

071606T4AMT

AUTOMOTIVE MECHATRONICS TECHNOLOGY LEVEL 6

ENG/OS/AMT/CC/07/6/A

APPLY MATERIAL SCIENCE PRINCIPLES

July/Aug 2023



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

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Instructions to Candidates:

1. This paper consists of **TWO** sections; A and B
2. Attempt all the questions in section **A** and any **THREE** questions in section **B**.
3. Marks for each question are indicated in brackets ().
4. You are provided with a separate answer booklet.
5. Do not write on the question paper.

This paper consists of THREE (3) printed pages.

**Candidate should check the question paper to ascertain that all the pages are
printed as indicated and that no questions are missing**

Turn over

SECTION A (40 MARKS)

Attempt ALL questions in this section.

1. Highlight **four** reasons why material testing is important. (4 marks)
2. Brinell method of testing materials is one of the methods of testing materials. Name **three** limitations of this method. (3 marks)
3. Crystal defect is the imperfection in the regular geometrical arrangement of the atoms in a crystalline solid. List **two** types of crystal defects. (2 marks)
4. Give the **three** major classifications of engineering materials. (3 marks)
5. Briefly describe **two** major classifications of plastics and give **one** example for each classification. (4 marks)
 - a. Thermoplastics
 - b. Thermo-setting plastics
6. Material testing is classified under destructive and non-destructive test. What is the difference between the two? (4 marks)
 - a. Destructive test
 - b. Non-destructive test
7. Plastics are engineering materials. Give **four** functions of plastics. (4 marks)
8. Briefly explain the following three forming operations applied to engineering materials. (6 marks)
 - a. Forging
 - b. Extrusion
 - c. Drawing
9. Ferrous materials are categorized in three groups steel, cast iron and wrought iron. Name **two** examples of steel and **two** examples of cast iron. (4 marks)
10. Outline **three** quenching media used in hardening process. (3 marks)

11. Engineering material testing processes should be carried out in a safe environment. Which **three** safety precaution should always be observed when in any engineering workshop? (3 marks)

SECTION B: (60 Marks)*Attempt any THREE questions in this section*

- 12 a) Discuss **five** mechanical properties of materials which are always considered in engineering works. (10 marks)
- b) Describe **five** major defects in a metal or an alloy that may be caused by faulty heat treatment. (10 marks)
- 13 a) The atomic radius of an iron atom is $1.238 \times 10^{-10} \text{ m}$. Iron crystallizes as BCC.
- i. Calculate the lattice parameter of the unit cell, **a**; (3 marks)
- ii. Find the atomic packing factor. (5 marks)
- b) Metals are engineering material t different crystalline structures. Using diagrams, describe the three cry es of Metals. (12 marks)
- 14.a) Briefly discuss **five** principal kinds of heat treatment processes of steel. (10 marks)
- b) What are the effects of the following elements in cast iron; (8 marks)
- i. Silicon.
- ii. Sulphur
- iii. Manganese
- iv. Phosphorus
- c) Name **two** annealing processes. (2 marks)
- 15 a) List **three** types of corrosion. (3 marks)
- b) Discuss **three** factors that affect the rate of corrosion in metals. (9 marks)
- c) Explain **four** methods used to prevent corrosion. (8 marks)