CBSE Sample Paper 3

Class XII Exam 2022-23

Physics

Time: 3 Hours **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.

SECTION-A

1. View Solution Two point charge Q and $-2Q$ are placed at some distance apart. If the electric field at the location of Q is E, then the electric field at the location of $-2Q$ will be

(a) $-\frac{E}{2}$ (b) $-\frac{3E}{2}$

(c) $-E$ (d) $-2E$

2. View Solution The electric potential due to a small electric dipole at a large distance r from the center of the dipole is proportional to

(a) r (b) $\frac{1}{r}$

(c) $\frac{1}{r^2}$ (d) $\frac{1}{r^3}$

3. View Solution If a current of 300 mA is flowing in a conductor, then the number of electrons passed through the conductor in 4 min. is (Charge on an electron $= 1.6 \times 10^{-19}$ C)

(a) 4.5×10^{20} (b) 9.0×10^{20}

(c) 4.5×10^{18} (d) 9.0×10^{18}

4. View Solution Two thin, long, parallel wires, separated by a distance d carry a current of (i) A in the same direction. They will

(a) attract each other with a force of $\mu_0 i^2/(2\pi d)$

(b) repel each other with a force of $\mu_0 i^2/(2\pi d)$

(c) attract each other with a force of $\mu_0 i^2/(2\pi d^2)$

(d) repel each other with a force of $\mu_0 i^2/(2\pi d^2)$

5. View Solution Two long straight parallel conductors separated by a distance of 0.5 m carry currents of 5 A and 8 A in the same direction. The force per unit length experienced by each other is

(a) 1.6×10^{-5} N (attractive)

(b) 1.6×10^{-5} N (repulsive)

(c) 16×10^{-5} N (attractive)

(d) 16×10^{-5} N (repulsive)

6. View Solution The direction of null points are on the equatorial line of a bar magnet, when the north pole of the magnet is pointing towards

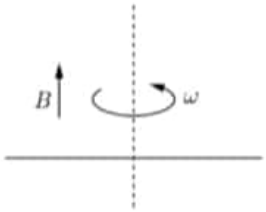
(a) north

(b) south

(c) east

(d) west

7. View Solution A conducting rod of length $2l$ is rotating with a constant angular speed ω about its perpendicular bisector as shown in the figure. A uniform magnetic field B exists parallel to the axis of rotation. The E.M.F. induced between two ends of the rod is



(a) zero

(b) $B\omega l^2$

(c) $\frac{1}{2}B\omega l^2$

(d) $\frac{1}{8}B\omega l^2$

Continue on next page.....

8. An electromagnetic wave of frequency 3 MHz passes from vacuum into a medium with dielectric constant $k = 4$. Then

View Solution

(a) both wavelength and frequency remain unchanged

(b) wavelength is doubled and frequency becomes half

(c) wavelength is halved and frequency remains unchanged

(d) wavelength is doubled and the frequency remains unchanged

9. If a wire of length 2 m is moving with a velocity of $1\ \text{m-s}^{-1}$ perpendicular to a magnetic field of 0.5 T, then E.M.F. induced in the wire will be

View Solution

(a) 0.2 V (b) 0.5 V

(c) 1 V (d) 2 V

10. When a compact disc is illuminated by a source of white light, coloured lanes are observed. This is due to

View Solution

(a) dispersion (b) diffraction

(c) interference (d) refraction

11. There are n_1 photons of frequency ν_1 in a beam of light. In an equally energetic beam, there are n_2 photons of frequency ν_2. Their correct relation is

View Solution

(a) $\frac{n_1}{n_2} = 1$ (b) $\frac{n_1}{n_2} = \frac{\nu_1}{\nu_2}$

(c) $\frac{n_1}{n_2} = \frac{\nu_2}{\nu_1}$ (d) $\frac{n_1}{n_2} = \frac{\nu_1^2}{\nu_2^2}$

12. The total energy of an electron in the first excited state of hydrogen atom is about $-3.4\ \text{eV}$. Its kinetic energy in this state is

View Solution

(a) $-3.4\ \text{eV}$ (b) $3.4\ \text{eV}$

(c) $-6.8\ \text{eV}$ (d) $6.8\ \text{eV}$

13. A nuclear reaction given by: ${}_ZX^A \rightarrow {}_{Z+1}Y^A + {}_{-1}e^0 + \overline{\nu}$ represents

View Solution

(a) β-decay (b) γ-decay

(c) fusion (d) fission

Continue on next page.....

14. An energy source will supply a constant current into the load, if its internal resistance is

View Solution

(a) zero

(b) equal to load resistance

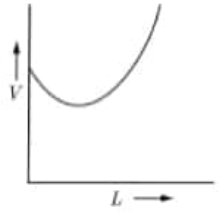
(c) very large than load resistance

(d) non-zero but less than load resistance

15. A dielectric plate is inserted between plates of a parallel plate capacitor, to fill the space between the plates. The capacitor is charged and later disconnected from the battery. Now the dielectric plate is slowly withdrawn from the capacitor. The graph of potential difference V across the plates and the length of the dielectric plate L with drawn is

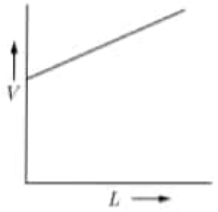
View Solution

(a)

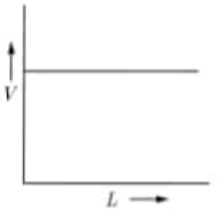


(b)

(c)

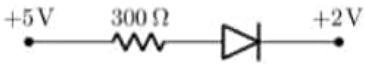


(d)



16. **Assertion :** The value of current through p - n junction in the given figure will be 10 mA.

View Solution



Reason : In the above figure, p-side is at higher potential than n-side.

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

17. View Solution **Assertion :** Thin films such a soap bubble or a thin layer of oil on water show beautiful colours when illuminated by white light.
Reason : It happens due to the interference of light reflected from the upper surface of the thin film.

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

18. View Solution **Assertion :** Mass of moving photon varies inversely as the wavelength.
Reason : Energy of the particle = mass $\times$ (speed of light)^2

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) The Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

SECTION-B

19. View Solution How are electromagnetic waves produced? What is the source of energy of these waves? Write mathematical expressions for electric and magnetic fields of an electromagnetic wave propagating along the z-axis. Write any two important properties of electromagnetic waves.

20. View Solution State two characteristic properties distinguishing behaviour of paramagnetic and diamagnetic materials.

21. View Solution What are isotones and isomers? Give suitable examples.

or

State the necessary conditions for nuclear fusion to occur.

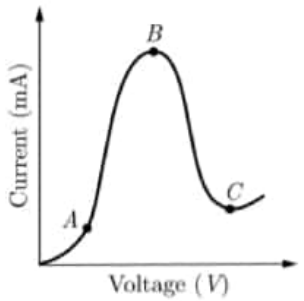
22. View Solution A ray of light passes though an equilateral glass prism such that the angle of incidence is equal angle of emergence and each of these angles is equal to $\frac{3}{4}$ of angle of prism. What is the value of deviation?

23. Distinguish between n-type and p-type semiconductors.

View Solution

or

The graph shown in the figure represents a plot of current versus voltage for a given semiconductor. Identify the region at which the semiconductor has a negative resistance.



24. Two plane monochomic waves propagating in the same direction with amplitudes A and $2A$ and differing in phase by $\pi/3$ superpose. Calculate the amplitude of the resultant wave.

View Solution

25. Find the electric dipole moment electron and a proton which distance is 4.3 nm apart.

View Solution

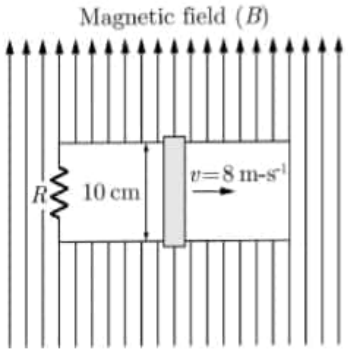
SECTION-C

26. State the factors on which the force acting on a charge moving in a magnetic field depends. Write the expression for this force. When is this force minimum and maximum?

View Solution

27. A metal rod makes contact and completes the circuit as shown in the figure. The direction of motion of rod is perpendicular to the magnetic field of 0.5 T. If the resistance R is 2 Ω. What is the force needed to move the rod as indicated with a constant velocity of 8 m-s^{-1} ?

View Solution



28. An applied voltage signal consists of a superposition of a DC voltage of high frequency. The View Solution circuit consists of an inductor and a capacitor in series. Show the DC signal will appear across C and the AC voltage across L.

or

An alternating voltage of frequency f is applied across LCR circuit. Let f_r be the resonance frequency for the circuit. Will the current in the circuit lag, lead or remain in phase with the applied voltage when

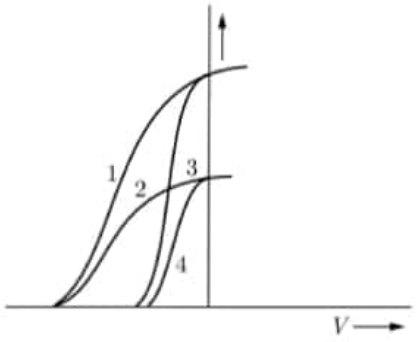
1. $f > f_r$
2. $f < f_r$?

Explain your answer in each case.

29. Describe the construction and work of a photocell (or photo-emissive cell). View Solution

or

The given graph shows the variation of photoelectric current I versus applied voltage V for two different photosensitive materials and for two different intensities of the incident radiations. Identify the pairs of curves that corresponds to different materials but same intensity of incident radiation.



30. A hydrogen atom initially in its ground absorbs a photon and is in the excited state with energy View Solution 12.5 eV. Calculate the longest wavelength of the radiation emitted and identify the series to which it belongs.
[Take Rydberg constant $R = 1.1 \times 10^7 \text{m}^{-1}$]

SECTION-D

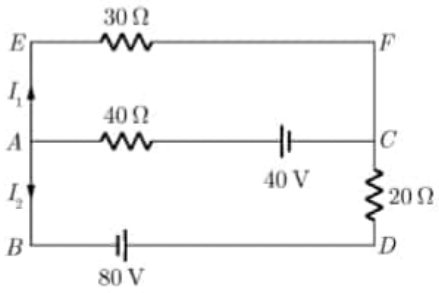
31. Two uniformly large parallel thin plates having charge densities $+\sigma$ and $-\sigma$ are kept in the View Solution X - Z plane at a distance d apart. Sketch and equipotential surface due to electric field between the plates. If a particle of mass m and charge $-q$ remains stationary between the plates, what is the magnitude and direction of this field ?

or

Find the electric potential and then electric field due to an electric dipole by differential relationship between field and potential.

32.

View Solution



(a) Using Kirchhoff's rules, calculate the current in the arm AC of the given circuit.
(b) On what principle does the meter bridge work? Why are the metal strips used in the bridge?

or

Define the terms drift velocity and relaxation time. Establish the relation between drift velocity of electrons and electric field applied to the conductor.

33. Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place at a single slit of aperture 2×10^{-4} m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.

View Solution

or

(i) State the essential conditions for diffraction of light.
(ii) Explain diffraction of light due to a narrow single slit and the formation of pattern of fringes on the screen.
(iii) Find the relation for width of central maximum in terms of wavelength λ, width of slit a , and separation between slit and screen D.
(iv) If the width of the slit is made double the original width, how does it affect the size and intensity of the central band?

SECTION-E

34. A child is observing a thin film such as a layer of oil on water show beautiful colours when illuminated by white light. He feels happy and surprised to see this. His teacher explains him the reason behind it. The child then gives an example of spreading of kerosene oil on water to prevent malaria and dengue.

View Solution

(a) Name the phenomenon involved ?
(b) What do you mean by interference?
(c) Write any four the necessary conditions for interference of light.

35. View Solution Vijay was preparing an electronic project for science exhibition. He required to light the LED using a 6V supply. LEDs need only a very small current to make them light and they do not heat up in use. So he put a resistor in series to limit the current. Then, there would be potential difference of 4V across the resistor as there is always 2.0V across the LED itself when it is conducting. The current should be 10 mA through both LED and the resistor. He could use the resistance by equation, $R = \frac{V}{I}$ to calculate the value of R.

$$R = \frac{V}{I} = \frac{4\text{V}}{10\text{mA}}$$

$$= \frac{4\text{V}}{0.01\text{A}} = 400\ \text{Volt}$$

Thus the protecting resistor should be around $400\,\Omega$.

(a) What do you mean by semiconductor?
(b) A semiconductor has equal electron and hole concentration $6 \times 10^8/\text{m}^3$. On doping with certain impurity, electron concentration increases to $9 \times 10^{12}/\text{m}^3$.
  (i) Identify the new semiconductor obtained after doping.
  (ii) Calculate the new hole concentration.