Code: AE04   Subject: MATERIALS AND PROCE...

AMIETE – ET (OLD SCHEME)

Time: 3 Hours   **OCTOBER 2012**   Max. Marks: 1...

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1   Choose the correct or the best alternative in the following: (2×10)

a. A plane in a unit cell intersects x, y, z respectively at points whose distances from origin are 1/3, 1/2 and 1/1 units. Its miller indices are

   (A) (6 3 2)   **(B)** (3 2 1)
   (C) (1 1 1)   **(D)** (1/3) (1/2) (1/1)

b. Fick's first law of diffusion is applicable under

   (A) Steady state conditions of mass flow
   (B) Non-steady state conditions
   (C) Steady as well as non-steady state conditions
   (D) None of the above

c. The maximum number of phases that can coexist in a single component system, at equilibrium is

   (A) 5   **(B)** 7
   (C) 3   **(D)** 2

d. Which one of the following material does not have permanent magnetic dipoles?

   (A) Ferromagnetic   **(B)** Antiferromagnetic
   (C) Paramagnetic   **(D)** Diamagnetic

e. Which one is the wrong anode-cathode combination?

   (A) Zinc-Iron   **(B)** Silver-zinc
   (C) Iron-Tin   **(D)** Nickel-Titanium

f. The property of a material by which it can be drawn into wires is known as

(A) Softness   (B) Malleability
(C) Ductility   (D) Tempering

g. In order to increase the mechanical strength of an aluminium conductor, one
    should go for

(A) Doping   (B) cold working
(C) Heat treatment   (D) steel reinforcement

h. Magnetic susceptibility has the dimensions of

(A) Wb-m   (B) dimensionless
(C) Wb/m^2 (D) Amp/m

i. For a tunnel diode a decrease in current causes

(A) Voltage constancy   (B) decrease in voltage
(C) Increase in voltage   (D) none of the above

j. Manganin is an alloy of

(A) Manganese, Chromium, nickel   (B) Manganese, aluminium, nickel
(C) Copper, manganese, nickel   (D) none of the above

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Bonding in the intermetallic compound Ni_3Al is predominantly metallic.
             Explain why there will be little, if any, ionic bonding component. The
             electronegativity of nickel is about 1.8.   **(4)**

         b. How many electrons are present in the 3d energy level of an element
             having a valence of 2 with an atomic number of 27?   **(4)**

         c. BCC lithium has a lattice parameter of 3.5089×10^{-8} cm and contains one
             vacancy per 200 unit cells. Calculate the number of vacancies per Cubic
             centimetre and the density of Li.   **(8)**

Q.3 a. Explain Gibbs phase rule and what does it indicate? Show that eutectoid
             reaction is non-variant.   **(8)**

         b. The diffusion coefficient for Cr^{+3} in Cr_2O_3 is 6×10^{-15} cm^2/s at 727°C and is
             1×10^{-9} cm^2/s at 1400°C. Calculate the activation energy and the constant
             D_o.   **(8)**

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Q.4 a. Find the conductivity of copper at 300 K, if the collision time for electron scattering in copper at 300 K is 2×10^{-14} sec. Given that density of copper= 8960 kg/m^3, atomic weight of copper = 63.54 amu and mass of an electron = 9.1×10^{-31} kg. **(8)**

b. Explain the effect of doping on the electrical conductivity of a semiconductor by giving a suitable example. The electrical conductivity of a semiconductor increases significantly on doping. Let us consider Ge at room temperature (=300 K). Given that electron mobility (μ_e) and hole mobility (μ_p) are 0.38 and 0.18 respectively. **(8)**

Q.5 a. State and explain Hall effect. What are its applications? **(8)**

b. Define:
  (i) polarizability.   (ii) dipole relaxation.
  (iii) loss angle.   (iv) dielectric breakdown. **(8)**

Q.6 a. What is mica? Write the chemical composition of two types of mica with its properties and uses. **(8)**

b. Write the chemical composition of constantan, German silver, manganin, and nichrome along with their applications **(8)**

Q.7 a. Describe the phenomenon of magnetic hysteresis and magnetization curve in a magnetic material. Also explain coercivity. **(8)**

b. Explain why ferromagnetic materials can be permanently magnetized whereas paramagnetic ones cannot. **(8)**

Q.8 a. Explain the process of fabrication of integrated circuits. **(8)**

b. What is extrusion? Explain hot and cold extrusion. **(8)**

Q.9 Write short notes on any **TWO**

    (i) Full annealing
    (ii) Hardening and tempering
    (iii) BURGER VECTOR **(8×2)**