

**J3022 – MATERIAL TECHNOLOGY 1**

**DATE: 24 NOVEMBER 2012(SATURDAY)**  
**DURATION: 2 HOURS (8:30AM-10:30AM)**

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This paper consists of **FOUR(4)** pages including the front page.  
Essay (6 questions – **answer 4 questions**)

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d) Complete the table below.

Element	Atomic Number	Numbers of Neutron	Atomic Mass	Elektron Valence
A	2	2	4	8
Magnesium	B	12	24	2
Aluminium	13	C	27	3
Lithium	3	4	D	1
Ferum	26	E	56	-
Sulphur	16	16	32	F

- i. A
- ii. B
- iii. C
- iv. D
- v. E
- vi. F

( 6 marks )

**QUESTION 2**

- a) Describe what is carbon steel and give **THREE (3)** types of carbon steel. (6 marks)
- b) Lists **FOUR (4)** advantages in using electric arc furnace. (4 marks)
- c) Lists **FIVE(5)** reasons for alloying the steel. (5 marks)
- d) Explain the process of steel manufacturing using basic oxygen furnace. (10 marks)

**QUESTION 3**

- a) State **THREE(3)** types of low carbon steel and explain clearly one of them. (5 marks)
- b) Beside carbon, there were other common elements found in plain carbon steel such as Mn(1.0%) , Si(0.3%) , S(0.05%) and P(0.05%). Lists **FOUR (4)** purpose why these elements were added into steel. (8 marks)
- c) Sketch a diagram dimensional changes of pure iron over temperature. (3 marks)
- d) Derive the term of ferrite and pearlite. Compare ferrite and pearlite micro spectrum from the perspective of tensile strength, percentage of elongation and hardness. (9 marks)

**QUESTION 4**

- a) Define the mechanical features below:
- i) Ductility
  - ii) Elasticity
- (4 marks)
- b) Explain how the value of Brinell hardness testing influenced the mechanical properties.
- (4 marks)
- c) Describe the condition of cracking in Charpy impact testing for the material below:
- i) metal
  - ii) polymer
- (8 marks)
- d) Explain briefly the ultrasound process (non-destructive testing) is carried out.
- (9 marks)

**QUESTION 5**

- a) Explain the reactions of Ferrus (Fe) and Copper (Cu) in electrochemical cell (with the chemical reactions).
- (7 marks)
- b) Describe the form of corrosion below:
- i. Intergranular Corrosion
  - ii. Concentrated Corrosion
- (5 marks)  
(5 marks)
- c) Aluminum is one of the popular metals. To improve the mechanical properties, other elements being added to Aluminium. Describe the aluminum alloys below:
- i) Aluminum-Manganese Alloys
  - ii) Aluminum-Silicone Alloys
- (4 marks)  
(4 marks)

**QUESTION 6**

- a) Define the metal work process below
- i. Cold working
  - ii. Hot Working
- (4 marks )
- b) Give TWO (2) advantage and TWO (2) disadvantage of cold working
- ( 6 marks )
- c) Describe by using a diagram how the drawing process to produce a product.
- (12 marks)
- d) State THREE (3) type of hot working
- ( 3 marks )