1. $V_b - V_d = \left[\dfrac{R_2R_3 - R_1R_4}{(R_1+R_2)(R_3+R_4)}\right]V$

$= \left[\dfrac{600-200}{(30)(50)}\right]\times 15 = 4\,\text{volt}$

2. Solve by symmetry

3. Let R_e is the effective resistance between a and b. The equivalent circuit is

Now, $R_{ab} = R + \dfrac{RR_e}{R+R_e} \Rightarrow R_e = \dfrac{R^2+2RR_e}{R+R_e}$

$\Rightarrow R_e^2 - RR_e - R^2 = 0 \Rightarrow R_e = \left[\dfrac{\sqrt{5}+1}{2}\right]R$

$R_e = \left[\dfrac{\sqrt{5}+1}{2}\right][1.235] = \left[\dfrac{\sqrt{5}+1}{2}\right][2.235-1]$

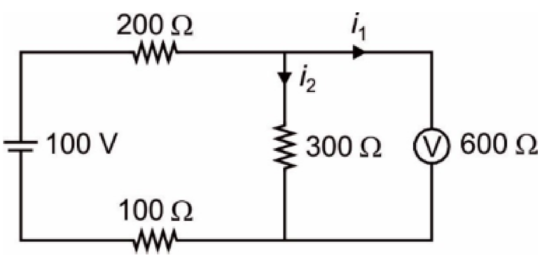
$= \left[\dfrac{\sqrt{5}+1}{2}\right]\left[\sqrt{5}-1\right] = \dfrac{4}{2} = 2\Omega$

4. $R_{AB} = \dfrac{3R}{4}$

5. Ohm's law is TRUE, when the resistivity of the material is independent of the applied electric field.

6. Mobility, $\mu = \dfrac{V_d}{E} = \dfrac{\frac{J}{ne}}{\frac{J}{\sigma}} = \dfrac{\sigma}{ne} = \text{const.}$

7.



$R_{eq} = 500$

$i = \dfrac{100}{500} = \dfrac{1}{5}A \Rightarrow i_2 = \dfrac{1}{5}\times\dfrac{600}{900} = \dfrac{6}{45}A$

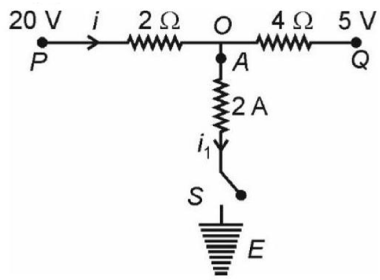
$V = \dfrac{6}{45}\times 300 = 40V$

8. $V_d = \dfrac{-e\vec{E}_\tau}{m} \Rightarrow V_d \propto E$

9. $E = E_1 + E_2 = 6V \Rightarrow R_{eq} = 6\Omega \Rightarrow i = \dfrac{6}{6} = 1A$

Current through $6\Omega = \dfrac{1}{3}A$

10.



Apply K.V.L in POQ

$20 - 2i - 4(i - i_1) = 5$

$6i - 4i_1 = 15$

Apply K.V.L in POE

$20 - 2i - 2i_1 = 0 \Rightarrow i + i_1 = 10$

On solving (i) and (ii)

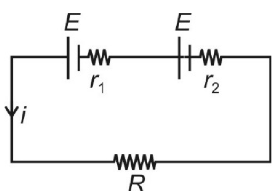
$i_1 = 4.5A$

11. No current flows via capacitor

$V_c = V_{r2}$

$V_c = \dfrac{Er_2}{r+r_2} \Rightarrow \dfrac{q}{C} = V_c \Rightarrow q = \dfrac{CEr_2}{r+r_2}$

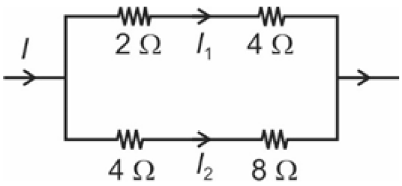
12.



$V = E_i - ir_1 = 0 \Rightarrow i = \dfrac{E}{r_1}$

$$i = \frac{2E}{R + r_1 + r_2} = \frac{E}{r_1}$$

$$R + r_1 + r_2 = 2r_1 \Rightarrow R = r_1 - r_2$$

14. 

Power consumed by 8? resistance is 8 W

$\therefore$ P = $(I_2)^2 \times 8 = 8$

$\therefore$ $I_2 = 1$ A

For parallel circuits $I_1(2 + 4) = I_2(4 + 8)$

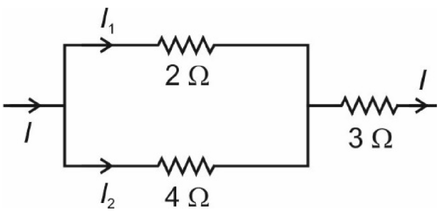
$$I_2 = I_2 \times \frac{12}{6} = 1 \times 2 = 2 \text{ A}$$

Now current through 2Ω resistance is 2 A

$P_2 = (I_1)^2 \times R = (2)^2 \times (2) = 8$ W

16 $$i = \frac{\frac{20}{3} \times 1}{\frac{20}{3} + 60} \Rightarrow i = \frac{20}{200} = 0.1$$

17. Aluminium is conductor and its resistivity increases with temperature but semiconductor Si has negative coefficient of resistivity. So as temperature increases, its resistivity decreases.

18. 

Heat in 2Ω resistor $H_1 = (I_1)^2 \times 2 \times t$

Heat in 4Ω resistor $H_2 = (I_2)^2 \times 4 \times t$

Heat in 3Ω resistor $H_3 = (I)^2 \times 3 \times t$

But $I_1 = I \times \frac{4}{2+4} = \frac{2}{3}I \Rightarrow I_2 = I \times \frac{2}{2+4} = \frac{1}{3}I$

$$\therefore H_1 : H_2 : H_3 :: \left(\frac{2}{3}I\right)^2 \times 2 \times t : \left(\frac{1}{3}I\right)^2 \times 4 \times t : (I)^2 \times 3 \times t$$

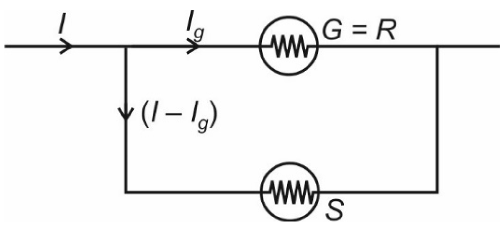
$$H_1 : H_2 : H_3 :: \frac{8}{9} : \frac{4}{9} : 3 \Rightarrow H_1 : H_2 : H_3 :: 8 : 4 : 27$$

19. $i = neAv = \frac{neA}{4} v_1 \Rightarrow v_1 = 4v$

20. $$\frac{P_2}{P_1} = \left(\frac{V_2}{V_1}\right)^2 \Rightarrow P_2 = P_1\left[\frac{V_2}{V_1}\right]^2$$

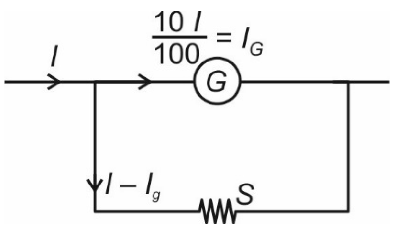
$$= 1000\left[\frac{50}{200}\right]^2 = 1000 \times \frac{1}{16} = 62.5\text{W}$$

21. $$\text{Required shunt} = \frac{\text{Original connected resistance}}{(\text{Range} - 1)}$$



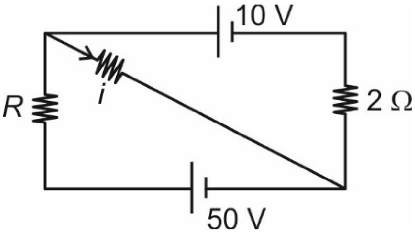
$(I - I_g)S = I_g G \Rightarrow (nI_g - I_g)S = I_g R$

$(n - I)I_g S = I_g \times R \Rightarrow S = \frac{R}{n-1}$

22. 

$I_g \times G = (I - I_g) \times S$

$0.1I \times 99 = (0.9)I \times S$

23.


For i = 0 $\Rightarrow \frac{10}{2} = \frac{50}{R}$

24. $v_d = \left(\frac{eE}{m}\right)\tau \Rightarrow v_d = \frac{e\tau}{m}\left(\frac{V}{l}\right) \propto \frac{1}{l}$

$l \to \frac{l}{2} \Rightarrow I \to \frac{I}{2}$

25. Direction of magnetic force remains perpendicular to direction of velocity so no work is done on charge particle.

26. $\dfrac{\dfrac{\mu_0 NIR^2}{2(R^2+x^2)^{3/2}}}{\dfrac{\mu_0 NI}{2R}} = \frac{1}{8} \Rightarrow \therefore = \sqrt{3}R$

27. Net force on current carrying loop in uniform magnetic field is zero.

28. Same ? same momentum. $\left(\lambda = \frac{h}{P}\right)$

$r = \frac{mv}{qB} \Rightarrow r \propto \frac{1}{q}$

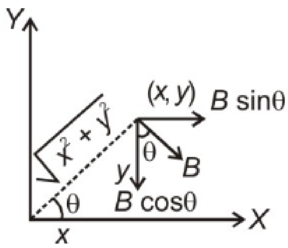
$r_p : r_\alpha \equiv \frac{1}{q_p} : \frac{1}{q_\alpha} \Rightarrow q_\alpha = 2q_p = 2:1$

29. $\vec{\tau} = \vec{M} \times \vec{B} = 50\hat{i} \times \left(0.5\hat{i} + 3\hat{j}\right) = 150\hat{k}\,Nm$

30. $r = \sqrt{x^2+y^2} \Rightarrow \vec{B} = B\sin\theta\hat{i} - B\cos\theta\hat{j}$

$= \frac{\mu_0 I}{2\pi r}\left[\frac{y}{r}\hat{i} - \frac{x}{r}\hat{j}\right] \qquad = \frac{\mu_0 I}{2\pi r^2}\left(y\hat{i} - x\hat{j}\right)$

$= \frac{\mu_0 I}{2\pi}\frac{\left(y\hat{i} - x\hat{j}\right)}{\left(x^2+y^2\right)}$



31. Lorentz force

$\vec{F} = q\vec{E} + q\left(\vec{v} \times \vec{B}\right)$

$\vec{F} = 0$, if particle was unaccelerated.

32. $B = B_1 - B_2 = \frac{\mu_0 i}{24}\left(\frac{1}{a} - \frac{1}{b}\right) \Rightarrow B = \frac{\mu_0 i}{24}\left(\frac{b-a}{ab}\right)$

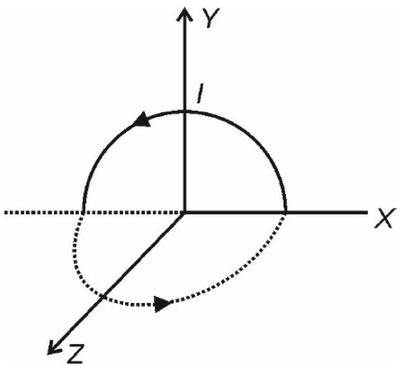
33. Radius of path $r = \frac{\sqrt{2Km}}{qB} \Rightarrow r \propto \sqrt{m}$

Radius of proton path > Radius of electron path

curvature $\propto \frac{1}{\text{Radius}}$

34. $F_m = I\vec{\ell} \times \vec{B} \Rightarrow I\ell(\hat{j} \times \hat{i} + 2\hat{j} \times \hat{j} + 2\hat{j} \times \hat{k})B_0$

$I\ell B_0(-\hat{k} + 2\hat{i}) = \sqrt{5}I\ell B_0$

35.


$\vec{B} = \vec{B}_1 + \vec{B}_2$; $\vec{B} = \frac{\mu_0 I}{4R}\hat{j} + \frac{\mu_0 I}{4R}\hat{k} \Rightarrow |\vec{B}| = \frac{\mu_0 I}{2\sqrt{2}R}$

36. V = cons tan

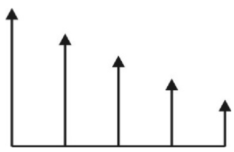
$t \Rightarrow \;\&\; q\vec{E} = q(\vec{v}\times\vec{B}) \Rightarrow \;\&\; \vec{E}\perp\vec{B}$

37. $2\pi r = L \Rightarrow M = IA \;= I\times\pi r^2$

$= I\times\pi\times\left[\frac{L}{2\pi}\right]^2 = I\frac{L^2}{4\pi}$

38. $B_1 = B_2 \Rightarrow \frac{\mu_0 i_1}{2r_1} = \frac{\mu_0 i_2}{2r_1} \Rightarrow \frac{i_1}{i_2} = \frac{r_1}{r_2} = \frac{1}{2}$

39. Force acting on conductor is like



So, it will turn clockwise.

40. $= \frac{qEx^2}{2mv^2} \Rightarrow y = \frac{qEx^2}{4(qV)} \Rightarrow y = \frac{Ex^2}{4V}$

41. $B = 2\left[\frac{\mu_0 I}{4\pi a}(\sin 45^\circ + \sin 90^\circ)\right]$

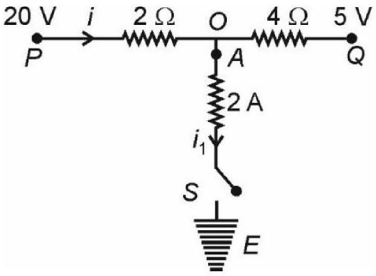
42. $B = \frac{\mu_0 I}{2R} = \frac{\mu_0 qf}{2R} = \frac{\mu_0 q\omega}{4\pi R}$

44. $B2\pi r = \frac{\mu_0 / r^2}{R^2} \Rightarrow \quad \therefore B = \frac{\mu_0 Ir}{2\pi R^2} = \frac{\mu_0 I}{8\pi}$

45. $\frac{T_1}{T_2} = \frac{m_1}{m_2} = \frac{1}{2}\left[\because T = \frac{2\pi m}{qB}\right] \Rightarrow \therefore \frac{K_1}{K_2} = \frac{m_1}{m_2} = \frac{1}{2}$

Answer-Key

1. 4	**2.** 4	**3.** 3	**4.** 4	**5.** 4	**6.** 4	**7.** 3	**8.** 4	**9.** 1	**10.** 1
11. 2	**12.** 3	**13.** 1	**14.** 2	**15.** 4	**16.** 1	**17.** 1	**18.** 2	**19.** 4	**20.** 1
21. 2	**22.** 2	**23.** 1	**24.** 1	**25.** 4	**26.** 3	**27.** 3	**28.** 4	**29.** 2	**30.** 1
31. 2	**32.** 2	**33.** 2	**34.** 1	**35.** 3	**36.** 2	**37.** 4	**38.** 4	**39.** 2	**40.** 2
41. 1	**42.** 2	**43.** 3	**44.** 3	**45.** 2	**46.** 1	**47.** 3	**48.** 2	**49.** 4	**50.** 3
51. 3	**52.** 4	**53.** 4	**54.** 1	**55.** 4	**56.** 1	**57.** 3	**58.** 4	**59.** 1	**60.** 2
61. 1	**62.** 3	**63.** 3	**64.** 4	**65.** 1	**66.** 4	**67.** 3	**68.** 2	**69.** 4	**70.** 2
71. 4	**72.** 2	**73.** 1	**74.** 2	**75.** 4	**76.** 2	**77.** 1	**78.** 2	**79.** 4	**80.** 3
81. 1	**82.** 3	**83.** 4	**84.** 4	**85.** 1	**86.** 4	**87.** 1	**88.** 1	**89.** 3	**90.** 4
91. 2	**92.** 2	**93.** 2	**94.** 1	**95.** 3	**96.** 3	**97.** 2	**98.** 2	**99.** 3	**100.** 2
101. 1	**102.** 2	**103.** 3	**104.** 3	**105.** 2	**106.** 2	**107.** 3	**108.** 4	**109.** 2	**110.** 3
111. 2	**112.** 2	**113.** 4	**114.** 3	**115.** 1	**116.** 3	**117.** 4	**118.** 2	**119.** 3	**120.** 2
121. 1	**122.** 3	**123.** 4	**124.** 2	**125.** 4	**126.** 3	**127.** 4	**128.** 3	**129.** 4	**130.** 3
131. 3	**132.** 2	**133.** 4	**134.** 3	**135.** 4	**136.** 3	**137.** 3	**138.** 3	**139.** 2	**140.** 2
141. 3	**142.** 3	**143.** 3	**144.** 2	**145.** 4	**146.** 1	**147.** 3	**148.** 1	**149.** 4	**150.** 1
151. 3	**152.** 2	**153.** 3	**154.** 2	**155.** 3	**156.** 2	**157.** 3	**158.** 3	**159.** 1	**160.** 1
161. 3	**162.** 3	**163.** 1	**164.** 1	**165.** 1	**166.** 1	**167.** 2	**168.** 2	**169.** 1	**170.** 4
171. 2	**172.** 3	**173.** 2	**174.** 1	**175.** 1	**176.** 2	**177.** 2	**178.** 3	**179.** 1	**180.** 3

1. 

Apply K.V.L in POQ

$20-2i-4(i-i_1)=5$

$6i-4i_1=15$

Apply K.V.L in POE

$20-2i-2i_1=0 \Rightarrow i+i_1=10$

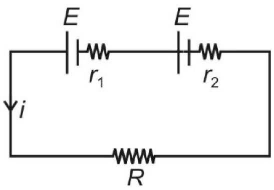
On solving (i) and (ii)

$i_1 = 4.5A$

2. No current flows via capacitor

$V_c = V_{r2}$

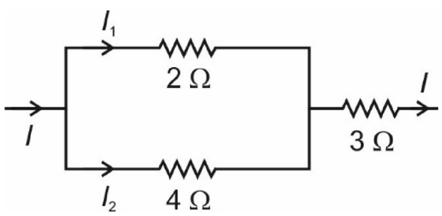
$V_c=\dfrac{Er_2}{r+r_2} \Rightarrow \dfrac{q}{C}=V_c \Rightarrow q=\dfrac{CEr_2}{r+r_2}$

3. 

$V=E_i-ir_1=0 \Rightarrow i=\dfrac{E}{r_1}$; $i=\dfrac{2E}{R+r_1+r_2}=\dfrac{E}{r_1}$

$R+r_1+r_2=2r_1 \Rightarrow R=r_1-r_2$

4. Aluminium is conductor and its resistivity increases with temperature but semiconductor Si has negative coefficient of resistivity. So as temperature increases, its resistivity decreases.

5. 

Heat in 2Ω resistor $H_1=(I_1)^2\times 2\times t$

Heat in 4Ω resistor $H_2=(I_2)^2\times 4\times t$

Heat in 3Ω resistor $H_3=(I)^2\times 3\times t$

But $I_1=I\times\dfrac{4}{2+4}=\dfrac{2}{3}I \Rightarrow I_2=I\times\dfrac{2}{2+4}=\dfrac{1}{3}I$

$\therefore H_1:H_2:H_3::\left(\dfrac{2}{3}I\right)^2\times 2\times t:\left(\dfrac{1}{3}I\right)^2$

$\times 4\times t:(I)^2\times 3\times t$

$H_1:H_2:H_3::\dfrac{8}{9}:\dfrac{4}{9}:3 \Rightarrow H_1:H_2:H_3::8:4:27$

6. $i=neAv=\dfrac{neA}{4}v_1 \Rightarrow v_1=4v$

7. Let R_e is the effective resistance between a and b. The equivalent circuit is

Now, $R_{ab}=R+\dfrac{RR_e}{R+R_e} \Rightarrow R_e=\dfrac{R^2+2RR_e}{R+R_e}$

$\Rightarrow R_e^2-RR_e-R^2=0 \Rightarrow R_e=\left[\dfrac{\sqrt{5}+1}{2}\right]R$

$R_e=\left[\dfrac{\sqrt{5}+1}{2}\right][1.235]=\left[\dfrac{\sqrt{5}+1}{2}\right][2.235-1]$

$=\left[\dfrac{\sqrt{5}+1}{2}\right][\sqrt{5}-1]=\dfrac{4}{2}=2\Omega$

8. $R_{AB}=\dfrac{3R}{4}$

9. Ohm's law is TRUE, when the resistivity of the material is independent of the applied electric field.

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$l\rightarrow\dfrac{l}{2} \Rightarrow l\rightarrow\dfrac{l}{2}$

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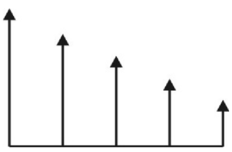
15. Radius of path $r=\frac{\sqrt{2Km}}{qB} \Rightarrow r \propto \sqrt{m}$

Radius of proton path > Radius of electron path

curvature $\propto \frac{1}{\text{Radius}}$

16. $B_1=B_2 \Rightarrow \frac{\mu_0 i_1}{2r_1}=\frac{\mu_0 i_2}{2r_1} \Rightarrow \frac{i_1}{i_2}=\frac{r_1}{r_2}=\frac{1}{2}$

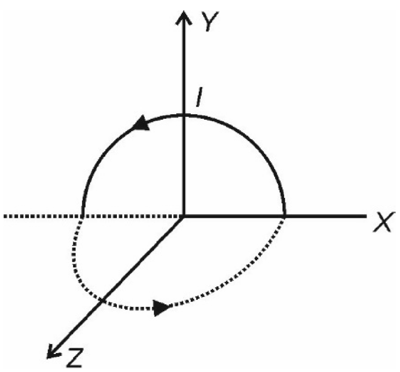
17. Force acting on conductor is like



So, it will turn clockwise.

18. $=\frac{qEx^2}{2mv^2} \Rightarrow y=\frac{qEx^2}{4(qV)} \Rightarrow y=\frac{Ex^2}{4V}$

19.



$\vec{B}=\vec{B}_1+\vec{B}_2$; $\vec{B}=\frac{\mu_0 I}{4R}\hat{j}+\frac{\mu_0 I}{4R}\hat{k} \Rightarrow |\vec{B}|=\frac{\mu_0 I}{2\sqrt{2}R}$

20. $V=$ constan

t $\Rightarrow$ & $q\vec{E}=q(\vec{v}\times\vec{B}) \Rightarrow$ & $\vec{E}\perp\vec{B}$

21. $2\pi r=L \Rightarrow M=IA=I\times\pi r^2$

$=I\times\pi\times\left[\frac{L}{2\pi}\right]^2=I\frac{L^2}{4\pi}$

22. $B=2\left[\frac{\mu_0 I}{4\pi a}\left(\sin 45^\circ+\sin 90^\circ\right)\right]$

23. $B=\frac{\mu_0 I}{2R}=\frac{\mu_0 qf}{2R}=\frac{\mu_0 q\omega}{4\pi R}$

25. Net force on current carrying loop in uniform magnetic field is zero.

26. Same ? same momentum. $\left(\lambda=\frac{h}{P}\right)$

$r=\frac{mv}{qB} \Rightarrow r\propto\frac{1}{q}$

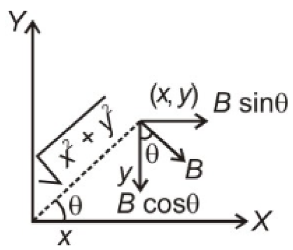
$r_p:r_\alpha \equiv \frac{1}{q_p}:\frac{1}{q_\alpha} \Rightarrow q_\alpha=2q_p=2:1$

27. $\vec{\tau}=\vec{M}\times\vec{B}=50\hat{i}\times\left(0.5\hat{i}+3\hat{j}\right)=150\hat{k}\,Nm$

28. $r=\sqrt{x^2+y^2} \Rightarrow \vec{B}=B\sin\theta\hat{i}-B\cos\theta\hat{j}$

$=\frac{\mu_0 I}{2\pi r}\left[\frac{y}{r}\hat{i}-\frac{x}{r}\hat{j}\right] \quad =\frac{\mu_0 I}{2\pi r^2}\left(y\hat{i}-x\hat{j}\right)$

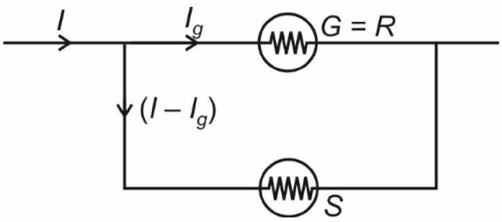
$=\frac{\mu_0 I}{2\pi}\frac{\left(y\hat{i}-x\hat{j}\right)}{\left(x^2+y^2\right)}$



29. $\dfrac{P_2}{P_1}=\left(\dfrac{V_2}{V_1}\right)^2 \Rightarrow P_2=P_1\left[\dfrac{V_2}{V_1}\right]^2$

$=1000\left[\dfrac{50}{200}\right]^2=1000\times\dfrac{1}{16}=62.5\text{W}$

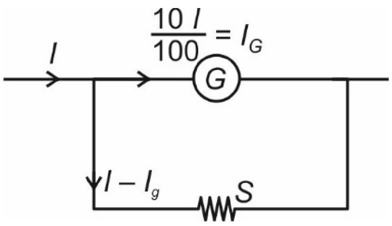
30. Required shunt $=\dfrac{\text{Original connected resistance}}{(\text{Range}-1)}$



$(I-I_g)S=I_g G \Rightarrow (nI_g-I_g)S=I_g R$

$(n-I)I_g S=I_g\times R \Rightarrow S=\dfrac{R}{n-1}$

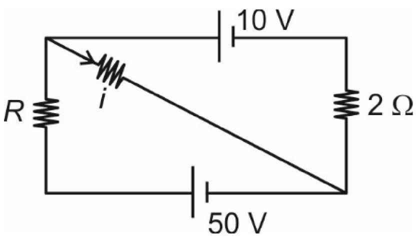
31.



$I_g\times G=(I-I_g)\times S$

$0.1I\times 99=(0.9)I\times S$

32.



For i = 0 $\Rightarrow \dfrac{10}{2}=\dfrac{50}{R}$

33. $F_m=I\vec{\ell}\times\vec{B} \Rightarrow I\ell(\hat{j}\times\hat{i}+2\hat{j}\times\hat{j}+2\hat{j}\times\hat{k})B_0$

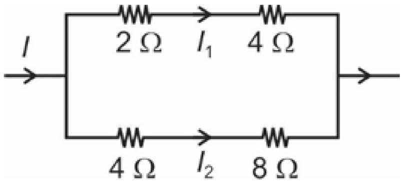
$I\ell B_0(-\hat{k}+2\hat{i})\ =\sqrt{5}I\ell B_0$

34. $B2\pi r=\dfrac{\mu_0/r^2}{R^2}$

$\therefore B=\dfrac{\mu_0 Ir}{2\pi R^2}=\dfrac{\mu_0 I}{8\pi}$

35. $\dfrac{T_1}{T_2}=\dfrac{m_1}{m_2}=\dfrac{1}{2}\left[\because T=\dfrac{2\pi m}{qB}\right] \Rightarrow \therefore \dfrac{K_1}{K_2}=\dfrac{m_1}{m_2}=\dfrac{1}{2}$

37.



Power consumed by 8? resistance is 8 W

$\therefore$ $P=(I_2)^2\times 8=8$

$\therefore$ $I_2=1$ A

For parallel circuits $I_1(2+4)=I_2(4+8)$

$I_2=I_2\times\dfrac{12}{6}=1\times 2=2$ A

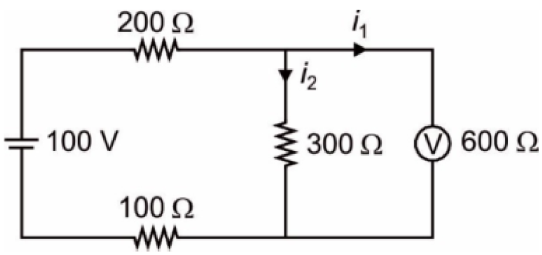
Now current through 2Ω resistance is 2 A

$P_2=(I_1)^2\times R=(2)^2\times(2)=8$ W

39 $i=\dfrac{\frac{20}{3}\times 1}{\frac{20}{3}+60} \Rightarrow i=\dfrac{20}{200}=0.1$

40. Mobility, $\mu=\dfrac{V_d}{E}=\dfrac{\frac{J}{ne}}{\frac{J}{\sigma}}=\dfrac{\sigma}{ne}=\text{const.}$

41.



$R_{eq} = 500$

$i = \frac{100}{500} = \frac{1}{5}A \Rightarrow i_2 = \frac{1}{5} \times \frac{600}{900} = \frac{6}{45}A$

$V = \frac{6}{45} \times 300 = 40V$

42. $V_d = \frac{-e\vec{E}_\tau}{m} \Rightarrow V_d \propto E$

43. $E = E_1 + E_2 = 6V \Rightarrow R_{eq} = 6\Omega \Rightarrow i = \frac{6}{6} = 1A$

Current through $6\Omega = \frac{1}{3}A$

44. $V_b - V_d = \left[\frac{R_2R_3 - R_1R_4}{(R_1+R_2)(R_3+R_4)}\right]V$

$= \left[\frac{600-200}{(30)(50)}\right] \times 15 = 4\,\text{volt}$

45. Solve by symmetry

Answer–Key

1.	1	**2.**	2	**3.**	3	**4.**	1	**5.**	2	**6.**	4	**7.**	3	**8.**	4	**9.**	4	**10.**	1
11.	4	**12.**	3	**13.**	2	**14.**	2	**15.**	2	**16.**	4	**17.**	2	**18.**	2	**19.**	3	**20.**	2
21.	4	**22.**	1	**23.**	2	**24.**	3	**25.**	3	**26.**	4	**27.**	2	**28.**	1	**29.**	1	**30.**	2
31.	2	**32.**	1	**33.**	1	**34.**	3	**35.**	2	**36.**	1	**37.**	2	**38.**	4	**39.**	1	**40.**	4
41.	3	**42.**	4	**43.**	1	**44.**	4	**45.**	4	**46.**	4	**47.**	1	**48.**	4	**49.**	3	**50.**	4
51.	1	**52.**	2	**53.**	4	**54.**	2	**55.**	1	**56.**	3	**57.**	1	**58.**	3	**59.**	4	**60.**	1
61.	1	**62.**	4	**63.**	4	**64.**	1	**65.**	1	**66.**	2	**67.**	4	**68.**	4	**69.**	3	**70.**	2
71.	3	**72.**	4	**73.**	1	**74.**	3	**75.**	3	**76.**	4	**77.**	2	**78.**	1	**79.**	3	**80.**	3
81.	4	**82.**	2	**83.**	4	**84.**	2	**85.**	4	**86.**	1	**87.**	1	**88.**	3	**89.**	2	**90.**	4
91.	2	**92.**	1	**93.**	2	**94.**	2	**95.**	3	**96.**	4	**97.**	2	**98.**	4	**99.**	3	**100.**	2
101.	3	**102.**	2	**103.**	4	**104.**	3	**105.**	4	**106.**	4	**107.**	3	**108.**	4	**109.**	1	**110.**	3
111.	3	**112.**	2	**113.**	2	**114.**	2	**115.**	2	**116.**	4	**117.**	3	**118.**	3	**119.**	3	**120.**	2
121.	1	**122.**	3	**123.**	4	**124.**	1	**125.**	3	**126.**	4	**127.**	2	**128.**	3	**129.**	2	**130.**	3
131.	3	**132.**	2	**133.**	2	**134.**	2	**135.**	3	**136.**	1	**137.**	3	**138.**	1	**139.**	3	**140.**	2
141.	3	**142.**	1	**143.**	1	**144.**	1	**145.**	2	**146.**	1	**147.**	1	**148.**	2	**149.**	2	**150.**	3
151.	2	**152.**	3	**153.**	2	**154.**	3	**155.**	3	**156.**	1	**157.**	4	**158.**	2	**159.**	3	**160.**	3
161.	1	**162.**	3	**163.**	2	**164.**	2	**165.**	2	**166.**	2	**167.**	1	**168.**	3	**169.**	1	**170.**	1
171.	4	**172.**	1	**173.**	3	**174.**	3	**175.**	3	**176.**	2	**177.**	4	**178.**	3	**179.**	3	**180.**	3