2024

PHYSICS

(Thory)

Full Marks : 70

Pass Marks : 21

Time : Three Hours

All questions are compulsory

The figure in the right margin indicate full marks for the questions.

You may use the following values of physical constants wherever necessary :

$$\mu_o = 4\pi \times 10^{-7} S.I.\ units$$

$$h = 6.6 \times 10^{-34}\ Js$$

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

$$1\ a.m.u. = 1.66 \times 10^{-27}\ Kg$$

Question Nos. 1 to 10 are "Very Short Answer" type questions carrying 1 mark each.

1. State Ampere's circuital law.   1

2. What is a transformer?   1

3. Of the bulbs in a house, one glows brighter than the other which of the two has a large resistance. Justify it.   1

4. A uniform magnified field and a uniform electric field are produced pointing in the same direction. An electron is projected with its same velocity pointing in the same direction. What will happen to the motion of the electron?   1

5. Find the time taken by 60 H_z a.c. to reach its peak value ?   1

P.T.O.

6. Can a.c. source be connected to a circuit and yet deliver no power to it. If so, under what circumstances ? 1

7. Draw a labelled diagram of an electromagnetic wave propagating in Z-direction. 1

8. The image of a small electric bulb fixed on the wall of a room is to be obtained on the opposite wall 3m away by means of a large convex lens. What is the maximum possible focal length of the lens required for the purpose ? 1

9. The shortest wavelength lines in Lyman and Balmer series have their wavelengths in the ratio 1:4. Justify it by calculation. 1

10. What is rectifier ? 1

Question Nos.11 to 20 are " Short Answer Type" questions carrying 2 marks each.

11. Define intensity of electric field. Write its unit in S.I. units. 2

12. When a proton approaches another fixed proton, what happens to – 2

    (i)   the kinetic energy of the approaching proton.

    (ii)   the total energy of the system.

13. A wire of 10gm, radius 1mm is compressed to its length by 10%. Calculate the percentage in its resistance. 2

14. At what position, the neutral point will lie for a bar magnet when magnetic axis of the 2 magnet is lying in the magnetic meridian –

    (i)   with North – Pole of magnet pointing North.

    (ii)   with South – Pole of magnet pointing North ?

15. 11 kW of electric power can be transmitted to a distant station at (i) 220V or (ii) 22000V. Which of the two modes of transmission should be preferred and why ? Support your answer with possible calculations. 2

16. 220V A.C. is more dangerous than 220V D.C. Why ?   2

17. Why did Maxwell introduce the concept of displacement current ? Give reason.   2

18. Can compound microscope function as a telescope by inverting it ? Can a telescope
    function as a compound microscope ?   2

19. Draw a labelled diagram of rays through a simple microscope.   2

20. What is doping ? What are the types of an extrinsic semiconductor?   2

Question Nos.21 to 26 are " Short Answer Type I" questions carrying 3 marks each.

21. n identical cells are joined in series with two cells A and B with reverse polarities e.m.f. of
    each cell is E and internal resistance R. Find the potential difference across the cell A and
    B.   3

                                        OR

    Distinguish between e.m.f. and terminal potential difference of a cell.
    (Give any three points)   3

22. A small candle 2.5cm in size is placed 27cm in front of a concave mirror of radius of

    curvature 36 cm. At what distance from the mirror should a screen be placed in order to

    receive a sharp image ? Describe the nature and size of the image. If the candle is moved

    closer to the mirror, how would the screen have to be moved ?   3

                                        OR

    One face of a prism of refraction index 1.5 and angle 75° is covered with a liquid of

    refractiveindex $\frac{3\sqrt{2}}{4}$ .What should be the angle of incidence of light on the clear face of

    prism for which light is just totally reflected at the liquid face ?   3

23. A proton and an electron have same de-Broglie wavelength which of them moves fast and
    which possesses more K.E. Justify your answer.   3

                                        OR

    If the frequency of incident radiation on a photo cell is doubled for the same intensity.

    What changes will you observe in (i) K.E. of photo-electron emitted (ii) Photo-electric

    current and   (iii) Stopping potential. Justify your answer in each cases.   3

12 Phy (T) 16/24 (i)   **3**   **Contd.**

24. Define (i) Binding energy
    (ii) Mass defect and
    (iii) Nuclear force.   1+1+1= 3

OR

Define (i) Atomic mass unit
    (ii) One electron volt and
    (iv) Mass number   1+1+1=3

25. What is the nuclear radius and mass of Al^{27} if the radius of Fe^{125} is 6 Fermi ?

$$1\frac{1}{2} + 1\frac{1}{2} = 3$$

OR

Distinguish between nuclear fission and fusion. (Give three points)   3

26. What is an intrinsicsemiconductor ? For the conduction of current in an intrinsic semiconductor what are the responsible charge carriers ? Does an intrinsic semiconductor carry charge ?   1+1+1=3

OR

Give any three characteristics of a hole.   3

Question Nos. 27 to 29 are " Long Answer Type " questions carrying 5 marks each.

27. Derive lens maker's formula for a thin convex lens.   5

OR

Prove the law's of refraction of light on the basis of Huygen's principle. 5

28. Find the Magnetic field due to a solenoid by applying Ampere's circuital law. A solenoid of length 0.20m having 120 turns carries a current of 2.5 A. Find the magnetic field
    (i) in the interior of the solenoid and
    (ii) at the one end of it.   3+2=5

OR

Find the magnetic field intensity at apoint to a magnetic dipole along its axis. A magnet 2cm long has a pole strength of 60 Am. Find the magnitude of magnetic field strength B at a point on its axis at a distance of 20cm from it.   3+2=5

29. Obtain the electric field outside the shell of a spherical shell. A spherical Gaussian surface encloses a charge of 8.85×10^{-8} C. If the radius of the Gaussian surface is 10m. Calculate the electric flux passing through the surface. 4+1=5

OR

Find the capacitance of a parallel plate capacitor with a dielectric slab completely filled between the plates. A parallel plate capacitor with air between the plates has a capacitance of 8pF(1pF = 10^{-12} F). What will be the capacitance if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric medium constant 6 ? 4+1=5

Question Nos. 30 to 36 are " Multiple Choice Type " questions carrying 1 marks each. Choose the correct answer out of the our alternatives and rewrite the correct answer.

30. The expression of mobility (μ) in terms of drift velocity and electric field is 1
    (A) $\mu = v_d E$
    (B) $\mu = \dfrac{v_d}{E}$
    (C) $\mu = \dfrac{E}{v_d}$
    (D) $\mu = E^2 v_d$

31. At resonance in A.C. circuit, the value of power factor is 1
    (A) Zero
    (B) 2
    (C) 1
    (D) ∞

32. The refracting angle of a prism is A, the refractive index of the prism is $\mathrm{Cot}(\frac{A}{2})$. The angle of minimum deviation is 1
    (A) $180° - 2A$
    (B) $90° - A$
    (C) $180° + 2A$
    (D) $180° - 3A$.

33. The parameter of light wave which remains unaffected on refraction of light is 1
    (A) Speed
    (B) Frequency
    (C) Wavelength
    (D) None of the above.

34. Through what potential difference should an electron be accelerated so that its
de – Broglie wavelength becomes 1.22Å ?   1

   (A)   125V

   (B)   150V

   (C)   100V

   (D)   200V

35. The wavelength of matter wave is independent of   1

   (A)   mass

   (B)   velocity

   (C)   momentum

   (D)   charge

36. The energy gap in energy band diagram in Geis   1

   (A)   0.72 eV

   (B)   5.54 eV

   (C)   3 eV

   (D)   1.1 eV

*****