



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN CIVIL ENGINEERING &

DIPLOMA IN BUILDING TECHNOLOGY

2707/102 & 2705/102: PHYSICAL SCIENCE

DATE:

TIME:

INSTRUCTIONS.

1. Answer all the questions.

2. Write your registration number and course in the answer sheet.

1.
 - a) Differentiate between permanent and temporary hardness of water. State the chemical compounds that cause each type of hardness (5 marks)
 - b) Briefly describe the procedure of removing permanent hardness of water (6 marks)
 - c) Outline with examples the disadvantages of hard water in the following situations (9 marks)
 - i). Industrial
 - ii). Domestic
 - iii). Health
2.
 - a) Define, with examples, acids and bases according to:
 - i). Arrhenius (3 marks)

- ii). Bronsted-Lowry (3 marks)
- b). Outline the difference between strong acid and a concentrated acid. Give an appropriate example in each case (4 marks)
- c). Using examples, differentiate between acid salt and normal salt (4 marks)
- d). With the aid of a diagram, describe a laboratory activity to demonstrate that the water is electrically charged (6 marks)
3. a) Briefly describe the mole concept. (5 marks)
- b) Calculate the mole of Potassium Chloride that is contained in 4grammes (5 marks)
- c) Calculate the mass of Magnesium Chloride that is contained in 0.02 mole solution. (Potassium 19, Magnesium 23, Chlorine 35) (5 marks)
- d) Find the concentration of a solution that is made by dissolving 3grammes of Potassium Sulphate in 100cm³ of water. (5 marks)
4. Using an appropriate example in each case, and with dots (.) and crosses (x), describe the following:-
- a) Ionic bond (4 marks)
- b) Covalent bond (4 marks)
- c) Name two intermolecular forces (2 marks)
- d) Briefly explain why Methane (CH₄) is a gas while trichloromethane (CHCl₃) is a liquid at room temperature. (4 marks)
- e) Outline the three properties of metals that arise from the nature of metallic bonds (6 marks)
5. a) Using the outermost energy level shell show how atoms are bonded in the following molecules. Use dots (.) and crosses (x) to represent electrons. (6 marks)
- i) CCl₄
- ii) PCl₃
- iii) CHCl₃
- iv) N₂
- v) CO₂
- vi) NH₃

(C= 6, Cl =17, P= 15, H= 1, O=8, N= 7)

b) Complete the table below

(8 marks)

Particle	Number of Electrons	Number of Neutrons	Number of protons	Mass number
K^{2+}		12	12	
L	35	45		
M^{2-}	18			32
N			13	27

c) Arrange elements as they appear in the electrochemical series

(6 marks)