UNIT TEST-02

Subject : Physics
Class : XII

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

Q.1 (4)

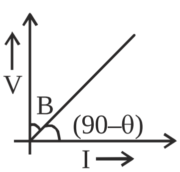
$Q = 2 \times 10^{-2}$ C, $\omega = 30$, $r = 0.40$ m

$$T = \frac{2\pi}{\omega} = \frac{6.28}{30} = 0.209 = 2 \times 10^{-1}$$

$$I = \frac{2\times10^{-2}}{2\times10^{-1}} = 0.1A$$

Q.2 (4)

$$R = \frac{V}{I} = \tan(90-\theta)$$



$R = \cot\theta$

Q.3 (3)

Let $R = R_0$ at 0ºC

$5 = R_0(1 + \alpha \times 50)$ ....(i)

$6 = R_0(1 + \alpha \times 100)$ ....(ii)

Solving (i) and (ii) $\Rightarrow$ $R_0 = 4\Omega$

Q.4 (1)

Low temperature coefficient of resistance ensures low vairation is resistance with temperature.

Q.5 (1)

If length is made 4 times then area becomes $\frac{1}{4}$ times.

$$R = \frac{\rho l}{a}$$

$$R' = \frac{\rho \times 4l}{\frac{a}{4}} = 16R = 160\Omega$$

Q.6 (2)

Microscopic law

$J = \sigma E$

Ohm's law $V = IR$

rate of flow of charge = I

$$I = \frac{dq}{dt}$$

electrical conductivity $\sigma = \frac{1}{p}$

$$\sigma = \frac{ne^2\tau}{m}$$

Q.7 (3)

$$\frac{R}{\ell} = 0.5\Omega m^{-1}$$

Perimeter of circle $= 2\pi R = 2\pi \times 1 = 2\pi$

Total $R = 0.5 \times 2\pi = \pi\Omega$

Resistance of upper & lower semi circle $= \frac{\pi}{2}\Omega$

Resistance of diameter = 1 Ω

All three are in parallel, hence

$$\frac{1}{R_{AB}} = \frac{1}{\pi/2} + \frac{1}{\pi/2} + 1$$

$$= \frac{2}{\pi} + \frac{2}{\pi} + 1$$

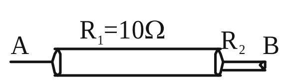
$$\Rightarrow \frac{1}{R_{AB}} = \frac{4+\pi}{\pi}$$

$$\boxed{R_{AB} = \frac{\pi}{4+\pi}\Omega}$$

Q.8 (1)

Two wires A and B

Ratio of area $\frac{a_1}{a_2} = \frac{3}{1}$



$$R = \rho\frac{l}{A}$$

$$\frac{R_1}{R_2}=\frac{A_2}{A_1}=\frac{1}{3}$$

$$\frac{10}{R_2}=\frac{1}{3}$$

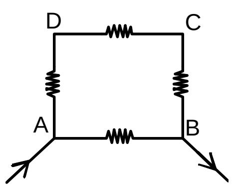
$R_2 = 30$
$R_{AB} = 10 + 30 = 40\Omega$

Q.9 (4)
$V_A = IR$

$$V_B = \left(\frac{2I}{3}\right) 1.5\,R = IR \quad V_C = \left(\frac{I}{3}\right)3R = IR$$

$\therefore \quad V_A = V_B = V_C$

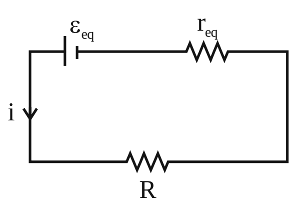
Q.10 (2)



$$R_{eq} = \frac{3R \times R}{4R} = \frac{3R}{4}$$

$$i = \frac{V}{R_{eq}} = \frac{V}{3R/4} = \frac{4V}{3R}$$

Q.11 (3)



$\varepsilon_{eq} = 5 \times 4 = 20\ V$
$r_{eq} = 5 \times 0.4 = 2\ \Omega$

$$i = \frac{\varepsilon_{eq}}{R + r_{eq}} = \frac{20}{2+2} = 5A$$

Q.12 (4)

Q.13 (2)
Kirchhoff 's first law is junction rule, according to which the algebraic sum of the currents into any junction is zero. The junction rule is based on conservation of electric charge. No charge can accumulate at a junction, so the total charge entering the junction per unit time must equal to charge leaving per unit time.
Kirchhoff's second law is loop rule according to which the algebraic sum of the potential difference in any loop including those associated emf's and those of resistive elements, must equal to zero.
This law is basically the law of conservation of energy.

Q.14 (4)

Q.15 (1)
If bulb 1 gets fuse then there is no path through which current can pass through, from battery to remaining circuit.

Q.16 (3)

Resistance of bulb = $\frac{V_{rated}^2}{P_{rated}}$

$$\Rightarrow R = \frac{200 \times 200}{100} = 400\Omega$$

For given voltage, $P = \frac{V_{supply}^2}{R}$

$$\Rightarrow P = \frac{160 \times 160}{400} = 64W$$

Q.17 (3)
for meter bridge
$R \times BC = 80 \times Ac$
$R \times 80 = 80 \times 20$
$R = 20\Omega$

Q.18 (4)

$$\frac{10}{\ell} = \frac{30}{(100-\ell)}$$

$\ell = 25$

$$\frac{30}{\ell^1} = \frac{10}{(100-\ell^1)}$$

$\ell^1 = 75$
$\therefore \Delta \ell = \ell^1 - \ell = 50$ cm

Q.19 (2)

$$S = \frac{R_A}{n-1} = \frac{180}{10-1}$$

$$\left[\text{Here } n = \frac{20}{2} = 10\right]$$

$= 20\ \Omega$
$R_S = 0.05\ \Omega$

Q.20 (1)

Magnetic field due to current carrying will at centre is

$$B = \frac{\mu_0 iN}{2R} = \frac{4\pi\times10^{-7}\times6\times50\times100}{2\times10}$$

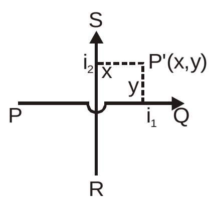
$B = 2\pi\times10^{-7}\times25\times180 = 50\,\pi\times10^{-5}$

$= 1.57\times10^{-3}$ T = 1.57 mT

Q.21 (2)

$$B_{PQ} = \frac{\mu_0 i_1}{2\pi y}$$

$$B_{RS} = \frac{\mu_0 i_2}{2\pi x}$$



‡ for zero magnetic field $B_{PQ} = B_{RS}$

$$\frac{\mu_0 i_1}{2\pi y} = \frac{\mu_0 i_2}{2\pi x}$$

$$\frac{i_1}{y} = \frac{i_2}{x} \text{ or } y = \frac{i_1}{i_2}x$$

Q.22 (1)

Magnetic field induction at the centre of circular coil

$$B = \frac{\mu_0 I}{2r}$$

$$c^2 = \frac{1}{\mu_0\varepsilon_0}$$

$$\therefore\ \mu_0 = \frac{1}{\varepsilon_0 c^2}$$

So, from Eq. (i)

$$B = \frac{1}{\varepsilon_0 c^2}\frac{I}{2r} = \frac{1}{\varepsilon_0\times(3\times10^8)^2}\times\frac{0.9}{2\times5\times10^{-2}}$$

$$= \frac{1\times9}{\varepsilon_0\times9\times10^{16}} = \frac{1}{\varepsilon_0\times10^{16}}$$

Q.23 (2)

For arc $\rightarrow$ $B = \dfrac{\mu_0 I\alpha}{4\pi a}$

Here $\alpha = \dfrac{3\pi}{2}$; $B_1 = \dfrac{3}{8}\dfrac{\mu_0 I}{a}\otimes$

$\alpha = \dfrac{\pi}{2}$ $\quad B_2 = \dfrac{\mu_0 I}{8a}\otimes$

Total magnetic field $B_{net} = B_1 + B_2$

Q.24 (3)

$$B = \frac{\mu_0}{4\pi}\cdot\frac{I}{2R}\times\frac{3\pi}{2}+\frac{\mu_0}{4\pi}\cdot\frac{I}{R}\times\frac{\pi}{2} = \frac{5\mu_0 I}{16R}$$

Q.25 (3)

Bio Savart Law

(a) Magnetic field due to long wire

$$B = \frac{\mu_0 I}{4\pi r}[\sin\theta_1 + \sin\theta_2]$$

$\theta_1 = \theta_2 = 90^\circ$

$$B = \frac{\mu_0 I}{2\pi r}$$

(b) inside solenoid

$B = \mu_0 nI$

(c) At centre of coil

$$B = \frac{\mu_0 nI}{2r}$$

(d) At the axis of coil

$$B = \frac{\mu_0 NIR^2}{2[R^2 + x^2]^{3/2}}$$

Q.26 (2)

N = 200/cm, i = 2.5

$B = m_0 \,.\, ni$

$$= 4\pi\times10^{-7}\times\frac{200}{\frac{1}{100}}\times2.5 = 6.28\times10^{-2}\ \text{Wb/m}^2$$

Q.27 (1)

$$\oint \vec{B}d\vec{\ell} = \mu_0\Sigma I$$

Q.28 (3)

In a perpendicular magnetic field, the radius of circular path travelled by electron beam is

$$r = \frac{mv}{eB}$$

$$\therefore\ r = \frac{9\times10^{-31}\times1.6\times10^7}{1.6\times10^{-19}\times0.1}$$

$= 9\times10^{-4}$ m

Q.29 (1)

$R = \frac{mV}{qB}$, $q_{proton} = e$, $q_{\alpha\text{-particle}} = 2q = 2e$

$m_{porton} = m, m_{\alpha\text{-particle}} = 4m$

$$\frac{R_1}{R_2} = \frac{m}{q}\left(\frac{2q}{4m}\right) = \frac{1}{2}$$

Q.30 (3)

$$E_{K\alpha} = \frac{q_\alpha^2 r^2 B^2}{2m_\alpha}$$

$$\therefore E_K \propto \frac{q^2}{m}$$

$$\therefore \frac{E_{k_\alpha}}{E_{k_p}} = \frac{q_\alpha^2}{q_p^2} \text{ x } \frac{m_p}{m_\alpha}$$

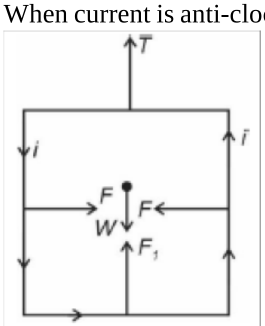
$$\text{or } \frac{E_{k_\alpha}}{E_{k_p}} = \frac{4}{1} \text{ x } \frac{1}{4} = 1$$

$$E_{k_\alpha} = 8\text{eV}$$

Q.31 (3)

FBD

When current is anti-clock wise



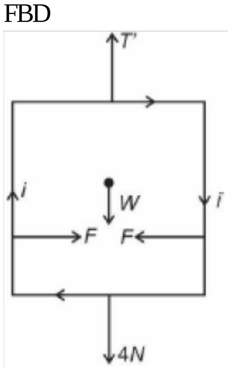
$$F_1 = ilB = 4 \times \frac{25}{100} \times 4 = 4\text{N(upwards)}$$

Thus $T + F_1 = W$

$T = W - 4$ ...(i)

For clock-wise current

FBD



$\Rightarrow T' = W + 4$ ...(ii)

Thus using (i) & (ii)

$T' - T = 8N$

$\therefore \Delta T = 8N$

Q.32 (3)

Given, $l_1 = l_2 = l = 9$ m,

$r = 0.15$ m, $i_1 = i_2 = i$

$F = 30 \times 10^{-7}$ N

Force exerted between two parallel current carrying wires

$$F = \frac{\mu_0}{2\pi}\frac{i_1 i_2}{r} l$$

$$30 \times 10^{-7} = 2 \times 10^{-7} \frac{i \cdot i}{0.15} \times 9$$

$$i^2 = \frac{30 \times 0.15}{2 \times 9} = \frac{4.5}{18} = \frac{1}{4}$$

$$i = \sqrt{\frac{1}{4}} = \frac{1}{2} = 0.5\text{A}$$

Q.33 (3)

Given, $m = 0.6$ g

$= 0.6 \times 10^{-3}$ kg,

$q = 25$ nC $= 25 \times 10^{-9}$ C

$v = 1.2 \times 10^4$ ms^{-1}

The particle is moving with uniform velocity (acceleration is zero), so magnetic force will be balancing the weight of the particle.

$mg = B qv$

$0.6 \times 10^{-3} \times 10 = B \times 25 \times 10^{-9} \times 1.2 \times 10^4$

$$B = \frac{0.6 \times 10^{-3} \times 10}{25 \times 10^{-9} \times 1.2 \times 10^4}$$

$$= \frac{6 \times 10^{-3}}{30 \times 10^{-5}} = \frac{6 \times 10^2}{30} = 20\text{T}$$

Q.34 (2)

$$M = \frac{I}{4}\left\{\pi(2R)^2 - \pi(R)^2\right\}$$

Q.35 (3)

Magnetic moment $M = iA$

$$\therefore \frac{M_1}{M_2} = \left(\frac{i_1}{i_2}\right)\left(\frac{A_1}{A_2}\right) = \left(\frac{i_1}{i_2}\right)\left(\frac{\pi r_1^2}{\pi r_2^2}\right)$$

Here, current is halved, so, $i_1 = 2i_2$

and radius is double so, $r_2 = 2r_1$

$$\therefore \frac{4}{M^2} = \left(\frac{2i_2}{i_2}\right)\left(\frac{r_1}{2r_1}\right)^2$$

$$= 2\left(\frac{1}{2}\right)^2 = 2 \times \frac{1}{4}$$

$$\frac{4}{M_2} = \frac{1}{2}$$

$$\therefore M_2 = 4 \times 2 = 8 \text{ unit}$$

Q.36 (2)

Volume = constant $\Rightarrow A = \dfrac{\text{volume}}{\text{length}}$

$\ell_{initial} = \ell_0,\ \ell_{final} = 1.3\ \ell_0$

$$R = \frac{\rho l}{A} = \frac{\rho l}{\left(\frac{V}{l}\right)} = \frac{\rho l^2}{V}$$

$$R' = \frac{\rho}{V} = (1.3 l_0)^2 = 1.69\frac{\rho l^2}{V}$$

$\Rightarrow R' = 1.6\,R$

$$\%\text{ increase in } R = \frac{\Delta R}{R}\times 100$$

$$= \left(\frac{1.69R - R}{R}\right)\times 100 = 69\%$$

Q.37 (4)

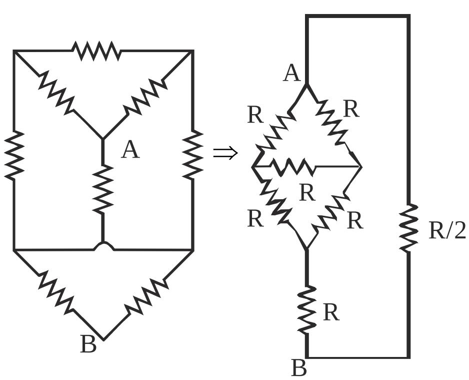
$$\frac{R_A}{R_B} = \frac{\rho_A l_A A_B}{A_A \rho_B l_B}$$

$$= \frac{A_B}{A_A} = \frac{4}{1}$$

$$\Rightarrow R_B = \frac{R_A}{4}$$

$$= \frac{48}{4} = 12\Omega$$

Q.38 (3)



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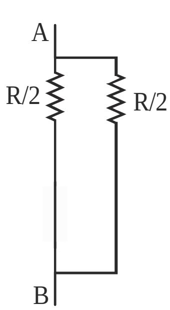
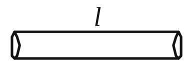
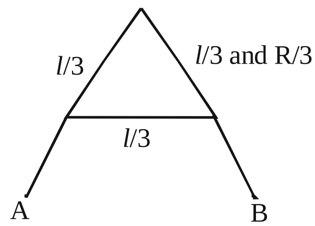


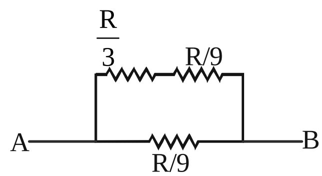
$\Rightarrow R_{AB} = R$

Q.39 (1)



resistance R = 12 Ω



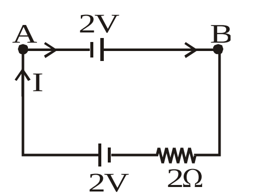


$$R_{AB} = \frac{\frac{2R}{3}\times R/3}{R} = \frac{2R}{9} = \frac{2}{9}\times 12 = \frac{8}{3}\ \Omega$$

Q.40 (2)

Circuit can be redrawn as

Total emf $= 2 + 2 = 4V$



$$\text{so } I = \frac{4}{2} = 2A$$

Q.41 (3)

$$R = \rho\frac{l}{A}$$

$$R = \rho\frac{l}{\pi\left(\frac{d}{2}\right)^2}$$

$$\frac{R_1}{R_2} = \frac{\rho_1}{\rho_2}\times\frac{l_1}{l_2}\times\frac{d_2^2}{d_1^2}$$

$$= \frac{1}{3}\times\frac{1}{3}\times\left(\frac{3}{1}\right)^2$$

$= 1$

$R_1 : R_2 = 1 : 1$

$R_1 = R_2 = 15\Omega$

Q.44 (2)

$P_1 = 25\,W, V_1 = 220\,V$

$P_2 = 100\,W, V_2 = 220\,V$

$$I_1 = \frac{25}{220} = \frac{5}{44}\,A$$

$$I_2 = \frac{100}{220} = \frac{5}{11}\,A$$

$$R_1 = \frac{V_1^2}{P_1} = \frac{220 \times 220}{25} = 484 \times 4\Omega$$

$$R_2 = \frac{V_2^2}{P_2} = \frac{220 \times 220}{100} = 484\Omega$$

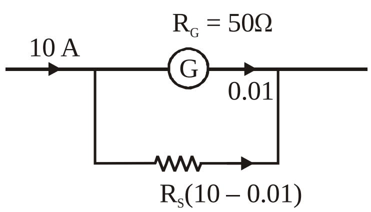
$R_{eq} = 484 \times 5$

$R_{eq} = 2420\Omega$

$$I = \frac{440}{2420} = \frac{2}{11}\,A$$

since $I > I_1$ Hence, bulb of 25 W will fuse.

Q.43 (2)



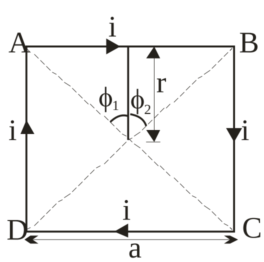
$R_G \times 0.01 = R_S \times 9.99$

$$R_S = \frac{R_G \times 0.01}{9.99}$$

$$= \frac{50 \times 0.01}{9.99}$$

Q.44 (3)

Magnetic field produced by side AB at the centre.



$$B_1 = \frac{\mu_0 i}{4\pi r}(\sin\phi_1 + \sin\phi_2)$$

$$= \frac{\mu_0 i}{4\pi a/2}(\sin 45^\circ + \sin 45^\circ)$$

$$= \frac{2\mu_0 i}{4\pi a}\left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)$$

$$= \frac{2\sqrt{2}\mu_0 i}{4\pi a}$$

$\therefore$ Total magnetic field at the centre

$B = 4\,B_1$

$$= 4\left(\frac{2\sqrt{2}\mu_0 i}{4\pi a}\right) = \frac{2\sqrt{2}\mu_0 i}{\pi a}$$

Q.45 (4)

$B = \mu_0 ni$

$$= 4\pi \times 10^{-7} \times \frac{1}{0.1 \times 10^{-3}} \times 1$$

$= 4\pi \times 10^{-3}\,J$

Q.46 (1)

$\omega = \frac{qB}{m}$ Thus ω is independent of speed

$\therefore$ The ratio is 1 : 1

Q.47 (2)

$E_{kp} = eV, \therefore E_k = qV,$

$\therefore E_k \propto q, \therefore V = \text{constant}$

$E_{kp} : E_{kd} : E_{ka} :: 1 : 1 : 2.$

Q.48 (2)

Initially $F_1 = mg + IaB$ (downwards)

When direction of current is reversed then

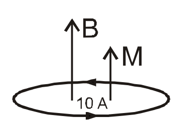
$F_2 = mg - IaB$ (downwards)

$\Delta F = F_1 - F_2 = 2IaB$

Q.49 (4)

Factual.

Q.50 (1)



$\vec{\tau} = \vec{M} \times \vec{B} = 0$