

SAMPLE PAPER-04
PHYSICS (Theory)
(Questions)
Class – XII

Time allowed: 3 hours

Maximum Marks: 70

General Instructions:

- a) All the questions are compulsory.
- b) There are **26** questions in total.
- c) Questions **1** to **5** are very short answer type questions and carry **one** mark each.
- d) Questions **6** to **10** carry **two** marks each.
- e) Questions **11** to **22** carry **three** marks each.
- f) Questions **23** to **26** carry **five** marks each.
- g) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
- h) Use of calculators is **not** permitted. However, you may use log tables if necessary.
- i) You may use the following values of physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

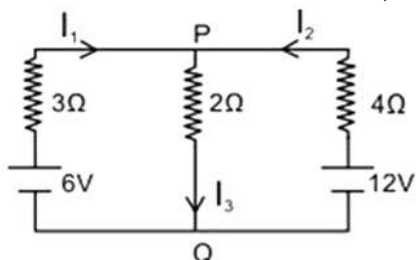
$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

1. What is the basic use of capacitor?
2. The current i flows in a wire of circular cross section with the free electrons travelling with a drift velocity v . What is the drift velocity of electrons when a current of $2i$ flows in another wire of twice the radius and of the same material?
3. A radioactive material has a half life of 1 minute. If one of the nuclei decays now, when will the next one decay?
4. What is the value of conductivity of a semiconductor at absolute zero?
5. The surfaces of sunglasses are curved, yet their power may be zero. Why?
6. Define the term electric dipole moment. Is it a scalar or a vector quantity?
7. In what ways electric and magnetic fields are different?
8. Velocity of light in glass is $2 \times 10^8 \text{ m/s}$ and that in air $3 \times 10^8 \text{ m/s}$. By how much would an ink dot appear to be raised, when covered by a glass plate 6.0 cm thick?
9. In a photoelectric effect experiment, for radiation with frequency ν_0 , with $h\nu_0 = 8 \text{ eV}$, electrons are emitted with energy 2 eV. What is the energy of the electrons emitted for incoming radiation of frequency $1.25\nu_0$?
10. Why is an FM signal less susceptible to noise than an AM signal?
11. (a) What is meant by energy density of a parallel plate capacitor? Derive its expression also.

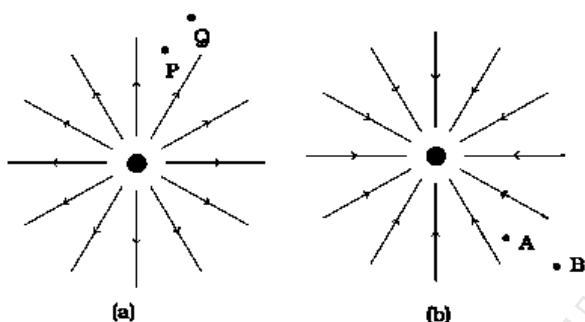
- (b) What is the area of the plates of a 2 Farad parallel plate air capacitor, given that the separation between the plates is 0.5 cm?
12. (a) For the given carbon resistor, let the first strip be yellow, second strip be red, third strip be orange and forth be gold. What is its resistance? (b) What are thermistors?
 13. State Ampere's circuital law. Also find the expression for the magnetic field due to the infinite long straight wire carrying current by using this law.
 14. (a) What do you mean by hypermetropia? What are its possible cause and how it is corrected?
(b) A hypermetropic person whose near point is at 100 cm wants to read a book at 25 cm. Find the nature and power of the lens needed.
 15. Light falls from glass ($n = 1.5$) to air. Find the angle of incidence from which the angle of deviation is 90° ?
 16.
 - a) Represent the AM process graphically.
 - b) Write its two advantages
 17. Why is the mass of a nucleus always less than the sum of the masses of its constituents, neutrons and protons?
 18. Define coefficient of mutual inductance of two cells. A secondary coil of n_2 turns is wound on a long solenoid of area of cross section A having a primary coil of n_1 turns per unit length. What is the mutual inductance of the two cells?
 19.
 - a. What is transmission medium?
 - b. Explain the term short wave band and medium wave band.
 - c. What is a transducer?
 20. Three point charges of $+2\mu\text{C}$ and $-3\mu\text{C}$ are kept at the vertices A,B and C respectively of an equilateral triangle of side 20cm. what should be the sign and magnitude of the charge to be placed at the mid-point M of side BC. So that charges at remains in equilibrium.
 21.
 - a. What do you understand by the term 'magnetic length' and 'geometric length' of the magnet?
 - b. How are the two related to each other?
 - c. Define angle of a dip at a given place.
 22. The oscillating magnetic field in a plane electromagnetic wave is given by $B_y = 8 \times 10^{-6} \sin(20 \times 10^{11} t + 300 \pi x) T$. Calculate the wavelength of electromagnetic wave. Write down the expression for oscillating electric field.
 23. Ram had gone out of station, on a vacation for one week. After coming back, he tried to start his car but failed. He realized that he needs to charge the battery of his car. He went to the workshop to hire a battery charger. Ram connected the black lead of the battery charger to the positive terminal of the car battery and the red lead to the negative terminal of the car battery. The car battery was not charged. Ram thought over it and decided to reverse the leads. Now he was successful in charging the car battery.
 - a. What according to you are the values displayed by Ram?
 - b. How should a battery charger be connected to a car battery?

24. Calculate the value of current I_1 , I_2 and I_3 in the circuit given below using Kirchhoff's law.



Or

The diagram given below shows the field lines of a positive and negative point charge respectively.



- Give the signs of the potential difference $V_P - V_Q$; $V_B - V_A$.
 - Give the sign of the potential energy difference of a small negative charge between the points Q and P; A and B.
 - Give the sign of the work done by the field in moving a small positive charge from Q to P.
 - Give the sign of the work done by the external agency in moving a small negative charge from B to A.
 - Does the kinetic energy of a small negative charge increase or decrease in going from B to A?
25. An object is placed at (i) 10 cm; (ii) 5 cm in front of a concave mirror of radius of curvature 15 cm. Find the position, nature, and magnification of the image in each case.

Or

Answer the following:

- A virtual image, we always say cannot be caught on a screen. Yet, when we see a virtual image we are obviously, bringing it on the screen of our eye. Is there a contradiction?

- b. Why must both objective and eye piece of a compound microscope have short focal lens?
 - c. When viewing through a compound microscope, our eye should be positioned not on the eye piece but a short distance away from it for best viewing. Why?
26. You have learnt in the text how Huygens's principle leads to the laws of reflection and refraction. Use the same principle to deduce directly that a point object placed in front of a plane mirror produces a virtual image whose distance from the mirror is equal to the object distance from the mirror.

Or

Answer the following:

- (a) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band?
- (b) In what way is diffraction from each slit related to the interference pattern in a double-slit experiment?
- (c) When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?
- (d) Two students are separated by a 7 m partition wall in a room 10 m high. If both light and sound waves can bend around obstacles, how is it that the students are unable to see each other even though they can converse easily?
- (e) Ray optics is based on the assumption that light travels in a straight line. Diffraction effects disprove this assumption. Yet the ray optics assumption is so commonly used in understanding location and several other properties of images in optical instruments. Justify?