

UNIVERSITY OF BOLTON

**SCHOOL OF THE BUILT ENVIRONMENT &
ENGINEERING – RAK CAMPUS**

BEng (Hons) in Mechanical Engineering

SEMESTER 2 EXAMINATIONS 2008/2009

MATERIALS AND MANUFACTURE I

MODULE NO: AME1022

Date: Friday, 29 May 2009

Time: 17.00 p.m. – 19.00 p.m.

INSTRUCTIONS TO CANDIDATES:

There are SIX questions

Answer any FOUR questions

All questions carry equal marks.

Marks for parts of questions are shown in brackets.

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- Q1 a) State the three classifications of plain carbon steels with their percentage of carbon. (5 marks)
- b) Explain what is meant by the term latent heat of fusion and why the temperature of a metal remains constant whilst fusion occurs. (10 marks)
- c) Define a metal and state two methods of hardening it. (5 marks)
- d) State the two main types of plastic. (5 marks)

Total 25 marks

- Q2 a) What is the difference between element, compound and a mixture? (10 marks)
- b) What is the difference between wear and erosion. (8 marks)
- c) Why are metals better conductors than ceramics? (7 marks)

Total 25 marks

- Q3 a) Define :
- (i) Yield point (2 marks)
 - (ii) Strength (2 marks)
 - (iii) Fatigue (2 marks)
 - (iv) Ductility (2 marks)
 - (v) Unit cell (2 marks)
- b) Pauli's exclusion principle states that within one atom :
- (i) No more than two electrons may have the same energy.
 - (ii) The spins of the electrons, interact so as to become parallel if possible.
 - (iii) No two electrons may have the same four quantum numbers.
 - (iv) There are only two values for the quantum number MS. (8 marks)

Question 3 continued over

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Question 3 continued

- c) The ionic bond is formed by the mixing of electrons from two atoms :
- (i) true
 - (ii) false (3 marks)
- d) The electrostatic nature of the ionic bond makes it :
- (i) non directional
 - (ii) weak
 - (iii) applicable only to group 1 and 1I elements (4 marks)

Total 25 marks

- Q4 a) State the main property in each case by a material used in the manufacture of :
- (i) Copper Wire (3 marks)
 - (ii) A cutting tool (3 marks)
 - (iii) The front wheel axle of a car. (4 marks)
- b) Explain the difference between an amorphous and a crystalline material. (5 marks)
- c) Close-packed structures are chosen by elements in which the bonding is :
- (i) directional
 - (ii) non-directional
 - (iii) metallic (5 marks)
- d) The structure of an Ionic crystal is determined primarily by :
- (i) the relative diameters of the constituent ions
 - (ii) the nature of the chemical bond
 - (iii) the vacancy of the ions
 - (iv) the co-ordination number (5 marks)

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- Q5 a) Define a polymer and the nature of the molecular bonds. (5 marks)
- b) Provide classical definition of the term composite material. (5 marks)
- c) Explain what is meant by the term dendrite. (5 marks)
- d) Explain the following processes :
- (i) annealing (4 marks)
 - (ii) hardening (3 marks)
 - (iii) tempering (3 marks)

Total 25 marks

- Q6 a) Define the following terms :
- (i) tensile strength (2 marks)
 - (ii) yield strength (2 marks)
 - (iii) modulus of elasticity (2 marks)
 - (iv) density (2 marks)
 - (v) stress (2 marks)
- b) Explain the difference between physical and mechanical properties of substance. (5 marks)
- c) A standard mild steel tensile test specimen has a diameter of 16mm and a gauge length of 80mm. Such a specimen was tested to destruction and the following results obtained :
- load at yield point = 87 kN
extension at yield point = 173 μ m
ultimate load = 124 kN
total extension at fracture = 24mm
diameter of specimen at fracture = 9.8mm
- Calculate :
- (i) the modulus of elasticity of the steel (4 marks)
 - (ii) the ultimate tensile stress (3 marks)
 - (iii) the yield stress (3 marks)

Total 25 marks

END OF QUESTIONS