

KENDRIYA VIDYALAYA SANGATHAN TINSUKIA REGION

PRE-BOARD EXAMINATION 2025-26

SUBJECT - PHYSICS (THEORY) CLASS-XII

TIME ALLOWED - 3 HOURS

MAXIMUM MARKS - 70

GENERAL INSTRUCTIONS:

Read the following instructions very carefully and strictly follow them:

- (i) There are 33 questions in all. All questions are compulsory.
- (ii) This question paper comprises FIVE sections - A, B, C, D and E. All sections are compulsory.
- (iii) SECTION - A contains SIXTEEN questions, TWELVE MCQ and FOUR Assertion Reasoning based of ONE 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.
- (iv) There is no overall choice in the question paper. However, an internal choice has been provided in one question in section B, one question in section C, one question of each CBQ in section D and all questions in section E. You have to attempt only one of choices in such questions.
- (v) Use of calculators and log tables is not permitted.
- (vi) You may use the following values of physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ m/s}$$

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

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

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$$

$$1/4\pi\epsilon_0 = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$$

$$\text{Mass of electron (} m_e \text{)} = 9.1 \times 10^{-31} \text{ Kg}$$

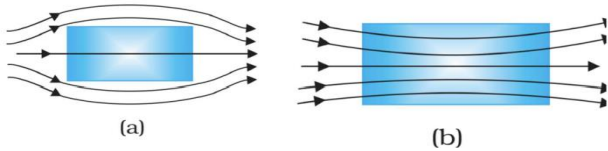
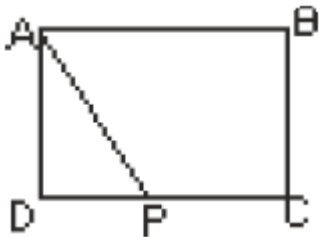
$$\text{Mass of neutron} = 1.675 \times 10^{-27} \text{ kg}$$

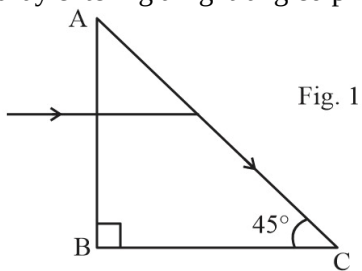
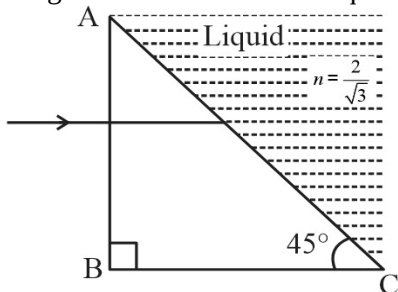
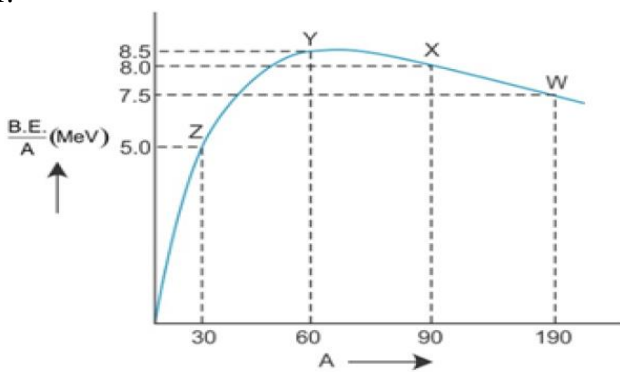
$$\text{Mass of proton} = 1.673 \times 10^{-27} \text{ Kg}$$

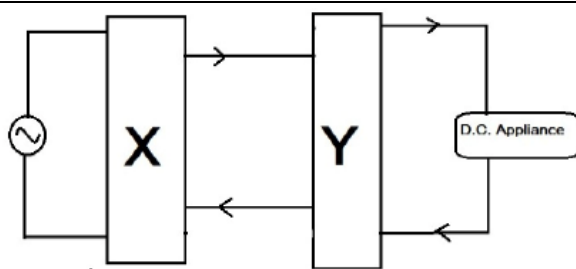
$$\text{Boltzmann constant} = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

QN	SECTION-A	MM
1	If a charge q is placed at the centre of the line joining two equal charges Q such that the system is in equilibrium, then the value of q is (A) $Q/2$ (B) $-Q/2$ (C) $Q/4$ (D) $-Q/4$	1
2	According to Coulomb's law, which is the correct relation for the following figure? (A) $q_1 q_2 > 0$ (B) $q_1 q_2 < 0$ (C) $q_1 q_2 = 0$ (D) $1 > q_1 / q_2 > 0$	1
3	If copper wire is stretched to make its radius decrease by 0.1%, then the percentage change in its resistance is approximately (A) -0.4% (B) $+0.8\%$ (C) $+0.4\%$ (D) $+0.2\%$	1
4	A galvanometer coil has a resistance of 10Ω and the meter shows full scale deflection for a current of 2 mA. A student can convert this galvanometer into an ammeter of range 0 to 5 A by connecting a resistance of (A) 0.004Ω in parallel with the coil. (B) 4Ω in series with the coil. (C) 0.04Ω in parallel with the coil. (D) 0.4Ω in series with the coil.	1
5	A rectangular, a square, a circular and an elliptical loop, all in the (x-y) plane, are moving out of a uniform magnetic field with a constant velocity $\vec{v} = v\hat{i}$. The magnetic field is directed along the negative z-axis direction. The induced emf, during the passage of these loops, out of the field region, will not remain constant for	1

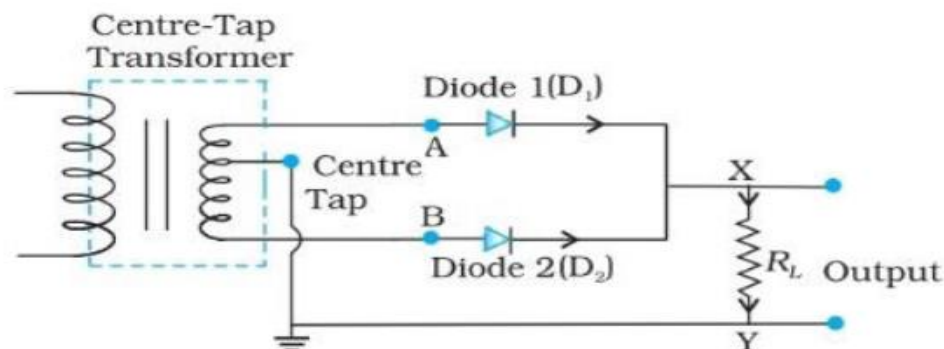
	(A) any of the four loops (C) the rectangular, circular and elliptical loops	(B) the circular and elliptical loops (D) only the elliptical loops	
6	Which of the following gives the direction of the induced e.m.f? (A) Faraday's law (B) Biot-Savart's law. (C) Ampere (D) Lenz's law		1
7	In an LCR series AC circuit, the voltage across each of the components, L, C and R is 50 V. The voltage across the LC combination will be (A) 50 V (B) $50\sqrt{2}$ V (C) 100 V (D) zero		1
8	Which of the following is not the property of an equipotential surface? A) They do not cross each other. B) The work done in carrying a charge from one point to another on an equipotential surface is zero. C) For a uniform electric field, they are concentric spheres. D) They can be imaginary spheres.		1
9	Which of the following statement is NOT true about the properties of electromagnetic waves? (A) These waves do not require any material medium for their propagation (B) Both electric and magnetic field vectors attain the maxima and minima at the same time (C) The energy in electromagnetic wave is divided equally between electric and magnetic fields (D) Both electric and magnetic field vectors are parallel to each other		1
10	Which of the following statements about nuclear forces is not true? (A) The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometres. (B) The nuclear force is much weaker than the Coulomb force. (C) The force is attractive for distances larger than 0.8 fm and repulsive if they are separated by distances less than 0.8 fm. (D) The nuclear force between neutron-neutron, proton-neutron and proton-proton is approximately the same.		1
11	The distance of closest approach of an alpha particle is d when it moves with a speed V towards a nucleus. Another alpha particle is projected with higher energy such that the new distance of the closest approach is $d/2$. What is the speed of projection of the alpha particle in this case? (A) $V/2$ (B) $\sqrt{2}V$ (C) $2V$ (D) $4V$		1
12	How does the focal length of a convex lens changes if mono chromatic red light is used instead of violet light? (A) Focal length is increased when red light is used (B) Focal length is decreased when red light is used (C) Focal length is remain same when red light is used (D) Not depends on color of light.		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 the correct explanation of Assertion. (B) If both Assertion and Reason are true and Reason is not the correct explanation of Assertion. (C) If Assertion is true but Reason is false (D) If both Assertion and Reason are false.		
13	Assertion (A): In a hydrogen atom there is only one electron but its emission spectrum shows many lines. Reason (R): In a given sample of hydrogen there are many atoms each containing one electron; hence many electrons in different atoms may be in different orbits so many transitions from higher to lower orbits are possible.		1

14	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 than that of the core.	1
15	ASSERTION: In an interference pattern observed in Young's double slit experiment, if the separation (d) between coherent sources as well as the distance(D) of the screen from the coherent sources both are reduced to 1/3rd, then new fringe width remains the same. REASON: Fringe width is proportional to (d/D).	1
16	Assertion (A): It is not possible to have interference between the waves produced by two independent light sources. Reason(R): For interference of two waves the phase difference between the two waves must remain constant and frequency must be same.	1
SECTION-B		
17	Two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite signs and of magnitude $17.7 \times 10^{-22} \text{ C/m}^2$. What is electric field intensity E: (a) in the outer region of the first plate, and (b) between the plates?	2
18	A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds to a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is 27.0°C and the temperature coefficient of resistance of nichrome is $1.70 \times 10^{-4} ^\circ\text{C}^{-1}$?	2
19	What is the nuclear radius of ^{125}Fe , if that of ^{27}Al is 3.6 fermi? OR The short wavelength limit for the Lyman series of the hydrogen spectrum is $913.4 \text{ \AA}$. Calculate the short wavelength limit for the Balmer series of the hydrogen spectrum.	2
20	A uniform magnetic field gets modified as shown in figure when two specimens 'a' and 'b' are placed in it.  (i) Identify the specimen 'a' and 'b'. (ii) How is the magnetic susceptibility of specimen 'a' different from that of specimen 'b'?	2
21	Electromagnetic waves with wavelength (i) λ_1 is suitable for radar systems used in aircraft navigation. (ii) λ_2 is used to kill germs in water purifiers. (iii) λ_3 is used to improve visibility in runways during fog and mist conditions. Identify and name the part of the electromagnetic spectrum to which these radiations belong. Also arrange these wavelengths in ascending order of their magnitude.	2
SECTION-C		
22	A wire of uniform cross-section and resistance 4 ohm is bent in the shape of square ABCD. Point A is connected to a point P on DC by a wire AP of resistance 1 ohm. When a potential difference is applied between A and C, the points B and P are seen to be at the same potential. What is the resistance of the part DP? 	3

23	A boy is holding a smooth, hollow and non-conducting pipe vertically with charged spherical ball of mass 10 g carrying a charge of +10 mC inside it which is free to move along the axis of the pipe. The boy is moving the pipe from East to West direction in the presence of magnetic field of 2T. With what minimum velocity, should the boy move the pipe such that the ball does not move along the axis. Also determine the direction of the magnetic field.	3
24	Define mutual inductance between two long coaxial solenoids. Find out the expression for the mutual inductance of inner solenoid of length l having the radius r_1 and the number of turns n_1 per unit length due to the second outer solenoid of same length and n_2 number of turns per unit length.	3
25	(I) State Huygens' principle and prove the laws of reflection on the basis of wave theory. OR (II) Write two distinguishing features between a diffraction pattern due to a single slit and the interference fringes produced in Young's double slit experiment? Why is the diffraction of sound wave more evident in daily experience than that of light wave	3
26	A light ray entering a right-angled prism undergoes refraction at the face AC as shown in Fig. 1.  Fig. 1 (I) What is the refractive index of the material of the prism in Fig. 1? (II) (a) If the side AC of the above prism is now surrounded by a liquid of refractive index $\frac{2}{\sqrt{3}}$ as shown in Fig. 2, determine if the light ray continues to graze along the interface AC or undergoes total internal reflection or undergoes refraction into the liquid.  Fig. 2 (b) Draw the ray diagram to represent the path followed by the incident ray with the corresponding angle values. (Given, $\sin^{-1}(\frac{\sqrt{2}}{\sqrt{3}}) = 54.6^\circ$)	3
27	Binding energy per nucleon vs mass number curve for nuclei is shown in the figure. W, X, Y and Z are four nuclei indicated on the curve. Identify which of the following nuclei is most likely to undergo (i) Nuclear Fission (ii) Nuclear Fusion. Justify your answer. 	3
28	(I) Identify the circuit elements X and Y as shown in the given block diagram and draw the output waveforms of X and Y.	3



(II) If the centre tapping is shifted towards Diode D₁ as shown in the diagram, draw the output waveform of the given circuit.

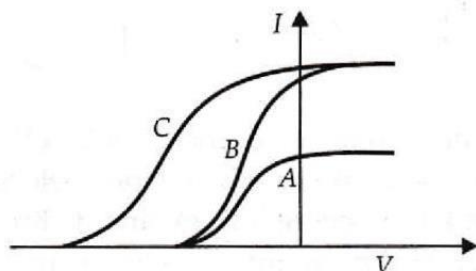


SECTION-D

29 Case Study Based Question: Photoelectric effect

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, cesium 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) 4×10^{-19} J (B) 1 J (C) 2×10^{-19} J (D) 3×10^{-19} J

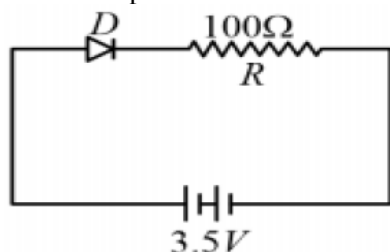
(IV) The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6 eV fall on it is 4 eV. The stopping potential is

- (A) 2 V (B) 4 V (C) 6 V (D) 10 V

OR

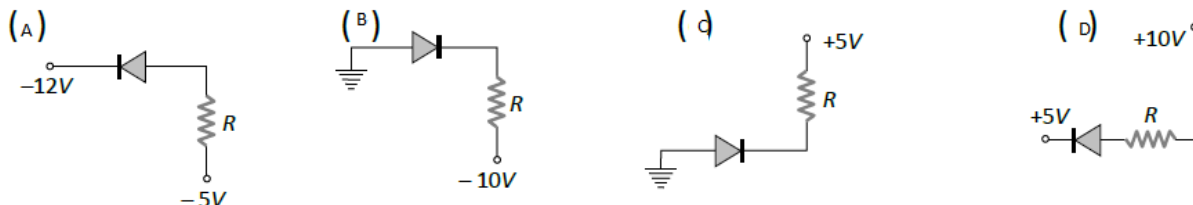
The minimum energy required to remove an electron from a substance is called its
 (A) work function (B) kinetic energy (C) stopping potential (D) potential energy

- 30 Read the following paragraph and answer the questions that follow:
 A semiconductor diode is basically a pn junction with metallic contacts provided at the ends for the application of an external voltage. It is a two terminal device. 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. 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.
 An ideal diode is one whose resistance in forward biasing is zero and the resistance is infinite in reverse biasing. When the diode is forward biased, it is found that beyond forward voltage called knee voltage, the conductivity is very high. When the biasing voltage is more than the knee voltage the potential barrier is overcome and the current increases rapidly with increase in forward voltage. When the diode is reverse biased, the reverse bias voltage produces a very small current about a few microamperes which almost remains constant with bias. This small current is reverse saturation current.
 (i) In the given figure, a diode D is connected to an external resistance $R = 100\ \Omega$ and an emf of 3.5 V . If the barrier potential developed across the diode is 0.5 V , the current in the circuit will be:



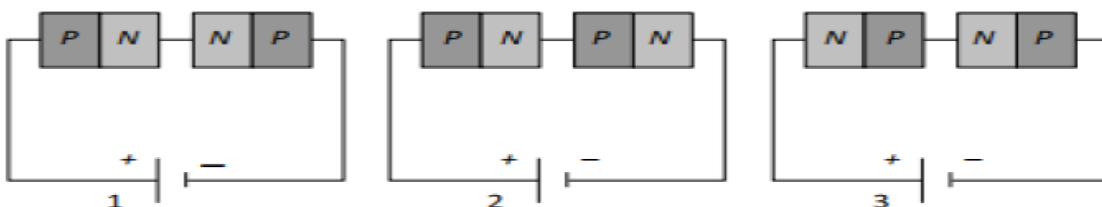
- (A) 40 mA (B) 20 mA (C) 35 mA (D) 30 mA

- (ii) In which of the following figures, the pn diode is reverse biased?



- (iii) Based on the V-I characteristics of the diode, we can classify diode as
 (A) bilateral device (B) ohmic device (C) non-ohmic device (D) passive element
 OR

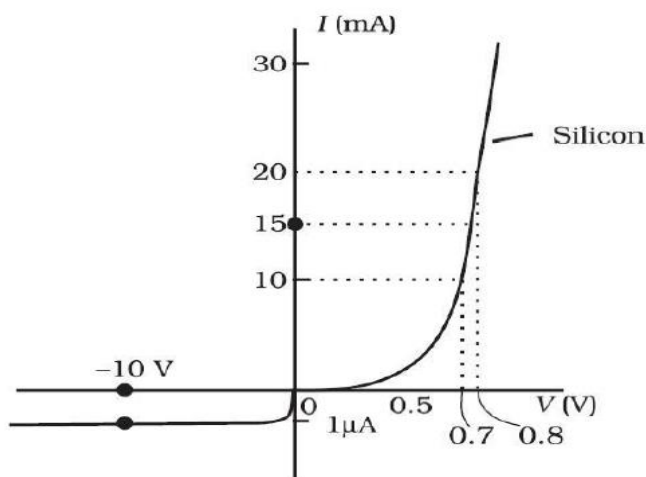
Two identical PN junctions can be connected in series by three different methods as shown in the figure. If the potential difference in the junctions is the same, then the correct connections will be



- (A) in the circuits (1) and (2) (B) in the circuits (2) and (3)

(C) in the circuits (1) and (3)
(iv)

(D) only in the circuit (1)

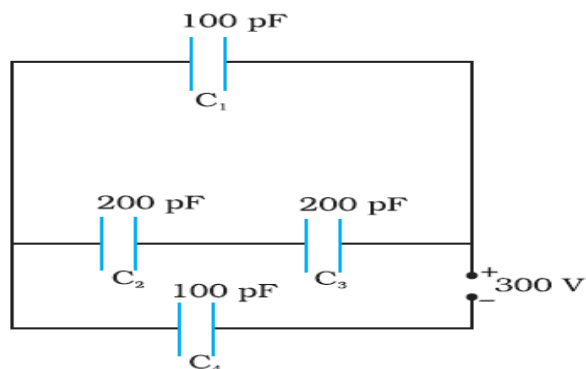


The V-I characteristic of a diode is shown in the figure. The ratio of the resistance of the diode at $I = 15 \text{ mA}$ to the resistance at $V = -10 \text{ V}$ is

- (A) 100 (B) 10^6 (C) 10 (D) 10^{-6}

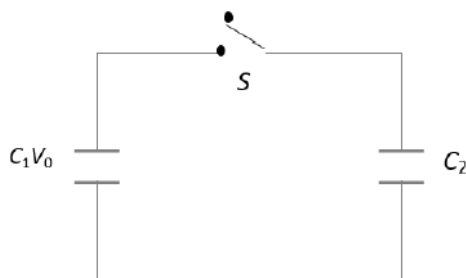
SECTION - E

- 31 i) Derive an expression for the capacitance of a parallel plate capacitor with air present between the two plates.
ii) Obtain the equivalent capacitance of the network shown in figure. For a 300 V supply, determine the charge on each capacitor.



OR

- i) A dielectric slab of thickness ' t ' is kept between the plates of a parallel plate capacitor with plate separation ' d ' ($t < d$). Derive the expression for the capacitance of the capacitor.
ii) A capacitor of capacity C_1 is charged to the potential of V_0 . On disconnecting with the battery, it is connected with an uncharged capacitor of capacity C_2 as shown in the adjoining figure. Find the ratio of energies before and after the connection of switch S .



32	(I) With the help of a labelled diagram, explain briefly, the basic principle of the working of an a.c. generator. In an a.c. generator, coil of N turns and area A is rotated at an angular velocity ω in a uniform magnetic field B. Derive an expression for the instantaneous value of the emf induced in coil. What is the source of energy generation in this device? OR (II) a) With the help of a diagram, explain the principle of a device which changes a low ac voltage into a high voltage . Deduce the expression for the ratio of secondary voltage to the primary voltage in terms of the ratio of the number of turns of primary and secondary winding. For an ideal transformer, obtain the ratio of primary and secondary currents in terms of the ratio of the voltages in the secondary and primary coils. b) Write any two sources of the energy losses which occur in actual transformers. c) A step-up transformer converts a low input voltage into a high output voltage. Does it violate law of conservation of energy? Explain.	5
33	(a) Draw the ray diagram showing refraction of ray of light through a glass prism. Derive the expression for the refractive index 'n' of the material of prism in terms of the angle of prism A and angle of minimum deviation δ_m. (b) A bright point source is placed at the bottom of a tank containing a transparent liquid of refractive index n to a height h. Let R be the radius of the circular area of the liquid surface through which light can emerge out. Find the ratio (R/h). OR (II) A compound microscope consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 15 cm. How far from the objective should an object be placed in order to obtain the final image at a) the least distance of distinct vision (25 cm) and b) infinity? What is the magnifying power of the microscope in each case?	5