

GOVERNMENT ZIRTIRI RESIDENTIAL SCIENCE COLLEGE

Subject: PHYSICS

Paper Name: Atomic, Nuclear Physics-I and Solid State Physics-I

Paper No: IV

Semester: 4th Semester

A. Multiple choice questions [25 (5 from each unit)]

1. K_{α} characteristic X-ray refers to the transition of electrons
 - a) from $n = 2$ to $n = 1$
 - b) from $n = 3$ to $n = 2$
 - c) from $n = 3$ to $n = 1$
 - d) from $n = 4$ to $n = 2$
2. If an electron in a hydrogen atom jumps from the third orbit to the second orbit, it emits a photon of wavelength λ . When it jumps from the fourth orbit to the third orbit, the corresponding wavelength of the photon will be
 - (a) $\frac{16}{25} \lambda$
 - (b) $\frac{9}{16} \lambda$
 - (c) $\frac{20}{7} \lambda$
 - (d) $\frac{20}{13} \lambda$
3. If the frequency of K_{α} X-ray emitted from an element with atomic number 31 is ν , then the frequency of K_{α} X-ray emitted from another element with atomic number 51 will be
 - (a) $\frac{25}{9} \nu$
 - (b) $\frac{5}{3} \nu$
 - (c) $\frac{51}{31} \nu$
 - (d) $\frac{9}{25} \nu$
4. Energy absorbed by electron in photoelectric effect is used in
 - (a) increasing the kinetic energy
 - (b) escaping the metal surface
 - (c) both (a) and (b)

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- (d) increasing the frequency
5. Maximum kinetic energy of the emitted photo-electrons depends on
(a) intensity of incident radiation
(b) frequency of incident radiation
(c) both (a) and (b)
(d) none of the above
6. The relation between nuclear radius and mass number is given by
a) $R = R_0 A^{\frac{1}{2}}$ ()
b) $R = R_0 A^{\frac{1}{3}}$ ()
c) $R = R_0 A^{\frac{1}{4}}$ ()
d) $R = (R_0 A)^{\frac{1}{3}}$ ()
7. The electron emitted in the radioactive decay process originates from
(a) inner orbits of atom
(b) free electrons existing inside the nucleus
(c) photons escaping from the nucleus
(d) decay of a neutron inside the nucleus
8. If the nucleus ${}_{13}^{27}\text{Al}$ has a nuclear radius of 3.6 fm, then the nuclear radius of ${}_{52}^{125}\text{Te}$ will be
(a) 9.6 fm
(b) 6.0 fm
(c) 4.8 fm
(d) 12.0 fm
9. An Alpha particle consist of
(a) one proton and two neutrons
(b) two protons and one neutron
(c) two proton and two neutrons
(d) one proton and one neutron
10. When beta-decay takes place from a nucleus of charge number (Z) and mass number (A), then for the product nucleus these become respectively
(a) Z+1, A
(b) Z, A+1
(c) Z-1, A-1
(d) Z, A-1
11. If the Interplaner distance of NaCl crystal is 0.28 nm, then the lattice parameter is
a) 0.14 nm

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- b) 0.28 nm
c) 0.58 nm
d) 0.84 nm
12. In HCP lattice, the effective number of lattice point per unit cell is
a) 7
b) 9
c) 10
d) 12
13. The Interplaner distance (d_{100}) for (100) plane of BCC is
a) $\frac{a}{\sqrt{2}}$
b) $\frac{a}{\sqrt{3}}$
c) a
d) $\frac{a}{2}$
14. If the packing fraction for a crystal is 74%, then the structure of the crystal is
a) BCC
b) FCC
c) HCP
d) both (b) & (c)
15. The number of diad axis of symmetry elements that are present in a cubic crystal are
a) 3
b) 4
c) 5
d) 6
16. Every reciprocal lattice vector is
a) Parallel to a lattice plane
b) Normal to a lattice plane
c) Inclined at 45° to a lattice plane
d) Inclined at 180° to a lattice plane
17. In Bragg's reflection for X-ray of wavelength $1 \text{ \AA}$, the reflection was found at a glancing angle of 30° . The spacing between the lattice planes is
a) $\sqrt{2} \text{ \AA}$
b) $1 \text{ \AA}$
c) $2 \text{ \AA}$

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d) $4 \text{ \AA}$

18. If V and V^* be the volume of a unit cell in direct and reciprocal lattice, then

a) $V = V^*$

b) $V = \frac{V^*}{8\pi^3}$

c) $V = 8\pi^3 V^*$

d) $V = \frac{8\pi^3}{V^*}$

19. At equilibrium condition of a diatomic molecule, the total force is

a) Minimum

b) Maximum

c) Unity

d) Zero

20. Van der Waal's interaction varies as

a) $\frac{1}{r^2}$

b) $\frac{1}{r^3}$

c) $\frac{1}{r^6}$

d) $\frac{1}{r^{12}}$

21. The value of Madelung constant of NaCl crystal is

a) 1.6381 ()

b) 1.7476 ()

c) 1.7627 ()

d) 1.4766 ()

22. Fermi level is defined as

a) Lowest filled level at 0K ()

b) Highest filled level at 0K ()

c) Lowest filled level at 300K ()

d) Highest filled level at 300K ()

23. As the temperature approaches absolute zero, the specific heat of solids approaches

(a) infinity

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- (b) zero
- (c) any value between zero and infinity
- (d) None of these

24. The average kinetic energy of an electron in the ground state in one dimension is equal to

- (a) $\frac{1}{2}E_F$
- (b) $\frac{1}{3}E_F$
- (c) $\frac{1}{4}E_F$
- (d) E_F

(where E_F is Fermi energy).

25. The relation between current density ($\vec{J}$) and electrical conductivity (σ) is given by

- (a) $\vec{J} = \sigma / \vec{E}$
- (b) $\vec{J} = \sigma \vec{E}$
- (c) $\vec{J} = 2\sigma \vec{E}$
- (d) $\vec{J} = \sigma^2 \vec{E}$

B. Fill up the blanks

1. In Hydrogen spectrum, _____ series is in the UV region.
2. In photoelectric effect, the _____ is the potential of cathode at which current becomes zero.
3. Compton effect is the _____ scattering between electron and photon.
4. The time at which the number of radioactive nuclei becomes half of the original number is known as _____ period.
5. Nuclear _____ reaction is the sources of stellar energy.
6. Regular and periodic arrangement of _____ in space is called Lattice.
7. Only _____ fold rotation axis of symmetry are possible in a single crystal.
8. Unit Cell description for Triclinic lattice is _____ and _____.
9. The number of lattice points/atoms per unit cell in Diamond Structure is _____.
10. Because of the periodic nature of Bravais lattice, each lattice point is surrounded by _____ of nearest neighbour.
11. The reciprocal lattice vector $\vec{a}^*$ is normal to _____ plane.
12. At sufficiently close separations the overlap energy in inert gas crystal is repulsive, in large part because of the _____.

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13. According to Debye, specific heat of solids at low temperature varies with absolute temperature(T) as $C_V \propto$ _____
14. Fermi level is defined for any temperature, but Fermi temperature is defined only at _____
15. Dulong and Petit's law fails for light elements such as Boron, Carbon, Beryllium etc because the Debye temperature of these elements is _____

Key Answers

A. Multiple choice questions

- | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (c) | 3. (a) | 4. (c) | 5. (b) | 6. (b) | 7. (d) |
| 8. (b) | 9. (c) | 10. (a) | 11. (b) | 12. (d) | 13. (d) | 14. (d) |
| 15. (d) | 16. (b) | 17. (b) | 18. (d) | 19. (d) | 20. (c) | 21. (b) |
| 22. (b) | 23. (b) | 24. (b) | 25. (b) | | | |

B. Fill up the blanks

1. Lyman
2. stopping potential
3. inelastic
4. half-life
5. fusion
6. geometrical points
7. 1, 2, 3, 4, 6
8. $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma$
9. 8
10. the same number
11. bc
12. Pauli Exclusion Principle
13. T^3
14. Absolute zero
15. Very high

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