

- 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