GateAssignment1

EE24BTECH11048-NITHIN.K

1 Q.21 to Q.75 carry two marks each.

1) The solid phase of an element follows van der Waals bonding with inter-atomic potential $V(r) = -\left(\frac{P}{r^6}\right) + \left(\frac{Q}{r^12}\right)$, where P and Q are constants. The bond length can be expressed as
   a) $\left(\frac{2Q}{P}\right)^{-6}$
   b) $\left(\frac{Q}{P}\right)^{-6}$
   c) $\left(\frac{P}{2Q}\right)^{-6}$
   d) $\left(\frac{P}{Q}\right)^{-6}$
2) Consider the atomic packing factor (APF) of the following crystal structures:
   P. Simple Cubic
   Q. Body Centred Cubic
   R. Face centred Cubic
   S. Diamond
   T. Hexagonal Close Packed
   Which two of the above structures have equal APF?
   a) P and Q
   b) S and T
   c) R and S
   d) R and T
3) In a powder diffraction pattern recorded from a face-centred cubic sample using x-rays, the first peak appears at 30°. The second peak will appear at
   a) 32.8°
   b) 33.7°
   c) 34.8°
   d) 35.3°
4) Variation of electrical resistivity ρ with temperature T of three solids is sketched(on different scales) in the figure, as curves P, Q and R. Which one of the following statements describes the variations most appropriately?

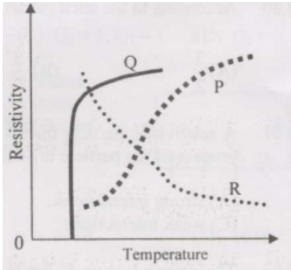

Fig. 4.1

a) P is for a superconductor, and R for a semiconductor.
b) Q is for a superconductor, and P for a conductor.
c) Q is for a superconductor, and R for a conductor.
d) R is for a superconductor, and P for a conductor.

5) An extrinsic semiconductor sample of cross-section A and length L is doped in such a way that the doping concentration varies as $N_D(x) = N_0 exp\left(-\frac{x}{L}\right)$, where N_0 is a constant. Assume that the mobility μ of the majority carriers remain constant. The resistance R of the sample is given by
a) $R = \frac{L}{A\mu eN_0}\left[exp(1.0) - 1\right]$
b) $R = \frac{L}{\mu eN_0}\left[exp(1.0) - 1\right]$
c) $R = \frac{L}{A\mu eN_0}\left[exp(-1.0) - 1\right]$
d) $R = \frac{L}{A\mu eN_0}$

6) A ferromagnetic mixture of iron and copper having 75% atoms of Fe exhibits a saturation magnetisation of $1.3 \times 10^6 Am^{-1}$. Assume that the total number of atoms per unit voulume is $8 \times 10^{28} m^{-3}$. The magnetic moment of an iron atom, in terms of the Bohr Magneton, is
a) 1.7
b) 2.3
c) 2.9
d) 3.8

7) Half life of a radio-isotope is 4×10^8years. If there are 10^3 radioactive nuclei in a sample today, the number of such nuclei in the sample 4×10^9 years ago were
a) 128×10^3
b) 256×10^3
c) 512×10^3
d) 1024×10^3

8) In the deuterium + tritium $(d + t)$ fusion more energy is released as compared to deuterium + deuterium $(d + d)$ fusion because
a) tritium is radioactive.
b) more nucleons participate in fusion.
c) the Coulomb barrier is lower for the d+t system than d+d system.
d) the reaction product ^4He is more tightly bound.

9) According to the shell model the ground state spin of the ^{17}O nucleus is
   a) $\frac{3}{2}^{+}$
   b) $\frac{5}{2}^{+}$
   c) $\frac{3}{2}^{-}$
   d) $\frac{5}{2}^{-}$
10) A relativistic particle travles a length of 3×10^{-3}m in air before decaying. The decay process of the particle is dominated by
   a) strong interactions.
   b) electromagnetic interactions.
   c) weak interactions.
   d) gravitational interactions.
11) The strange baryon $\sum^{+}$ has the quark structure
   a) uds
   b) uud
   c) uus
   d) $u\bar{s}$
12) A neutron scatters elastically from a heavy nucleus. The initial and final states of the neutron have the
   a) same energy.
   b) same energy and linear momentum.
   c) same energy and angular momentum.
   d) same linear and angular momentum.
13) The circuit shown is based on ideal operational amplifiers. It acts as a

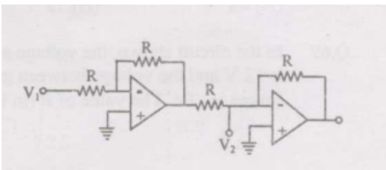

Fig. 13.1

   a) subtracter.
   b) buffer amplifier.
   c) adder.
   d) divider.
14) Identify the function F generated by the logic network shown

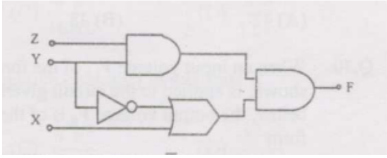

Fig. 14.1

a) $F = (X + Y)Z$
b) $F = Z + Y + \bar{Y}X$
c) $F = ZY(Y + X)$
d) $F = XYZ$

15) In the circuits shown, the ports Q_1 and Q_2 are in the state $Q_1 = 1$, $Q_2 = 0$. The circuit is now subjected to two complete clock pulses. The state of these ports now becomes

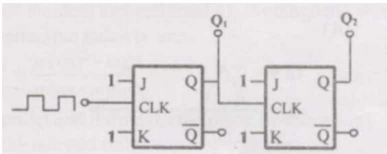

Fig. 15.1

a) $Q_2 = 1, Q_1 = 0$
b) $Q_2 = 0, Q_1 = 1$
c) $Q_2 = 1, Q_1 = 1$
d) $Q_2 = 0, Q_1 = 0$

16) The registers $Q_D, Q_C, Q_B and Q_A$ shown in the figure are initially in the state 1010 respectively. An input sequence $S_1 = 0101$ is applied. After two clock pulses, the state of the shift registerds $(in the same sequence Q_D Q_C Q_B Q_A)$ is

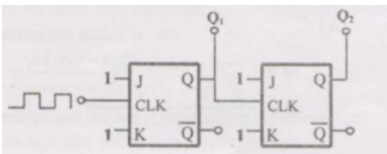

Fig. 16.1

a) 1001
b) 0100
c) 0110
d) 1010

17) For the circuit shown, the potential difference $(in Volts)$ across R_L is

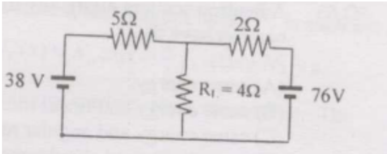

Fig. 17.1

a) 48
b) 52
c) 56
d) 65