

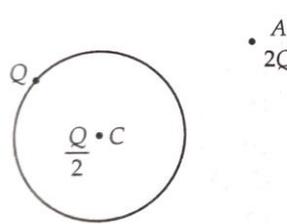
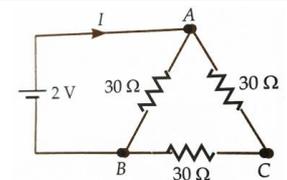
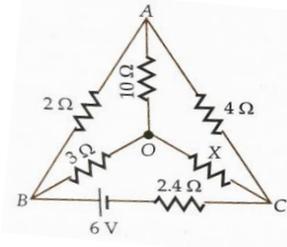
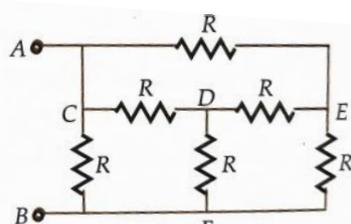
**KENDRIYA VIDYALAYA SANGATHAN, ERNAKULAM REGION****PRE-BOARD EXAMINATION 2025 - 26****CLASS: XII****SUBJECT: PHYSICS (042)****Time: 3 HRS****M.M: 70****General Instructions:**

- (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 **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 calculator 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.  $m_p = 1.7 \times 10^{-27}$  kg
  - iv.  $e = 1.6 \times 10^{-19}$  C
  - v.  $\mu_0 = 4\pi \times 10^{-7}$  T m A<sup>-1</sup>
  - vi.  $h = 6.63 \times 10^{-34}$  J s
  - vii.  $\epsilon_0 = 8.854 \times 10^{-12}$  C<sup>2</sup>N<sup>-1</sup>m<sup>-2</sup>
  - viii. Avogadro's number =  $6.023 \times 10^{23}$  per gram mole

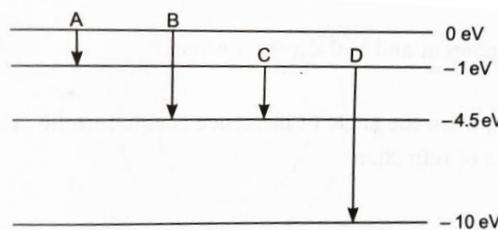
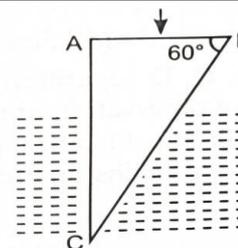
**SECTION-A**

Q. No	Question	Marks
1.	A metallic hemisphere of radius 'r' is placed in a region having a uniform electric field 'E' perpendicular to its cross section. The electric flux 'ϕ' passing through the curved surface is: (A) $\frac{2}{3}\pi r^3 E$ (C) $\pi r^2 E$ (B) $2\pi r E$ (D) $2\pi r^2 E$	1
2	At an axial point, distance 'r' away from the centre of an electric dipole, the electric potential is proportional to: (A) $r^{-1}$ (C) $r$ (B) $r^{-3}$ (D) $r^{-2}$	1
3	Which of the following is wrong? Resistivity of a conductor is : (A) Independent of temperature (C) inversely proportional to temperature (B) Independent of dimensions of conductor (D) less than resistivity of a semiconductor	1
4	A thin circular wire carrying a current 'I', has a magnetic moment 'M'. The shape of a wire is changed into a square and it carries the same current. It will have a magnetic	1

	moment: (A) $\frac{4M}{\pi^2}$ (B) $\frac{\pi M}{4}$	(C) $M$ (D) $\frac{4M}{\pi}$	
5	A coil having 500 square loops of 10 cm is placed normal to magnetic field which increases at the rate of 1 T/s. The induced e.m.f is : (A) 0.1 V (B) 1 V	(C) 0.5 V (D) 5 V	1
6	In an a.c circuit, an alternating voltage $E=200\sqrt{2} \sin 100t$ (in volt) is connected to a capacitor of capacitance $1\mu\text{F}$ . The r.m.s value of the current in the circuit is: (A) 10 mA (B) 100 mA	(C) 20 mA (D) 200 mA	1
7	A capacitor of capacitance $\frac{10^{-4}}{\pi}$ F, an inductor of inductance $\frac{2}{\pi}$ H and a resistor of resistance $100 \Omega$ are connected to form a series RLC circuit. When an AC supply of 220 V, 50 Hz is applied to the circuit, determine the impedance of the circuit: (A) $14.14 \Omega$ (B) $200 \Omega$	(C) $141.4 \Omega$ (D) $100 \Omega$	1
8	Which of the following has maximum penetrating power? (A) Ultraviolet radiation (B) Gamma rays	(C) Microwaves (D) Radio waves	1
9	A convex lens forms a real image of a point object kept 0.5 m away from it, on the other side of the lens 0.5 m away from it. A convex mirror is now placed on the mid-point between the lens and the image. If the image formed now coincides with the object, then the focal length of the mirror is: (A) 1 m (B) 0.125 m	(C) 50 cm (D) 25 cm	1
10	In a Young's double slit experiment, the width of one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit width. Find the ratio of the maximum to the minimum intensity in the interference pattern. (A) 4:1 (B) 3:1	(C) 2:1 (D) 1:4	1
11	Calculate the short and long wavelength limits of Lyman series in H-atom. (A) $\frac{1}{R}$ and $\frac{4}{3R}$ (B) $\frac{2}{R}$ and $\frac{3}{4R}$	(C) $\frac{4}{3R}$ and $\frac{1}{R}$ (D) $\frac{R}{2}$ and $\frac{4R}{3}$	1
12	One a.m.u is equal to: (A) 931 MeV (B) $1.66 \times 10^{-27}$ Kg	(C) $1.49 \times 10^{-10}$ J (D) all of the above	1
	<p><b>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.</b></p> <p>(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.            (B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.            (C) Assertion is true but Reason is false.            (D) Both Assertion and Reason are false.</p>		
13	<p><b>Assertion (A):</b> For a charged particle moving from point P to point Q, the net work done by an electrostatic field on the particle is independent of the path connecting point P to point Q</p> <p><b>Reason (R):</b> The net work done by a conservative force on the object moving along a closed loop is zero.</p>		1
14	<p><b>Assertion (A):</b> When a source of light is placed at the focus of a paraboloidal mirror,</p>		1

	the reflected beam is accurately parallel. <b>Reason (R):</b> Paraboloidal mirrors are used in astronomical telescopes.	
15	<b>Assertion (A):</b> The separation between the light sources should be as small as possible in Young's double slit experiment <b>Reason (R):</b> The fringe width will be very small if the separation of the light sources is large.	1
16	<b>Assertion (A):</b> Electron in an atom are held by Coulombian forces <b>Reason (R):</b> The atom is stable because the centripetal force due to Coulomb's law is balanced by the centrifugal force	1
<b>SECTION-B</b>		
17	A thin metallic spherical shell of radius 'R' carries a charge 'Q' on its surface. A point charge $\frac{Q}{2}$ is placed at the centre C and another charge +2Q is placed outside the shell at a distance 'x' from the centre as shown in figure. Find (i) the force on the charge at the centre of the shell and at the point A (ii) the electric flux through the shell.	2
		
18	Draw magnetic field lines when a (a) diamagnetic (b) paramagnetic substances is placed in an external magnetic field. <b>OR</b> The susceptibility of a magnetic material is $-2.6 \times 10^{-5}$ . Identify the type of magnetic material and state its two properties.	2
19	Find the value of current I in the circuit shown in figure	2
		
20	Prove that the average energy density of the oscillating electric field is equal to the oscillating magnetic field <b>OR</b> Write any two characteristics of an electromagnetic wave. Why are microwaves used in RADAR systems?	2
21	A proton and an alpha particle, both initially at rest, are accelerated so as to have the same kinetic energy. What is the ratio of their de-Broglie wavelengths?	2
<b>SECTION-C</b>		
22	Find the value of the unknown resistance 'X' in the circuit, if no current flows through the section AO. Also calculate the current drawn by the circuit from the battery of e.m.f 6 V and negligible internal resistance. <b>OR</b> Six equal resistors, each of value 'R', are joined together as shown in figure. Calculate the equivalent resistance across AB. If a supply of e.m.f 'E' is connected across AB compute the current through the arms DE and AB.	3
		
		
23	Using Biot-Savart law, derive expression for the magnetic field ( $\vec{B}$ ) due to a circular current carrying loop at a point on its axis and hence at its centre.	3

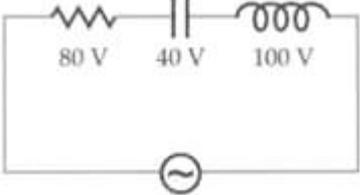
24	A metallic rod of length 'l' is moved perpendicular to its length with velocity 'v' in a magnetic field $\vec{B}$ acting perpendicular to the plane in which rod moves. Derive the expression for the induced e.m.f	3
25	A ray of light is incident normally on the face AB of a right angled prism of refractive index $\mu_a = 1.5$ . The prism is partly immersed in a liquid of unknown refractive index. Find the value of refractive index of the liquid so that the ray grazes along the face BC after refraction through the prism.	3
26	State Huygen's principle of wave theory of light. Using it prove Snell's law of refraction when light passes from a rarer medium to a denser medium	3
27	The energy level diagram of an element is given below. Identify, by doing necessary calculations, which transition corresponds to the emission of a spectral line of wavelength 275 nm?	3
28	With necessary circuit diagram, Explain the working of a full wave rectifier.	3



### SECTION-D

29	An arrangement of two conductors separated by an insulating medium can be used to store electric charge and electric energy. Such a system is called a capacitor. The more charge a capacitor can store, the greater is its capacitance. Usually, a capacitor consists of two conductors having equal and opposite charge +Q and Q. Hence, there is a potential difference V between them. By the capacitance of a capacitor, we mean the ratio of the charge Q to the potential difference V. By the charge on a capacitor we mean only the charge Q on the positive plate. Total charge of the capacitor is zero. The capacitance of a capacitor is a constant and depends on geometric factors, such as the shapes, sizes and relative positions of the two conductors, and the nature of the medium between them. The unit of capacitance is farad (F), but the more convenient units are $\mu\text{F}$ and $\text{pF}$ . A commonly used capacitor consists of two long strips or metal foils, separated by two long strips of dielectrics, rolled up into a small cylinder. Common dielectric materials are plastics (such as polyester and polycarbonates) and aluminium oxide. Capacitors are widely used in television, computer, and other electric circuits.		
	I. A parallel plate capacitor C has a charge Q. The actual charges on its plates are: (A) Q, Q (B) Q, -Q (C) Q/2, Q/2 (D) Q/2, -Q/2	1	
	II. A parallel plate capacitor is charged. If the plates are pulled apart, (A) The capacitance increases (B) The total charge increases (C) the potential difference increases (D) the charge and potential difference remains the same	1	
	III. If 'n' capacitors, each of capacitance 'C' are connected in series, then the equivalent capacitance of the combination will be: (A) nC (B) C/n (C) n <sup>2</sup> C (D) C/n <sup>2</sup>	1	

	<p>IV. Three capacitors of 2.0, 3.0 and 6.0 <math>\mu\text{F}</math> are connected in series to a 10 V source. The charge on the 3.0 <math>\mu\text{F}</math> capacitor is:</p> <p>(A) 5 <math>\mu\text{C}</math> (B) 12 <math>\mu\text{C}</math> (C) 10 <math>\mu\text{C}</math> (D) 15 <math>\mu\text{C}</math></p>	1	
30	<p>In case of isolated atoms, there are discrete energy levels. But when we take a solid as a whole there are bonds between atoms. For a particular atom in the solid, neighbouring atoms influence the energies of the outer electrons. These discrete levels spread into continuous bands of energies. The highest filled band is called valence band. The next higher unfilled band is called conduction band. The valence band and conduction band are usually separated by forbidden energy region called forbidden energy gap. In case of metallic conductors, valence band overlaps conduction band and electrons are readily available for conduction. Hence, they are good conductors. In case of insulators, there is large energy gap between valence and conduction bands. Therefore, conductivity is negligible. In case of semiconductors, the energy gap is small and at room temperature some of the electrons of valence band cross the energy gap and reach the conduction band to contribute some electrical conductivity.</p>		
	I. Explain the effect of temperature on the conductivity of semiconductors, using energy band theory.	2	
	II. In a solid, the conduction band is empty and the valence band is completely filled with electrons. Identify the type of the solid.	1	
	III. For an ideal conductor, what is the value of energy gap?	1	
<b>SECTION-E</b>			
31	<p>(A) A dielectric slab of thickness <math>t</math>, is introduced between the plates of parallel plate capacitor of area <math>A</math> and separation <math>d</math> (where <math>t &lt; d</math>). Find an expression for the capacitance of the capacitor with the dielectric slab.</p> <p>(B) Find the equivalent capacitance of the combination of capacitors between the points A and B as shown in figure. Also calculate the total charge that flows in the circuit when a 100 V battery is connected between the points A and B.</p> <p style="text-align: center;"><b>OR</b></p> <p>(A) Derive expression for the capacitance of a parallel plate capacitor in terms of area of the plates 'A' and separation between the plates 'd'.</p> <p>(B) Four capacitors are connected as shown in figure. Calculate the equivalent capacitance between the points X and Y.</p> <p>(C) A capacitor is kept connected across potential difference 'V' and the separation between plates 'd' is increased using insulating stick. Will the energy stored in capacitor increase or decrease? Justify.</p>		3+2
		2+2+1	
32	<p>(A) Derive an expression for the average power consumed by an LCR series circuit when it is connected to an a.c supply.</p> <p>(B) A 200 V variable frequency a.c. source is connected to a series combination of <math>L =</math></p>	3+2	

	<p>5 H, <math>C = 80 \mu\text{F}</math> and <math>R = 40 \Omega</math>. Calculate (i) the current amplitude at resonance and (ii) the power dissipated in the circuit.</p> <p style="text-align: center;"><b>OR</b></p> <p>(A) Draw the phasor diagram representing the voltages across various elements in an LCR series circuit and thus obtain an expression for the impedance of the circuit.</p> <p>(B) In the LCR series circuit, the potential differences across resistance, capacitance and inductance are 80V, 40V and 100V respectively. Find the emf of the source of alternating current and power factor of the circuit.</p> 	
33	<p>(A) Draw a labelled ray diagram of a refracting telescope at normal adjustment. Define its magnifying power and write the expression for it. Write two important limitations of a refracting telescope over a reflecting telescope.</p> <p>(B) A beam of light converges to a point P. A concave lens is placed in the path of the convergent beam 12 cm from P. At what point does the beam converge if the lens is of focal length 16 cm ?</p> <p style="text-align: center;"><b>OR</b></p> <p>(A) With suitable ray diagram, derive lens maker's formula.</p> <p>(B) Equi-convex lenses are to be manufactured from glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 10 cm?</p>	3+2

