BRAIN INTERNATIONAL SCHOOL

PRACTICE PAPER-1 (2025-26)

SUBJECT: - PHYSICS (042) (SET-I)

Maximum Marks: 70 Marks **Time: 3 hours.**

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(3) All the sections are compulsory.

(4) **Section A** contains **sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B** contains **five questions of two marks each, Section C** contains seven questions of three marks each, **Section D** contains **two case study based questions of four marks each** and **Section E** contains **three long answer questions of five marks each.**

(5) There is no overall choice. However, an internal choice has been provided in two questions in Section B, one question in Section C and all three questions in Section E. You have to attempt only one of the choices in such questions.

(6) Use of calculators is not allowed.

(7) You may use the following values of physical constants where ever necessary

i. $c = 3 \times 10^{8}$ m s^{-1}

ii. $m_e = 9.1 \times 10^{-31}$ kg

iii. $e = 1.6 \times 10^{-19}$ C

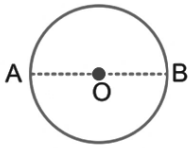
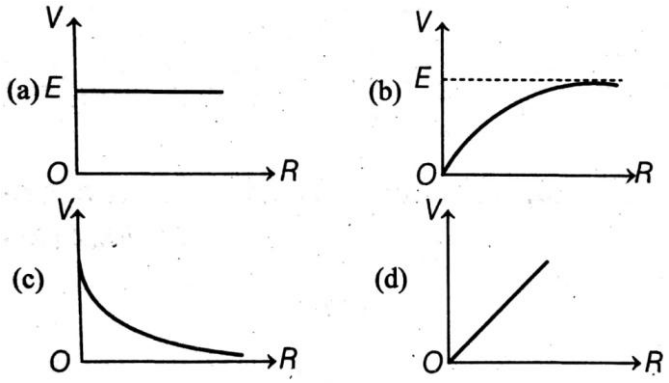
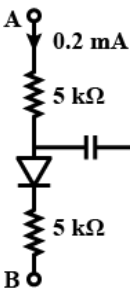
iv. $\mu_0 = 4\pi \times 10\text{-}7$ TmA^{-}

v. $h = 6.63 \times 10^{-34}$ Js

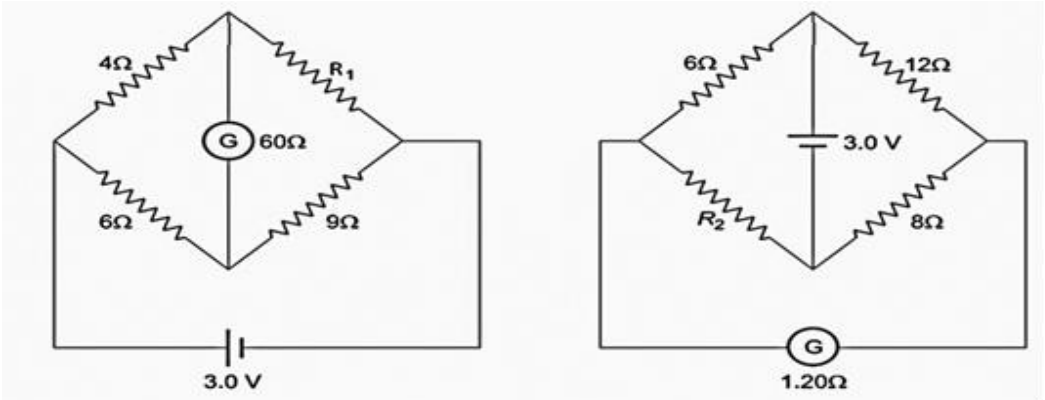
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^{2}N^{-1}m^{-}$

vii. Avogadro's number = 6.023×10^{23} per gram mole

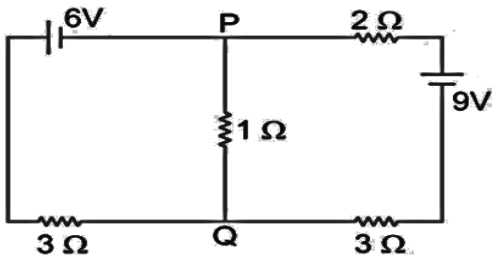
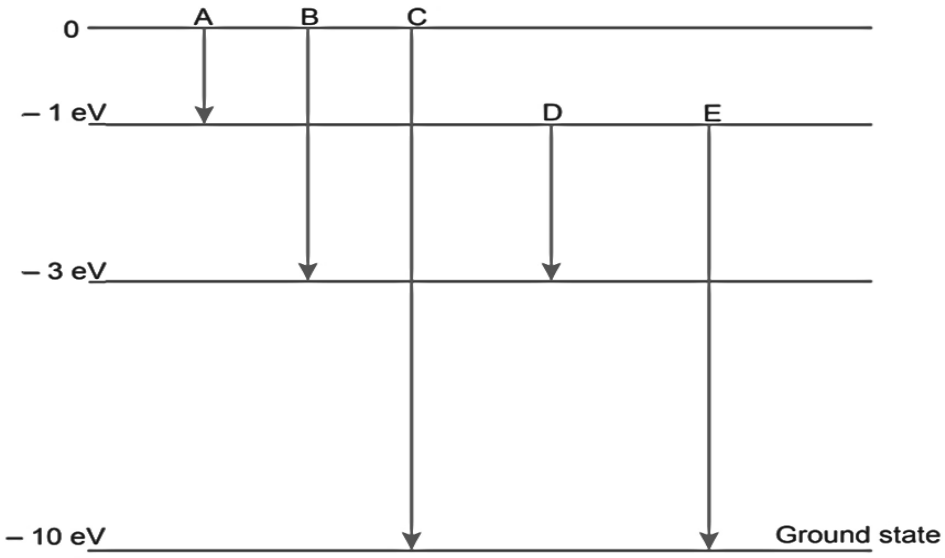
	SECTION A	
1.	The threshold frequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectron emission is nearly	1

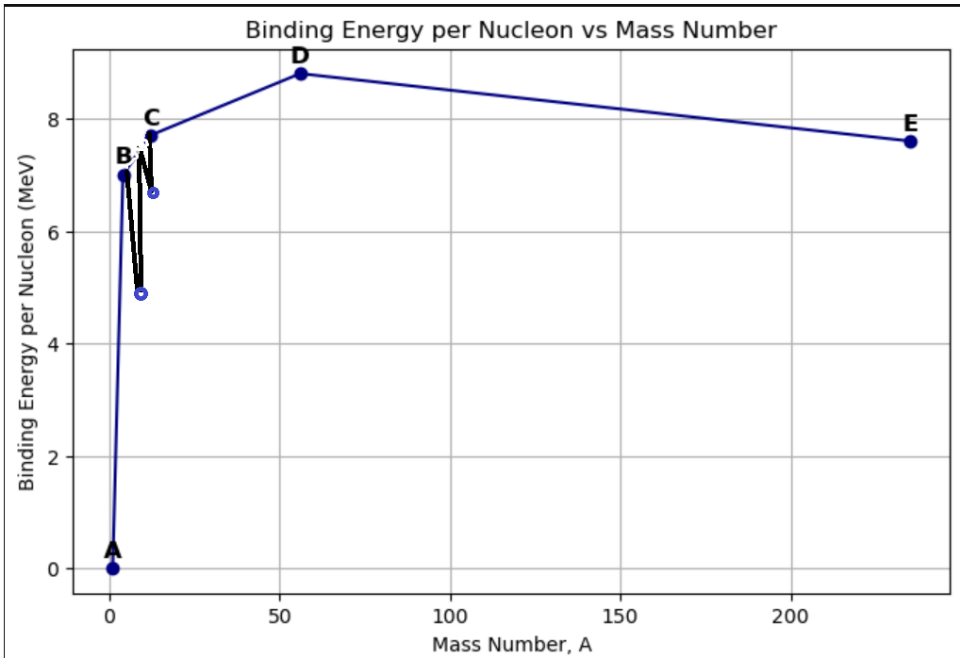
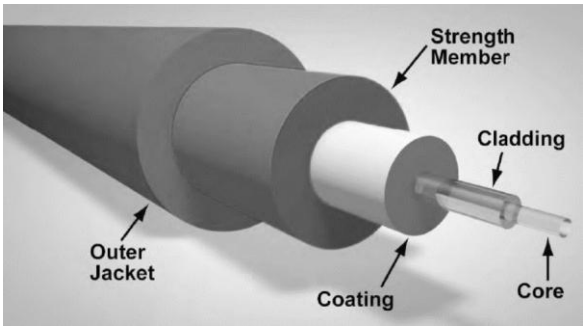
	(a) 1 V (b) 2 V (c) 3 V (d) 5 V	
2.	A wire of resistance 12Ω/m is bent to form a complete circle of radius 10 cm. The resistance between its two diametrically opposite points A and B as shown in figure is  (a) 3 Ω (b) 6 π Ω (c) 6 Ω (d) 0.6πΩ	1
3.	A cell of emf E and internal resistance r is connected across a variable external resistance R. The graph of terminal potential difference V as a function of R is 	1
4.	The impurity atoms to be doped in pure silicon to form p-type semiconductor are, of (a) phosphorus (b) germanium (c) antimony (d) aluminium	1
5.	In the circuit shown in figure, if the diode forward voltage is 0.3 V, the voltage difference between A and B is (a) 1.3 V (b) 2.3 V (c) 0 (d) 0.5 V 	1
6.	The ratio of energies of the hydrogen atom in its first to second excited state is (a) 1 : 4 (b) 4 : 1 (c) 4 : 9 (d) 9 : 4	1
7.	If the focal length of objective lens is increased, then magnifying power of (a) microscope will increase but that of telescope decrease (b) microscope and telescope both will increase (c) microscope and telescope both will decrease (d) microscope will decrease but that of telescope will increase	1
8.	The angle between electric field and equipotential surface is (a) 90^o always (b) 0^0 always (c) 0^0 to 90^o (d) 0^o to 180^o	1

9.	The S I unit of inductance is (a) Farad (b) Henry (c) weber (d) Tesla	1
10.	The permeability of a magnetic material is 0.9983. Name the type of magnetic materials it represents. (a) Paramagnetic (b) Ferromagnetic (c) Diamagnetic (d) all of the above	1
11.	Out of the following options which one can be used to produce a propagating electromagnetic wave? (a) A charge less particles (b) An accelerating charge (c) A charge moving at constant velocity (d) A stationary charge	1
12.	A proton and a deuteron are accelerated through the same accelerating potential, value of de-Broglie wavelength of (a) proton greater than deuteron (b) deuteron greater than proton (c) deuteron and proton have same (d) none of the above	1
	For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. **(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.** **(b) If both Assertion and Reason are true but Reason is not the correct of Assertion.** **(c) If Assertion is true but Reason is false.** **(d) If both Assertion and Reason are false.**	
13.	**Assertion:** Thin films such as soap bubble or a thin layer of oil on water show beautiful colours when illuminated by white light. **Reason:** It is due to interference of sun's light reflected from upper and lower surfaces of the film.	1
14.	**Assertion:** Two parallel conducting wires carrying currents in same direction, come close to each other. **Reason:** Parallel wires carrying currents in same direction repel and Parallel wires carrying currents in opposite direction attract.	1
15.	**Assertion (A):** On increasing the intensity of light the photocurrent increases. **Reason (R):** The photocurrent increases with increase of frequency of light.	1
16	**Assertion (A):** If a convex lens is kept in water, its convergence power decreases. **Reason (R):** The refractive index of convex lens relative to water is less than that	1

	relative to air.	
	SECTION B	
17.	Figure shows two circuits each having a galvanometer and a battery of 3 V. When the galvanometers in each arrangement do not show any deflection, obtain the ratio R_1/R_2.  **Circuit -1** **Circuit -2**	2
18.	What role does infra-red radiation play in (i) maintaining the earth's warmth and (ii) physical therapy?	2
19.	(i) Draw a graph showing variation of photo-electric current (I) with anode potential (V) for different intensities of incident radiation. Name the characteristic of the incident radiation that is kept constant in this experiment.	2
20.	(A) Distinguish between diamagnetic and ferromagnetic material. OR (B) Show diagrammatically the behaviour of magnetic field lines in the presence of (i) paramagnetic and (ii) diamagnetic substances. How does one explain this distinguishing feature?	2
21.	(A) What is total internal reflection? Write the conditions for total internal reflection OR (B) A small bulb is placed at the bottom of a tank containing water to a depth of 80 cm. What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 4/3.	2
	SECTION C	
22.	(A)Which two of the following lenses L_1, L_2 and L_3 will you select as objective and eyepiece for constructing best possible (i) telescope, (ii) microscope? Give reason to support your answer.	3

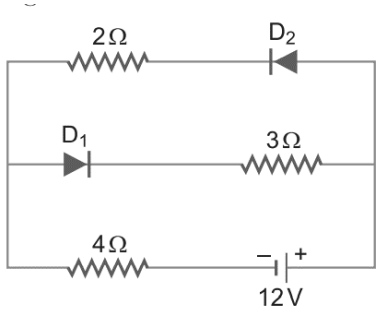
Lens	Power (P)	Aperture (A)
L_1	6 D	1
L_2	3 D	8

	L_3 | 10 D | 1 (B) In a Young's double-slit experiment the fringe width is found to be 0.4 mm. If the whole apparatus is dipped in water of refractive index 4/3, without disturbing the arrangement, Find the value of new fringe width.	
23.	An ac source of voltage $V = V_0 \sin \omega t$ is connected to a series combination of L, C and R. Use the phasor diagram to obtain expressions for impedance of the circuit and phase angle between voltage and current.	3
24.	Find the magnitude and direction of current in 1Ω resistor in the given circuit. 	3
25.	Define wave front. What is the shape of the wavefront in each of the following cases (i) light diverging from a point source. (ii) light emerging out of a convex lens when a point source is placed at its focus.	3
26.	(A) Show that energy of electron in Bohr's orbit is inversely proportional to square of principle quantum number. OR (B) The energy levels of an atom of element X are shown in the diagram. Which one of the level transitions will result in the emission of photons of wavelength 620 nm? Support your answer with mathematical calculations. 	3
27.	State Gauss's law derive an expression for electric field due to an infinite charged plane	3

	sheet	
28.	Why do stable nuclei never have more protons than neutrons? The figure shows the plot of binding energy (BE) per nucleon as a function of mass number A. The letters A, B, C, D and E represent the positions of typical nuclei on the curve. Point out, giving reasons, the two processes (in terms of A, B, C, D and E), one of which can occur due to nuclear fission and the other due to nuclear fusion.  	3
	SECTION D **Case Study Based Questions**	
29.	**Read the following paragraph and answer the questions that follow.** An optical fibre is a thin rod of high-quality glass. Light/infrared getting in at one end undergoes repeated total internal reflection and emerges at the other end. Optical Fibre is wave guided die – electric cable which non-conducting in nature used to data transmission using light pulses travelling in it. It transmits the light without any loss of energy. From one place to another for longer as well as for a shorter distance.  In optical fibre cable light pulses bounce back and transmit from one place to	

	another with any loss in the energy of light. Basically bounce back of light is the phenomena of Reflection of light in the same medium and happens without any loss. We can say Optical Fibre works on the principle of total internal reflections. It is a power full Phenomena which is used in optical fibre cable to transmit data from one place to another place.	
	(i) On which principle, optical fibre works? (a) refraction of light (b) interference of light (c) diffraction of light (d) total internal reflection of light	1
	(ii) The refractive indices of core is (a) equal to cladding (b) more than cladding (c) less than cladding (d) none of the above	1
	(iii) Write two examples similar to optical fibre which are also working on the principle of total internal reflection. (a) Mirage, endoscopy (medical diagnostic tool) (b) Mirage, MRI (medical diagnostic tool) (c) Mirage and X-ray (medical diagnostic tool) (d) brilliance of diamond and ECG (medical diagnostic tool)	1
	(iv) An optical fiber system is designed for efficient data transmission. If a system uses a fiber with a core refractive index of n_1=1.53 and a cladding with an index of n_2. The possible value of n_2 is. (a) 1.63 (b) 1.58 (c) 1.48 (d) 1.65	1
30.	**Read the following paragraph and answer the questions that follow.** Electromagnetic induction finds many applications such as in electrical components which includes transformers, inductors, and other devices such as electric motors and generators. An inductor is a passive component that is used in most power electronic circuits to store energy in the form of magnetic energy when electricity is applied to it. When a current begins to flow through a coil of wire, it undergoes an opposition to its flow in addition to the resistance of the metal wire. On the other hand, when an electric circuit carrying a steady current and containing a coil is suddenly opened, the collapsing, and hence diminishing, magnetic field causes an induced electromotive force that tends to maintain the current and the magnetic field and may cause a spark between the contacts of the switch.	
	(i) Why does a spark appear when a current-carrying circuit with a coil is suddenly	1

	opened?	
	(ii) What is the basic principle behind the working of electric generators and transformers?	1
	(iii) Two spherical bobs, one metallic and the other of glass, of the same size are allowed to fall freely from the same height above the ground. Which of the two would reach earlier and why?	2
	SECTION E	
31.	(a) Show that the potential energy of a dipole making angle θ with the direction of the field is given by U = - $\vec{P}.\vec{E}$. Hence find out the amount of work done in rotating it from the position of unstable equilibrium to the stable equilibrium. (b) Plot a graph comparing the variation of potential V and electric field E due to a point charge Q as a function of distance R from the point charge.	5
	OR (a) An infinitely long positively charged straight wire has a linear charge density λ Cm^{-1}. An electron is revolving around the wire as its centre with a constant velocity in a circular plane perpendicular to the wire. Deduce the expression for its kinetic energy. (b) Plot a graph of the kinetic energy as a function of charge density λ. (c) Five point charges, each of charge +q are placed on five vertices of a regular hexagon of side '*l*'. Find the magnitude of the resultant force on a charge – q placed at the centre of the hexagon.	
32.	(a) Derive an expression for the force per unit length between two long straight parallel current carrying conductors. Hence define SI unit of current (ampere). (b) Draw graphs showing dependence of (i) F on I_1, I_2 when d is kept constant (ii) F on d when the product I_1 I_2 is maintained at a constant positive value.	5
	OR (a) What is working principle moving coil galvanometer. Show that deflection in galvanometer is directly proportional to current flowing through coil. (b) A galvanometer coil has a resistance of 12 Ω and the meter shows full scale deflection for a current of 3 mA. How will you convert the meter into a voltmeter of range 0 to 18 V?	

33.	(a) Explain how the width of depletion layer in a p-n junction diode changes when the junction is (i) forward biased (ii) reverse biased. (b) Draw V – I characteristics of a p–n junction diode. Answer the following questions, giving reasons: (i) Why is the current under reverse bias almost independent of the applied potential upto a critical voltage? (ii) Why does the reverse current show a sudden increase at the critical voltage?	5
	OR (a) Explain the working of P-N junction diode as a full wave rectifier. (b) The circuit shown in the figure has two oppositely connected ideal diodes connected in parallel. Find the current flowing through each diode in the circuit.  (c) A p-n junction diode is damaged by a strong current, why?	

BRAIN INTERNATIONAL SCHOOL

PRACTICE PAPER -2 (2025-26)
SUBJECT: - PHYSICS (042)

Time: 3 Hr	Class – XII	M.M 70

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $e = 1.6 \times 10^{-19}$ C
iv. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A}^{-1}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION A

Q1. The temperature (T) dependence of resistivity of materials A and material B is represented by fig (i) and fig (ii) respectively. Identify material A and material B.

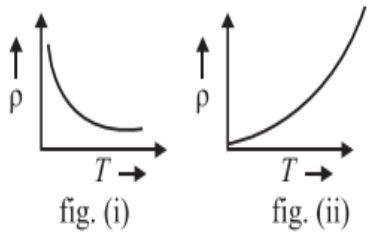


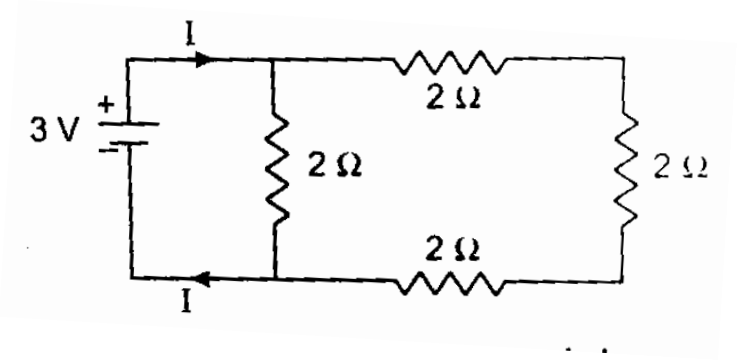
fig. (i) fig. (ii)

(A) Material A is copper and material B is germanium
(B) Material A is germanium and material B is copper
(C) Material A is nichrome and material B is germanium
(D) Material A is copper and material B is nichrome.

Q2. Electric field 'E' at a point situated at a normal distance 'r' from an infinitely long uniformly charged straight wire is proportional to 1

(A) $E \propto r$ (B) $E \propto 1/r$ (C) $E \propto 1/r^2$ (D) $E \propto 1/r^3$

Q3. What is the value of current I shown in the following figure? 1



(A) 2A (B) 1.2A (C) 1A (D) 0.5A

Q4. The magnetic field $\overrightarrow{dB}$ due to a small current element $\overrightarrow{dl}$ carrying a current I at a distance $\vec{r}$ is given as 1

(A) $\overrightarrow{dB} = \frac{\mu_0}{4\pi} I \left[\frac{\overrightarrow{dl} \times \vec{r}}{r}\right]$ (B) $\overrightarrow{dB} = \frac{\mu_0}{4\pi} I^2 \left[\frac{\overrightarrow{dl} \times \vec{r}}{r}\right]$

(C) $\overrightarrow{dB} = \frac{\mu_0}{4\pi} I^2 \left[\frac{\overrightarrow{dl} \times \vec{r}}{r^2}\right]$ (D) $\overrightarrow{dB} = \frac{\mu_0}{4\pi} I \left[\frac{\overrightarrow{dl} \times \vec{r}}{r^3}\right]$

Q5. A coil of 100 turns carries a current of 5A and creates a magnetic flux of 10^{-5}Tm^2 per turn. The value of its inductance is 1

(A) 0.05mH (B) 0.10mH (C) 0.15mH (D) 0.20Mh

Q6. An ac circuit consist of an inductor of inductance 0.5 H and a capacitor of capacitance 8μF in series. The current in the circuit is maximum when the angular frequency of AC source is 1

(A) 500 rads^{-1} (B) 4000 rads^{-1} (C) 5000 rads^{-1} (D) 2 x 10^6 rads^{-1}

Q7. A convex lens of focal length 30 cm produces 5 times magnified real image of an object. The object distance is 1

(A) 36cm (B) 25cm (C) 180cm (D) 150cm

Q8. For an incidence angle Θ on an equilateral prism of reflective index √3, the refracted ray is parallel to the base of the prism. The value of incidence angle Θ is 1

(A) 30° (B) 45° (C) 60° (D) 75°

Q9. In a certain double – slit experiment arrangement, interference fringes of widths 1.0 mm each are observed on a screen when light of wavelength 500nm is used. Keeping the setup same, if we use light of wavelength 600nm, the fringe width will be 1

(A) 1.0mm (B) 0.83mm (C) 1.2mm (D) 1.44mm

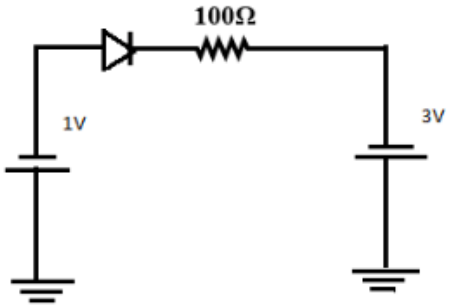
Q10. In a single - slit diffraction pattern, the distance between the first minimum on the left and the first minimum on the right is 5mm. The screen on which the diffraction pattern is displayed is at distance of 1.0 m from the slit and the wavelength of light 600nm. The slit width is 1

(A) 0.12mm (B) 0.24mm (C) 0.36mm (D) 0.40mm

Q11. Radiation of two photons, having photon energy 2 times and 5 times of work function for a metal respectively, are incident successively on the metal surface, the ratio of minimum velocity of photoelectrons emitted in the two cases will be 1

(A) 1:1 (B) 1:2 (C) 1:3 (D) 1:4

Q12. Figure given below shows a circuit having an ideal PN junction. Current flowing in the circuit is: 1



(A) zero (B) 10mA (C) 20mA (D) 30mA

For Questions 13 to 16, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

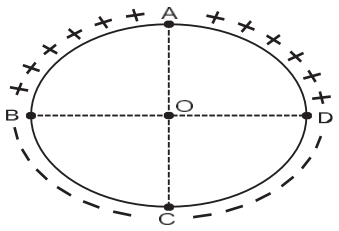
a) Both A and R are true and R is the correct explanation of A
b) Both A and R are true and R is NOT the correct explanation of A
c) A is true but R is false
d) A is false and R is also false

Q13. Assertion (A): Propagation of light through an optical fibre is due to total internal reflection taking place at the core-cladding interface.

Reason (R): Refractive index of the material of the cladding of the optical fibre is greater thanthat of the core. 1

Q14. Assertion(A): Equal amount of positive and negative charges are distributed uniformly on two halves of a thin circular ring as shown in the figure. The resultant electric field at the centre O of the ring is along OC.

Reason (R): It is so because the net potential at O is not Zero. 1



Q15. Assertion (A): The energy of a charged particle moving in a magnetic field does not change.

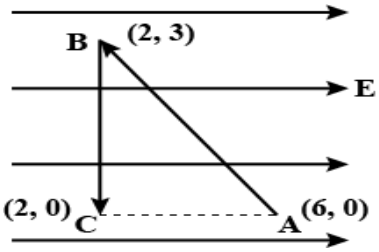
Reason (R) : It is because the work done by the magnetic force on the charge moving in a magnetic field is zero . 1

Q16. Assertion (A): For three-point charges to be in equilibrium, they must be collinear.

Reason(R): One of the three charges must have different polarity than rest of the two.

SECTION – B

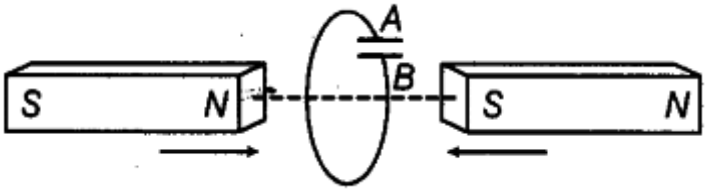
Q17. A test charge ‘q’ is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in figure.



A. Calculate the potential difference between A and C.

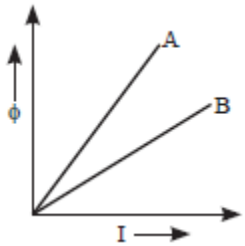
B. At which point (of the two) is electric potential more and why? 2

Q18. (I) Predict the polarity of the capacitor in the situation described by given figure. Explain the reason too. 2



OR

Q18, (II)A plot of magnetic flux (ϕ) versus current (I) is shown in the figure for two inductors 'A' and 'B'. Which of the two has large value of self-inductance? 2



Q19. A telescope consists of an objective of focal length 150cm and an eyepiece of focal length 6.0cm. If the final image is formed at infinity, then calculate 1+1

(A)the length of the tube in this adjustment, and

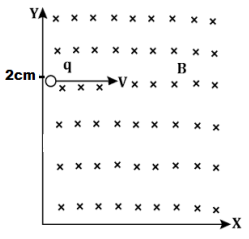
(B)the magnification produced

Q20. In a single – slit diffraction, explain why the maximum at diffraction angle $\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{a}$ becomes weaker as n increases. 2

Q21. The amplitude of the magnetic field of a plane electromagnetic wave propagating along positive X axis in vacuum is 510 nT$\hat{k}$ and its angular frequency is 60 x 10^6 rad/sec. Write the expression for the electric field ($\vec{E}$). 2

SECTION C

Q22(I). If a point sized object having charge 1C and mass 1g is projected with velocity of $2\hat{\imath}$ m/s from a point (0,2cm,0) in the region of magnetic field -0.1$\hat{k}$ T which spreads in the first quadrant. 1+1+1



(A) What will be the shape of the path followed by the given charged particle?

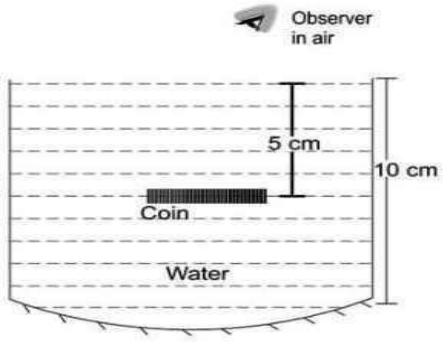
(B) At what point it will cross the X-axis?

(C) What will be the kinetic energy of particle when it will enter in the fourth quadrant?

Q23. (I) Define current sensitivity of a galvanometer and write an expression for it. How can it be enhanced?

(II) A moving coil galvanometer of resistance RG gives its full-scale deflection when a current Ig flows through it coil. It can be converted into an ammeter of range 0 to I (I > Ig) when a shunt of resistance S is connected across its coil. If this galvanometer is converted into an ammeter of range 0 to 2I, find the expression for the shunt required in terms of S and RG.
1+2

Q24. A glass beaker of height 10 cm, completely filled with water (refractive index = 4/3), has a curvedbottom which is silvered as shown above. A plastic coin remains submerged in water at a depth of 5 cm from the top of the beaker. An observer sees the coin in the water and its image in the mirror. If the image formed by the curved mirror is seen by the observer at a distance of 15 cm from the surface of the water, what is the focal length of the curved surface? (Assume the silvered curved surface acts as a spherical mirror.) 3



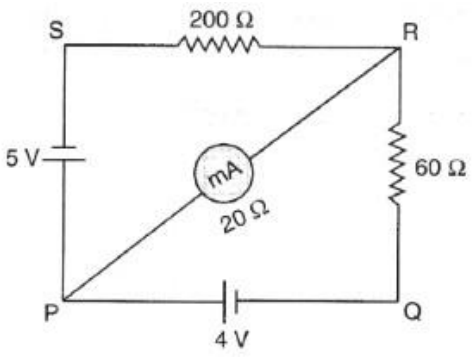
Q25. A cylindrical conductor of length l and cross-section area A is connected to a DC source. Under the influence of electric field set up due to source, the free electrons begin to drift in the opposite direction of the electric field. 1+2

(A)Draw the curve showing the dependency of drift velocity on relaxation time.

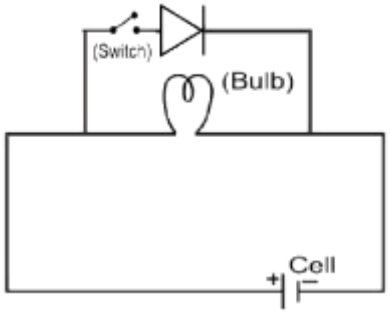
(B)If the DC source is replaced by a source whose current changes its magnitude with time such that I = Io sin 2πνt , where ν is the frequency of variation of current, then determine the average drift velocity of the free electrons over one complete cycle.

Q26. State Kirchhoff's second law. ` 1+2

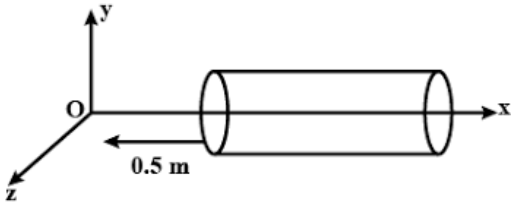
The network PQRS, shown in the circuit diagram, has the batteries of 4 V and 5 V and negligible internal resistance. A milliammeter of 20 Ω resistance is connected between P and R. Calculate the reading in the milliammeter.



Q27. (A) Draw the energy band diagram for P-type semiconductor at (i) T=0K and (ii) room temperature.
(B)In the given diagram considering an ideal diode, in which condition will the bulb glow (i) when the switch is open (ii) when the switch is closed Justify your answer. 2+1



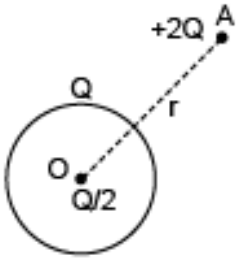
Q28. (I) A hollow cylindrical box of length 1m and area of cross section $25cm^2$ is placed in a three-dimensional coordinate system. The electric field in the region is given by $\vec{E} = 50x\vec{i}$, where E is in NC^{-1} and x is in metres. 2+1



Find
(A)Net flux through the cylinder
(B)Charge enclosed by the cylinder.

OR

(II)A thin metallic spherical shell of radius 'R' carries a charge Q on its surface. A point charge Q/2 is placed at the centre 'O' and another charge +2Q is placed outside the shell at A at a distance 'r' from the centre as shown in the figure. 2+1



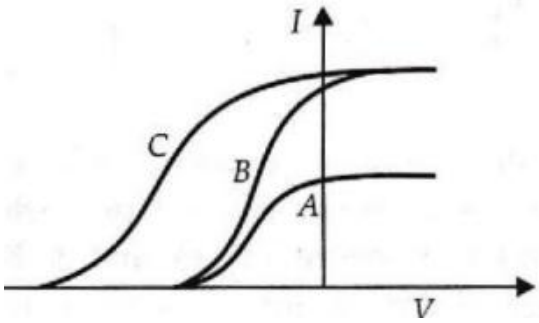
(A) Find the electric flux through the shell.
(B) Find the force on the charges at the centre 'O' of the shell and at the point

SECTION – C

Case Study: Read the following paragraph and answer the questions 4+4

Q29. It is the phenomenon of emission of electrons from a metallic surface when light of a suitable frequency is incident on it. The emitted electrons are called photoelectrons.
Nearly all metals exhibit this effect with ultraviolet light but alkali metals like lithium, sodium, potassium, caesium etc. show this effect even with visible light. It is an instantaneous process i.e. photoelectrons are emitted as soon as the light is incident on the metal surface. The number of photoelectrons emitted per second is directly proportional to the intensity of the incident radiation. The maximum kinetic energy of the photoelectrons emitted from a given metal surface is independent of the intensity of the incident light and depends only on the frequency of the incident light. For a given metal surface there is a certain minimum value of the frequency of the incident light below which emission of photoelectrons does not occur.

(I)In a photoelectric experiment plate current is plotted against anode potential.



(A) A and B will have same intensities while B and C will have different frequencies
(B) B and C will have different intensities while A and B will have different frequencies
(C) A and B will have different intensities while B and C will have equal frequencies
(D) B and C will have equal intensities while A and B will have same frequencies.

(II) Photoelectrons are emitted when a zinc plate is
(A)heated (B) hammered
(C) irradiated by ultraviolet light (D) subjected to a high pressure.

(III) The threshold frequency for photoelectric effect on sodium corresponds to a wavelength of 500 nm. Its work function is about
(A) $4x10^{-19}$ J (B) 1 J (C) $2x10^{-19}$ J (D) $3x10^{-19}$ J

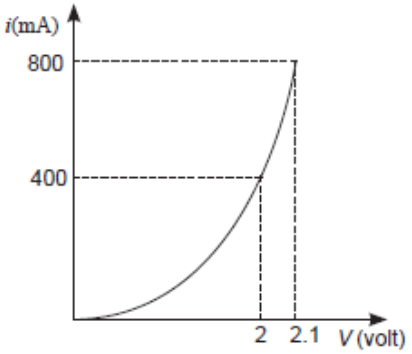
(IV) The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6 eV fall on it is 4 eV. The stopping potential is
(A)2 V (B) 4 V (C) 6 V (D) 10 V

OR

(V) The minimum energy required to remove an electron from a substance is called its
(A)work function (B) kinetic energy
(C) stopping potential (D) potential energy.

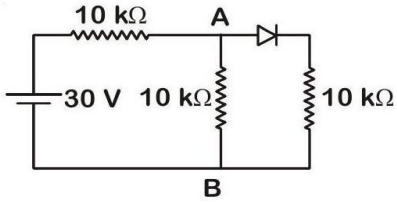
Q30. When an external voltage is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal it is said to be forward biased. The applied voltage mostly drops across the depletion region and the voltage drop across the p-side and n-side of the junction is negligible. When an external voltage is applied across the diode such that n-side is positive and p-side is negative, it is said to be reverse biased. The applied voltage mostly drops across the depletion region.

(I) The I-V characteristic of a p-n junction diode is shown below. The approximate dynamic resistance of the p-n junction when a forward bias of 2 volt is applied



(A) 1 Ω (B) 0.25 Ω (C) 0.5 Ω (D) 5 Ω

(II) In the figure, potential difference between A and B is



(A) Zero (B) 5V (C) 10 V (D) 15 V

(III) Electrical conductivity of a semiconductor
(A) decreases with the rise in its temperature.
(B) increases with the rise in its temperature.
(C) does not change with the rise in its temperature.
(D) first increases and then decreases with the rise in its temperature.

(IV) When a p-n junction is forward biased, then
(A) only diffusion current flows.
(B) both diffusion current and drift current flow but diffusion current is more than drift current.
(C) only drift current flows.
(D) both diffusion and drift current flow but drift current exceeds the diffusion current.

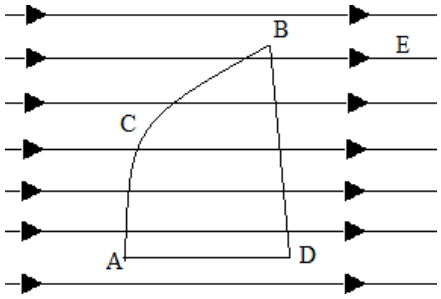
OR

(V) In a p-type semiconductor, there is
(A) excess of one electron. (B) absence of one electron.
(C) a missing atom. (D) a donor level.

SECTION – D

Q31(I) (A) If a charge of 1μC is placed at the origin and another charge of 3 μC placed at the point (20m,0m,0m) in an external uniform electric field of 40V/m $\hat{\imath}$ with the electric potential at origin to be zero. Find the electrical potential energy of system.

(B) If one charge particle is moved from A to C to B and another charge particle of equal magnitude is moved from A to D to B, In uniform external electric field then for which charge particle more work will be needed and why?



(C) Electrostatic potential is constant throughout the volume of conductor why? 2+2+1

OR

Q31. (II) (A) A dielectric slab of thickness t, is introduced between the plates of parallel plate capacitor of area A and separation d (where t<d). Find an expression for the capacitance with the dielectric slab.

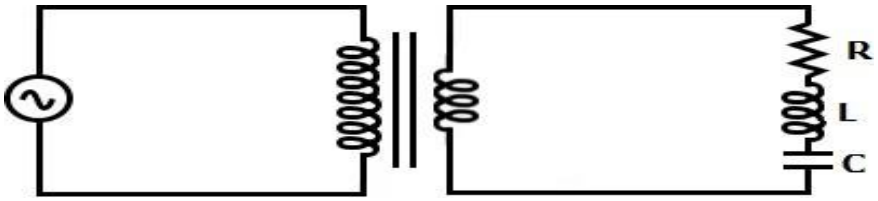
(B)A copper sphere of capacitor C is dropped in ocean. Will the capacitance of the sphere increase, decrease or remain same? Justify.

(C)A capacitor is connected across a source of potential difference V and then the separation ‘d’ between the plates is increased using insulating stick. Plot ‘V’ vs ‘d’ graph for the given capacitor
3+1+1

Q32.(I) (A) A series LCR circuit with R = 20Ω, L = 2H and C = 50μF is connected to a 200 volts ac source of variable frequency. What is (i)the amplitude of the current, and (ii) the average power transferred to the circuit in one complete cycle, at resonance? (iii)Calculate the potential drop across the capacitor.
(B) Current in a circuit falls from 5.0A to 10.0A in 0.1s. If an average emf of 200V is induced, give an estimate of the self-inductance of the circuit. 3.5+1.5

OR

Q32 (II)(A) An input potential Vin=200 Sin $100\pi t$ V is provided to an ideal transformer having 1000 turns in primary coil and 100 turns in secondary coil as shown in figure. The load circuit has a resistance of 4Ω, a capacitive reactance of 2Ω and an inductive reactance of 6Ω.



Find:
(i) the output voltage across the load circuit
(ii) the current flowing through the load circuit
(iii) the power supplied to the load circuit by the transformer.

(B)State the working principle of a transformer and explain how it is a key component in the transfer of electrical power over long distances. 3+2

Q33. (I)(A) State Huygen’s principle. Draw the reflected wave front for a plane wave front incident on a plane reflecting surface. Hence verify the laws of reflection using Huygen’s principle.

(B) A planoconvex lens is made of glass of refractive index 1.5. The radius of curvature of the convex surface is 25 cm. Calculate the focal length of the lens. If an object is placed 50cm in front of the lens, find the nature and position of the image formed. 3+2

OR

Q33 (II)(A) Obtain the relation A+δ=i+e for a prism where A is the angle of prism, δ is the angle of deviation, i is the angle of incidence and e is the angle of emergence. Write this relation for the minimum deviation?
(B) If one of the two identical slits producing interference in Young's experiment is covered with glass, so that the light intensity passing through it is reduced to 50%, find the ratio of the maximum and minimum intensity of the fringe in the interference pattern. 3+2