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| Text  Description automatically generated  **PB2/PHEEEQP/1222/B 16-JAN-2023**  **EEE CONSORTIUM**  **PRE BOARD EXAMINATION(2022 -2023)** | | | | |
| **Subject: Physics**  **Grade: XII** | | | **Max. Marks: 70**  **Time : 3 Hours** | |
| **Name:** | | **Section:** | **Roll No:** | |
| ***General Instructions:***   * *There are* ***35*** *questions in total. All questions are compulsory.* * *This question paper has five sections: Section A, Section B, Section C, Section D and*   *Section E. All the sections are compulsory.*   * *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.*   * *There is no overall choice. However, an internal choice has been provided in two questions of section B, two questions of section C and all three questions of section D. You have to attempt only one of the given choices in such questions.* * *You may use the following values of physical constants wherever necessary:*   c = 3 x 10 8 ms – 1 h = 6.63 x 10 – 34 Js  e = 1.6 x 10 – 19 C  Mass of electron, me = 9.1 x 10 – 31 kg Mass of proton, mp = 1.673 x 10 – 27 kg  Avogadro’s number = 6.023 x 10 23 per gram mole Boltzmann constant,KB=1.38 x 10 – 23 J K – 1   * *Use log tables if needed.* | | | | |
| **SECTION A** | | | | |
|  | The total flux through the faces of the cube with side of length ‘a’, if a charge ‘q’ is placed at corner ‘A’ of the cube is  (i) (ii) (iii) (iv) | | | 1 |
|  | Two capacitors of capacitance 6 µF and 4 µF are put in series across a 120 V battery. What is the potential difference across the 4 µF capacitor?  (i) 72 V (ii) 60 V (iii) 48 V (iv) zero | | | 1 |
|  | Two wires of the same metal have same length, but their cross-sections are in the ratio 3:1 They are joined in series. The resistance of thicker wire is 10 Ω. The total resistance of the combination will be  (i) 40 Ω (ii) 100 Ω (iii) (5/2) Ω (iv) (40/3) Ω | | | 1 |
|  | In a moving coil galvanometer, current in the coil is:  (i) Directly proportional to angle of deflection.  (ii) Inversely proportional to the angle of deflection.  (iii) Directly proportional to the square root of the angle of deflection.  (iv) Inversely proportional to the square root of the angle of deflection | | | 1 |
|  | Electron is revolving around a nucleus in circular orbit of radius 1Å with a speed 4x104 m/s. Magnetic moment produced due to rotation of electron is  (i) 3.2 x 10-29Am2 (ii) 6.4 x 10-25 Am2(iii) 3.2 x 10-25 Am2 (iv) 1.6 x 10-29 Am2 | | | 1 |
|  | A metal conductor of length 1 m rotates vertically about one of its ends with angular velocity 5 rad s-1. If the horizontal component of earth’s magnetism is 2 × 10-5 T, then e.m.f. developed between the two ends of the conductor is:  (i) 5 µV(ii) 50 µV (ii) 5 mV(iv) 50 mV | | | 1 |
|  | Which of the following statements is/are correct? I. In LCR series ac circuit, as the frequency of the source increases, the impedance of the circuit first decreases and then increases. II. If the net reactance of an LCR series ac circuit is same as its resistance, then the current lags behind the voltage by 45°. III. Below resonance, voltage leads the current while above it, current leads the voltage. (i) I only (ii) II only (iii) I and III (iv) I and II | | | 1 |
|  | A convex lens is dipped in a liquid, whose R.I. is equal to that of R.I. of material of the lens. Then its focal length will:  (i) become zero (iii) become infinite(ii) reduce (iv) increase | | | 1 |
|  | A single slit diffraction pattern is obtained using a beam of red light What happened the red light is replaced by the blue light?  (i) There is no change in diffraction pattern.  (ii) Diffraction fringes become narrower and crowded.  (iii) Diffraction fringes become broader and farther apart.  (iv) The diffraction pattern disappears. | | | 1 |
|  | Protons and alpha particles have the same de-Broglie wavelength. Which one of the following is same for both of them?  (i) Kinetic Energy (ii) speed (iii) Mass (iv) Linear Momentum | | | 1 |
|  | Paschen series of atomic spectrum of Hydrogen gas lies in  (i) Infrared region. (ii) Ultraviolet region.  (iii) Visible region. (iv) Partially in UV and Partially in Visible. | | | 1 |
|  | When two nuclei (A ≤ 10) fuse together to form a heavier nucleus, the  (i) binding energy per nucleon increases.  (ii) binding energy per nucleon decreases.  (iii)binding energy per nucleon does not change.  (iv) total binding energy decreases. | | | 1 |
|  | If the two ends of a p-n junction are joined by a wire  (i) there will not be a steady current in the circuit.  (ii) there will be a steady current from the n-side to the p side.  (iii) there will be a steady current from the p-side to the n side.  (iv) there may or may not be a current depending upon the resistance of the connecting wire. | | | 1 |
|  | What is the de-Broglie wavelength of an electron accelerated from rest through a potential difference of 100 volts?  (i) 12.3 Å (ii) 1.23 Å (iii) 0.123 Å (iv) 0.0123 Å | | | 1 |
|  | To obtain p-type silicon semiconductor, we need to dope pure silicon with:  (i) aluminium (ii) phosphorus (iii) oxygen (iv)germanium | | | 1 |
|  | **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(A) :** The resistivity of semiconductors increases with increase in temperature.  **Reason(R) :**As temperature increases the atoms of semiconductor material vibrate with larger amplitude. | | | 1  1 |
|  | **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(A) :** In electric circuits, wires carrying currents in opposite directions are often twisted together. **Reason(R) :** If the wires are not twisted together, the combination of the wires forms a current loop, the magnetic field generated by the loop might affect adjacent circuits or components. | | | 1 |
|  | **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(A) :** Energy is absorbed when light nuclei undergo fusion.  **Reason(R) :**For light nuclei, binding energy per nucleon decreases with increasing Z. | | | 1 |
| **SECTION B** | | | | |
|  | A straight wire carrying a current of 12 A is bent into a semi-circular arc of radius 2.0 cm as shown on the right.  What is the direction and magnitude of magnetic field at the center of the semi-circular arc?  OR  A current of 10 A is flowing east to west in a long wire kept in the east-west direction. Find magnetic field in a horizontal plane at a distance of 10 cm north. | | | 2  OR  2 |
|  | A square loop is placed in a uniform magnetic field as shown in the figure given below.    The loop is pulled with a constant speed till it comes out from the magnetic field. Depict the graphs showing the variation of magnetic flux and induced emf as a function of time. | | | 2 |
|  | How are electromagnetic waves produced? Draw a sketch of the plane EM wave propagating along X axis depicting the oscillating electric and magnetic fields. | | | 2 |
|  | A ray of light PQ falls normally on the refractive face BA of a prism ABC made of a material of refractive index as shown in the figure given here.  Complete the path of the ray through the prism.  From which face will the ray emerge? | |  | 2 |
|  | Sketch the graphs showing the variation of stopping potential with frequency of incident radiations for two photosensitive material ‘A’ and ‘B’ having threshold frequencies fA > fB. For which material is the stopping potential more at a given frequency ‘f’ higher than fA and fB? Give reason.  **OR**  The frequency of the incident radiation on the cathode of a photocell is doubled. How will the photo current and the stopping potential change? Justify your answer with the help of Einstein’s photoelectric equation. | | | 2  2 |
|  | Draw a diagram to show the variation of binding energy per nucleon with mass number. Mark the region where the nuclei are (i) prone to fusion and (ii) prone to fission. | | | 2 |
|  | Class 12 Physics Important Questions Chapter 14 Semiconductor Electronics 15Two semiconductor materials X and Y showed in the figure are made by doping germanium crystal with indium and arsenic respectively. The two are joined end to end and connected to a battery as shown in the figure given below. (i) Will the junction be forward or reverse biased? (ii) Sketch a V-l graph for this arrangement. | | | 2 |
| **SECTION C** | | | | |
|  | An electric dipole having charges 8 µC and dipole length 8 cm, when placed with its axis making an angle of 600 with a uniform external electric field, experiences a torque of 16 Nm. Calculate (i) dipole moment and (ii) the magnitude of external electric field.  **OR**  Two point charges + 0.2 C and + 0.4 C are placed 0.1 cm apart. Calculate the magnitude and direction of the resultant electric field at midpoint of the line joining them. | | | 3  OR  3 |
|  | The given graphs show the variation of intensity of magnetization I with strength of applied magnetic field H for two magnetic materials P and Q  (i) Identify the materials P and Q  (ii) For material P plot the variation of intensity of magnetisation with temperature. Justify your answer. | | | 3 |
|  | Estimate the angular separation between. first order maximum and third order minimum of the diffraction pattern due to a single-slit of width 1 mm, when light of wavelength 600 nm is incident normal on it | | | 3 |
|  | A hydrogen atom is in its third excited state.  (A) How many spectral lines can be emitted by it before coming to the ground state? Show these transitions in the energy band diagram.  (B) In which of the above transitions will the spectral line of shortest wavelength be emitted?  **OR**  (A) State Bohr postulate of hydrogen atom that gives the relationship for the frequency of emitted photons in a transition.  (B) An electron jumps from third excited state to first orbit in a hydrogen atom. How many maximum numbers of spectral lines can be emitted by the electron? To which series these lines correspond? | | | 3  OR  3 |
|  | (A) Explain with the help of diagram, the formation of potential barrier and depletion region in a p – n junction diode.  (B) How does the width of the depletion region of p – n junction diode be affected when it is (i) forward biased and (ii) reverse biased? | | | 3 |
| **SECTION D** | | | | |
|  | (i) Define electrostatic potential at a point. Write its SI unit.  (ii) Three point charges q1, q2 and q3 are kept respectively at points A, B and C as shown in figure. Derive the expression for the potential energy of the system.  (iii) Depict the equipotential surface due to an electric dipole separated by a small distance.  **OR**  (i)What is a dielectric?  (ii) Why does the capacitance of a parallel plate capacitor increases on introduction of a dielectric in between its two plates.  (iii) Derive an expression for the capacitance of such a capacitor having two identical plates each of area A and separated by distance d. The sapce between the plates has a dielecric slab of thickness t which is less than the plate separation | | | 1  3  1  OR  1  1  3 |
|  | (A) An a.c. voltage V(t) = V0 sin ωt is applied across a series connection of an inductor coil, capacitor and a resistor as shown in the figure given below.    Use the phasor diagram to obtain the expression for impedance of the circuit.  (B) In the circuit shown below calculate the capacitance of the capacitor if the power factor of the circuit is unity.  In the following circuit, calculate (i) the capacitance 'C' of the capacitor,  if the power factor of the circuit is unity, and - Sarthaks eConnect |  Largest Online Education Community  OR  (A) With the help of labelled diagram explain the working principle of an a.c. generator.  (B) Obtain an expression for the induced voltage in an AC generator having a coil of area‘A’and number of turns ‘N’ rotating inside a magnetic field of strength ‘B’ with angular speed ‘ω’. | | | 3  2  OR  3  2 |
|  | (A) Two thin convex lenses of focal lenses f1 and f2 are placed coaxially in contact as shown in the figure given below.    Obtain the expression for the effective focal length of this combination in terms of f1 and f2.  (B) Two thin lenses of powers + 15 D and – 5 D are in contact with each other forming a combination lens. An object is placed at 30 cm in front of this combination. Calculate the position of image formed.  **OR**  (A) A light ray incident on a face of an equilateral glass prism. Draw a labelled diagram showing the refraction of ray of light by prism. Also write the expression of refractive index of prism in terms of angle of minimum deviation and angle of prism.  (B) A ray of light incident on a face of an equilateral prism shows minimum deviation of 300. Calculate the speed of light in through the prism. | | | 3  2  OR  3  2 |
| **SECTION E** | | | | |
|  | **Wheatstone bridge**  A Wheatstone bridge is an electrical circuit used to measure an unknown electrical resistance by balancing two legs of a bridge circuit, one leg of which includes the unknown component. The primary benefit of the circuit is its ability to provide extremely accurate measurements. The resistance is adjusted until the bridge is "balanced" and no current flows through the galvanometer. At this point, the voltage between the two midpoints (B and D) will be zero. Therefore, the ratio of the two resistances in the known leg is equal to the ratio of the two resistances in the unknown leg  i) What is the principle of the Wheatstone bridge?  ii) What are the factors on which sensitivity of a galvanometer depends?  iii) The resistances of the four arms R1, R2, R3 and RX in a Wheatstone's bridge are 10Ω, 30Ω, 90Ω and 30Ω, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50Ω, find the current drawn from the cell?  OR  iii) A Wheatstone bridge has four resistances R1, R2, R3 and RXof values 200Ω, 20Ω, 400Ω, and 40Ω respectively. If the bridge is connected to a 1.5 V battery, calculate the currents through individual resistors. | | | 1  1  2  OR  2 |
|  | **Huygens’ Principle**  Huygens principle is the basis of wave theory of light. According to Huygens principle, each point on a wavefront is a source of secondary waves, which add up to give a wavefront at any later time. The secondary wavelets spread out in all direction with the speed of light in the given medium. Reflection of light and refraction of light can be proved by using Huygens principle.  (i). A light wave enters from air into glass. How will the wavelength and frequency of light be affected.  (ii). What is the phase difference between two points on a wavefront?  (iii). Using Huygens principle verify Snell’s law of refraction of a plane wave propagating from rarer to denser medium.  OR  (iii). Depict the shape of the refracted wavefront when a plane wavefront is incident on(i) a convex lens (ii) a prism. | | | 1  1  2  OR  2 |

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