COMMON PRE-BOARD EXAMINATION 2022-23

Subject: (Physics - 042)

Date: Time Allowed: 3 hours

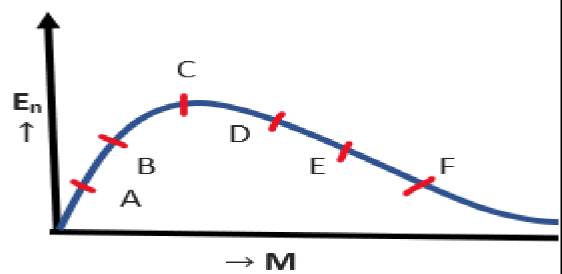
Class: XII Max. Marks: 70

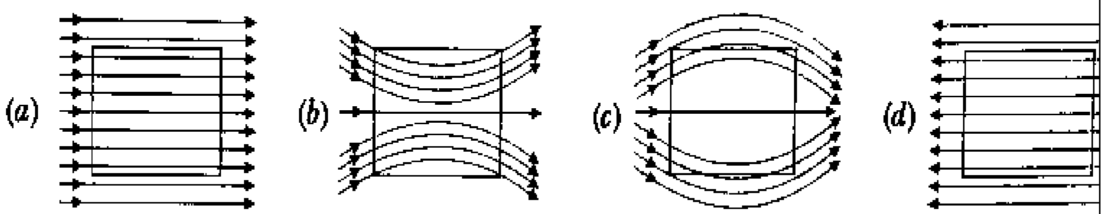
General Instructions:
(1) There are 35 questions in all. All questions are compulsory
(2) This question paper has five sections: Section A, Section B, Section C, Section D and
Section E. All the sections are compulsory.
(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions
of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
(4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.
5. Use of calculators is not allowed.

<u>You may use the following values of physical constants wherever necessary:</u>

$c = 3 \times 10^8\ ms^{-1}$, $h = 6.626 \times 10^{-34}$Js, $e = 1.6 \times 10^{-19}$ C, $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1} $\frac{1}{4\pi\epsilon o} = 9 \times 10^9\ N\ m^2\ C^{-2}$, $\epsilon o = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$, $m_e = 9.1 \times 10^{-31}$kg, Avogadro's number = 6.023×10^{23} per gram mole, Boltzmann Constant $=1.38 \times 10^{-23}$ J/K, $m_n = 1.675 \times 10^{-27}$kg, $m_p = 1.673 \times 10^{-27}$ kg

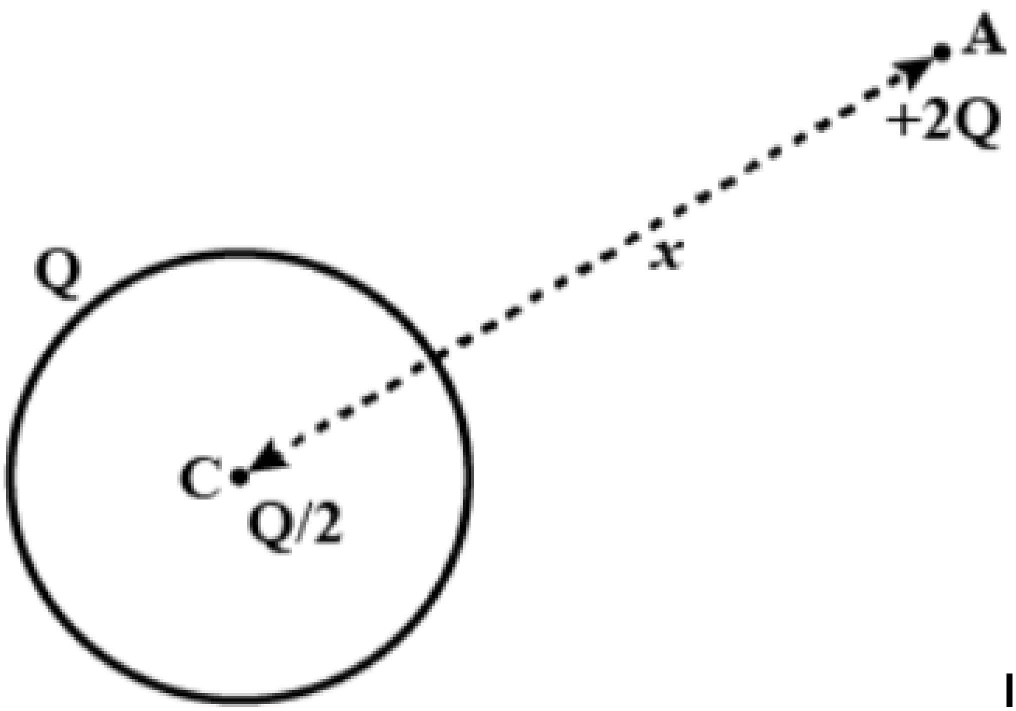
SECTION A(1 x 18)		
Q. NO.	**QUESTION**	**MARKS**
1	A negatively charged object X is repelled by another charged object Y. However, an object Z is attracted to object Y. Which of the following is the most possibility for the object Z? (a) positively charged only (b) negatively charged only (c) neutral or positively charged (d) neutral or negatively charged	1

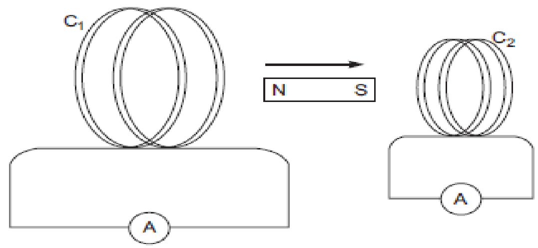
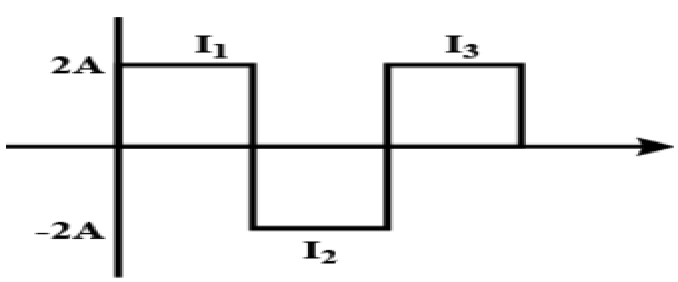
2	If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd orbit, it emits a photon of wavelength λ. when jumps from 4th orbit to 3rd orbit, the corresponding wavelength of photon will be, (a)16/25 λ (b) 9/16 λ (c) 20/7 λ (d) 20/13 λ	1
3	Three capacitors 2μF, 3 μF and 6 μF are joined in series with each other. The equivalent capacitance is (a) 1/2 μF (b) 1 μF (c) 2 μF (d) 11 μF	1
4	Which of the following is NOT the property of equipotential surface? (a) They do not cross each other. (b) The rate of change of potential with distance on them is zero. (c) For a uniform electric field, they are concentric spheres. (d) They can be imaginary spheres.	1
5	Fig. shows a plot of binding energy per nucleon E_n against the nuclear mass M. A, B, C, D, E and F correspond to different nuclei. Consider four reactions: (i)A + B → C + ε (ii) C → A + B + ε (iii)D + E → F + ε (iv) F → D + E + ε  Where ε is the energy released. In which all reactions ε is positive. (a) (i) and (iv) (b) (i) and (iii) (c) (ii) and (iv) (d) (ii) and (iii)	1
6	Which of the following has a negative temperature co-efficient of resistivity? (a) metal (b) metal and semiconductor (c) semiconductor (d) metal and alloy	1
7	A uniform magnetic field exists in space in the plane of paper and is initially directed from left to right. When a bar of soft iron is	1

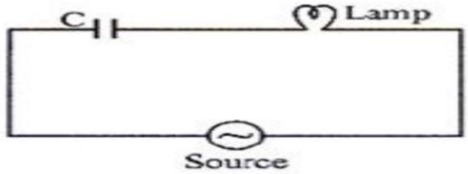
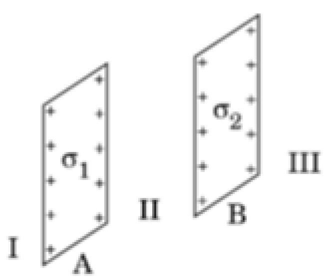
	placed in the field parallel to it, the lines of force passing through it will be represented by  	
8	The Si unit of magnetic field is (a) AmN^{-1} (b) $NA^{-1}m^{-1}$ (c) $NA^{-2}m^{-2}$ (d) $NA^{-1}m^{-2}$	1
9	A copper ring is held horizontally and a magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is (a) equal to acceleration due to gravity (b) less than acceleration due to gravity (c) more than acceleration due to gravity (d) depends on the diameter of the ring and the length of the magnet	1
10	Inductance plays the role of (a) inertia (b) friction (c) source of emf (d) force	1
11	When an ac voltage of 220 V is applied to the capacitor C (a) the maximum voltage between plates is 220 V. (b) the current is in phase with the applied voltage. (c) the charge on the plates is in phase with the applied voltage. (d) power delivered to the capacitor is zero.	1
12	The phase difference between the current and the voltage in series LCR circuit at resonance is (a) π (b) π/2 (c) π/3 (d) zero	1
13	A welder wears special glasses to protect his eyes mostly from the harmful effect of (a) very intense visible light (b) infrared radiation (c) ultraviolet rays (d) microwaves	1

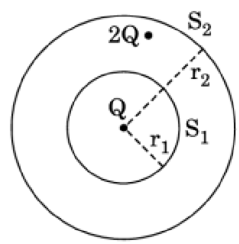
14	The slope of frequency of incident light and stopping potential for a given surface will be (a)h (b) h/e (c)eh (d) e	1
15	Consider the diffraction pattern for a small pinhole. As the size of the hole is increased (a) the size decreases (b) the size increases (c) the intensity remains same (d) none	1
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 **Assertion**: Photoelectric effect demonstrates the wave nature of light. **Reason**: The number of photo electrons is proportional to the frequency of light.	1
17	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 **Assertion:** - When the temperature of a semiconductor is increased then its resistance decreases. **Reason: -** The energy gap between valence and conduction bands is very small for semiconductors.	1
18	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	1

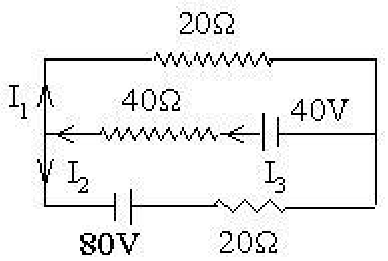
	d) A is false and R is also false **Assertion:** - If the source of the light in Young's Double Slit Experiment is changed from red to violet, then the separation between the interference fringes will increase. **Reason:** - The wavelength of violet light is greater than the wavelength of red light.	
	SECTION B(2 x 7)	
19	An electric dipole is held in a uniform electric field. (i) show that the net force acting on it is zero. (ii) the dipole is aligned parallel to the field. Find the work done in rotating it through the angle of 180°.	2
20	Write two properties of a material suitable for making (a) a permanent magnet, and (b) an electromagnet. Or A long straight wire carries a current of 35 A. What is the magnitude of the field B at a point 20 cm from the wire?	2
21	State Lenz's law. A metallic rod held horizontally along east-west direction is allowed to fall under gravity. Will there be an emf induced at its ends? Justify your answer.	2
22	A radio can tune into any station in the 7.5 MHz to 12 MHz band. What is the corresponding wavelength band?	2
23	In a pure semiconductor crystal of Silicon,if antimony is added then what type of extrinsic semiconductor is obtained. Draw the energy band diagram of this extrinsic semiconductor so formed. OR What is meant by doping of an intrinsic semiconductor? Name the two types of atoms used for doping of Germanium/Silicon.	2
24	In Young's double slit experiment the slits are separated by 0.28mm and the screen is placed 1.4m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of the light used in this experiment.	2
25	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 C and another charge +2Q is placed outside the shell at A at a distance x from the centre as shown in the figure. (i) Find the electric flux through the shell. State the law used.	2

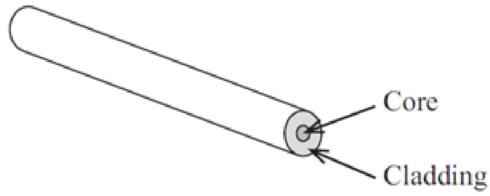
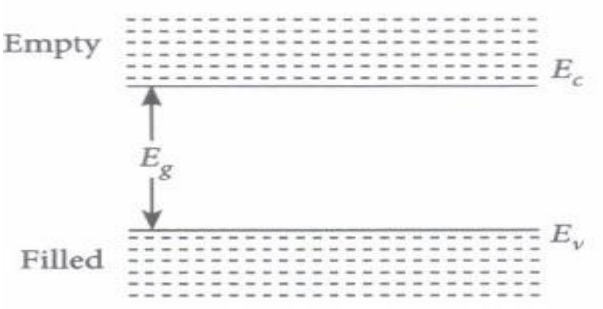
	(ii) Find the force on the charges at the centre C of the shell and at the point A. 	
	SECTION C (3 x 5)	
26	(i) Briefly explain how a galvanometer is converted to a voltmeter. (ii) A voltmeter of a certain range is constructed by connecting a resistance of 980Ω in series with a galvanometer. When the resistance of 470Ω is connected in series, the range gets halved. Find the resistance of the galvanometer.	3

27	(i)A magnet is quickly moved in the direction indicated by an arrow, between two coils C_1 and C_2, as shown in the figure. What will be the direction of induced current in each coil, as seen from the magnet? Justify your answer.  (ii)A 1.0 m long metallic rod is rotated with an angular frequency of 400 rad s^{-1} about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field of 0.5 T parallel to the axis exists everywhere. Calculate the emf developed between the centre and the ring.	3
28	(i) For a given a.c, $I = I_m \sin\omega t$, show that the average power dissipated in a pure resistor R over a complete cycle is $\frac{1}{2}I_m^2R$.Draw I^2-t graph also. (ii) What is the rms value of alternating current shown in the figure?  **OR** (i) In a series LCR circuit, obtain the condition under which (a)the impedance of the circuit is minimum and (b) wattless current flows in the circuit. (ii) An electric lamp is connected in series with a capacitor and an ac source as shown in the figure is glowing with a certain brightness. How does the brightness of the lamp change on reducing the capacitance?Give reason.	3

		
29	Find the frequency of light which ejects electrons from a metal surface, fully stopped by a retarding potential of 3.3V. If photo electric emission begins in this metal at a frequency of 8 x 10^{14} Hz, calculate the work function (in eV) for this metal. **OR** (i) If the intensity of incident radiation on a metal is doubled, what happens to the kinetic energy of electrons emitted? (ii) Monochromatic light of frequency 6.0 x 10^{14} Hz is produced by a laser. The power emitted is 2.0 x 10^{-3} W. Calculate the (i) energy of a photon in the light beam and (ii) number of photons emitted on an average by the source.	3
30	A 12.5 eV electron beam is used to bombard gaseous hydrogen at room temperature. Upto which energy level the hydrogen atoms would be excited? Calculate the wavelength of the first member of Lyman and first member of Balmer series.'(R = 1.097 x $10^7 m^{-1}$)	3
	SECTION D (5 x 3)	
31	(i) Two infinitely large plane thin parallel sheets having surface charge densities $\sigma_1$and σ_2 ($\sigma 1 > \sigma 2$) are shown in the fig. Write the magnitudes and directions of the net fields in the regions marked II and III  (ii) In a parallel plate capacitor with air between the plates, each plate has an area 5 x10^{-3} m^2 and the separation between the plates is 2.5mm. (i) Calculate the capacitance of the capacitor.(ii) If this capacitor is connected to100V,What would be the charge on each plate ?(iii) How would charge on the plates be affected ,if	5

	a 2.5mm thick mica sheet of K = 8 is inserted between the plates while the voltage supply remains connected? **OR** (i) Derive the expression for electrostatic potential energy of a system of 3 charges q_1, q_2 and q_3 (ii)(a) A sphere S_1 of radius r_1 encloses a net charge 'Q'. If there is another concentric sphere S_2 of radius r_2 ($r_2 > r_1$) enclosing charge 2Q, find the ratio of the electric flux through S_1 and S_2. (b)How will the electric flux through sphere S_1 change if a medium of dielectric constant 'K' is introduced in the space inside S_2 in place of air  	
32	(i) Deduce Ohm's law using the concept of drift velocity (ii) Plot a graph showing the variation of resistivity of a conductor with temperature (iii) A conductor of length ℓ is connected to a dc source of emf V.If this conductor is replaced by another conductor of same material and same area of cross section but of length 3ℓ,how will the drift velocity change ? **OR** (i) Sketch a graph showing variation of resistivity of carbon with temperature. (ii) Explain how the internal resistance of a cell changes in the following cases: (a) when the concentration of the electrolyte is increased (b) when the temp. of the electrolyte is increased (iii) Using Kirchhoff's rules of current distribution in an electrical network, determine the value of the current I_1 in the electric circuit given below.	5

		
33	(i) Using Huygens's principle principles draw a diagram to show how a plane wave front incident at the interface of the two media gets refracted when it propagates from a rarer to a denser medium. Hence verify Snell's law of refraction. (ii) When monochromatic light travels from a rarer to a denser medium speed decreases. Does the decrease in speed imply a reduction in the energy carried by light wave?Explain (iii) A slit of width 'd' is illuminated by light of wavelength 700nm.what will be the value of slit width 'd' when (a) first minimum falls at an angle of diffraction 30^0? (b) first maximum falls at an angle of diffraction 30^0 OR (i) Draw a labeled ray diagram to show the formation of image in an astronomical telescope for a distant object in normal adjustment (ii) Write two distinct advantages of a reflecting type telescope over a refracting type telescope. (iii) A convex lens of focal length 10 cm is placed co-axially 5 cm away from a concave lens of focal length 10 cm. If an object is placed 30 cm in front of the convex lens find the position of the final image formed by the combined system.	5
	SECTION E (4 x 2)	
34	Read the following paragraph and answer the questions. A number of optical devices and instruments have been designed and developed such as periscope, binoculars, microscopes and telescopes utilizing the reflecting and refracting properties of mirrors, lenses and prisms. Most of them are in common use. Our knowledge about the formation of images by the mirrors and lenses is the basic requirement for understanding the working of these devices.	4

	Optical fiber communication is a communication method in which light is used as an information carrier and optical fiber is used as a transmission medium. First, an electrical signal is converted into an optical signal, and then an optical signal is transmitted through the optical fiber, which is a type of wired communication.   Some optical fibers are made from a central core of transparent material surrounded by a material of a different refractive index as a cladding. (i) In an optical fiber, the speed of light is more in core or cladding ? (ii) Why is total internal reflecting prism preferred over plane mirror in periscopes ? (iii)How does the magnifying power of a telescope change on increasing the linear diameter of its objective ? Why? or In the visible light, red or violet will produce maximum magnifying power in a compound microscope ? Why?	
35	From Bohr's atomic model, we know that the electrons have well defined energy levels in an isolated atom. But due to inter atomic interactions in a crystal, the electrons of the outer shells are forced to have energies different from those in isolated atoms. Each energy level splits into a number of energy levels forming a continuous band.The gap between top of valence band and bottom of the conduction band in which no allowed energy levels for electrons can exist is called energy gap. 	4

	(i) What is the energy gap in a semiconductor at room temperature ? (ii) What will happen to the size of the potential barrier, when a PN junction diode is reverse biased ? (iii) Name two important processes that occur during the formation of a pn junction Or What are knee voltage and Zener voltage		