

- 1) Equal size spherical balls when packed together will yield maximum theoretical packing of
 - a) 52%
 - b) 68%
 - c) 74%
 - d) 86%
- 2) Steel containing 0.8% carbon cooled under equilibrium conditions from molten state to room temperature is soft, because it consists of lamellae of
 - a) Ferrite and cementite
 - b) Ferrite and austenite
 - c) Ferrite and bainite
 - d) Ferrite and martensite
- 3) Line broadening in X-ray diffraction pattern occurs on account of
 - a) Coarse crystallite size
 - b) Residual stresses
 - c) Multiplicity of phases
 - d) Coring of crystallites
- 4) Inter-granular corrosion of austenitic stainless steel is promoted by
 - a) Fine grained microstructure
 - b) Coarse grained microstructure
 - c) Soaking steel at 700°C in air
 - d) Quenching from 1000°C
- 5) Ferrites are preferred materials for use in high frequency applications (GHz range) as opposed to other ferromagnetic materials because ferrites also have
 - a) High permeability
 - b) High electrical resistivity
 - c) High saturation magnetization
 - d) Low coercivity
- 6) During indirect intra-band transition, electrons undergo
 - a) Change in energy and momentum
 - b) Change in momentum but no change in energy
 - c) Change neither in energy nor in momentum
 - d) Change in energy but no change in momentum
- 7) A material has a band gap of 2.4 eV. Which of the following wavelengths of light will it absorb?
 - a) 700 nm
 - b) 550 nm
 - c) 650 nm
 - d) 400 nm
- 8) Thermal conductivity of a material at a temperature greater than Debye temperature
 - a) is independent of temperature
 - b) decreases inversely with temperature
 - c) increases linearly with temperature
 - d) increases exponentially with temperature
- 9) Match the following classes of materials given in Column I with the electron spin alignments in atoms shown in Column II.

| | Column I | | Column II |
|---|--------------------|----|------------------|
| P | Ferromagnetic | 1. | ↑↓↑↓ |
| Q | Anti-ferromagnetic | 2. | → ↗ ↘ ↙ ↖ ← |
| R | Ferrimagnetic | 3. | ↑↑↑↑ |
| S | Paramagnetic | 4. | ↓↓↓ |
| | | 5. | ↑↑ |

- a) P-3, Q-1, R-4, S-5 b) P-4, Q-2, R-5, S-3 c) P-3, Q-1, R-5, S-2 d) P-3, Q-2, R-4, S-1

10) Match the following experimental techniques given in Column I with applications given in Column II.

| | Column I | | Column II |
|---|-----------------------------------|----|-------------------------|
| P | Differential Scanning Calorimetry | 1. | Dislocation studies |
| Q | Atomic Absorption Spectroscopy | 2. | Surface Topography |
| R | Scanning Electron Microscopy | 3. | Electrical Conductivity |
| S | Transmission Electron Microscopy | 4. | Trace Element Analysis |
| | | 5. | Phase Transformation |

- a) P-5, Q-4, R-2, S-1 b) P-5, Q-1, R-3, S-2 c) P-2, Q-5, R-3, S-1 d) P-1, Q-5, R-4, S-2

11) Match the following materials given in Column I with their applications given in Column II.

| | Column I | | Column II |
|---|-------------------|----|---------------------------|
| P | Nylon | 1. | Electrical switch housing |
| Q | Urea formaldehyde | 2. | Conducting polymers |
| R | Polyaniline | 3. | Heating Element |
| S | Alumina | 4. | Gears for toys |
| | | 5. | Polishing material |

- a) P-2, Q-4, R-3, S-5 b) P-4, Q-1, R-2, S-5 c) P-3, Q-4, R-2, S-1 d) P-4, Q-5, R-3, S-2

12) Match the following materials given in Column I with their applications given in Column II.

| | Column I | | Column II |
|---|-----------------------|----|------------------------|
| P | Silicon carbide fibre | 1. | Fibre glass boat |
| Q | Polyester fibre | 2. | Heating element |
| R | Thoria doped tungsten | 3. | Magnetic material |
| S | Nichrome | 4. | Electric bulb filament |
| | | 5. | Armour material |

- a) P-5, Q-1, R-3, S-2 b) P-1, Q-5, R-4, S-2 c) P-5, Q-3, R-2, S-1 d) P-5, Q-1, R-4, S-2