14

PRACTICE PAPER

Time allowed: 45 minutes **Maximum Marks: 200**

General Instructions: *Same as Practice Paper-1.*

Choose the correct option in the following questions.

1. Four charges + 8Q, – 3Q + 5Q and –10Q are kept inside a closed surface. What will be the outgoing flux through the surface?

(*a*) 26 V-m (*b*) 0 V-m

(*c*) 10 V-m (*d*) 8 V-m

2. When air is replaced by a medium of dielectric constant *K*, the force of attraction between two charges separated by a distance *r*

(*a*) decreases *K* times (*b*) remains unchanged

(*c*) increases *K* times (*d*) increases K^{-2} times

3. Due to the presence of a point charge at the centre of a spherical Gaussian surface of diameter *a*, 10^6 Nm^2/C amount of electric flux passes through it. Keeping the point charge at the centre, the Gaussian surface is changed to a cubical Gaussian surface of side *a*. The flux through the new Gaussian surface will be

(*a*) $\sqrt{2} \times 10^6$ Nm^2/C (*b*) $\frac{10^6}{\sqrt{2}}$ Nm^2/C

(*c*) 10^6 Nm^2/C (*d*) $2\sqrt{2} \times 10^6$ Nm^2/C

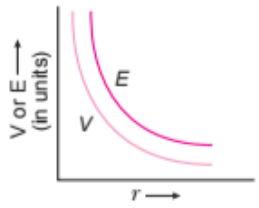
4. The electric potential at a point (*x*, *y*, *z*) is given by $V = -x^2y - xz^3 + 4$. The electric field $\vec{E}$ at that point is

(*a*) $\vec{E} = 2xy\,\hat{i} + (x^2 + y^2)\,\hat{j} + (3xz - y^2)\,\hat{k}$ (*b*) $\vec{E} = z^3\,\hat{i} + xyz\,\hat{j} + z^2\,\hat{k}$

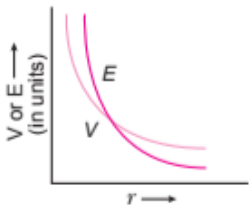
(*c*) $\vec{E} = (2xy - z^3)\,\hat{i} + xy^2\,\hat{j} + 3z^2x\,\hat{k}$ (*d*) $\vec{E} = (2xy + z^3)\,\hat{i} + x^2\,\hat{j} + 3xz^2\,\hat{k}$

5. The variation potential *V* with *r* and electric field *E* with *r* for a point charge is correctly shown in the graphs.

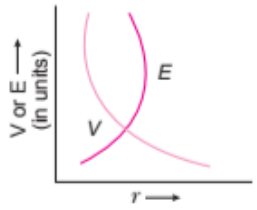
(*a*)



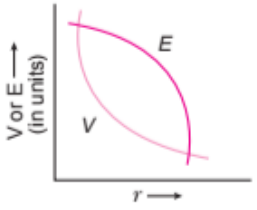
(*b*)



(*c*)



(*d*)



6. **The equivalent capacitance of two capacitors when joined in parallel is 16 μF and when joined in series is 3 μF. The capacitances of the capacitors are**

(*a*) 8 μF and 8 μF
(*b*) 4 μF and 12 μF
(*c*) 6 μF and 10 μF
(*d*) 2 μF and 14 μF

7. **Two conducting spheres A and B of radii a and b respectively are at the same potential. The ratio of surface charge densities of A and B is**

(*a*) $\frac{b}{a}$
(*b*) $\frac{a}{b}$
(*c*) $\frac{a^2}{b^2}$
(*d*) $\frac{b^2}{a^2}$

8. **When temperature of a metallic resistor is increased, the product of its resistivity and conductivity**

(*a*) decreases
(*b*) remains constant
(*c*) increases
(*d*) may increase or decrease

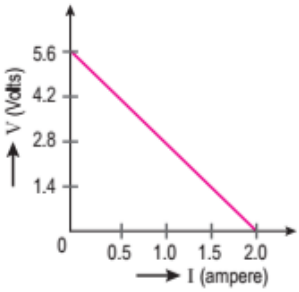
9. **Two cells when connected in series are balanced on 8 m on a potentiometer. If the polarity of one of the cell is reversed, they balance on 2 m. The ratio of emf's of the two cells is**

(*a*) 3 : 5
(*b*) 5 : 3
(*c*) 3 : 4
(*d*) 4 : 3

10. **An electric current is passed through a circuit containing two wires of same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 3:2 and 2:3, then the ratio of the current passing through the wire will be**

(*a*) 2:3
(*b*) 3:2
(*c*) 8:27
(*d*) 27:8

11. **A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it, is shown in the figure. The internal resistance of the cell would be then**



(*a*) 2.8 ohms
(*b*) 1.4 ohms
(*c*) 1.2 ohms
(*d*) zero

12. **The SI unit of magnetic permeability μ_0 is**

(*a*) $WA^{-1}m^{-1}$
(*b*) $NA^{-1}m^{-1}$
(*c*) NA^{-2}
(*d*) Both $WA^{-1}m^{-1}$ and NA^{-2}

13. **Given below are two statements labelled as Statement P and Statement Q:**

Statement P : A proton and an electron, with same momenta, enter in a magnetic field in a direction at right angles to the lines of the force. The radius of the paths followed by them will be same.

Statement Q : Electron has less mass than the proton.

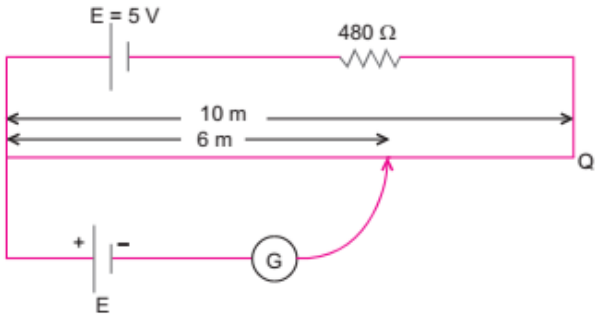
Select the most appropriate option:

(*a*) P is true, but Q is false
(*b*) P is false, but Q is true
(*c*) Both P and Q are true
(*d*) Both P and Q are false

14. **The magnetic force acting on a charged particle of charge –3μC moving with velocity $(2\hat{i} + 4\hat{j}) \times 10^6$ ms^{-1} in a magnetic field of 6 T directed in y-direction is**

(*a*) 44 N in z-direction
(*b*) 36 N in y-direction
(*c*) 48 N in z-direction
(*d*) 36 N in negative z-direction

15. A 10 m long wire of uniform cross-section and 20 Ω resistance is used in a potentiometer. The wire is connected in series with a battery of 5 V along with an external resistance of 480 Ω. If an unknown emf E is balanced at 6.0 m length of the wire, then the value of unknown emf is



(*a*) 1.2 V (*b*) 1.02 V (*c*) 0.2 V (*d*) 0.12 V

16. A stationary magnet does not interact with

(*a*) magnet (*b*) stationary charge (*c*) iron rod (*d*) moving charge

17. How does the magnetic susceptibility χ of a paramagnetic material change with absolute temperature T?

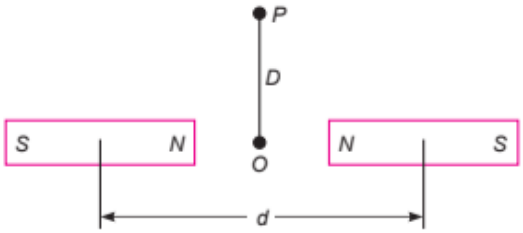
(*a*) $\chi \propto T$ (*b*) $\chi \propto T^{-1}$ (*c*) χ = constant (*d*) $\chi \propto e^{T}$

18. The time-period of a freely-suspended magnet is independent of

(*a*) length of the magnet (*b*) moment of inertia of the magnet

(*c*) horizontal component of earth's magnetic field (*d*) length of the suspension

19. Two identical bar magnets are fixed with their centers at a distance '*d*' apart. A stationary charge + Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in fig. The force on charge $+Q$ is



(*a*) directed along $\overrightarrow{OP}$

(*b*) directed along $\overrightarrow{PO}$

(*c*) directed perpendicular to the plane of the paper

(*d*) zero

20. Eddy current have negative effect because they produce

(*a*) heating only (*b*) damping only

(*c*) heating and damping (*d*) harmful radiation

21. Am emf is produced in a coil, which is not connected to an external voltage source. This can be due to

(*a*) the coil being in a time varying magnetic field (*b*) the coil moving in a time varying magnetic field

(*c*) the coil moving out of a constant magnetic field (*d*) all of the above

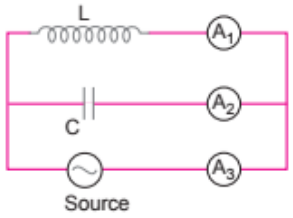
22. The phase difference between the alternating current and emf is $\frac{\pi}{2}$. Which of the following can not be the constituent of the circuits?

(*a*) R, L (*b*) C alone (*c*) L alone (*d*) L, C

23. The voltage of an *ac* supply varies with time as $V = 120 \sin \pi t \cos 100 \pi t$. The maximum voltage and frequency respectively are

(*a*) 120 V, 100 Hz (*b*) $60\sqrt{2}$ V, 100 Hz (*c*) 60 V, 200 Hz (*d*) 60 V, 100 Hz

24. **A circuit containing L, C and ac source with ammeters A_1, A_2, A_3 is shown in figure. At resonance which ammeter reads zero?**



(*a*) A_1 (*b*) A_2
(*c*) A_3 (*d*) all the three A_1, A_2 and A_3

25. **The correct order of visible electromagnetic radiation arranged in increasing order of frequency is**
(*a*) violet, red, blue, green (*b*) blue, green, yellow, red
(*c*) orange, green, blue, violet (*d*) orange, red, yellow, green

26. **If ε_0 and μ_0 the electric permittivity and magnetic permeability in free space, ε and μ are corresponding quantities in a medium, then index of refraction of the medium is**

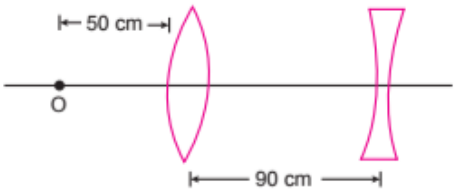
(*a*) $\sqrt{\frac{\varepsilon_0\mu}{\varepsilon\mu_0}}$ (*b*) $\sqrt{\frac{\varepsilon}{\varepsilon_0}}$ (*c*) $\sqrt{\frac{\varepsilon_0\mu_0}{\varepsilon\mu}}$ (*d*) $\sqrt{\frac{\varepsilon\mu}{\varepsilon_0\mu_0}}$

27. **Arrange the following electromagnetic radiations per quantum in the order of increasing energy:**
(A) Blue light **(B) Yellow light**
(C) X-ray **(D) Radiowave**
(*a*) (A), (B), (D), (C) (*b*) (C), (A), (B), (D) (*c*) (B), (A), (D), (C) (*d*) (D), (B), (A), (C)

28. **Light travels as a**
(*a*) parallel beam in each medium
(*b*) convergent beam in each medium
(*c*) divergent beam in each medium
(*d*) divergent beam in one medium and convergent beam in the other medium

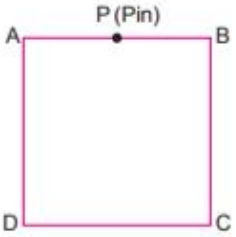
29. **A biconcave lens of power P vertically splits into two identical plano concave parts. The power of each part will be**
(*a*) $2P$ (*b*) $P/2$ (*c*) P (*d*) $P/\sqrt{2}$

30. **Focal length of convex lens is 100 cm and focal length of concave lens is 8 cm. Find the magnification of the given combination of lens if object is placed at point O.**



(*a*) 1.02 (*b*) 0.04 (*c*) 2.01 (*d*) 0.08

31. **A rectangular block of glass $ABCD$ has a refractive index 1.6. A pin is placed midway on the face AB when observed from the face AD, the pin shall**



(*a*) appear to be near A (*b*) appear to be near D (*c*) both (*a*) and (*b*) (*d*) not be seen at all

32. **The apparent depth of an object at the bottom of tank filled with a liquid of refractive index 1.3 is 10 cm. The actual depth of the liquid in the tank is**

(*a*) 10 cm (*b*) 11 cm (*c*) 12 cm (*d*) 13 cm

33. **If E_1, E_2, E_3, E_4 are the respective kinetic energies of electron, deuteron, proton and neutron having same de-Broglie wavelength. Select the correct order in which those values would increase**

(*a*) E_1, E_3, E_4, E_2 (*b*) E_2, E_4, E_1, E_3 (*c*) E_2, E_4, E_3, E_1 (*d*) E_3, E_1, E_2, E_4

34. **The yellow light source in Young's double-slit experiment is replaced by a monochromatic red light source of same intensity. Then the fringe width of the interference pattern in comparison with that of the previous pattern will**

(*a*) increase (*b*) decrease (*c*) remain unchanged (*d*) vanish

35. **The shape of the interference fringes in Young's double slit experiment when D (distance between slit and screen) is very large as compared to fringe width is nearly**

(*a*) straight line (*b*) parabolic (*c*) circular (*d*) hyperbolic

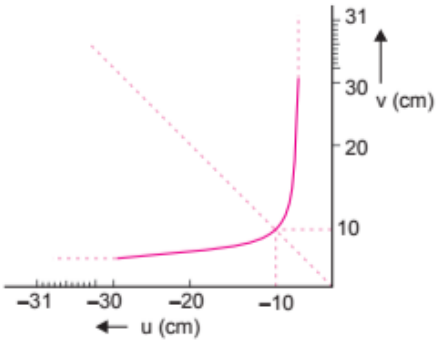
36. **Unpolarised beam of light of intensity I_0 is incident on a polariser P_1. If another polariser P_2 is held parallel to it such that its pass axis is oriented at an angle 60°, then what percentage of light will emerge from the system?**

(*a*) 30% (*b*) 100% (*c*) 12.5% (*d*) 37.5%

37. **For constructive interference to take place between two monochromatic light waves of wavelength λ, the path difference should be**

(*a*) $(2n - 1)(\lambda / 4)$ (*b*) $(2n - 1)(\lambda / 2)$ (*c*) $n\lambda$ (*d*) $(2n + 1)\lambda$

38. **Graph of position of image versus position of point object from a convex lens is shown. Then the focal length of the lens is**



(*a*) $0 \cdot 50 \pm 0 \cdot 05$ cm (*b*) $0 \cdot 50 \pm 0 \cdot 10$ cm

(*c*) $5 \cdot 00 \pm 0 \cdot 05$ cm (*d*) $5 \cdot 00 \pm 0 \cdot 10$ cm

39. **When radiation of given frequency is incident upon different metals, the maximum kinetic energy of electrons emitted**

(*a*) decrease with increase of work function

(*b*) increase with increase of work function

(*c*) remains same with the increase of work function

(*d*) does not depend upon work function

40. **Given below are two statements labelled as Statement P and Statement Q:**

Statement P : Photoelectric effect demonstrates the wave nature of light.

Statement Q : The number of photoelectrons is proportional to the frequency of light.

Select the most appropriate option:

(*a*) P is true, but Q is false (*b*) P is false, but Q is true

(*c*) Both P and Q are true (*d*) Both P and Q are false

41. **In any Bohr orbit of hydrogen atom, the ratio of kinetic energy to the potential energy of the electron is:**

(*a*) 1/2 (*b*) 2 (*c*) –1/2 (*d*) –2

42. **Total energy of an electron in hydrogen atoms above 0 eV leads to**

(*a*) ionisation of the atom (*b*) accelerate the atom

(*c*) send the atom in higher excited state (*d*) none of these

43. **The reaction of Column A shows the condition in Column B. Match the Columns A and B.**

Column A	Column B
(*i*) Nuclear fission	(*p*) weak nuclear forces
(*ii*) Nuclear fusion	(*q*) for atoms having higher atomic number
(*iii*) β-decay	(*r*) for atoms having longer atomic number
(*iv*) α-decay	(*s*) atomic number decreases by 2

(*a*) (*i*)–(*q*), (*ii*)–(*r*), (*iii*)–(*p*), (*iv*)–(*s*) (*b*) (*i*)–(*s*), (*ii*)–(*p*), (*iii*)–(*r*), (*iv*)–(*q*)

(*c*) (*i*)–(*p*), (*ii*)–(*r*), (*iii*)–(*q*), (*iv*)–(*s*) (*d*) (*i*)–(*r*), (*ii*)–(*q*), (*iii*)–(*s*), (*iv*)–(*p*)

44. **The function of a moderator in a nuclear reactor is to**

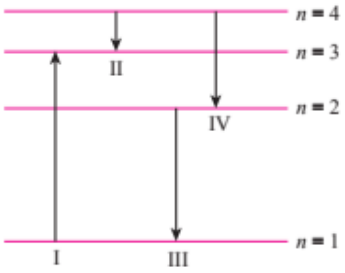
(*a*) absorb dangerous γ-rays (*b*) react with uranium to release energy

(*c*) release energy by combustion (*d*) slow down fast neutrons so as to have controlled fission

45. **When $^{7}_{3}$Li nuclei are bombarded by protons and the resultant nuclei are $^{8}_{4}$Be the emitted particles will be**

(*a*) alpha particles (*b*) beta particles (*c*) gamma particles (*d*) neutrons

46. **The diagram shows the energy levels for an electron in a certain atom. The transition that represents the emission of a photon with the highest energy is**



(*a*) I (*b*) II (*c*) III (*d*) IV

47. **To obtain a *p*-type germanium semiconductor, it must be doped with**

(*a*) arsenic (*b*) antimony (*c*) indium (*d*) phosphorous

48. **If i_e, i_b and i_c represent emitter current, base current and collector current of a transistor, then**

(*a*) $i_c > i_e$ (*b*) $i_b > i_e$ (*c*) $i_b > i_e$ (*d*) $i_e > i_c$

49. **The range of TV transmission tower of height *h* is (R_e = radius of earth)**

(*a*) $\sqrt{h\,R_e}$ (*b*) $\sqrt{2h\,R_e}$ (*c*) $\sqrt{h^2 - 2h\,R_e}$ (*d*) $\sqrt{h^2 + 2hR_e}$

50. **A *p* – *n* photodiode is fabricated from a semiconductor with a band gap of 2.5 eV. It can detect a signal of wavelength**

(*a*) 4000 nm (*b*) 6000 nm (*c*) 4000 Å (*d*) 6000 Å

ANSWERS

PRACTICE PAPER – 14

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

SOLUTIONS

PRACTICE PAPER–14

1. (*b*) Net charge, $Q_{net} = 8Q - 3Q + 5Q - 10Q = 0$
$\Rightarrow$ Net outward flux is zero.

2. (*a*) In air, the force of attraction between two charges in given by

$$F_{air} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$$

In dielectric medium, the force of attraction between two charges is given by

$$F_{mid} = \frac{1}{4\pi\varepsilon_0 K}\frac{q_1 q_2}{r^2} = \frac{F_{air}}{K}$$

So, force decreases K-times.

3. (*c*) The flux does not depend on the shape and size of the surface but the charge enclosed by it. The charge is same and so is the flux.

4. (*d*) $E = -\left(\hat{i}\frac{\partial V}{\partial x} + \hat{j}\frac{\partial V}{\partial y} + \hat{k}\frac{\partial V}{\partial z}\right)$

Here $V = -x^2y - xz^2 + 4$

$\therefore \quad \vec{E} = -[\hat{i}(-2xy - z^3) + \hat{j}(-x^2) + \hat{k}(-3xz^2)]$

$= (2xy + z^3)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$

5. (*b*) $E \propto \frac{1}{r^2}$ and $V \propto \frac{1}{r}$

6. (*b*) As given in parallel, $C_1 + C_2 = 16$ ...(*i*)

In series, $\frac{C_1 . C_2}{C_1 + C_2} = 3 \quad \Rightarrow C_1 . C_2 = 48$ ...(*ii*)

Now, $(C_1 - C_2)^2 = (C_1 + C_2)^2 - 4\,C_1C_2$

$= 256 - 192 = 64$

$C_1 - C_2 = 8$ ...(*iii*)

From equation (*i*) and (*iii*)

$C_1 + C_2 = 16$

$C_1 - C_2 = 8$

$2C_1 = 24$

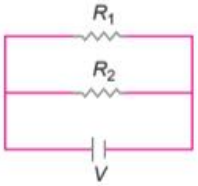
$2C_1 = 24 \quad \Rightarrow \quad C_1 = 12\,\mu F, C_2 = 4\,\mu F$

7. (*a*) $\sigma \propto \frac{1}{r} \quad \Rightarrow \quad \frac{\sigma_A}{\sigma_B} = \frac{b}{a}$

8. (*b*) As resistivity increases while conductivity decreases. So product overall remains constant.

9. (*b*) $\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2} = \frac{(8+2)}{(8-2)} = \frac{5}{3}$

10. (*c*) Given, $l_1 : l_2 = 3 : 2$



$r_1 : r_2 = 2 : 3$

For same material, ρ = constant

$$\frac{R_1}{R_2} = \frac{\rho\frac{l_1}{A_1}}{\rho\frac{l_2}{A_2}} = \frac{l_1}{l_2}\times\frac{A_2}{A_1} = \frac{l_1}{l_2}\times\left(\frac{r_2}{r_1}\right)^2$$

$$\frac{R_1}{R_2} = \frac{3}{2}\times\left(\frac{3}{2}\right)^2 = \frac{27}{8}$$

Now, in parallel, V = constant

$$\frac{I_1}{I_2} = \frac{V/R_1}{V/R_2} = \frac{R_2}{R_1} = \frac{8}{27}$$

11. (*a*) We know that, $V = E - Ir$

From the graph, $I = 0, V = E$,

$\therefore \quad E = 5.6$ V

Now, internal resistance,

$$r = \frac{E}{I} = \frac{5.6}{2} = 2.8\,\Omega$$

13. (*c*) We know that, radius of path of charge particles in uniform magnetic field is

$$r = \frac{mv}{qB} = \frac{p}{qB} = \frac{\text{momentum of charge}}{qB}$$

Here, magnetic field, B is constant and the momentum, p is same for both the particles.

Also, electron and proton have same magnitude of charge.

So, radius of path for both the charges is same.

Also, $m_e = 9.1 \times 10^{-31}$ kg, $m_p = 1.6 \times 10^{-27}$ kg

So, $m_e < m_p$

14. (*d*) $\vec{F}_m = q(\vec{v} \times \vec{B})$

$= -3\times10^{-6}\times(2\hat{i} + 4\hat{j})\times10^6\times6\hat{j} = -36\hat{k}$ N

15. (*d*) Let PQ is a potentiometer wire of length 10 m, then,

$$I = \frac{E}{R + R'} = \frac{5}{480 + 20} = \frac{5}{500} = 0.01\,A$$

$V_{PQ} = IR_{PQ} = 0.01 \times 20 = 0.2$ V

Now, potential gradient,

$$K = \frac{V_{PQ}}{l} = \frac{0.2}{10} = 0.02$$

Hence, emf of cell, $E = Kl_1 = 0.02 \times 6$

$= 0.12$ V

19. (*d*) Force on a stationery charge in magnetic field is zero.

20. (*c*) When a conductive material is subjected to a time-varying magnetic flux, eddy current are generated in the conductor. Due to the internal resistance of conductor, the eddy current dissipated, heat and also energy removed from the system produce damping effect.

21. (*d*) Emf is produced in coil if the magnetic flux linked with it changes. When a coil moves into or out of a uniform magnetic field, the area associated with it changes which in turn changes the magnetic flux linked with the coil and an emf is induced.

22. (*a*) In *RL* circuit, the phase difference is $\tan^{-1}\left(\frac{\omega L}{R}\right)$ which is never $\frac{\pi}{2}$ for finite values of L and R.

23. (*d*) $V = 120 \sin 100\pi t \cos 100\pi t = 60 \sin (2 \times 100\pi t)$

Maximum voltage $= V_0 = 60$ V

Frequency, $f_r = \frac{\omega_r}{2\pi} = \frac{200\pi}{2\pi} = 100$ Hz

24. (*c*) At resonance $i_L = i_C$ with a phase difference of π. Current in main circuit $i_3 = i_C - i_L = 0$, so ammeter A_3 reads zero.

25. (*c*) The frequency increases in order: orange, green, blue, violet; because $\upsilon \propto \frac{1}{\lambda}$, as λ decreases frequency increases.

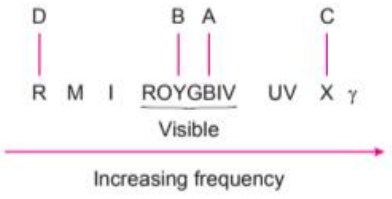
26. (*d*) As we know,

$$c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \qquad v = \frac{1}{\sqrt{\mu\varepsilon}}$$

Refractive index,

$$\therefore \quad n = \frac{c}{v} = \sqrt{\frac{\mu\varepsilon}{\mu_0 \varepsilon_0}}$$

27. (*d*)



The radiations in the order of increasing energy are

(*D*), (*B*), (*A*), (*C*)

28. (*a*) Refraction only changes the direction of propagation and so each medium will have parallel beam.

29. (*b*) For a biconcave lens, ($R_1 = -R$ and $R_2 = +R$)

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{1}{f} = -(n-1)\frac{2}{R} = P$$

When a lens is split,

$$\frac{1}{f_1} = -(n-1)\frac{1}{R} \text{ and}$$

$$\frac{1}{f_2} = -(n-1)\frac{1}{R}$$

Then, $\frac{1}{f_1} = \frac{1}{f_2} = \frac{1}{2f}$

Hence, $P_1 = P_2 = \frac{P}{2}$

30. (*d*) For convex lens : $f = 100$ cm, $u = -50$ cm

$$m_1 = \frac{v}{u} = \frac{f}{u+f} = \frac{100}{-50+100} = 2$$

Image distance, $v = 2u = -100$ cm

For concave lens: $f = -8$ cm, $u = -190$ cm

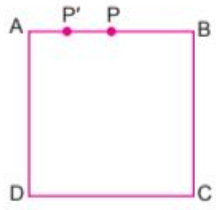
$$m_1 = \frac{v}{u} = \frac{f}{u+f} = \frac{100}{-50+100} = 2$$

For combination of lens,

$\therefore$ Magnification, $m = m_1 m_2$

$= 2 \times 0.04 = 0.08$

31. (*c*) $\because \quad \sin i_c = \frac{1}{n} \quad \Rightarrow \quad i_c = 38.7$



The point P is on the mid point of face AB. When seen through face AD, near the point A, the angle of incidence (i_1) will be smaller than the critical angle $i_c = 38.7°$, so, image of P will form at P' that is nearer to both A and D.

32. (*d*) Apparent depth $= \frac{\text{Real depth}}{n}$

$$10 = \frac{\text{Real depth}}{1.3}$$

Real depth $= 1.3 \times 10 = 13$ cm

33. (*c*) $E = \frac{1}{2}mv^2 = \frac{1}{2}\frac{h^2}{m\lambda^2}$

$$\lambda = \frac{h}{\sqrt{2mK}} \quad \Rightarrow \quad E \propto \frac{1}{\sqrt{m}} \quad (\because \lambda = \text{same})$$

Here, $m_1 < m_3 \leq m_4 < m_2$

So, $E_2 < E_4 < E_3 < E_1$

34. (*a*) Fringe width, $\beta = \frac{\lambda D}{d}$ *i.e.*, $\beta \propto \lambda$

For red light, as the wavelength is larger, the fringe width also be larger.

35. (*a*) When the distance between the slits and the screen is D is large, the fringe width is nearly a straight line.

36. (*c*) $I = I_0 \cos^2\theta$

After passing from polariser, $I = I_0 \cos^2\theta$

$$I = \frac{I_0}{2}\cos^2 60° = \frac{I_0}{2} \times \frac{1}{4} = \frac{I_0}{8}$$

i.e., $\frac{1}{8} \times 100 = 12.5\%$

38. (*c*) From lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ gives,

$$\frac{1}{f} = \frac{1}{10} - \frac{1}{(-10)} = \frac{2}{10} \quad \Rightarrow \quad f = 5\,\text{cm}$$

Again, $\frac{1}{f} = \frac{1}{v} - \frac{1}{v}$

On differentiating,

$$-\frac{\Delta f}{f^2} = -\frac{\Delta v}{v^2} + \frac{\Delta u}{u^2} \Rightarrow \quad \Delta f = \left(\frac{\Delta v}{v^2} - \frac{\Delta u}{u^2}\right) f^2$$

Permissible error is,

$$\Delta f = \left(\frac{\Delta v}{v^2} + \frac{\Delta u}{u^2}\right) f^2 = \left(\frac{0 \cdot 1}{100} + \frac{0 \cdot 1}{100}\right) \times 5^2$$

$$= 0.05$$

$\therefore \quad f = 5 \cdot 00 \pm 0 \cdot 05\,\text{cm}$

39. (*a*) According to Einstein photoelectric equation, $KE_{max} = h\nu - W$

40. (*d*) Photoelectric effect confirms particle nature of light. The number of photoelectrons is proportional to the intensity of light.

41. (*c*) We know that, $KE = -TE$

Also, $PE = 2\,TE$

$$\frac{KE}{PE} = \frac{-TE}{2TE} = -\frac{1}{2}$$

42. (*a*) Total energy of an electron above 0 eV leads to ionisation of hydrogen atom.

45. (*c*) From nuclear reaction, $p + {}^{7}_{3}\text{Li} \longrightarrow {}^{8}_{4}\text{Be} + \gamma$ *i.e.*, gamma particles emitted.

46. (*c*) In emission line I, energy is absorbed and not emitted. While in the emission lines II, III and IV, energy is emitted. The line having maximum energy is III, because energy difference between successive levels decreases rapidly with increase of n.

47. (*c*) Only indium is trivalent dopant.

50. (*c*) As we know,

$$\lambda_{max} = \frac{hc}{E} = \frac{12431.25}{2.5}\text{Å} = 4972.4\ \text{Å}$$

So, λ_{max} is nearly 4950 Å is correct according to option.