# RIB RANK IMPROVEMENT BATCH
## ELECTRONICS ENGINEERING

**RIB-R | T7**

**Session 2019-20 | S.No. : 260819_LS1**

## ANSWER KEY ➤ Material Science

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

## DETAILED EXPLANATIONS

**1. (c)**

Ferrites exhibit hysteresis during magnetization. The hysteresis loops of Cu-Mn ferrite, Mg-Mn ferrite and Zn-Mn ferrite are square, and they are used as memory cores in computers.

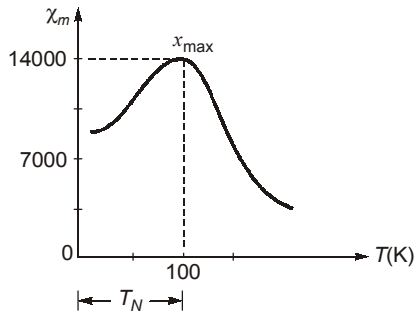
**2. (a)**

Ferrites have following properties:

- High electrical resistivities.
- Low power loss at high frequencies.
- Suitable for temporary as well as permanent magnetic application due to their spontaneous magnetization.
- Conductivity behaviour like those of semiconductors.
- Hysteresis loop is almost rectangular.

Hence, statements 1, 4 and 5 are correct.

**3. (d)**




At Neel temperature ($T_N$), susceptibility ($\chi_m$) is maximum.

**4. (d)**

Clausius Mossotti equation is valid for Lorentz internal field only and for Lorentz internal field, internal field constant is $\gamma = \frac{1}{3}$.

**5. (a)**

$$\text{Uniaxial stress } (P) = Y \cdot \frac{\Delta C}{C}$$

$$q = CV$$

$\Rightarrow$ Polarization, $$P = \frac{q}{A} = \frac{C}{A} \cdot V$$

Where $A$ is area of the crystal capacitor.

$\therefore$ $$\Delta P = \left(\frac{V}{A}\right) \times \Delta C$$

$\Rightarrow$ $$\frac{\Delta P}{P} = \frac{\Delta C}{C}$$

$\Rightarrow$ $$\text{Stress } (P) = Y \cdot \frac{\Delta P}{P} = \frac{130 \times 20}{500} = 5.2 \text{ GPa}$$

**6. (c)**

Both the given statements are correct.

**7. (c)**

Secondary or molecular bonds are either ion-dipole interaction, dipole-dipole interaction or vanderwalls are weaker than primary bonds (ionic, covalent).

**8. (a)**

Graphene consists of a monolayer of a 2 D lattice of $sp^2$ bonded carbon.

**10. (b)**

Total flux density is given by:

$$\vec{B} = \mu_0\vec{H} + \mu_0\vec{M}$$

$\mu_0\vec{M}$ = flux density due to magnetization

$\mu_0\vec{H}$ = flux density due to applied field

**11. (a)**

- Polarization of a pyroelectric material changes on heating.
- Every pyroelectric material is piezoelectric material but converse is not true.

**15. (a)**

The dielectric constant $\varepsilon_r$ (or relative permittivity) is a measure of polarization of dielectric materials. Dielectric strength is the voltage per unit thickness that can be sustained by an insulating material before its breakdown. A good insulating material or a dielectric material should have high value of dielectric strength but low value of dielectric constant ($\varepsilon_r$).

**16. (d)**

Space charge polarization occurs due to the accumulation of charges at the electrodes or at the interfaces in a multi-phase material.

**17. (c)**

In the presence of dielectric,

$$D = (\varepsilon_0 E + P) = (\varepsilon_0 E + \varepsilon_0 \gamma_e E)$$

**18. (d)**

- A diamagnetic material does not obey Curie's law.
- Paramagnetic material obeys Curie's law i.e. susceptibility of a paramagnetic material is inversely proportional to temperature.

$$\chi_m \propto \frac{1}{T}$$

or, $\chi_m T = \text{Constant}$

- A ferromagnetic material is strongly attracted by a magnet.
- In antiferromagnetic materials the permanent dipoles tend to align themselves so that alternate dipoles are antiparallel to the applied field. The result is a cancellation of the effects of each dipole and a zero net increase in flux density in the material. Hence, the permanent dipole moment is zero in these materials.

**20. (b)**

Option (a) is Debye's generalisation of Claussius-Mosotti's equation and only applicable for gases.

**21. (d)**

The intercepts $C_1$ (along $x$-axis) = $a$,

$C_2$ (along $y$-axis) = $b/2$,

and $C_3$ (along $z$-axis) = $3c$

Therefore, $p = \frac{c_1}{a} = \frac{a}{a} = 1$

$q = \frac{c_2}{b} = \frac{b/2}{b} = \frac{1}{2}$

and $r = \frac{c_3}{c} = \frac{3c}{c} = 3$

$\therefore \quad h = \frac{1}{p} = \frac{1}{1} = 1$

$k = \frac{1}{q} = \frac{1}{1/2} = 2$

and $l = \frac{1}{r} = \frac{1}{3}$

Hence, $(h, k, l) = \left(1, 2, \frac{1}{3}\right) = \frac{1}{3}(3, 6, 1)$

$= (3, 6, 1)$

(Since Miller indices is always an integer)

**23. (a)**

The bond that is formed between water molecules due to attraction between the positively charged hydrogen end of a molecule and the negatively charged oxygen end of another molecule is called the hydrogen bond.

The strength of various bonds in increasing order are as follows:

Vander walls bonds < Hydrogen bonds < Ionic bonds < Metallic bonds < Covalent bonds.

**24. (c)**

It is not due to cooperative effect among domains.

**25. (c)**

When many unit cells repeat in a three-dimensional space, a crystal is obtained. The structure of a crystal is same as that of a repeating unit cell.

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