

S.No. : 519

BAS 3202

No. of Printed Pages : 07

Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 39907

Roll
No.

--	--	--	--	--	--	--	--	--	--

B. Tech. Examination 2021-22

(Even Semester)

PHYSICS - II

Time : Three Hours]

[Maximum Marks : 60

Note :— Attempt all questions.

SECTION – A

1. Attempt all parts of the following : $8 \times 1 = 8$

(a) In momentum of a particle is increased to four time then the De-Broglie wave length will become :

- (i) Two times
- (ii) Four times
- (iii) Half times
- (iv) One-fourth times

[P. T. O.

(b) Dual nature of matter was predicted by :

- (i) Schrodinger
- (ii) Louis-de-Broglie
- (iii) G. P. Thomson
- (iv) Werner-Heisenberg

(c) For non-relativistic for particle, the relation between phase velocity (V_p) any group velocity (V_g) is :

(i) $V_p = \frac{V_g}{2}$

(ii) $V_g = \frac{V_p}{2}$

(iii) $V_p = V_g$

(iv) $V_g = \frac{3}{2} V_p$

(d) The atomic diameter of an BCC crystal (if a is lattice parameter) is :

(i) a

(ii) $\frac{a}{2}$

ected by :

(iii) $\frac{a}{\left(\frac{4}{\sqrt{3}}\right)}$

(iv) $\frac{a}{\left(\frac{4}{\sqrt{2}}\right)}$

(e) Co-ordination number in simple cubic crystal structure :

(i) 1

(ii) 2

(iii) 3

(iv) 4

(f) The order of wavelength of X-rays is :

(i) 10^{-10} m

(ii) 10^{-6} m

(iii) 10^{-14} m

(iv) 10^{-16} m

(g) Super conductors are perfect :

(i) Diamagnetic

(ii) Ferromagnetic

(iii) Antiferromagnetic

(iv) Paramagnetic

[P. T. O.]

(h) Which of the property is not exhibited by super conductors :

- (i) $\mu_r = 0$
- (ii) Copper loss = 0
- (iii) $B \neq 0$
- (iv) $X = -1$

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

- (a) What is the uncertainty principle? Apply this to prove the non-existence of the electron in the nucleus.
- (b) What are the conventions while choosing a unit cell? Describe four different types of possible unit cells in three dimension.
- (c) Define poynting vector. Derive an expression for it and explain its physical significance for a plane electromagnetic wave.
- (d) Explain super conductivity on the basis of free electron model.

SECTION - C

Note :- Attempt all questions. Attempt any two parts from each questions. $5 \times 8 = 40$

3. (a) Show that De-Broglie wavelength of helium atom having energy at temperature T °K is given by :

$$\lambda = \frac{h}{\sqrt{3m\gamma B^T}}$$

- (b) Calculate the uncertainty in the position of an electron which has been accelerated through a potential difference of :

$$V = (1000 \pm 6) \text{ Volts } (h = 6.62 \times 10^{-34} \text{ Joule sec})$$
$$m = 9.1 \times 10^{-31} \text{ kg})$$

- (c) A particle is moving in one dimensional potential box (of infinite height) of width $25 \text{ \AA}$. Calculate the probability of finding the particle with in an interval of $5 \text{ \AA}$ at the centers of the box when it is in its state of least energy.

4. (a) Obtain the Miller indices of a plane whose intercepts are a , a/b and $3c$ on x , y and z axes respectively in a simple cubic unit cell.

[P. T. O.]

- (b) The ionic radii of Na^{++} (atomic weight 23) and Cl^- (atomic weight 35.5) are 1.0 and 1.8 Å, respectively. Assuming ions to be hard spheres. Calculate the density of NaCl . Compare this with measured density of 2.17 g/cm^3 .
- (c) The first order reflection from the plane of NaCl is obtained at an angle $2\theta = 20^\circ$ with the incident beam. If $d_0 = 2.82 \text{ Å}$. Calculate the wave length of X-ray used.
5. (a) An a.c. voltage $V = V_0 \sin \omega t$ is connected across a parallel plate capacitor C . Verify that the displacement current in the capacitor is the same as the conduction current in the wires.
- (b) If the earth receives $2 \text{ cal min}^{-1} \text{ cm}^{-2}$ solar energy what are the amplitude of electric and magnetic field of radiation.
- (c) Using Maxwell's relation $\nabla \cdot \vec{D} = \rho$ and $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$, prove that :
- $$\nabla \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$$
- equation of continuity.

6. (a) What is super conductivity? Draw the curve of resistivity versus temperature for normal metal.
- (b) Calculate the energy gap for Sn (tin), whose critical temperature is 3.72°K .
- (c) Write short notes on the following :
- (i) Nanomaterial
 - (ii) Nanotechnology

⌘⌘⌘⌘