|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PB/PH/1220/A 25/01/2021** | | | | | |
| **PRE-BOARD EXAMINATION (2020-21)** | | | | | |
| **Subject: PHYSICS**  **Grade: XII** | | Max. Marks:70Time:3 Hours | | | |
| **Name:** | | | **Section:** | **Roll No:** | |
| **General Instructions:**   * All questions are compulsory. There are 33 questions in all. * This question paper has five sections: Section A, Section B, Section C, Section D and Section E. * Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each. * There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions. | | | | | |
|  | **SECTION A**  **(All questions are compulsory. In case of internal choices, attempt any one of them.)** | | | |  |
| 1 | Why is it necessary that the field lines from a point charge placed in the vicinity of a conductor must be normal to the surface of the conductor at every point? | | | | 1 |
| 2. | What is the electrostatic potential due to an electric dipole at an equatorial point? | | | | 1 |
| 3. | The horizontal component of the earth’s magnetic field at a place is B and angle of dip is 60°. What is the value of vertical component of earth’s magnetic field at equator?  **OR**  A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip down at 60° with the horizontal. The horizontal component of the earth’s magnetic field at the place is known at to be 0.4 G. Determine the magnitude of the earth’s magnetic field at the place. | | | | 1 |
| 4. | A plane electromagnetic wave travels in vacuum along z-direction. What can you say about the direction of electric and magnetic field vectors?  **OR**  Arrange the following electromagnetic waves in order of increasing frequency:  ϒ-rays, microwaves, infrared rays and ultraviolet rays. | | | | 1 |
| 5. | The stopping potential in an experiment on photoelectric effect is 1.5 V. What is the maximum kinetic energy of the photoelectrons emitted? | | | | 1 |
| 6. | An electron and alpha particle have the same de Broglie wavelength associated with them. How are their kinetic energies related to each other? | | | | 1 |
| 7. | The ground state energy of hydrogen atom is – 13.6 eV. If an electron makes a transition from an energy level – 0.85 eV to –3.4 eV, calculate the wavelength of the spectral line emitted. | | | | 1 |
| 8. | Define impact parameter. | | | | 1 |
| 9. | Write two characteristic features to distinguish between n-type and p-type semiconductors. | | | | 1 |
| 10. | Give two advantages of LED’s over the conventional incandescent lamps. | | | | 1 |
|  | **For question numbers 11, 12, 13 and 14, 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 but 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** | | | |  |
| 11. | **Assertion (A):** Workdone in moving a charge on equipotential surface is zero  **Reason (R)**: All points on equipotential surface has variable potentials. | | | | 1 |
| 12. | **Assertion(A):** Manganin wire is used to make metre bridge wire  **Reason (R):** Temperature coefficient of resistance is low and positive for alloys. | | | | 1 |
| 13. | **Assertion(A):** Gamma rays travels faster than x-rays in vacuum.  **Reason (R):** Speed of em wave doesn’t depends on medium. | | | | 1 |
| 14. | **Assertion(A):** Energy of electron in Hydrogen atom is negative.  **Reason (R):** Electron is bounded to the nucleus. | | | | 1 |
|  | **SECTION – B**  **(Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.)** | | | |  |
| 15. | **FARADAY'S LAWS OF ELECTROMAGNETIC INDUCTION:**  Faraday performed a series of experiments to demonstrate the phenomenon of electromagnetic induction. He summed up his conclusions into two laws, known as Faraday's laws of electromagnetic induction.  • **First Law:** When the magnetic flux Unking a conductor or coil changes, an e.m.f. is induced in it. The induced emf. lasts so long as the change in magnetic flux linking the coil continues. It does not matter how the change in magnetic flux is brought about. The essence of the first law is that the induced emf. appears in a circuit subjected to changing magnetic field.  • **Second Law:** It gives the magnitude of the induced emf. in a conductor or coil and may be stated as under: The magnitude of the emf. induced in a conductor or coil is directly proportional to the rate of change of flux linkages  The direction of induced emf. is given by **Lenz's law**- It states that the induced current will flow in such a direction so as to oppose the cause that produces it i.e., induced current opposes the changing magnetic field that causes it.   1. Induced emf depends on 2. area of coil 3. Magnetic field strength 4. number of turns of coil 5. all the above 6. If north pole of bar magnet moving towards a coil then 7. South pole will be created on the face of coil 8. North pole will be created on the face of coil 9. Current flows in the coil in clockwise direction 10. All the above 11. Lenz law is the consequence of 12. Law of conservation of angular momentum 13. Law of conservation of mass 14. Law of conservation of energy 15. None of the above 16. Predict the directions of induced current in metal rings 1 lying in the same plane where current I in the wire is increasing steadily.      1. Clockwise 2. Anticlockwise 3. First clockwise then anticlockwise 4. cannot predict 5. If a square of side 5cm is moving horizontally with uniform velocity 25m/s within the magnetic field of strength of 4T,acting normal to its surface then the induced emf is 6. 0.5V 7. 6V 8. 3.05V 9. Zero | | | | 4 |
| 16. | **TOTAL INTERNAL REFLECTION:**  When light travels from a denser medium (e.g., water) to a rarer medium (e.g., air), under certain conditions, light is totally reflected back at the interface into the denser medium. This phenomenon is called total internal reflection.  For a pair of media in contact, the angle of incidence in the denser medium for which the angle of refraction in the rarer medium becomes 90° is called critical angle C.  **Conditions for total internal reflection:**  The two essential conditions for total internal reflection are:  (i) Light must travel from a denser medium (i.e. having higher refractive index) to a rarer medium (i.e. having lower refractive index).  (ii) The angle of incidence in the denser medium must be greater than the critical angle for the two media in contact.   1. During refraction of light from denser to rarer medium 2. Frequency decreases 3. Frequency increases 4. frequency remains same 5. speed increases 6. If the critical angle is 300 then the refractive index of denser medium will be 7. 1 8. 2 9. 3 10. 4 11. Light cannot easily escape a diamond without multiple internal reflections. This is because: 12. Its critical angle with reference to air is too large 13. Its critical angle with reference to air is too small 14. The diamond is transparent 15. Rays always enter at angle greater than critical angle  Fiber optic cables work because of the principle of \_\_\_\_\_.  1. total internal reflection 2. total internal refraction 3. incomplete internal refraction 4. partial internal reflection 5. In case of TIR 6. i> iC 7. Light travels from denser to rarer 8. TIR obeys laws of reflection 9. All the above | | | | 4 |
|  | **SECTION– C**  **(All questions are compulsory. In case of internal choices, attempt anyone.)** | | | |  |
| 17. | Obtain the expression for potential energy of an electric dipole of dipole moment **P** placed in an electric field **E**.  **OR**  Obtain the expression for energy stored in the parallel plate capacitor. | | | | 2 |
| 18. | The plot of the variation of potential difference across a combination of three identical cells in  series, versus current is as shown below. What is the emf of each cell? Find the internal resistance of each cell. | | | | 2 |
| 19. | Define the term: magnetic dipole moment of a current loop. Write the expression for the magnetic moment when an electron revolves at a speed ‘v’, around an orbit of radius ‘r’ in hydrogen atom.  **OR**    A charge ‘q’ moving along the X-axis with a velocity v is subjected to a uniform magnetic field B acting along the Z-axis as it crosses the origin O.   1. Trace its trajectory. 2. Does the charge gain kinetic energy as it enters the magnetic field? Justify your answer. | | | | 2 |
| 20. | What are eddy currents? How are these currents reduced in the metallic cores of transformers? | | | | 2 |
| 21. | A small telescope has an objective lens of focal length 150 cm and an eye piece of focal length 5 cm. If this telescope is used to view a 100 m high tower 3 km away, find the height of the final image when it is formed 25 cm away from the eye piece. | | | | 2 |
| 22. | A beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes in a Young’s double slit experiment. What is the least distance from the central maximum where the bright fringes due to the both the wavelengths coincide? The distance between the slits is 2mm and the distance between the plane of the slits and screen is 120 cm  **OR**  A parallel beam of monochromatic light of wavelength 500 nm falls normally on a narrow slit and the resulting diffraction pattern is obtained on a screen 1 m away. It is observed that the first minimum is at a distance of 2.5mm from the centre of the screen.  Find   1. the width of the slit. 2. the distance of the second maximum from the centre of the screen. | | | | 2 |
| 23. | Using Bohr’s second postulate of quantization of orbital angular momentum show that the circumference of the electron in the nth orbital state in hydrogen atom is n times the de Broglie wavelength associated with it. | | | | 2 |
| 24. | Consider the D-T reaction (deuterium-tritium fusion)    Calculate the energy released in MeV in this reaction from the data: | | | | 2 |
| 25. | Draw the circuit diagram of a full wave rectifier using p-n junction diode. Explain its working and show the output, input waveforms. | | | | 2 |
|  | **SECTION -D**  **(All questions are compulsory. In case of internal choices, attempt anyone.)** | | | |  |
| 26. | Answer the following:   1. Why are the connections between the resistors in a meter bridge made of thick copper strips? 2. Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire? 3. Which material is used for the meter bridge wire and why?   **OR**  Two students X and Y perform an experiment on potentiometer separately using the circuit diagram shown here. Keeping other things unchanged  (i) X increases the value of resistance R  (ii) Y decreases the value of resistance S in the set up.  How would these changes affect the position of the null point in each case and why? | | | | 3 |
| 27. | A wire AB is carrying a steady current of 12 A and is lying on the table. Another wire CD carrying 5A is held directly above AB at a height of 1 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of g = 10 ms–2] | | | | 3 |
| 28. | Find the position of the image formed of the object 'O’ by the lens combination given in the  figure. | | | | 3 |
| 29. | A proton and an alpha particle are accelerated through the same potential. Which one of the two has i) greater de Broglie wavelength and ii) less kinetic energy? Give reasons to justify your answer  **OR**  A beam of monochromatic radiation is incident on a photosensitive surface. Answer the following questions giving reasons:   1. Do the emitted photoelectrons have the same kinetic energy? 2. Does the kinetic energy of emitted electrons depend on intensity of incident radiation? 3. On what factors does the number of emitted photoelectrons depend? | | | | 3 |
| 30. | 1. How is photodiode fabricated? 2. Briefly explain its working. Draw its V–I characteristics for two different intensities of illumination. | | | | 3 |
|  | **SECTION – E**  **(All questions are compulsory. In case of internal choices, attempt any one.)** | | | |  |
| 31. | 1. Using Gauss law, derive an expression for the electric field intensity at any point near infinite plane sheet of uniform surface charge density σ C/m2. 2. A hollow cylindrical box of length 1m and area of cross-section 25 cm2 is placed in a three-dimensional coordinate system as shown in the figure. The electric field in the region is given by E =50 x, where E is in NC–1 and x is in metres. Find 3. Net flux through the cylinder. 4. Charge enclosed by the cylinder.   **OR**   1. Derive an expression for electric field at a point on equatorial line of an electric dipole. 2. Three point charges +2µC , -3µC , -3µC are kept at the vertices A B and C respectively of an equilateral triangle of side 30cm. Calculate the electric field at the vertex A due to charges at B and C? | | | | 5 |
| 32. | 1. Describe briefly, with the help of a labelled diagram, the basic elements of an AC generator. 2. State its underlying principle. Show diagrammatically how an alternating emf is generated by a loop of wire rotating in a magnetic field. 3. Write the expression for the instantaneous value of the emf induced in the rotating loop.   **OR**   1. Derive an expression for the impedance of a series LCR circuit connected to an AC supply of variable frequency. 2. Plot a graph showing variation of current with the frequency of the applied voltage. 3. Explain briefly how the phenomenon of resonance in the circuit can be used in the tuning mechanism of a radio or a TV set. | | | | 5 |
| 33. | 1. What is the importance of coherent sources in the phenomenon of interference. 2. Deduce the expression for the fringe width in Young’s double slit experiment. 3. How does the fringe width get affected, if the entire experimental apparatus of Young is immersed in a medium of refractive index n?   **OR**   1. State Huygen’s principle. Using this principle explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a narrow beam coming from a monochromatic source of light is incident normally. 2. Show that the angular width of the first diffraction fringe is half of that of the central fringe. 3. If a monochromatic source of light is replaced by white light, what change would you observe in the diffraction pattern? | | | | 5 |
|  | \*\*\* | | | |  |