



- Q17** A charge  $q$  moves with a velocity  $2 \text{ m s}^{-1}$  along  $x$ -axis in a uniform magnetic field  $\vec{B} = (\hat{i} + 2\hat{j} + 3\hat{k})\text{T}$ , then charge will experience a force  
 (A) in  $zy$  plane  
 (B) along  $-y$  axis  
 (C) along  $+z$  axis  
 (D) along  $-z$  axis

- Q18** A wire is placed between the poles of two fixed bar magnets as shown in the figure. A small current in the wire is into the plane of the paper. The direction of the magnetic force on the wire is



- (A)  
 (B)  
 (C)  
 (D)

- Q19** A particle crossing the origin of co-ordinates at time  $t = 0$  moves in the  $xy$ -plane with a constant acceleration  $a$  in the  $y$ -direction. If its equation of motion is  $y = bx^2$  ( $b$  is a constant), its velocity component in the  $x$ -direction is

- (A)  $\sqrt{\frac{2b}{a}}$                       (B)  $\sqrt{\frac{a}{2b}}$   
 (C)  $\sqrt{\frac{a}{b}}$                       (D)  $\sqrt{\frac{b}{a}}$

- Q20** For a certain metal, incident frequency  $\nu$  is five times of threshold frequency  $\nu_0$  and the maximum velocity of coming out photoclectrons is  $8 \times 10^6 \text{ m s}^{-1}$ . If  $\nu = 2\nu_0$ , the maximum velocity of photoelectrons will be  
 (A)  $4 \times 10^6 \text{ m s}^{-1}$   
 (B)  $6 \times 10^6 \text{ m s}^{-1}$   
 (C)  $8 \times 10^6 \text{ m s}^{-1}$   
 (D)  $1 \times 10^6 \text{ m s}^{-1}$

- Q21** The ratio of the de-Broglie wavelengths of proton and  $\alpha$ -particle which have been accelerated through same potential difference is  
 (A)  $2\sqrt{3}$                       (B)  $3\sqrt{2}$   
 (C)  $2\sqrt{2}$                       (D)  $3\sqrt{3}$

- Q22** In the diffraction of light of wavelength  $\lambda$  at a single slit of small width  $e$ . the angle  $\theta$  between the central maximum and first minimum on either side is  
 (A)  $\lambda/e$                       (B)  $\lambda/2e$   
 (C)  $\lambda/4e$                       (D)  $\pi/2$

- Q23** The Rutherford's  $\alpha$ -particle experiment shows that most of the  $\alpha$ -particles pass through almost unscattered while some are scattered through large angles. What information does it give about the structure of the atom?  
 (A) Atom mostly consists of empty space  
 (B) The whole mass of the atom is concentrated in a small centre called nucleus.  
 (C) Nucleus is positively charged.  
 (D) All of the above.

- Q24** The energy of an electron in the  $n^{\text{th}}$  orbit of a hydrogen atom is given by  $E_n = \frac{-13.6}{n^2} \text{ eV}$  The energy required to excite the electron from the first orbit to the third orbit is  
 (A) 10.2 J                      (B) 12.09 J  
 (C) 10.2 eV                      (D) 12.09 eV



**Q25** An object moves at a constant speed along a circular path in a horizontal X-Y plane, with the centre at the origin. When the object is at  $x = -2$  m, its velocity is  $-4\hat{j}$  ms<sup>-1</sup>. What is the object's acceleration when it is  $x = 2$  m?  
 (A)  $-8\hat{j}$ ms<sup>-2</sup>  
 (B)  $-8\hat{i}$ ms<sup>-2</sup>  
 (C)  $-4\hat{j}$ ms<sup>-2</sup>  
 (D)  $-4\hat{i}$ ms<sup>-2</sup>

**Q26** In the Young's experiment with sodium light, the slits are 0.589 m apart. What is the angular width of the fourth maximum? Given that  $\lambda = 589$  nm  
 (A)  $\sin^{-1}(3 \times 10^{-6})$   
 (B)  $\sin^{-1}(3 \times 10^{-8})$   
 (C)  $\sin^{-1}(0.33 \times 10^{-6})$   
 (D)  $\sin^{-1}(0.33 \times 10^{-8})$

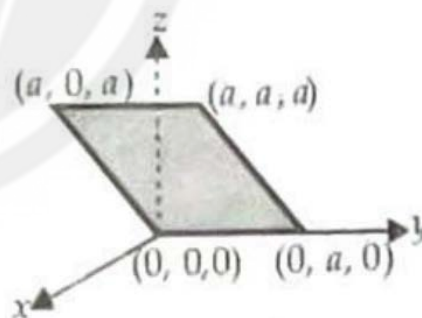
**Q27** The radius of a planet is  $R$  and its density is  $\rho$ . The escape velocity of a body from the surface of the planet is proportional to  
 (A)  $V_e \propto R\sqrt{\rho}$   
 (B)  $V_e \propto \frac{1}{\sqrt{\rho R}}$   
 (C)  $V_e \propto \rho R$   
 (D)  $V_e \propto \frac{\sqrt{\rho}}{R}$

**Q28** Two identical conducting balls A and B have positive charges  $q_1$  and  $q_2$  respectively. But  $q_1 \neq q_2$ . The balls are brought together so that they touch each other and then kept in their original positions. The force between them is  
 (A) less than that before the balls touched  
 (B) greater than that before the balls touched  
 (C) same as that before the balls touched  
 (D) zero

**Q29** Two charges  $+6 \mu\text{C}$  and  $+15 \mu\text{C}$  are placed along the x-axis at  $x = 0$  and  $x = 2$  m respectively. A negative charge is placed between them such that the resultant force on it is zero. The negative charge is placed at  
 (A)  $x = 0.775$ m  
 (B)  $x = 1.2$ m  
 (C)  $x = 0.5$ m  
 (D) position depends on the amount of charge

**Q30** In the uniform electric field of  $E = 1 \times 10^4$  NC<sup>-1</sup>, an electron is accelerated from rest. The velocity of the electron when it has travelled a distance of  $2 \times 10^{-2}$  m is nearly ...ms<sup>-1</sup>  
 ( $\frac{e}{m}$  of electron =  $1.8 \times 10^{11}$  C kg<sup>-1</sup>)  
 (A)  $1.6 \times 10^6$   
 (B)  $0.85 \times 10^6$   
 (C)  $0.425 \times 10^6$   
 (D)  $8.5 \times 10^6$

**Q31** Consider an electric field where  $\vec{E} = E_0\hat{x}$  is a constant. The flux through the shaded area (as shown in the figure) due to this field is



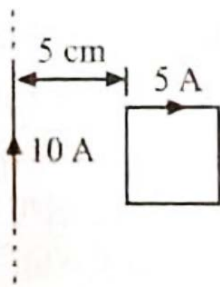
- (A)  $2E_0a^2$                       (B)  $\sqrt{2}E_0a^2$   
 (C)  $E_0a^2$                         (D)  $\frac{E_0a^2}{\sqrt{2}}$

**Q32** The velocity of a body moving in a vertical circle of radius  $r$  is  $\sqrt{7gr}$  at the lowest point of the circle. What is the ratio of maximum and minimum tension?  
 (A) 4 : 1                              (B)  $\sqrt{7} : 1$   
 (C) 3 : 1                              (D) 2 : 1



- Q33** If a linear isotropic dielectric is placed in an electric field of strength  $E$ , then the polarization  $P$  is  
 (A) independent of  $E$   
 (B) inversely proportional to  $E$   
 (C) directly proportional to  $E$   
 (D) inversely proportional to  $\sqrt{E}$

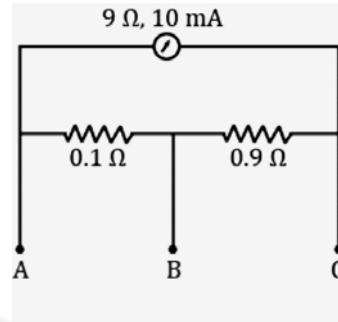
- Q34** A square loop of side 15 cm carrying a steady current of 5 A is placed with its one side parallel to a long straight conductor carrying a current of 10A as shown in figure. The correct statement related to net force experienced by the loop due to wire is



- (A) repulsive in nature having magnitude equal to  $3.75 \times 10^{-5}$  N.  
 (B) repulsive in nature having magnitude equal to  $2.25 \times 10^{-5}$  N  
 (C) attractive in nature having magnitude equal to  $2.25 \times 10^{-5}$  N.  
 (D) attractive in nature having magnitude equal to  $3.75 \times 10^{-5}$  N

- Q35** A rectangular coil, of sides 2 cm and 3 cm respectively, has 10 turns in it. It carries a current of 1 A, and is placed in a uniform magnetic field of 0.2 T in such a manner that its plane makes an angle  $60^\circ$  with the field direction. The torque on the loop is  
 (A)  $6.0 \times 10^{-4}$  Nm  
 (B)  $6.0 \times 10^{-5}$  Nm  
 (C)  $1.2 \times 10^{-3}$  Nm  
 (D) 6.0 Nm

- Q36** A milliammeter of range 10 mA and resistance  $9\Omega$  is joined in a circuit as shown in the figure. The metre gives full scale deflection for current  $I$  when A and B are used as its terminals, i.e., current enters at A and leaves at B (C is left isolated). The value of  $I$  is

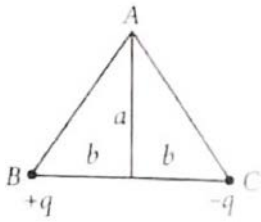


- (A) 100 mA  
 (B) 900 mA  
 (C) 1 A  
 (D) 1.1 A

- Q37** The moment of inertia of a body about a given axis is  $1.2 \text{ kg m}^2$ . Initially, the body is at rest. In order to produce a rotational kinetic energy of 6000 joule, an angular acceleration of  $25 \text{ rad m}^2$  must be applied about that axis for a duration of  
 (A) 4 s  
 (B) 2 s  
 (C) 85  
 (D) 10 s

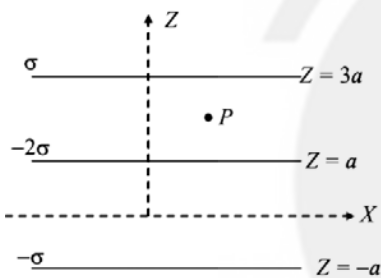


**Q38** As shown in the figure, charges  $+q$  and  $-q$  are placed at the vertices B and C of an isosceles triangle. The potential at the vertex A is



- (A)  $\frac{1}{4\pi\epsilon_0} \cdot \frac{2q}{\sqrt{a^2+b^2}}$
- (B) zero
- (C)  $\frac{1}{4\pi\epsilon_0} \cdot \frac{q}{\sqrt{a^2+b^2}}$
- (D)  $\frac{1}{4\pi\epsilon_0} \cdot \frac{(-q)}{\sqrt{a^2+b^2}}$

**Q39** Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is

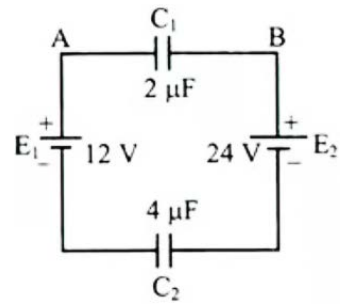


- (A)  $\frac{2\sigma}{\epsilon_0} \hat{k}$
- (B)  $\frac{4\sigma}{\epsilon_0} \hat{k}$
- (C)  $-\frac{2\sigma}{\epsilon_0} \hat{k}$
- (D)  $-\frac{4\sigma}{\epsilon_0} \hat{k}$

**Q40** If speed of sound in air is  $330 \text{ ms}^{-1}$ , then find the number of tones present in an open organ pipe of length 1 m whose frequency .

- (A) 2
- (B) 4
- (C) 8
- (D) 6

**Q41** Two capacitors  $C_1$  and  $C_2$  are connected in a circuit as shown in figure. The potential difference ( $V_A - V_B$ ) is



- (A) 8 V
- (B) -12 V
- (C) -8 V
- (D) 12 V

**Q42** A parallel plate capacitor with air between the plates has a capacitance of 9 pF. The separation between its plates is  $d$ . The space between the plates is now filled with two dielectrics. One of the dielectrics has dielectric constant  $K_1 = 3$  and thickness  $d/3$  while the other one has dielectric constant  $K_2 = 6$  and thickness  $2d/3$ . Now, the new capacitance (in pF) of the capacitor is

- (A) 40.5 pF
- (B) 20.4 pF
- (C) 16 pF
- (D) 15.8 pF

**Q43** The temperature of equal masses of three different liquids A, B and C are  $12^\circ\text{C}$ ,  $19^\circ\text{C}$  and  $28^\circ\text{C}$  respectively. The temperature when A and B are mixed is  $16^\circ\text{C}$  and when B and C are mixed is  $23^\circ\text{C}$ . The temperature when A and C are mixed is

- (A)  $18.2^\circ\text{C}$
- (B)  $22^\circ\text{C}$
- (C)  $20.3^\circ\text{C}$
- (D)  $24.2^\circ\text{C}$

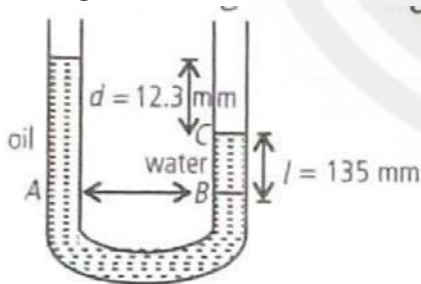


**Q44** The magnetic needle has magnetic moment  $8.7 \times 10^{-2} \text{ A m}^2$  and moment of inertia  $11.5 \times 10^{-6} \text{ kg m m}^2$ . It performs 10 complete oscillations in 6.70 s, what is the magnitude of the magnetic field?  
 (A) 0.012 T  
 (B) 0.120 T  
 (C) 1.200 T  
 (D) 2.10 T

**Q45** When orientation of dipoles parallel and antiparallel to magnetic field is distributed unequally, then the material is  
 (A) paramagnetic  
 (B) ferromagnetic  
 (C) ferrimagnetic  
 (D) antiferromagnetic

**Q46** The total charge, induced in a conducting loop when it is moved in magnetic field depend on  
 (A) the rate of change of magnetic flux  
 (B) initial magnetic flux only  
 (C) the total change in magnetic flux  
 (D) final magnetic flux only.

**Q47** What is density of oil for the given arrangement?

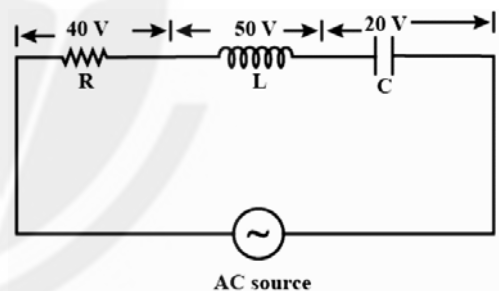


- (A)  $212.6 \text{ kg/m}^3$       (B)  $916.5 \text{ kg/m}^3$   
 (C)  $105.67 \text{ kg/m}^3$       (D)  $400 \text{ kg/m}^3$

**Q48** The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux  $\phi$  linked with the primary coil is given by  $\phi = \phi_0 + 4t$ , where  $\phi$  is in webers,  $t$  is time in seconds and  $\phi_0$  is a constant, the output voltage across the secondary coil is  
 (A) 120 volts      (B) 220 volts  
 (C) 30 volts      (D) 90 volts

**Q49** An air cored coil has a self-inductance of 0.1H. A softiron core of relative permeability 100 is introduced and the number of turns is reduced to . The value of selfinductance now is:  
 (A) 0.1 H  
 (B) 1 mH  
 (C) 1 H  
 (D) 10 mH

**Q50** In series LCR circuit, the voltages across R,L and C shown in figure. The voltage of applied source is



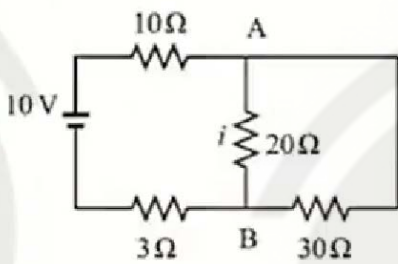
- (A) 110 volt  
 (B) 10 volt  
 (C) 50 volt  
 (D) 70 volt

**Q51** A free electron is placed in the path of a plane electromagnetic wave. The electron will start moving  
 (A) along the electric field  
 (B) along the magnetic field  
 (C) along the direction of propagation of wave  
 (D) in a plane containing the magnetic field and the direction of propagation



- Q52** For a perfectly rigid body  
 (A) Young's modulus is infinite and bulk modulus is zero  
 (B) Young's modulus is zero and bulk modulus is infinite.  
 (C) Young's modulus is infinite and bulk modulus is also infinite.  
 (D) Young's modulus is zero and bulk modulus is also zero.

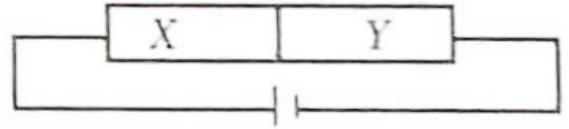
- Q53** In the electrical circuit shown in the figure, the current  $i$  through the side AB is



- (A)  $\frac{6}{25} A$  (B)  $\frac{10}{33} A$   
 (C)  $\frac{1}{5} A$  (D)  $\frac{10}{63} A$

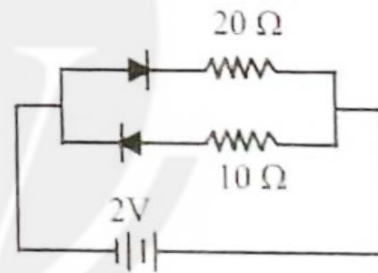
- Q54** The displacement of a particle is represented by the equation  $y = 0.4 \left\{ \cos^2 \left( \frac{\pi t}{2} \right) - \sin^2 \left( \frac{\pi t}{2} \right) \right\}$  metre  
 The motion of a particle is  
 (A) a S.H.M. with amplitude 0.8 m  
 (B) oscillatory but not S.H.M.  
 (C) a S.H.M. with amplitude 0.4 m  
 (D) a S.H.M. with amplitude  $0.4\sqrt{2}$  m

- Q55** A semiconductor  $X$  is made by doping a germanium crystal with arsenic ( $Z=33$ ). A second semiconductor  $Y$  is made by doping germanium with indium ( $Z = 49$ ). The two are joined end to end and connected to a battery as shown.  $X$   $Y$  Which of the following statements is correct?



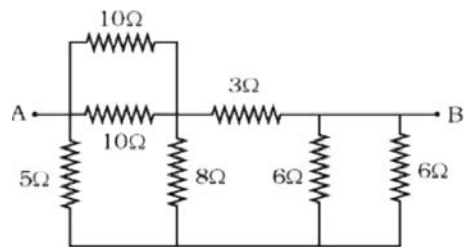
- (A)  $X$  is p-type,  $Y$  is n-type and the junction is forward biased  
 (B)  $X$  is n-type,  $Y$  is p-type and the junction is forward biased  
 (C)  $X$  is p-type,  $Y$  is n-type and the junction is reverse biased  
 (D)  $X$  is n-type,  $Y$  is p-type and the junction is reverse biased

- Q56** In the following figure, the current supplied by the battery is



- (A) 0.1 A (B) 0.2 A  
 (C) 0.3 A (D) 0.4 A

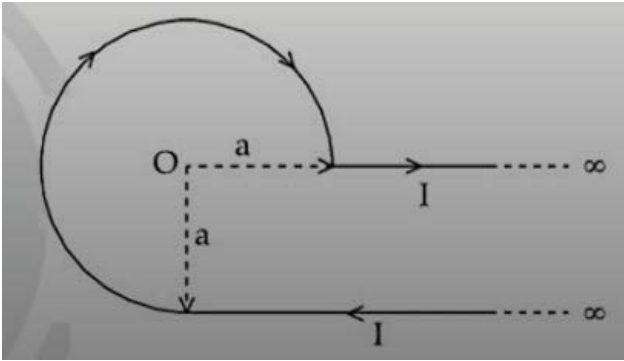
- Q57** Seven resistances are connected between points  $A$  and  $B$  as shown in figure. The equivalent resistance between  $A$  and  $B$  is



- (A)  $5\Omega$  (B)  $4.5\Omega$   
 (C)  $4\Omega$  (D)  $3\Omega$



- Q58** An infinite wire has a circular bend of radius  $a$  and carrying a current  $I$  as shown in figure. The magnitude of magnetic field at the origin  $O$  of the arc is given by.



- (A)  $\frac{\mu_0}{4\pi} \frac{I}{a} \left[ \frac{3\pi}{2} + 2 \right]$   
 (B)  $\frac{\mu_0}{4\pi} \frac{I}{a} \left[ \frac{3\pi}{2} + 1 \right]$   
 (C)  $\frac{\mu_0}{2\pi} \frac{I}{a} \left[ \frac{\pi}{2} + 2 \right]$   
 (D)  $\frac{\mu_0}{4\pi} \frac{I}{a} \left[ \frac{\pi}{2} + 1 \right]$

- Q59** Li nucleus has three protons and four neutrons. Mass of Li nucleus is  $7,016005 \text{amu}$ . Mass of proton is  $1,007277 \text{amu}$  and mass of neutron is  $1.008665 \text{amu}$ . Mass defect of lithium nucleus in amu is  
 (A)  $0.04048 \text{amu}$ , (B)  $0.040450 \text{amu}$ ,  
 (C)  $0.04052 \text{amu}$ , (D)  $0.04055 \text{amu}$ ,

- Q60** The energy released in the fission of  $1 \text{ kg}$  of  ${}_{92}^{235}\text{U}$  is (Energy per fission =  $200 \text{MeV}$ )  
 (A)  $5.1 \times 10^{24} \text{eV}$   
 (B)  $5.1 \times 10^{26} \text{eV}$   
 (C)  $8.2 \times 10^{13} \text{eV}$   
 (D)  $8.2 \times 10^{13} \text{MeV}$



# Answer Key

Q1 B  
Q2 C  
Q3 D  
Q4 B  
Q5 B  
Q6 D  
Q7 D  
Q8 A  
Q9 D  
Q10 B  
Q11 C  
Q12 C  
Q13 D  
Q14 D  
Q15 A  
Q16 C  
Q17 A  
Q18 D  
Q19 B  
Q20 A  
Q21 C  
Q22 A  
Q23 D  
Q24 B  
Q25 B  
Q26 A  
Q27 A  
Q28 B  
Q29 A  
Q30 D

Q31 B  
Q32 A  
Q33 C  
Q34 C  
Q35 A  
Q36 C  
Q37 A  
Q38 B  
Q39 C  
Q40 D  
Q41 C  
Q42 A  
Q43 C  
Q44 A  
Q45 C  
Q46 C  
Q47 B  
Q48 A  
Q49 C  
Q50 C  
Q51 A  
Q52 C  
Q53 A  
Q54 C  
Q55 D  
Q56 B  
Q57 C  
Q58 B  
Q59 B  
Q60 C



# Hints & Solutions

Note: scan the QR code to watch video solution

## Q1 Text Solution:

$$V = IR = 2.33 \times 10.485 = 24.43005 \text{ volt}$$

$$= 24.4$$

with least number of significant figures (3).

### Video Solution:



## Q2 Text Solution:

Applying principle of conservation of linear momentum,

$$p = \sqrt{p_1^2 + p_2^2} \text{ or } (m_1 + m_2)v$$

$$= \sqrt{(m_1 v_1)^2 + (m_2 v_2)^2}$$

$$(30 + 20)v = \sqrt{(30 \times 1)^2 + (20 \times 2)^2} = 50$$

$$\therefore v = \frac{50}{50} = 1 \text{ m/s}$$

### Video Solution:



## Q3 Text Solution:

Given:

$$A = 2 \times 10^{-6} \text{ m}^2, n_e = 5 \times 10^{22} \text{ cm}^{-3}$$

$$I = 16 \text{ A}$$

$$\therefore I = n_e e A v_d a$$

$$16 \text{ A}$$

$$= (5 \times 10^{28} \text{ m}^{-3}) (1.6 \times 10^{-19} \text{ C}$$

$$) (2 \times 10^{-6} \text{ m}^2) \times v_d$$

$$\Rightarrow v_d = 1 \times 10^{-3} \text{ ms}^{-1} = 0,001 \text{ ms}^{-1}$$

### Video Solution:



## Q4 Text Solution:

The resistance of a metallic wire increases with the increase in temperature due to increase in the thermal motion of core ions.

The resistance of a metallic wire at a temperature is given by  $R_p = R_0(1 + \alpha t)$  where  $\alpha$  is the temperature coefficient of resistance.

$$\text{Also, from ohm's law, } \frac{V}{I} = R$$

Hence, on increasing the temperature, the ratio  $\frac{V}{I}$  increase.

### Video Solution:



**Q5 Text Solution:**

Let be the power consumed by each bulb.

Then the resistances of two bulbs are

$$R_1 = \frac{(200 \text{ V})^2}{P} \text{ and } R_2 = \frac{(300 \text{ V})^2}{P} \text{ (as } P = \frac{V^2}{R} \text{)}$$

When these bulbs are connected in series across 500 V : the current through each bulb will be same. The ratio of potential difference across them is

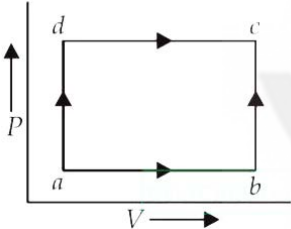
$$\frac{V_1}{V_2} = \frac{IR_1}{IR_2} = \frac{R_1}{R_2} = \frac{(200 \text{ V})^2/P}{(300 \text{ V})^2/P} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

**Video Solution:**



**Q6 Text Solution:**

According to first law of thermodynamics  $\delta Q = \delta U + \delta W$ , Along the path change in internal energy,



$$\delta U_1 = \delta Q_1 - \delta W_1 = 50 \text{ J} - 20 \text{ J} = 30 \text{ J}$$

Along the path change in internal energy

$$\delta U_2 = \delta Q_2 - \delta W_2 = 36 \text{ J} - \delta W_2$$

As change in internal energy is path independent,

$$\therefore \delta U_1 = \delta U_2 \text{ or } 30 \text{ J} = 36 \text{ J} - \delta W_2 \text{ or}$$

$$\delta W_2 = 6 \text{ J}$$

**Video Solution:**

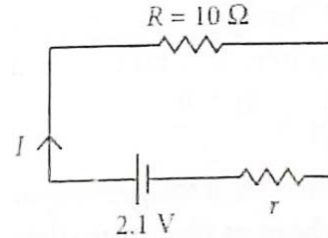


**Q7 Text Solution:**

Given, emf of the cell,  $E = 2.1 \text{ V}$

Current in the circuit,  $I = 0.2 \text{ A}$  External

resistance,  $R = 10\Omega$  When two resistors and are connected in series with a battery of emf , then current in the circuit is



$$I = \frac{E}{R+r} \therefore 0.2 = \frac{2.1}{10+r}$$

$$\text{or } 2 + 0.2r = 2.1 \text{ or } 0.2r = 0.1 \text{ or } r = 0.5\Omega$$

**Video Solution:**



**Q8 Text Solution:**

Wavelength,  $\lambda = \frac{c}{\nu}$

$$= \frac{3 \times 10^8}{6 \times 10^{14}} = 0.5 \times 10^{-6} = 500 \text{ nm}$$

This wavelength lies in the visible region.

**Video Solution:**



**Q9 Text Solution:**

Here,  $I = -4$  cm,  $O = 8$  cm,  $v = -60$  cm

Magnification,  $m = \frac{I}{O} = -\frac{v}{u}$  or  $u = -120$  cm

Now, mirror formula  $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$$\frac{1}{f} = \frac{1}{(-120)} + \frac{1}{(-60)} = -\frac{1}{120} - \frac{1}{60} = \frac{-1-2}{120}$$

$$= \frac{-3}{120}$$

$$\therefore f = -40 \text{ cm}$$

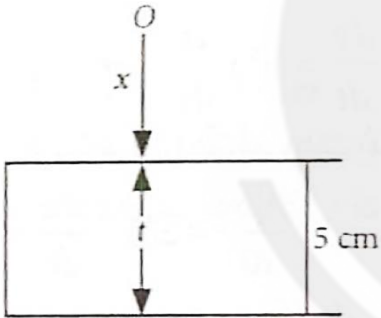
As image is real, inverted, diminished and located between focus and centre of curvature hence the mirror is concave mirror.

**Video Solution:**



**Q10 Text Solution:**

Velocity of light in this slab



$$v = \frac{5}{t} \Rightarrow t = \frac{5}{v}$$

$$\Rightarrow \frac{x}{c} = \frac{5\mu}{c} \left( \because t = \frac{x}{c} \text{ and } v = \frac{c}{\mu} \right)$$

$$x = 5\mu = 5 \times 1.6 \Rightarrow x = 8 \text{ cm}$$

**Video Solution:**



**Q11 Text Solution:**

$$\text{Normal shift} = t \left( 1 - \frac{1}{\mu} \right)$$

$$\text{Lateral shift} = t \sin i \left( 1 - \frac{\cos i}{\sqrt{\mu^2 - \sin^2 i}} \right)$$

**Video Solution:**



**Q12 Text Solution:**

$$\text{Given } x = at^2 - bt^3$$

Velocity,

$$v = \frac{dx}{dt} = \frac{d}{dt} (at^2 - bt^3) = 2at - 3bt^2$$

Acceleration,

$$a = \frac{dv}{dt} = \frac{d}{dt} (2at - 3bt^2) = 2a - 6bt$$

When  $a = 0$  then

$$0 = 2a - 6bt \text{ or } t = \frac{a}{3b}$$

**Video Solution:**



**Q13 Text Solution:**

Lens maker's formula,

$$\frac{1}{f} = (\mu - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right).$$

Here

$$f = 20 \text{ cm. } \mu = 1.55; R_1 = R; R_2 = -R$$

$$\Rightarrow \frac{1}{20} = (1.55 - 1) \left( \frac{1}{R} - \left( \frac{1}{-R} \right) \right)$$

$$\Rightarrow \frac{1}{20} = 0.55 \left( \frac{2}{R} \right)$$

$$\Rightarrow R = 2 \times 0.55 \times 20 = 22 \text{ cm}$$

**Video Solution:**



**Q14 Text Solution:**

The refractive index of the material of a prism is

$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\frac{A}{2}}$$

where  $\delta_m$  is the angle of minimum deviation.

$$\text{Here, } \mu = \sqrt{2}, A = \delta_m$$

$$\therefore \sqrt{2} = \frac{\sin\left(\frac{A+A}{2}\right)}{\sin\frac{A}{2}} = \frac{\sin A}{\sin\frac{A}{2}}$$

$$= \frac{2\sin\frac{A}{2}\cos\frac{A}{2}}{\sin\frac{A}{2}} = 2\cos\frac{A}{2}$$

$$\text{or } \cos\frac{A}{2} = \frac{1}{\sqrt{2}} \text{ or } \cos\frac{A}{2} = \cos 45^\circ \text{ or}$$

$$A = 90^\circ$$

**Video Solution:**



**Q15 Text Solution:**

$$I_{\max} = \left( \sqrt{I_1} + \sqrt{I_2} \right)^2$$

$$I_{\min} = \left( \sqrt{I_1} - \sqrt{I_2} \right)^2$$

Contrast is maximum when  $I_{\min} = 0$  i.e.

$$I_1 = I_2,$$

**Video Solution:**



**Q16 Text Solution:**

As per kinetic theory of gases, kinetic energy of gas molecules is directly proportional to the temperature of the gas.

**Video Solution:**



**Q17 Text Solution:**

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$$= 4 \left\{ (2\hat{i} \times (\hat{i} + 2\hat{j} + 3\hat{k})) \right\} = (4q)\hat{k} - (6q)\hat{j}$$

**Video Solution:**



**Q18 Text Solution:**

According to Fleming's left hand rule, the direction of the magnetic force on the wire is

**Video Solution:**



**Q19 Text Solution:**

$$y = bx^2$$

Differentiating w.r.t on both sides, we get

$$\frac{dy}{dt} = b2x \frac{dx}{dt} \text{ or } v_y = 2bxv_x$$

Again, differentiating w.r.t. on both sides,

$$\text{we get } \frac{dv_y}{dt} = 2bv_x \frac{dx}{dt} + 2bx \frac{dv_x}{dt} = 2bv_x^2 + 0$$

$I \frac{dv_x}{dt} = 0$ , because the particle has constant acceleration along y-direction]

As per question  $\frac{dv_y}{dt} = a = 2bv_x^2$  or

$$v_x = \sqrt{\frac{a}{2b}}$$

**Video Solution:**



**Q20 Text Solution:**

According to Einstein's photoelectric equation

$$hv = hv_0 + \frac{1}{2}mv_{\max}^2 \text{ or } \frac{1}{2}mv_{\max}^2 = hv$$

$$- hv_0$$

According to the given problem

$$\frac{1}{2}m(8 \times 10^6)^2 = h(5v_0 - v_0)$$

$$\frac{1}{2}mv_{\max}^2 = h(2v_0 - v_0)$$

Dividing equation (i) by (ii)

$$\frac{(8 \times 10^6)^2}{v_{\max}^2} = \frac{4v_0}{v_0}$$

$$v_{\max}^2 = \frac{(8 \times 10^6)^2}{4} \text{ or } v_{\max} = 4 \times 10^6 \text{ m s}^{-1}$$

**Video Solution:**



**Q21 Text Solution:**

K. E. gained by a charge  $q$  after being accelerated through a potential difference  $V$  volt is given by  $qV = \frac{1}{2}mv^2$

$$v = \sqrt{\frac{2qV}{m}} \text{ and } mv = \sqrt{2mqV}$$

de Broglie wavelength,  $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mqV}}$

Now,  $\lambda_p = \frac{h}{\sqrt{2m_p q_p V_p}}$  For  $\alpha$ -particle

$$\lambda_\alpha = \frac{h}{\sqrt{2m_\alpha q_\alpha V_\alpha}} \therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha q_\alpha V_\alpha}{m_p q_p V_p}}$$

Putting  $V_\alpha = V_p$  we get

$$\frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_0 q_\alpha}{m_p q_p}} = \sqrt{\frac{4 \times 2}{1 \times 1}} = \sqrt{8} = 2\sqrt{2}$$

**Video Solution:**



**Q22 Text Solution:**

$$c \sin \theta = \lambda \Rightarrow \theta = \lambda \Rightarrow \theta = \frac{\lambda}{c}$$

**Video Solution:**



**Q23 Text Solution:**

All of the above options are correct about structure of atom

**Video Solution:**



**Q24 Text Solution:**

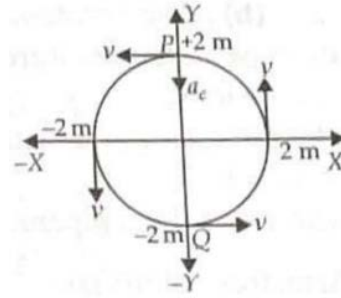
The energy required to excite the electron from the first orbit to the third orbit is  
 $= E_3 - E_1$   
 $= \left(-\frac{13.6}{9} + 13.6\right) \text{eV} = 12.09 \text{eV}$

**Video Solution:**



**Q25 Text Solution:**

Here, radius of circular path,  $r = 2 \text{ m}$   
 Speed of the object,  $v = 4 \text{ m s}^{-1}$  The magnitude of centripetal acceleration



$$a_c = \frac{v^2}{r} = \frac{4^2}{2} = 8 \text{ ms}^{-2}$$

This acceleration is directed towards the centre. Therefore, when the object is at  $x = 2 \text{ m}$ , its position is (see figure), Its acceleration is  $-8\hat{i} \text{ m s}^{-2}$

**Video Solution:**



**Q26 Text Solution:**

$$= x_n = \frac{n\lambda \cdot D}{2d} \text{ or } \frac{x_n}{D} = \frac{n\lambda}{2d}$$

$$\therefore \sin\theta = \frac{n\lambda}{2d} = \frac{3 \times 589 \times 10^{-9}}{0.589}$$

$$\theta = \sin^{-1}(3 \times 10^{-6})$$

**Video Solution:**



**Q27 Text Solution:**

$$: V_c = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G \cdot \frac{4}{3}\pi R^3 \rho}{R}}$$

$$= \sqrt{\frac{8}{3}G\pi\rho R^2} = 2R\sqrt{\frac{2}{3}G\pi\rho}$$

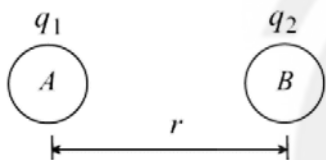
Thus,  $V_e \propto R\sqrt{\rho}$

**Video Solution:**



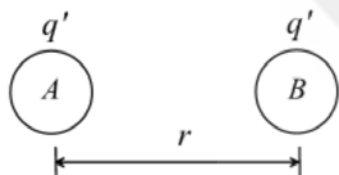
**Q28 Text Solution:**

According to Coulomb's law, the force of repulsion between them is  $F = \frac{q_1 q_2}{4\pi\epsilon_0 r^2}$



When the charged spheres A and B are brought in contact, each sphere will attain equal charge  $q$

$$q' = \frac{q_1 + q_2}{2}$$



Now, the force of repulsion between them at the same distance  $r$  is

$$F' = \frac{q' \times q'}{4\pi\epsilon_0 r^2} = \frac{1}{4\pi\epsilon_0} \frac{\left(\frac{q_1 + q_2}{2}\right)\left(\frac{q_1 + q_2}{2}\right)}{r^2}$$

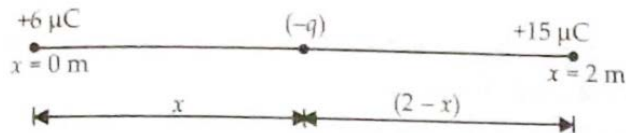
$$= \frac{\left(\frac{q_1 + q_2}{2}\right)^2}{4\pi\epsilon_0 r^2}$$

As  $\left(\frac{q_1 + q_2}{2}\right)^2 > q_1 q_2$  for  $q_1 \neq q_2 \therefore F' > F$

**Video Solution:**



**Q29 Text Solution:**



Let the charge  $(-q)$  be placed at a distance  $+6\mu\text{C}$  from . As the resultant force on  $(-q)$  is zero

$$\therefore \frac{(-q) \times 6 \times 10^{-6}}{4\pi\epsilon_0 \times x^2} = \frac{(-q) \times 15 \times 10^{-6}}{4\pi\epsilon_0 \times (2-x)^2}$$

$$\frac{6}{x^2} = \frac{15}{(2-x)^2}, \frac{1}{x} = \pm \frac{\sqrt{5}}{\sqrt{2}(2-x)}$$

On solving, we get,  $x = 0.775 \text{ m}$  or  $x = -3.44 \text{ m}$

**Video Solution:**



**Q30 Text Solution:**

Force on electron in uniform electric field is  $F = eE$  The acceleration of the electron is  $a = \frac{F}{m} = \frac{eE}{m}$ , where  $m$  is the mass of the electron.

Starting from rest, the velocity of the electron when it has travelled distance  $s$  is

$$v = \sqrt{2as} = \sqrt{2 \frac{eE}{m} s}$$

Here,  $\frac{e}{m} = 1.8 \times 10^{11} \text{ Ckg}^{-1}$

$$E = 1 \times 10^4 \text{ NC}^{-1}, s = 2 \times 10^{-2} \text{ m}$$

$$\therefore v = \sqrt{2 \times 1.8 \times 10^{11} \times 1 \times 10^4 \times 2 \times 10^{-2}}$$

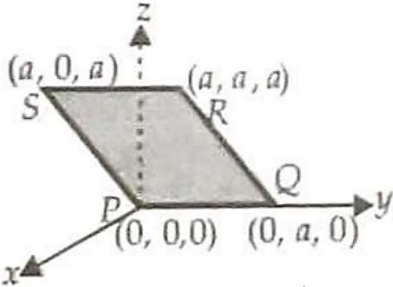
$$= 8.5 \times 10^6 \text{ m s}^{-1}$$

**Video Solution:**





**Q31 Text Solution:**



Here,  $\vec{E} = E_0 \hat{x}$

In this problem,  $x, y$  and  $z$  are the unit vectors along  $x, y$  and  $z$  axes respectively

Shaded area,  $\vec{A} = \vec{PQ} \times \vec{PS}$

$$\vec{A} = (0\hat{x} + a\hat{y} + 0\hat{z}) \times (a\hat{x} + 0\hat{y} + a\hat{z})$$

$$= a^2\hat{x} - a^2\hat{z}$$

$$\phi = \vec{E} \cdot \vec{A} = (E_0\hat{x}) \cdot (a^2\hat{x} - a^2\hat{z}) = E_0 a^2$$

**Video Solution:**



**Q32 Text Solution:**

Tension is maximum at the lowest point and minimum at the highest point. Tension at the lowest point,

$$T_L = mg + \frac{mv_L^2}{r} = mg + \frac{7mgr}{r}$$

$$= 8mg \quad (\because v_L = \sqrt{7gr})$$

Tension at the highest point,

$$\begin{aligned} T_H &= \frac{mv_H^2}{r} - mg = \frac{m(v_L^2 - 4gr)}{r} \\ &- mg \quad (\because v_L^2 - v_H^2 = 4gr) \\ &= \frac{m(7gr - 4gr)}{r} - mg = 3mg - mg = 2mg \\ \therefore \frac{T_L}{T_H} &= \frac{4}{1} \text{ or } \frac{T_{\max}}{T_{\min}} = \frac{4}{1} \end{aligned}$$

**Video Solution:**



**Q33 Text Solution:**

For linear isotropic dielectric,

Polarization  $P = \chi_t E$ .

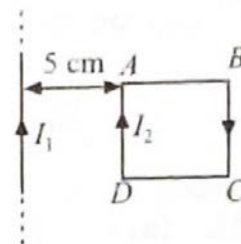
where  $\chi_r$  is a constant characteristic of the dielectric and is known as the electric susceptibility of the dielectric medium

**Video Solution:**



**Q34 Text Solution:**

Force experienced by AB and CD are equal and opposite, so the contribution in the net force experienced by loop is only due to AD and BC. Magnetic field at the location of AD is



$$\vec{B}_1 = \frac{\mu_0 I_1}{2\pi(5 \times 10^{-2} \text{ m})} = \frac{2 \times 10^{-7} \times 10}{5 \times 10^{-2}} \otimes$$

$$= 4 \times 10^{-5} \text{ T} \otimes$$

Magnetic force experienced by AD is,  
 $F_1 = I_2 B_1 \times (15 \times 10^{-2} \text{ m}) = 3 \times 10^{-5} \text{ N}$   
 towards wire.

Magnetic field at the location of BC is

$$\vec{B}_2 = \frac{\mu_0 I_1}{2\pi \times (20 \text{ cm})} = \frac{2 \times 10^{-7} \times 10}{20 \times 10^{-2}} = 1 \times 10^{-5} \text{ T}$$

$$\otimes$$

Magnetic force experienced by BC is,  
 $F_2 = I_2 B_2 \times (15 \text{ cm}) = 0.75 \times 10^{-5} \text{ N}$  away  
 from wire.

Net force experienced by loop is  
 $\vec{F} = (F_1 - F_2)$ , towards the wire towards the  
 wire.

**Video Solution:**



**Q35 Text Solution:**

When a current carrying coil is placed in a uniform magnetic field, it experiences a torque whose magnitude is given by  
 $\tau = MB \sin \theta = (NIA)B \sin \theta$

Here,  $N = 10$ ,  $I = 1 \text{ A}$ ,  $B = 0.2 \text{ T}$   
 $A = 3 \text{ cm} \times 2 \text{ cm} = 6 \text{ cm}^2 = 6 \times 10^{-4} \text{ m}^2$   
 $\theta = 90^\circ - 60^\circ = 30^\circ$

Torque,  $\tau = NLBA$

$$\sin \theta = 10 \times 1 \times 0.2 \times 6 \times 10^{-4} \times \sin 30^\circ$$

$$= 10 \times 1 \times 0.2 \times 6 \times 10^{-4} \times \frac{1}{2} = 6$$

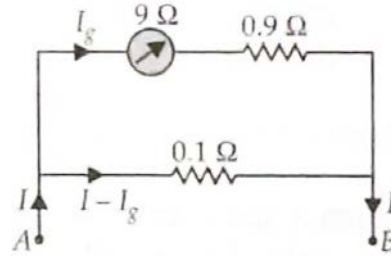
$$\times 10^{-4} \text{ N m}$$

Torque,  $NLBA$

**Video Solution:**



**Q36 Text Solution:**



$$I_g = 10 \text{ mA} = 0.01 \text{ A}$$

$$V_A - V_n = (I - I_g)(0.1) = I_R \times 9.9$$

or  $I \times 0.1 = I_g \times 10$

$$\therefore I = \frac{0.01 \times 10}{0.1} = 1 \text{ A}$$

**Video Solution:**



**Q37 Text Solution:**

Rotational kinetic energy,  
 $K_R = \frac{1}{2} I \omega^2 = \frac{1}{2} I \alpha^2 t^2$   
 Substituting the given values, we get  
 $6000 = \frac{1}{2} \times 1.2 \times (25)^2 \times t^2$  or  $t^2 = 16$  or  
 $t = 4 \text{ s}$

**Video Solution:**



**Q38 Text Solution:**

$$V_A = \frac{K(+q)}{\sqrt{a^2+b^2}} + \frac{K(-q)}{\sqrt{a^2+b^2}} = 0$$

**Video Solution:**



**Q39 Text Solution:**

All the three charge sheets will produce electric field at  $P$ . The field will be along negative  $Z$ -axis. Hence

$$\vec{E} = \left[ \frac{\sigma}{2\epsilon_0} + \frac{2\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0} \right] (-\hat{k}) \text{ or } \vec{E} = -\frac{2\sigma}{\epsilon_0} \hat{k}$$

**Video Solution:**



**Q40 Text Solution:**

Fundamental frequency

$$= f = \frac{v}{2l} = \frac{330}{2 \times 1} = 165 \text{ Hz}$$

$$\text{Number of overtones allowed} = \frac{1000}{165} = 6$$

**Video Solution:**



**Q41 Text Solution:**

Net emf in the circuit,

$$E = 24 - 12 = 12 \text{ V}$$

Since there is only one path for the charge flow, therefore  $C_1$  and  $C_2$  are in series,

$$\therefore \frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{2} + \frac{1}{4} = \frac{3}{4}; C_s = \frac{4}{3} \mu\text{F}$$

Charge on each capacitor,

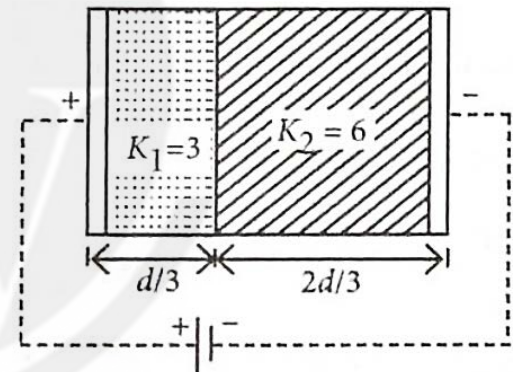
$$Q = C_s \times E = \frac{4}{3} \times 12 = 16 \mu\text{C}$$

$$V_A - V_B = -\frac{Q}{C_1} = -\frac{16}{2} = -8 \text{ V}$$

**Video Solution:**



**Q42 Text Solution:**



$$C_1 = \frac{K_1 A \epsilon_0}{d/3} = \frac{9A\epsilon_0}{d}, C_2 = \frac{K_2 A \epsilon_0}{2d/3} = \frac{9A\epsilon_0}{2d}$$

$C_1$  and  $C_2$  are in series (check polarity).

$$\therefore C_{eq} = \frac{9}{2} \frac{A\epsilon_0}{d} = \frac{9}{2} \times 9 = \frac{81}{2} = 40.5 \text{ pF}$$

**Video Solution:**



**Q43 Text Solution:**

$$\text{Let } m_1 = m_2 = m_3 = m$$



Let  $s_1, s_2, s_3$  be the respective specific heats of the three liquids. When A and B are mixed, temperature of mixture =  $16^\circ\text{C}$  As heat gained by A = heat lost by B

$$\therefore ms_1(16 - 12) = ms_2(19 - 16)$$

$$4s_1 = 3s_2$$

When B and C are mixed, temperature of mixture =  $23^\circ\text{C}$ .

As heat gained by B = heat lost by C,

$$ms_2(23 - 19) = ms_3(28 - 23)$$

$$\therefore 4s_2 = 5s_3$$

$$\text{From (i) and (ii), } s_1 = \frac{3}{4}s_2 = \frac{15}{16}s_3$$

When A and C are mixed, suppose temperature of mixture =  $t$  Heat gained by A = Heat lost by C

$$ms_1(t - 12) = ms_3(28 - t)$$

$$\frac{15}{16}s_3(t - 12) = s_3(28 - t); 15t - 180 = 448 - 16t$$

$$31t = 448 + 180 = 628; t = \frac{628}{31} = 20.3^\circ\text{C}$$

**Video Solution:**



**Q44 Text Solution:**

Here, Magnetic moment,

$$M = 8.7 \times 10^{-2} \text{ A m}^2$$

Moment of inertia,  $I = 11.5 \times 10^{-6} \text{ kg m}^2$

Time period of oscillation is

$$T = \frac{6.70}{10} = 0.675 \text{ s}$$

$$\text{As } T = 2\pi\sqrt{\frac{I}{MB}}$$

$$\therefore B = \frac{4\pi^2 I^2}{MT^2} = \frac{4 \times (3.14)^2 \times 11.5 \times 10^{-6}}{8.7 \times 10^{-2} \times (0.67)^2} = 0.012 \text{ T}$$

**Video Solution:**



**Q45 Text Solution:**

The orientation of dipoles parallel and antiparallel to magnetic field is distributed unequally in ferrimagnetic materials.

**Video Solution:**



**Q46 Text Solution:**

Charge,

$$q = \int idt = \frac{1}{R} \int \epsilon dt = \frac{1}{R} \int \left( \frac{-d\phi}{dt} \right) dt = \frac{1}{R} \int d\phi$$

Hence total charge induced in the conducting loop depend upon the total change in magnetic flux.

As the emf or depends on rate of change of  $\phi$ , charge induced depends on change of flux.

**Video Solution:**



**Q47 Text Solution:**

$$P_B = P_0 + \rho_w gl$$

$$P_A = P_0 + \rho_{oil} (l + d)g$$

A and B are two points at the same level.

According to Pascal's law,  $P_A = P_B$

$$P_0 + \rho_w gl = P_0 + \rho_{oil} (l + d)g$$

$$\rho_{oil} = \frac{\rho_w l}{(l+d)} = \frac{1000 \times (135)}{(135+12.3)} = 916.5 \text{ kg/m}^3$$

**Video Solution:**



**Q48 Text Solution:**

Given : No. of turns across primary  $N_p = 50$   
 Number of turns across secondary  $N_s = 1500$

Magnetic flux linked with primary,  
 $\phi = \phi_0 + 4t$

Voltage across the primary,

$$|V_p| = \frac{d\phi}{dt} = \frac{d}{dt}(\phi_0 + 4t) = 4 \text{ volt. Also,}$$

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$\therefore V_s = \left( \frac{1500}{50} \right) \times 4 = 120 \text{ V}$$

**Video Solution:**



**Q49 Text Solution:**

$$L = 0.1 = \frac{\mu_0 N^2 A}{l}, L' = \frac{\mu_r \mu_0 N_1^2 A}{l} N_1 = \frac{N}{10}$$

$$\therefore \frac{L'}{0.1} = \frac{1000 \times \mu_0 (N/10)^2 A \cdot I}{l \times \mu_0 N^2 A} \text{ or } L' = 1 \text{ H}$$

**Video Solution:**



**Q50 Text Solution:**

$$V^2 = (V_L - V_C)^2 + V_R^2 = (50 - 20)^2 + 40^2$$

$$\text{or } V = 50 \text{ V}$$

**Video Solution:**



**Q51 Text Solution:**

When an electron is placed in the path of a harmonic electromagnetic wave, it will experience a force due to electric field only. It will start moving along the electric field.

**Video Solution:**



**Q52 Text Solution:**

For a perfectly rigid body, both Young's modulus and bulk modulus is infinite.

**Video Solution:**



**Q53 Text Solution:**

$$\sin i = \frac{2}{AB}, \sin r = \frac{1}{AB}$$

$$\frac{\sin i}{\sin r} = \frac{2/AB}{1/AB} = 2 = \frac{\mu_2}{\mu_1}; 2 = \frac{\mu_2}{1} \Rightarrow \mu_2 = 2$$

**Video Solution:**



**Q54 Text Solution:**

Given,  $y = 0.4\left(\cos^2 \frac{\pi t}{2} - \sin^2 \frac{\pi t}{2}\right)$

$$y = 0.4(\cos \pi t)$$

$$y = 0.4(\sin(\pi - \pi t)) \Rightarrow y = 0.4 \sin \pi(1 - t)$$

We know the equation of SHM is  $y = A \sin \omega t$   
It is SHM with amplitude,  $A = 0.4$

**Video Solution:**



**Q55 Text Solution:**

Arsenic is pentavalent and is a donor impurity and supplies extra electrons, so electrons become majority charge carriers and the material becomes *n*-type whereas indium is trivalent and is an acceptor impurity and supplies holes, which become majority charge carriers and the material behaves as *p*-type semiconductors.

As *X* is *n*-type and *Y* is *p*-type and negative of battery is connected to *p*-type and positive of battery is connected to *n*-type so the junction is reverse biased.

**Video Solution:**



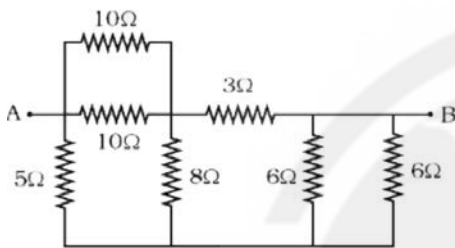
**Q56 Text Solution:**

The diode in series with  $20\Omega$  is reverse biased and hence will not conduct current. The diode in series with  $10\Omega$  is forward biased. Hence  $i = \frac{2\text{ V}}{10\Omega} = 0.2\text{ A}$

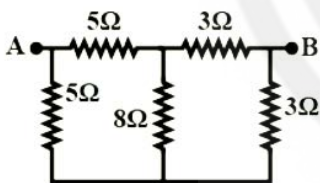
**Video Solution:**



**Q57 Text Solution:**



In the given figure, two  $10\Omega$  resistances and two  $6\Omega$  resistances are connected in parallel. So their equivalent resistances are  $5\Omega$  and  $3\Omega$  respectively. The equivalent circuit is shown in figure



It is a balanced Wheatstone bridge. Hence the resistance of arm CD becomes ineffective.

Now the resistance of arm ACB ( $5\Omega + 3\Omega = 8\Omega$ ) is in parallel with the resistance of arm ADB ( $5\Omega + 3\Omega = 8\Omega$ ).

The equivalent resistance between A and B is

$$R_{eq} = \frac{(8\Omega)(8\Omega)}{8\Omega + 8\Omega} = 4\Omega$$

**Video Solution:**



**Q58 Text Solution:**

The circuit in option (d) will provide full wave rectification of an ac input.

**Video Solution:**



**Q59 Text Solution:**

Here,  $m_p = 1.007277\text{amu}$   
 $m_n = 1.008665\text{amu}$ ,  $m_U = 7.016005\text{amu}$   
 Sum of the masses of three protons and four neutrons  
 $= 3m_p + 4m_n = 3 \times 1.007277 + 4 \times 1.008665$   
 $= 3.021831 + 4.03466 = 7.056491\text{amu}$   
 $\therefore$  Mass defect  
 $= 7.056491 - 7.016005 = 0.040486\text{amu}$

**Video Solution:**



**Q60 Text Solution:**

Energy of single fission is 200 MeV .

Number of atoms in 235 g =  $6.023 \times 10^{23}$

Number of atoms in 1 kg of uranium 235

$$= \frac{1000}{235} \times 6.023 \times 10^{23}$$

Energy released in fission of 1 kg of  $U^{235}$

$$= \frac{200 \times 10^6 \times 1000 \times 6.023 \times 10^{23} \times 1.6 \times 10^{-14}}{235} \text{ J}$$

$$= 8.2 \times 10^{11} \text{ J}$$

**Video Solution:**

[Android App](#)

| [iOS App](#)

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