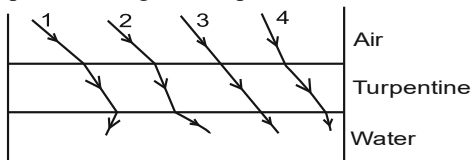


1 to 7

5 x 1 = 5

- The capacitance of a parallel plate capacitor ----- (increases/decreases) when a dielectric is inserted between the plates.
- Which one of the following is not ferromagnetic ?
(a)Cobalt (b)Iron (c)Nickel (d)Bismuth
- Identify the constituent radiation of electromagnetic spectrum which is used in medicine to destroy cancer cells.
(a)X-rays (b)UV rays (c)IR rays (d)Gamma rays
- The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. Which of the following four rays incident on turpentine in figure, the path shown is correct ?

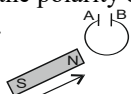


- (a)1 (b)2 (c)3 (d)4
- The perpendicular distance of the initial velocity vector of α -particle from the centre of the nucleus is termed as -----
- The nucleus is approximately spherical in shape. Then the surface area of nucleus having mass number A varies as -----
(a) $A^{2/3}$ (b) $A^{4/3}$ (c) $A^{1/3}$ (d) $A^{5/3}$
- A pure semiconductor when doped with a pentavalent impurity becomes a p-type semiconductor. (True/False)

8 to 14

5 x 2 = 10

- Arrive at an expression for torque on a rectangular current loop in a uniform magnetic field.
- (a)State Lenz's law.
(b)Predict the polarity of the capacitor in the situation described by the figure.



- List out ANY FOUR energy losses in transformers.
- (a)Define displacement current.
(b)Give Maxwell's modified form of Ampere's circuital law. (1+1)
- (a)Define coherent sources.
(b)Write the path difference between two coherent waves for each:
(i)constructive interference
(ii)destructive interference (1+1)
- Arrive at the quantum condition proposed in second postulate of Bohr's atom model using de Broglie's equation.
- Complete the following table using the words same of different :

Nuclide	Z (atomic number)	A (mass number)	N (neutron number)
Isotope	Same	_____	_____
Isotone	Different	_____	_____

15 to 21

6 x 3 = 18

- (a)An electric dipole with dipole moment $4 \times 10^{-9} \text{ Cm}$ is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^4 \text{ N/C}$. Calculate the magnitude of the torque acting on the dipole.
(b)The maximum value of torque experienced by the dipole will be when it is aligned at an angle $\theta = \text{-----}$ (2+1)
- Arrive at an expression for equivalent capacitance of 3 capacitors each with capacitance C_1, C_2, C_3 respectively, when connected in
(a)Series (b)Parallel (1.5+1.5)
- Obtain the balancing condition Wheatstone's bridge.
- (a)Define Magnetisation.
(b)A bar magnet made of steel has a magnetic moment of 2.5 Am^2 and a mass of $6.6 \times 10^{-3} \text{ kg}$. If the density of steel is $7.9 \times 10^3 \text{ kgm}^{-3}$, find the magnetisation of the magnet. (1+2)
- Arrive at Snell's law of refraction using Huygen's principle.

- (a)Give Einstein's photo electric equation.
(b)Draw a graph showing the variation of stopping potential with frequency.
(c)Slope of the above graph is ----- ? (1+1+1)
- (a)With the help of a circuit diagram, explain the working of a full wave rectifier.
(b)How can we get a steady dc output from the pulsating output voltage of a full wave rectifier ? (2+1)

22 to 25

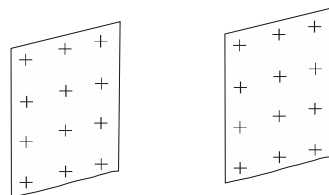
3 x 4 = 12

- (a)Define electrostatic potential.
(b)Deduce the relation for electrostatic potential due to an electric dipole. (1+3)
- (a)Arrive at a relation connecting current in a metallic conductor and the drift velocity of the conduction electron.
(b)A copper wire of 10^{-6} m^2 area of cross section, carries a current of 2A. If the number of free electrons per cubic metre in the wire is 8×10^{28} , calculate the average drift velocity of electrons. (2+2)
- (a)Derive an expression for self-inductance of a long solenoid of cross sectional area A, length l, having n turns per unit length.
(b)The self-inductance of an air core solenoid is 4.8mH. If its core is replaced by iron core, then its self-inductance becomes 1.8H. Find out the relative permeability of iron. (2+2)
- (a)A simple microscope is a ----- (converging/diverging) lens of small focal length.
(b)With the help of a ray diagram, arrive at an expression for
(i)Linear magnification of a simple microscope when image is formed at near point of vision.
(ii)Angular magnification of a simple microscope when image is formed at infinity. (1+1.5+1.5)

26 to 29

3 x 5 = 15

- (a)State Gauss's law in electrostatics.
(b)Derive an expression for the electric field due to an infinite plane sheet of charge at a point P distance r from the sheet. The sheet is charged uniformly with a surface charge density σ .
(c)Two large, thin metal plates are parallel and close to each other on their inner faces, the plates have equal surface charge densities. What is E in the region between the two plates ?



- (a)Show that the steady deflection produced by a moving coil galvanometer is proportional to the current flowing through it.
(b)Write down the expression for current sensitivity and voltage sensitivity.
(c)What happens to current sensitivity when number of turns of the galvanometer coil is increased ? (2+2+1)
- (a)Derive an expression for impedance in series LCR circuit and hence arrive at an expression for resonant frequency of the circuit.
(b)A sinusoidal voltage of peak value 283V and frequency 50Hz is applied to a series LCR circuit in which $R = 3\Omega$, $L = 25.48 \text{ mH}$ and $C = 796 \mu\text{F}$. What is the frequency of the source at which resonance occurs ? (3+2)
- (a)Derive an expression for Lenz's formula.
(b)Double convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of same radius of curvature. What is the radius of curvature required to get a focal length of 20 cm ? (3+2)

Binu Baby

Principal, St Sebastian's HSS Koodaranhi

1 to 7			5 x 1 = 5			22 to 25			3 x 4 = 12		
1.Increases	2.Bismuth	3.(a)X-rays	or (d)Gamma rays	7		22 (a)	Definition of electrostatic potential	1			
4. 2	5.Impact parameter	6.(a) $A^{2/3}$	7.False			(b)	Equation 1/2 score	1			
8 to 14			5 x 2 = 10				Figure	1/2	4		
8		Derivation	2	2			$V=V_1+V_2$	1			
		or Figure 1/2 score,					Values of V_1 and V_2 (1/2 x 2 = 1 score)	1			
		$\tau = \text{force} \times \text{perpendicular distance}$ 1/2 score,					Final equation	1/2			
		$\tau = NAB \sin\theta$ or $\tau = mxB$ or $\tau = mB \sin\theta$ 1 score				23 (a)	$Q = neAL$	1/2			
9	(a)	Statement of Lenz's law	1				Current $I = Q/t = neAL/t$	1/2			
		or $\varepsilon = -(d\phi/dt)$ 1/2 score					$I = neAv_d$	1			
	(b)	Current anticlockwise direction or current marked	1	2		(b)	$v_d = I/neA$	1			
		figure or A negative, B positive / B negative, A					$= 2/(1.6 \times 10^{-19} \times 8 \times 10^{28} \times 10^{-6})$	1/2			
		positive / No polarity on A and B					$= 1.56 \times 10^{-4} \text{ m/s}$	1/2			
10		Any Four Energy losses	1/2 x 4 = 2 score	2	2	24 (a)	$\phi = Li$	1/2			
							$\phi = \mu_0 n_i AN$ or $\phi = BAN$ or $\phi = \mu_0 n_i$	1/2			
11	(a)	Definition of displacement current	1				$L = \mu_0 n AN$ or $L = \mu_0 n^2 AL$	1			
		or $I = \varepsilon_0 (d\phi_E/dt)$ 1 score				(b)	New inductance $L' = \mu_r L$	1/2			
	(b)	$\int B \cdot dl = \mu_0 (I_c + I_d)$	1	2			$1.8 = \mu_r \times 4.8 \times 10^{-3}$	1			
		or $\int B \cdot dl = \mu_0 [I_c + \varepsilon_0 (d\phi_E/dt)]$ 1 score					$\mu_r = 375$	1/2			
12	(a)	Sources are said to be coherent if they emit light	1				or Any correct solution 2 score				
		waves of same frequency and same phase or					If only $L = \mu_0 n AN$ or $L = \mu_0 n^2 AL$ 1/2 score				
		constant phase difference.				25 (a)	Converging	1			
	(b)	(i) Constructive interference	1/2	2		(b)	(i) Labelled diagram	1/2			
		Path difference = $n\lambda$ or $2n(\lambda/2)$					Magnification $m = (v/u)$	1/2			
		(ii) Destructive interference	1/2				$m = 1 + (D/f)$	1/2			
		Path difference = $(n \pm 1/2)\lambda$ or $(2n \pm 1)\lambda/2$					or Figure only or Final eqn. only 1 score				
13		$2\pi r = n\lambda$	1/2				(ii) Angular magnification $m = \theta_i/\theta_o$	1/2			
		$\lambda = h/mv$	1/2	2			$m = D/f$ or Any correct Eqn. 1 score	1			
		$mvr = nh/2\pi$	1				Only $m = D/f$ 1 score				
14		Isotope-diff.mass number,diff. neutron no. 1/2+1/2	1	2		26 to 29			3 x 5 = 15		
		Isotone - diff. mass number,same neutron no.1/2+1/2	1			26 (a)	Statement of Gauss's law	1			
15 to 21			6 x 3 = 18				or Equation 1/2 score				
15	(a)	$\tau = PE \sin\theta$	1			(b)	Labelled figure	1			
		$= 4 \times 10^{-9} \times 5 \times 10^4 \times \sin 30$	1/2	3			Derivation	2			
		$= 10^{-4} \text{ Nm}$ (Unit not necessary)	1/2				or $\phi = 2Eds$ (also with $ds = A$) 1/2 score				
	(b)	$\theta = 90^\circ$	1				$q = \sigma ds$ 1/2 score, $\phi = q/\varepsilon_0$ or $2Eds = \sigma ds/\varepsilon_0$ 1/2 score				
16	(a)	Figure	1/2				$E = \sigma/2\varepsilon_0$ 1/2 score				
		$V = V_1 + V_2 + V_3$ or $Q/C = Q/C_1 + Q/C_2 + Q/C_3$	1/2			(c)	Zero	1			
		$1/C = 1/C_1 + 1/C_2 + 1/C_3$	1/2			27 (a)	Torque $\tau = NAB$	1/2			
	(b)	Figure	1/2	3			$\tau = c\phi$	1/2			
		$Q = Q_1 + Q_2 + Q_3$ or $CV = C_1 V + C_2 V + C_3 V$	1/2				$NAB = c\phi$	1			
		$C = C_1 + C_2 + C_3$	1/2				or $\phi = (NAB/c)I$ 1 score, Figure only 1/2 score				
		or $Q = CV$ or $V = Q/C$ only 1/2 score				(b)	Current sensitivity $(\phi/i) = (BAN/c)$				
17		Circuit diagram	1				/ any correct expression				
		Rule applied to two closed loops- 2 Eqns 1/2 x 2 = 1	2	3			Statement or expression (ϕ/i) 1/2 score				
		Final equation	1				Voltage sensitivity $(\phi/V) = (BAN/cR)$	1			
		or $I_g = 0$ only 1/2 score					/ any correct expression				
18	(a)	Definition of magnetisation	1				Statement or expression (ϕ/V) 1/2 score				
		or $M = m/V$ 1/2 score				(c)	Current sensitivity increases	1			
	(b)	$M = m/V$	1/2	3			or Current sensitivity $\propto N$ 1/2 score				
		$= 2.5/(6.6 \times 10^{-3}/7.9 \times 10^3)$	1			28 (a)	LCR series circuit or LCR series circuit phasor dia.	1/2			
		$= 2.99 \times 10^6 \text{ Am}^{-1}$ (Unit not necessary)	1/2				$V = \sqrt{V_R^2 + (V_L - V_C)^2}$	1/2			
19		Labelled Figure	1				$Z = \sqrt{R^2 + (X_L - X_C)^2}$	1			
		Correct derivation	2	3			At resonance, $X_L = X_C$ or $L\omega = (1/C\omega)$	1/2			
		or $n = \text{Sini/Sinr}$ (1/2 score)					$\omega = 1/\sqrt{LC}$ or $f = 1/2\pi\sqrt{LC}$	1/2			
		Writing the values of Sini and Sinr (1/2 x 2 = 1 score)				(b)	$f = 1/2\pi\sqrt{LC}$	1/2			
		$n = c/v$ or $(\text{Sini/Sinr}) = n_2/n_1$ (1/2 score)					$= 1/2\pi \times 1.4 \sqrt{25.48 \times 10^{-3} \times 796 \times 10^{-6}}$	1			
20	(a)	$h\nu = h\nu_0 + 1/2 mv^2$ or $h\nu = h\nu_0 + eV_0$	1				$= 222.1 \text{ rad/s}$	1/2			
	(b)	Graph	1	3		29 (a)	Labelled diagram	1/2			
	(c)	h/e	1				$n_2/v_1 - n_1/u = (n_2 - n_1)/R_1$	1/2			
21	(a)	Circuit diagram - full wave rectifier	1				$n_1/v - n_2/v_1 = -(n_2 - n_1)/R_2$	1/2			
		Explanation of working	1				$n_1/v - n_1/u = [(n_2 - n_1)[1/R_1 - 1/R_2]]$	1/2			
		or i/p and o/p wave forms (1/2 x 2 = 1 score)					$1/v - 1/u = [(n_2/n_1 - 1)[1/R_1 - 1/R_2]]$	1/2			
	(b)	Filter circuit/ Connecting a capacitor in O/P	1	3			In air, $1/f = (n-1)(1/R_1 - 1/R_2)$	1/2			
		/ Correct explanation / Showing Filter					Diagram only or Final eqn. only 1 score				
		(Capacitor) in the circuit diagram				(b)	$1/f = (n-1)(1/R_1 - 1/R_2)$	1/2			
		Binu Baby, Principal, St. Sebastian's HSS Koodaranhi					$1/20 = (1.55 - 1)[1/R_1 - (-1/R)]$	1			
							$R = 22 \text{ cm}$	1/2			