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कक्षा बारहवी प्रथम प्री बोर्ड परीक्षा 2025 -26

PRE-BOARD I EXAMINATION 2025-26 FOR CLASS XII
SUBJECT: PHYSICS (042)
SET-I A

M.M.: 70 MARKS **TIME: 3 Hours**

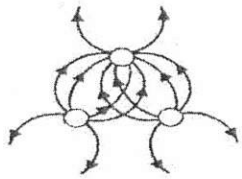
GENERAL INSTRUCTIONS:

(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, 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
$c = 3 \times 10^8$ m/s, $m_e = 9.1 \times 10^{-31}$ kg , $e = 1.6 \times 10^{-19}$ C, $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1} , $\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2N^{-1}m^{-2}$, $h = 6.6 \times 10^{-34}$ J/s

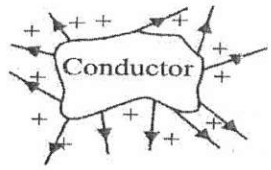
Section A

1 Which of the following curves shown below can possibly represent electrostatic field lines? 1

(A)



(B)



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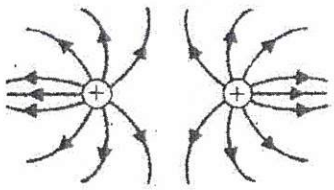
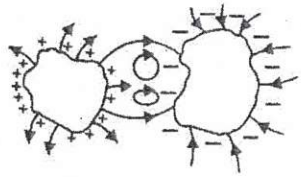
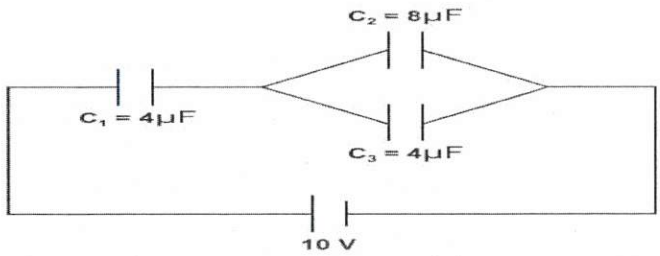


(D)



2 Three capacitors C_1, C_2 and C_3 are connected in a combination as shown below. 1



Identify the correct statement(s).

(i) The charge on capacitor C_1 is greater than that on capacitor C_2.
(ii) The charge on capacitor C_1 is the same as that on capacitor C_3.
(iii) The charge on capacitor C_1 is 30 μC.

(A) Only (i) is correct (B) Only (iii) is correct.
(C) Both (i) and (iii) are correct. (D) Both (i) and (ii) are correct.

3 A charged particle moving in a magnetic field experiences a resultant force 1
(A) In the direction of field
(B) In the direction opposite to that field
(C) In the direction perpendicular to both the field and its velocity
(D) None of the above

4 The magnetic field at a point due to a long straight wire carrying current I is B. A circular loop carries same current. For same magnetic field at its center, the radius of the circular loop shall be 1
(A) 2a (B) a (C) a/2 (D) much more than 'a'

5 Nuclear Fusion reactions take place at high temperature because 1
(A) atoms are ionised at high temperature
(B) molecules break up at high temperature
(C) nuclei break up at high temperature
(D) kinetic energy is high enough to overcome repulsion between nuclei

6 Consider the following statements : 1
I - Monopoles exist only as electric charges, not in magnetism.
II- Gauss law states that the net magnetic or electric flux through any closed surface is always zero.
(A) Both I and II are correct
(B) Only II is correct
(C) Only I is correct
(D) Both I and II are wrong.

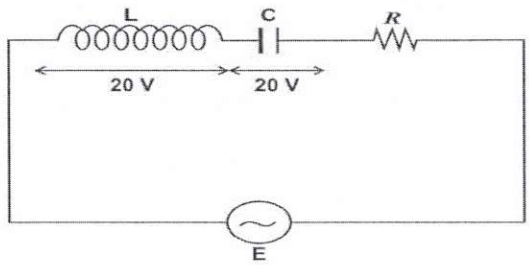
7 Which of the following material can possibly has magnetic susceptibility equal to -0.5 1
(A) Iron (B) Nickel (C) Aluminium (D) Copper

8 In Young's double slit interference experiment, third bright fringe is obtained at a point on the screen with a light of 700 *nm*. What should be the wavelength of the light source in order to obtain 5th bright fringe at the same point 1
(A) 500 nm (B) 630 nm (C) 750 nm (D) 420 nm

9 A light of wavelength belonging to the blue region of the visible spectrum causes photoelectric emission in a metal. 1
When light of wavelength belonging to the red region is incident on the metal, photoelectric emission does not take place.
When an EM wave belonging to IR region is incident on the metal, will photoelectric emission take place?
(A) Yes, because IR rays are highly energetic.
(B) No, because IR rays cannot cause photoelectric emission.
(C) Yes, because IR rays have a higher frequency than red light.
(D) No, because IR rays have a longer wavelength than red light.

10 Wavelength of second line of Pashen series observed in hydrogen atom spectrum is (where R = Rydberg's Constant) 1
(A) 225/61R (B) 125/4R
(C) 225/16R (D) 522/16R

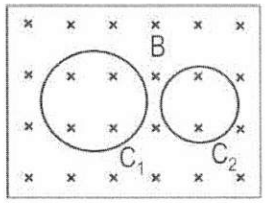
11 Shown below is a series LCR circuit connected to an ac source of emf E. The voltage drop across the inductor and the capacitor is 20 V. 1



Which of the following will happen if the value of R is doubled?

(A) The voltage across L will be doubled.
(B) The voltage across C will remain the same.
(C) The voltage across the LC combination will be halved.
(D) The voltage across the LC combination will remain the same.

12 Two static coils C_1 and C_2 are placed in the same plane in a region of uniform magnetic field B. If the magnetic field begins to increase at a constant rate, identify the directions of the induced currents in the two coils as seen from above. 1



(A) Anticlockwise in both the coil
(B) Clockwise in both the coils
(C) Anticlockwise in C1 and clockwise in C2
(D) Anticlockwise in C1 and clockwise in C2

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. Assertion and Reason are true and Reason is the correct explanation of Assertion.
B. 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.

13 **Assertion:** The images formed by total internal reflections are much brighter than those formed by mirrors or lenses. 1
Reason: There is no loss of intensity in total internal reflection.

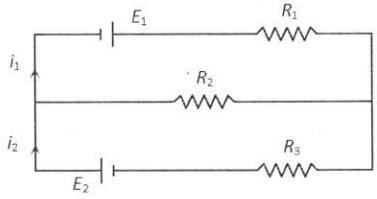
14 **Assertion:** Electromagnetic wave picture of light can also explain the photoelectric effect in addition to the particle nature of light. 1
Reason: Electric field of an em wave would cause the electrons in the metal to oscillate and tear free from the surface when the amplitude of the oscillation becomes large enough.

15 **Assertion :** n-type semiconductors of silicon are electrically charged. 1
Reason : In n-type semiconductors, the doped atom has 1 less valence electron than silicon.

16 **Assertion:** If the distance between plates of a parallel plate capacitor is halved and medium of dielectric constant 3 is inserted between the plates then the capacitance becomes 6 times. 1
Reason: Capacitance of a parallel plate capacitor is independent of geometric configuration of the capacitor and medium between the plates of the capacitor.

SECTION - B

17 In the following circuit $E_1 = 4V$, $R_1 = 2\Omega$, $E_2 = 6V$, $R_2 = 2\Omega$ and $R_3 = 4\Omega$. Find current i_1 in the circuit. 2



.

OR

Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of ' drift velocity '.

18 A converging lens of refractive index 1.5 and of focal length 15 cm in air, has the same radii of curvature for both sides. If it is immersed in a liquid of refractive index 1.7, find the focal length of the lens in the liquid. 2

19 Draw a ray diagram to show image formation by a combination of two thin convex lens in contact. Obtain the expression for the power of this combination in terms of the focal lengths of the lenses. 2

20 (a) An alpha particle and a proton are accelerated from rest by the same potential. Find the ratio of their de Broglie wavelength. 2

(b) Write Einstein's photoelectric equation and using this explain the concept of threshold frequency.

21 Draw the circuit arrangement of a p-n junction diode in (i) forward bias, (ii) reverse bias. Draw the typical V-I characteristics and mark breakdown voltage and knee voltage. 2

OR

Draw a circuit diagram of a full wave rectifier. Explain its working principle. Draw the input/output waveforms indicating clearly the function of the two diodes used.

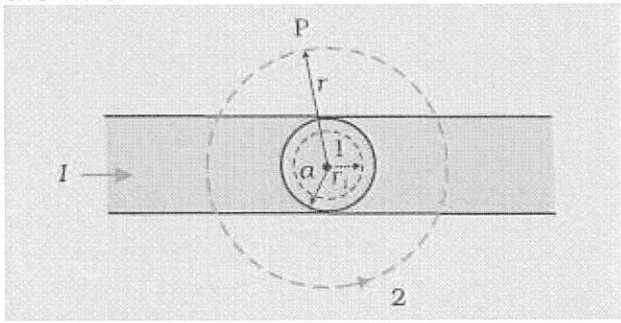
SECTION C

22 A dimmer is a device that is connected to a light bulb and is used to lower the brightness of the light from the bulb. It introduces a resistance in series with the bulb for this purpose. A 44 W bulb in a household circuit is connected across a 220 V power supply. 3

(A) How much current does the bulb draw initially without the dimmer in action?

(B) What resistance in series would the dimmer introduce in order to drive a current of 0.1 A through this bulb?

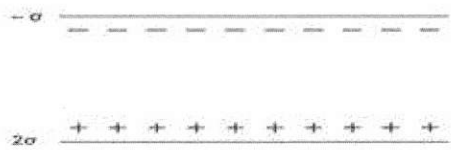
23 Figure shows a long straight wire of a circular cross-section (radius *a*) carrying steady current *I*. The current *I* is uniformly distributed across this cross-section. Using Ampere's Circuital law, calculate the magnetic field in the region $r < a$ and $r > a$. Also show a plot of the magnitude of **B** with distance *r* from the centre of the wire. 3



OR

23 (A) With the help of a diagram, explain the principle and working of a moving coil galvanometer. 2+1
(B) Why is it that while using a moving coil galvanometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used?

24 Two charged sheets having charge density 2σ and $-\sigma$ are placed parallel and close to each other in a vertical plane as shown in the figure. A particle having positive charge q and mass m is placed between these sheets and released from rest under gravity. What is the acceleration of this particle? 3



25 Coil 1 has self-inductance L_1 which is 3 times the self-inductance L_2 of coil 2. If during a certain instant, the rate of increase in current and the power dissipated in these two coils is the same, then determine the ratio of their 3
(i) Induced voltages
(ii) Induced currents
(iii) Energy stored in the two coils at that instant.

26 Name the Electromagnetic radiations with wavelengths 3
(a) λ_1 plays an important role in maintaining the earth's warmth.
(b) λ_2, are used in T V communication system .
(c) λ_3, as diagnostic tool in medicine.
How are these waves produced?

27 State any two postulates of Bohr's Atomic model. Using Bohr's postulates, show that radii of first three orbits of the electron in hydrogen atom is in the ratio of 1:4:9. 3

28 The table below represents the binding energy per nucleon and mass number of a few elements. 3

Element	Mass Number	Binding energy per nucleon (MeV)
Hydrogen	1	0
Helium`	2	7.4
Lithium	6	4.9
Iron	56	8.8
Gold	197	7.7
Uranium	238	7.5

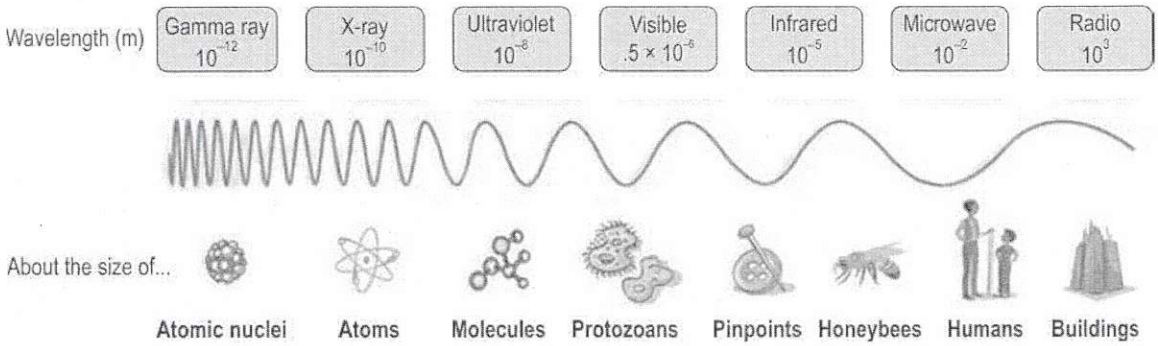
Study the table and answer the following questions.
(i)What does the binding energy per nucleon of hydrogen signify?
(ii)Which element has the highest mass defect per nucleon among the given elements? Give reason.
(iii) Of lithium and gold which element has a more tightly forces. Give reason.

SECTION D

Case Study Based Questions

29 **Read the following paragraph and answers the questions:** 4

Diffraction of incoming beams by an obstacle or aperture is convincing proof of the wave nature of light. Diffraction takes place for all types of waves, mechanical or non-mechanical, transverse or longitudinal. However, its effects are perceptible only if the wavelength of radiation is comparable to the dimensions of the diffracting device.
In the case of diffraction of light through apertures and obstacles instead of sharp shadow or uniform illumination, we get a fringe pattern called a diffraction pattern that depends on the nature of the diffracting device and the wavelength of the incoming light used.
Given here is the representation of wavelengths of light waves in comparison to the sizes of various objects.



(I) If the spacing of atoms in crystals is of the order of few Å, then which of the following waves **can not** be used to to study the arrangement of atoms in a crystal using diffraction principle -

(A) Visible (B) Infra red (C) radio waves (D) None of the above.

(II) In the single slit diffraction arrangement, how would the image on the screen appear in case the wavelength λ of the incident light is much less than the aperture width d
(A) There will be a uniform illumination of the screen
(B) All the bright bands have same intensity
(C) Linear width of all the bands will be equal.
(D) All of the above.

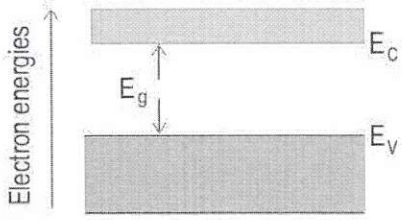
(III) Which of the following electromagnetic waves can be heard or received around the corner of a building. (Consider the wavelength of a clap to be about 0.1 m.)
(A) A Clap sound (B) Radio waves (C) X rays (D) both (A) and (B).

(IV) Essential condition for diffraction to take place is
(A) no relation between width of obstacle and wavelength of wave.
(B) the width of the obstacle must be greater than the wavelength of the wave
(C) the width of the obstacle must be less than or comparable with the wavelength of the wave.
(D) the width of the obstacle must be greater than or comparable with the wavelength of the wave

30 **Read the following paragraph and answers the questions:** 4

In a representation of energy band diagram of a material X, the energy band that includes the energy levels of the valence electrons is the valence band, E_v whereas the energy band above the valence band is the conduction band, E_c.

The gap between the conduction and the valence band is represented by the energy gap, E_g. For the given sample material, the energy gap, E_g is about 2.8 eV. If the given sample material has N atoms with 'p' number of valence electrons in each atom, then there would be a total of pN, the total number of electrons in its valance band.



(I) Identify the nature of the sample material X. What happens to the electrons in the valence energy band at a temperature, say 40 °C, that is, slightly above the room temperature?

(II) With the increase in the temperature of material X, both the number of charge carriers as well the extent of thermal vibrations in the lattice increase. Is the temperature coefficient of resistivity of material X - Negative, Zero OR positive? Give reason for your answer.

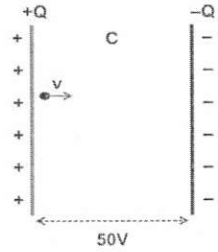
(III) Represent energy band diagram of a material with

(a) E_g more than that of given material X. (b) $E_g \leq 0$

SECTION E

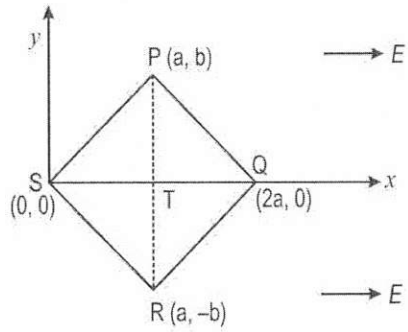
31 (A) Show that an electric dipole held in uniform electric field will not undergo any translatory motion. Hence derive an expression for the torque experienced by the dipole. 5

(B) A small ball of mass 2×10^{-16} kg carrying a charge $q = -2\ \mu C$ is fired from the positive conducting plate towards the negative conducting plate with a speed of 3×10^6 m/s. (figure) Will the ball strike the negative plate? Give mathematical working of your answer.



OR

(A) Test charge q moves along a path P -> Q -> R -> S in a uniform electric field region directed along +x-axis. The coordinates of the points are as follows: P (a, b, 0), Q (2a, 0, 0), R (a, -b, 0) and S (0, 0, 0). 5



Identify the plane of motion of the test charge. Determine the work done by the electric field as the test charge moves from P to S. Use diagram, if necessary.

(B) How would electric field inside a conductor and a dielectric get modified when placed in external electric field.

32 (A) Name the device which can increase alternating current or alternating voltage without violating law of conservation of energy. State the principle of working of this device. 5

(B) Explain why the above device cannot be used for same purpose when direct current source is used?

(C) An ideal transformer is designed to convert 50 V into 250 V. It draws 200 W power from an ac source whose instantaneous voltage is given by $\mathbf{v_i = 20 \sin (100\pi t)\ V}$. Find

(i) RMS value of input current

(ii) Expression for instantaneous output voltage

(iii) Expression for instantaneous output current

OR

(A) Derive an expression for the average power consumed in a series LCR circuit connected to an ac source in which the phase difference between the voltage and the current in the circuit is Φ. 5

(B) Consider a series LCR circuit connected to a variable frequency 230 V source with L = 5.0 H,C = 80 μF, R = 40 Ω.

(i) Determine the source frequency makes the power factor of the circuit unity.

(ii) Obtain the impedance of the circuit and the amplitude of the current at the resonating frequency.

(iii) Determine the potential drop across Resistance.

33 (A) Draw a labeled ray diagram of a refracting type telescope in normal adjustment. 5

(B) Calculate the angle of minimum deviation of an equilateral prism having refractive index $\sqrt{3}$.

(C) A thin pencil of length (f/4) is placed coinciding with the principal axis of a mirror of focal length f. The image of the pencil is real and enlarged, just touches the pencil. Calculate the magnification produced by the mirror.

OR

(A) Draw a ray diagram to show image formation when the concave mirror produces a real, inverted and magnified image of the object. Using the diagram Obtain the mirror formula and write the expression for the linear magnification. 5

(B) A beam of light converges at a point P. Now a 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 (a) a convex lens of focal length 20cm, and (b) a concave lens of focal length 16cm?