Sample Paper 1

ANSWER KEYS																			
1	(b)	**7**	(a)	**13**	(a)	**19**	(c)	**25**	(b)	**31**	(d)	**37**	(b)	**43**	(c)	**49**	(c)	**55**	(d)
2	(b)	**8**	(a)	**14**	(a)	**20**	(b)	**26**	(a)	**32**	(b)	**38**	(c)	**44**	(b)	**50**	(a)		
3	(a)	**9**	(d)	**15**	(d)	**21**	(b)	**27**	(d)	**33**	(c)	**39**	(a)	**45**	(d)	**51**	(b)		
4	(c)	**10**	(b)	**16**	(b)	**22**	(b)	**28**	(c)	**34**	(a)	**40**	(b)	**46**	(a)	**52**	(b)		
5	(d)	**11**	(b)	**17**	(d)	**23**	(c)	**29**	(a)	**35**	(d)	**41**	(d)	**47**	(b)	**53**	(d)		
6	(b)	**12**	(d)	**18**	(a)	**24**	(d)	**30**	(c)	**36**	(a)	**42**	(c)	**48**	(c)	**54**	(b)		

SOLUTIONS

1. **(b)** When we say that a body is charged, we always mean that the body is having excess of electrons (negatively charged) or is of deficient of electrons (positively charged).

2. **(b)**

3. **(a)** Due to insertion of a dielectric slab capacitance increase by K times. The potential difference, the electric field and the stored energy decreases by $\frac{1}{K}$ times.

4. **(c)** The potential energy is negative whenever there is attraction. Since a positive and negative charge attract each other therefore their energy is negative. When both the charges are separated by infinite distance, they do not attract each other and their energy is zero.

5. **(d)** Electric flux, $\phi = EA\cos\theta$, where θ = angle between E and normal to the surface.

Here $\theta = \frac{\pi}{2} \Rightarrow \phi = 0$

6. **(b)** We have $E_a = \frac{2kp}{r^3}$ and $E_e = \frac{kp}{r^3}$; $\therefore E_a = 2E_e$

7. **(a)** We know that $\frac{W_{AB}}{q} = V_B - V_A$

$\therefore V_B - V_A = \frac{2\,\text{J}}{20\,\text{C}} = 0.1\,\text{J/C} = 0.1\,\text{V}$

8. **(a)** [Hint $\Rightarrow R_t = R_0(1+\alpha t)$]

$5\Omega = R_0(1+\alpha \times 50)$ and $7\Omega = R_0(1+\alpha\times 100)$

or $\frac{5}{7} = \frac{1+50\alpha}{1+100\alpha}$ or $\alpha = \frac{2}{150} = 0.0133/°\text{C}$

9. **(d)** **10.** **(b)**

11. **(b)** Since, the voltage is same for the two combinations, therefore $H \propto \frac{1}{R}$. Hence, the combination of 39 bulbs will glow more.

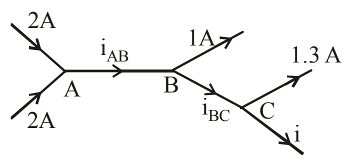
12. **(d)** Resistivity depends on various other factors like temp.

13. **(a)**

14. **(a)** According to Kirchhoff's first law

At junction A, $i_{AB} = 2 + 2 = 4\,\text{A}$

At junction B, $i_{AB} = i_{BC} + 1 \Rightarrow i_{BC} = 4 - 1 \Rightarrow 3\text{A}$



At junction C, $i = i_{BC} - 1.3 = 3 - 1.3 = 1.7\,\text{A}$

15. **(d)** Force, $F = qVB = \frac{mv^2}{R}$ $\therefore R = \frac{mv}{Bq}$

16. **(b)** We know that magnetic field at the centre of circular coil,

$$B = \frac{\mu_0 In}{2r} = \frac{4\pi\times10^{-7}\times2\times50}{2\times0.5} = 1.25\times10^{-4}\,T$$

17. **(d)** $\tau = MB\sin\theta \Rightarrow \tau_{max} = NIAB$, $(\theta = 90°)$

18. **(a)**

19. **(c)** $\tan\delta = \frac{V}{H} = \frac{V}{\sqrt{3}V} = \frac{1}{\sqrt{3}}$

$\therefore \delta = 30° = \pi/6$ radian

20. **(b)** The charge through the coil = area of current-time $(i - t)$ graph

$q = \frac{1}{2}\times0.1\times4 = 0.2\,\text{C}$

$q = \frac{\Delta\phi}{R}$ [$\because$ Change in flux $(\Delta\phi) = q \times R$]

$q = 0.2 = \frac{\Delta\phi}{10}$

$\Delta\phi = 2$ weber

21. **(b)** Given $\frac{\ell_1}{\ell_2}=\frac{1}{2}$ and $\frac{N_1}{N_2}=\frac{1}{2}$ From

$$L=\frac{\mu_0 N^2 A}{\ell} \alpha \frac{N^2}{\ell}$$

we get, $\frac{L_1}{L_2}=\left(\frac{N_1}{N_2}\right)^2 \Big/ \left(\frac{\ell_1}{\ell_2}\right)=\frac{(1/2)^2}{1/2}=\frac{1}{2}$

22. **(b)** Mutual inductance depends on the relative position and orientation of the two coils.

23. **(c)** $i_{rms}=\frac{i_0}{\sqrt{2}}=\frac{4}{\sqrt{2}}=2\sqrt{2}$ ampere

24. **(d)** **25.** **(b)**

26. **(a)** Since lines of force starts from A and ends at B, so A is +ve and B is –ve. Lines of forces are more crowded near A, so A > B.

27. **(d)**

28. **(c)** $\oint \vec{E}.d\vec{A}=0,$ represents charge inside close surface is zero. Electric field as any point on the surface may be zero.

29. **(a)** In parallel grouping of capacitors

$C_{eq}=C_1+C_2+\ldots\ldots\ldots\ldots C_n$

30. **(c)** $\frac{W_{PQ}}{q}=(V_Q-V_P)$

$\Rightarrow W_{PQ}=q(V_Q-V_P)$

$=(-100\times 1.6\times 10^{-19})(-4-10)$

$=+2.24\times 10^{-16}J$

31. **(d)** $V=120\sin 100\pi t\cos 100\pi t \Rightarrow V=60\sin 200\pi t$

$V_{max}=60V$ and $v=100Hz$

32. **(b)**

33. **(c)** The work done (in displacing a charge particle) by a electric force is given by $W_{12}=q(V_2-V_1)$. Here initial and final potentials are same in all three cases are equal (20V) and same charge is moving from A to B, so work done is (ΔVq) same in all three cases.

34. **(a)** The potential difference across 4Ω resistance is given by $V=4\times i_1=4\times 1.2=4.8$ volt

So, the potential across 8Ω resistance is also 4.8 volt.

Current $i_2=\frac{V}{8}=\frac{4.8}{8}=0.6$ amp

Current in 2Ω resistance $i=i_1+i_2$

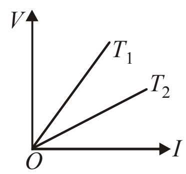
$\therefore i=1.2+0.6=1.8$ amp

Potential difference across 2Ω resistance

$V_{BC}=1.8\times 2=3.6$ volts

35. **(d)** As $R\times\frac{1}{\text{Power}}$ $\therefore R_1:R_2=2:1$

36. **(a)** The slope of V–I graph gives the resistance of a conductor at a given temperature.From the graph, it follows that resistance of a conductor at temperature T_1 is greater than at temperature T_2 As the resistance of a conductor is more at higher temperature and less at lower temperature, hence $T_1>T_2$.



37. **(b)** Motion of conduction electrons due to random collisions has no preffered direction and average to zero. Drift velocity is caused due to motion of conduction electrons due to applied electric field $\vec{E}$.

38. **(c)** The current sensitivily of a galvanometer is defined as the deflection produced in the galvanometer per unit current flowing through it.

39. **(a)** Current loop acts as a magnetic dipole. Its magnetic moment is given by

$M=NIA$

where N = number of turns, I = current in a loop,

A = area of the loop

From the above relation, we can conclude that magnetic dipole moment of a current loop is independent of magnetic field in which it is lying.

40. **(b)** On bending a rod it's pole strength remain unchanged where as its magnetic moment changes new magnetic moment $M'm(2R)=\left(\frac{2L}{\pi}\right)=\frac{2M}{\pi}$.

41. **(d)** Given : $\phi=4t^2+2t+1$ wb

$\therefore \frac{d\phi}{dt}=\frac{d}{dt}(4t^2+2t+1)=8t+2=|\varepsilon|$

$I=\frac{|\varepsilon|}{R}=\frac{8t+2}{10\Omega}=\frac{8t+2}{10}A=1A$ At t = 1 s

42. **(c)** When resistance is connected to A.C source, then current & voltage are in same phase.

43. **(c)** As I increases, ϕ increases

$\therefore I_i$ is such that it opposes the increases in ϕ.

Hence, ϕ decreases (By Right Hand Rule). The induced current will be counter clockwise.

44. **(b)** Because there is no change in flux linked with coil.

45. **(d)** Ampere's circuital law can be derived from Biot-Savart law.

46. **(a)**

47. **(b)** When a magnet is cut into pieces, each piece becomes new magnet. $M'=\frac{m\ell}{2}=\frac{M}{2}$.

48. **(c)** Since the magnetic force is always perpendicular to the velocity of the charged particle so, work done is always zero.

49. (c)

50. (a) $-eE = mg$

$$\overline{E} = -\frac{9.1\times10^{-31}\times10}{1.6\times10^{-19}} = -5.6\times10^{-11}\,N/C$$

51. (b) (i) Electrostatic field is zero inside a charged conductor or neutral conductor.

(ii) Electrostatic field at the surface of a charged conductor must be normal to the surface at every point.

(iii) There is no net charge at any point inside the conductor and any excess charge must reside at the surface.

52. (b) $\frac{I_0}{\sqrt{2}}$ = RMS current

53. (d)

54. (b) Given equation, $e = 80 \sin 100\pi t$ …(i)

Standard equation of instantaneous voltage is given by $e = e_m \sin\omega t$ …(ii)

Compare (i) and (ii), we get $e_m = 80$ V

where e_m is the voltage amplitude.

Current amplitude $I_m = \frac{e_m}{Z}$ where Z = impendence

$= 80/20 = 4$ A.

$$I_{r.m.s} = \frac{4}{\sqrt{2}} = \frac{4\sqrt{2}}{2} = 2\sqrt{2} = 2.828\text{ A}.$$

55. (d) $V = 120\sin 100\pi t \cos 100\pi t \Rightarrow V = 60 \sin 200\pi t$

$V_{max} = 60V$ and $v = 100$Hz