



SIR ARTHUR LEWIS COMMUNITY COLLEGE

ACADEMIC YEAR (2024/2025) - SEMESTER ONE

END OF SEMESTER EXAMINATION

COURSE CODE : CHM002

COURSE TITLE : Fundamentals in Chemistry I

LECTURER(S) : Marina Matthews, Celeste Regis

DATE : 18th December 2024

TIME : 1 p.m. to 3 p.m.

DURATION : 2 Hours

STUDENT ID # : _____

GENERAL INFORMATION AND INSTRUCTIONS

- 1. This is a TWO hour examination consisting of TWO Sections and a Periodic Table.

Section A – 25 Multiple Choice Questions
Section B – 4 Structured Questions
- 2. Answer ALL questions for each section in the SPACES provided.
- 3. For numerical problems, ALL working must be shown for full marks.
- 4. Use of pocket electronic calculators is permitted.

Section	Number	Marks Earned	Maximum Marks
Section A Multiple choice	1 – 25		25 marks
Section B Structured Questions	1		20 marks
	2		25 marks
	3		15 marks
	4		15 marks
	TOTAL		100 marks

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A – MULTIPLE CHOICE

Shade the letter that corresponds to the correct answer for each question.

1. Which of the following defines Chemistry?
 - (A) The study of the interactions of biological systems.
 - (B) The study of the properties of substances, the changes they undergo, and the natural laws that describe these changes.
 - (C) The study of the nature of matter, motion and energy and their interactions with each other.
 - (D) The study of the natural world using observation and experimentation.

2. Which of the following is the BEST written, testable hypothesis?
 - (A) If plants are watered, they are healthy.
 - (B) At high temperatures, diffusion occurs.
 - (C) Metals in the sun tarnish.
 - (D) Iron rusts faster in salt water than in fresh water.

3. Read the following procedure and then identify a controlled variable, the manipulated variable and the responding variable.

Procedure

1. Three 100ml beakers were labelled A, B and C respectively.
2. 50 cm³ of distilled water was placed in beaker A.
3. 50 cm³ of corn starch was placed in beaker B.
4. 50 cm³ of oil was placed in beaker C.
5. One drop of blue dye was placed in beakers A, B and C and the time taken for each beaker to turn completely blue was recorded.

- (A) Controlled variable : blue dye
Manipulated variable : volume of liquid
Responding variable : time taken

- (B) Controlled variable : volume of water
Manipulated variable : time taken
Responding variable : type of liquid

- (C) Controlled variable : size of the beakers
Manipulated variable : time taken
Responding variable : amount of blue dye

- (D) Controlled variable : amount of blue dye
Manipulated variable : type of liquid
Responding variable : time taken

4. Which of the following correctly describes the information placed in the conclusion of a chemistry laboratory report?

- (A) The purpose of the experiment.
- (B) A step-by-step account of what was done to conduct the experiment.
- (C) Theories and other scientific information that guides the experiment
- (D) Summarize the main findings of the experiment.

5. Write the number 0.004598 correct to three significant figures in standard form.

- | | |
|----------------------------|-------------------------|
| (A) 4.598×10^{-3} | (C) 4.598×10^3 |
| (B) 4.60×10^{-3} | (D) 4.59×10^3 |

6. Convert 225K temperature to Celsius.

- | | |
|------------|---------|
| (A) - 48 | (C) 498 |
| (B) - 54.7 | (D) 48 |

7. Convert 60.5 lbs to Kilograms ($1\text{Kg} = 2.2\text{ lbs}$)

- | | |
|-------------|--------------|
| (A) 27.5 Kg | (C) 133.1 Kg |
| (B) 62.7 Kg | (D) 0.036 Kg |

8. Which of the following is an example of systematic error?

- (A) Anne studying the reproduction of a strain of bacterium got a slight error due to slight variation of temperature or light in the room. However, when the readings are spread over a period, she was able to minimize the error by averaging out her results.
- (B) Amanda balance has a fault in that it keeps giving 2g lower than the actual value of what is measured.
- (C) A strong wind affected the measurement from a balance.
- (D) Vaughn was using the pipette to measure liquid while talking to his friend. He inadvertently did not position his eyes correctly because he was distracted



Figure 1: 500 ml Measuring Cylinder

Questions 9 and 10 refer to Figure 1 above

9. The measuring cylinder shown in **Figure 1** above can be used to measure volume in mL. What is the value of the smallest gradation on this instrument?

(A) 1 mL (C) 20 mL
(B) 10 mL (D) 5 mL

10. What volume of liquid is shown in **Figure 1** above?

(A) 402 mL (C) 420 mL
(B) 440 mL (D) 410 mL

11. John used a balance to measure a 25g mass four times and obtained the following measurements: 24.6, 23.9, 25.4 and 24.1. Which of the following statements is TRUE?

I The measurements have good precision and good accuracy
II The measurements indicate that there was random error.
III The balance was faulty, and thus systematic error was introduced into the measurements.
IV The measurements are not very precise.

(A) I, II, III, IV (C) I, II
(B) II, IV (D) I and III

12. Which of the following is NOT a characteristic of a Pure Substance?

(A) Indefinite composition
(B) Shows only one spot when analyzed by chromatography
(C) Fixed melting points and boiling points
(D) Can be either an element or a compound

13. Which of the following represents a physical change?

- (A) Iodine sublimates on heating.
- (B) Boiling an egg.
- (C) Leaves decomposed in the yard.
- (D) A nail rusting.

14. Which of the following are properties of a gas?

- I Definite shape and volume
- II Particles move past each other cohering with each other.
- III Easily compressible
- IV Weak attractive forces between particles

- (A) I, II and III
- (B) II, III and IV
- (C) III and IV
- (D) II and IV

15. An atom has 30 electrons, 35 neutrons and 30 protons. It follows that its mass number is:

- (A) 30
- (B) 60
- (C) 35
- (D) 65

16. What is the total number of valence electrons in an atom with an electron configuration of 2.8.7?

- (A) 2
- (B) 7
- (C) 8
- (D) 17

17. Which of the following compounds contain covalent bonds?

- (A) Lithium oxide
- (B) Nitrogen dioxide
- (C) Lead nitrate
- (D) Salt

18. When bonding with non-metallic atoms, metallic atoms will

- (A) lose electrons and form negative ions
- (B) gain electrons and form negative ions
- (C) lose electrons and form positive ions
- (D) gain electrons and form positive ions

19. Which of the following is NOT a property of a metal?

- (A) Hard but brittle
- (B) Electrical conductor
- (C) High melting point
- (D) Malleable

20. What is the chemical formula of a compound with three fluorine atoms and one bromine atom?

- (A) FBr₃
- (B) BrF₃
- (C) F₃Br₃
- (D) Br₃F

21. What is the charge of iron in the following compound: $\text{Fe}_2(\text{SO}_4)_3$?

- | | |
|--------|--------|
| (A) +1 | (C) +3 |
| (B) +2 | (D) +4 |

22. Which of the following is NOT a property of diamond?

- | | |
|--------------------------|-----------|
| (A) Electrical conductor | (C) Hard |
| (B) Covalent bonding | (D) Shiny |

23. Which of the following reactions does NOT result in salt being formed?

- | | |
|------------------------|--------------------|
| (A) Acid and base | (C) Acid and Water |
| (B) Acid and carbonate | (D) Acid and metal |

24. Which of the following are properties of bases?

- I Sour Taste
- II pH level greater than 7
- III Turns red litmus blue
- IV Turns blue litmus red

- | | |
|------------------------|-----------------------|
| (A) I and II only | (C) II and III only |
| (B) I, II and III only | (D) I, II and IV only |

25. Which of the following indicators identifies the specific pH of a substance?

- | | |
|---------------------|-------------------------|
| (A) Phenolphthalein | (C) Methyl orange |
| (B) Litmus paper | (D) Universal indicator |

TOTAL 25 MARKS

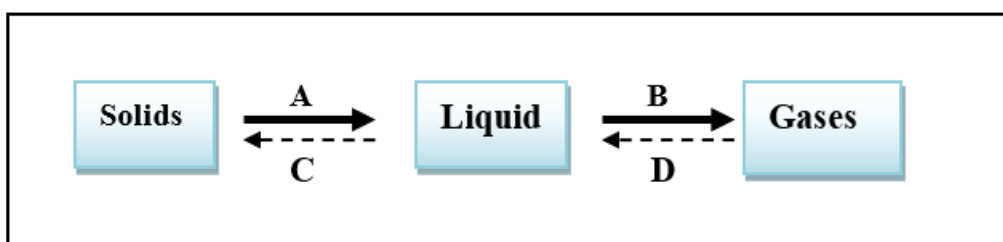
SECTION B

Answer ALL questions in the spaces provided

1. Matter exists all around us.

(a) Give TWO examples of matter and TWO examples of non-matter. (2 marks)

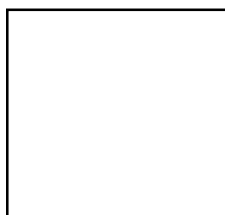
(b) (i) Name the four phase changes labelled (A – D). (4 marks)



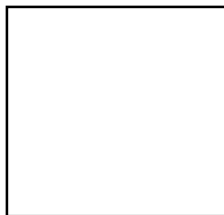
A: _____ C: _____

B: _____ D: _____

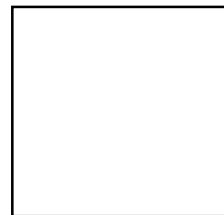
(ii) Draw three diagrams to illustrate the arrangement of particles in the three different states. Label the diagrams appropriately. (3 marks)



Solids



Liquids



Gases

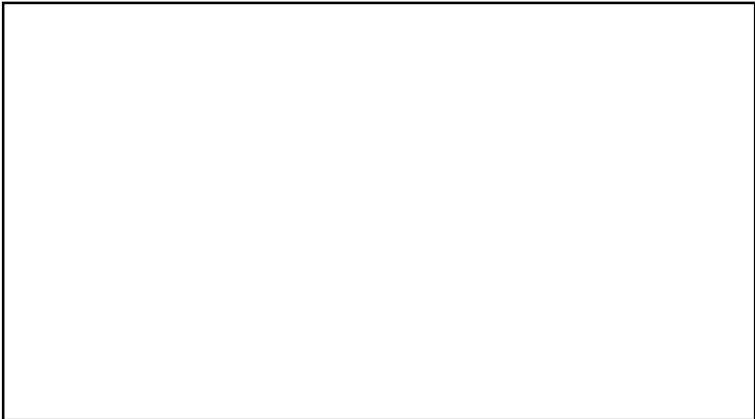
(c) At 30°C a liquid of volume 3820 mL weighs **6.5 kilograms** (Kg).

(i) What is the temperature of the liquid in Fahrenheit? (2 marks)

(ii) What is the density of the liquid in **g/mL**? (3 marks)

(d) When chalk dust was added to 25 mL of the liquid in a beaker, it did not dissolve. After a short while the chalk dust could be seen at the bottom of the beaker and the water at the top.

- (i) What type of mixture was formed? _____ (1 mark)
- (ii) Draw and label the apparatus that can be used to show how the chalk dust can be separated from the liquid. (3 marks)



- (iii) What would you expect to see when the mixture is separated using the apparatus you drew above. (2 marks)

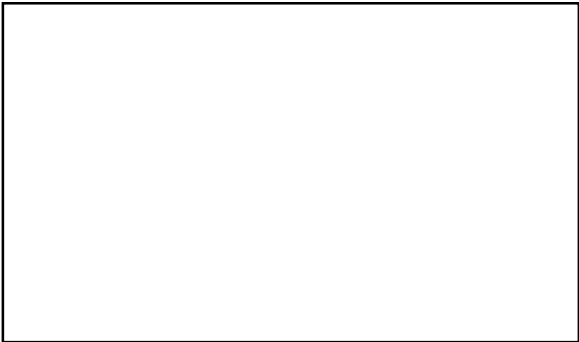
TOTAL 20 MARKS

2. Complete the table below with information on some common elements.

Element	Symbol	No. of Neutrons	Atomic Number	Electronic Configuration	Chemical Notation	Metal, Nonmetal or Metalloid?
	H		1	1	${}^1_1\text{H}$	Nonmetal
Silicon		14	14			
Helium			2		${}^4_2\text{He}$	
	Cl	18		2.8.7		
	Ca	20	20			

(10 marks)

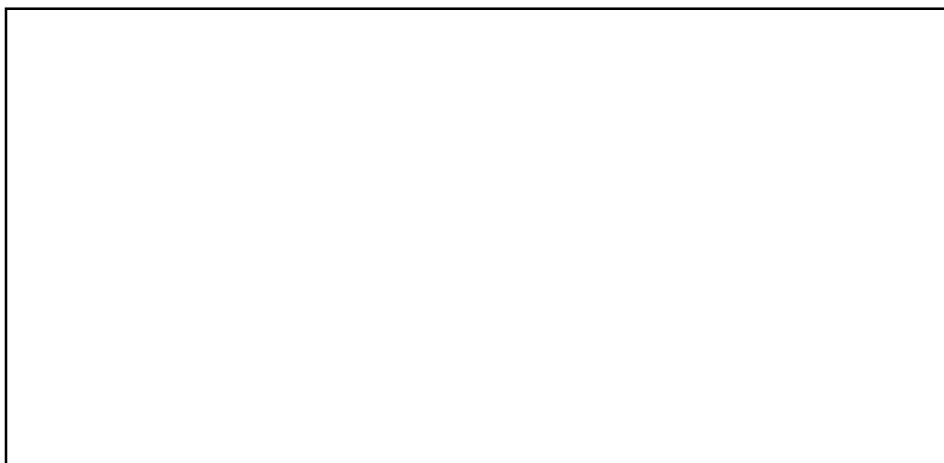
- (a) Draw a diagram of the Silicon atom to show the number and location of the subatomic particles. (2 marks)



- (b) Draw dot and cross diagrams to show bonding between the following elements, identifying the name and formula of the compound formed.

(i) Hydrogen and Chlorine

(4 marks)

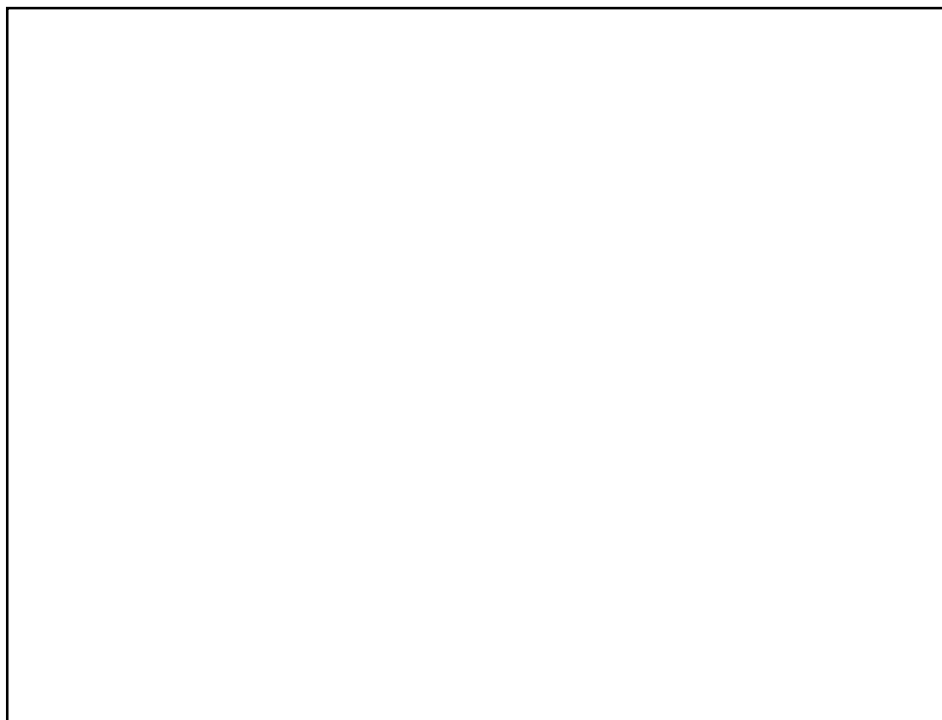


Formula of Compound: _____

Name of Compound: _____

(ii) Calcium and Chlorine

(6 marks)



Formula of Compound: _____

Name of Compound: _____

(c) (i) What are isotopes? (1 mark)

(ii) Using the following information about Silicon and its isotopes, determine the relative atomic mass of Silicon. (2 marks)

Isotope	Natural Abundance
Silicon-28	92.2%
Silicon-29	4.7%
Silicon-30	3.1%

TOTAL 25 MARKS

3. The Periodic Table is a very important tool for Chemists as they carry out their work.

(a) How are the elements in the periodic table arranged? (1 mark)

(b) (i) Identify the first **THREE alkali metals** in the periodic table. (3 marks)

(ii) Write down **THREE** properties of alkali metals (3 marks)

- (iii) Explain how the atomic radius of the alkali metals changes as you go down the group. Give a reason for this trend in atomic radius. (3 marks)

- (c) Graphite and diamond are allotropes of carbon.

- (i) What are allotropes? (1 mark)

- (ii) Identify TWO differences in the **physical properties** of diamond and graphite. (4 marks)

TOTAL 15 marks

4. (a) Write the chemical formula of the following compounds. (4 marks)

- (i) Dinitrogen Pentoxide _____
- (ii) Magnesium Fluoride _____
- (iii) Ammonium Sulphate _____
- (iv) Copper (II) Chloride _____

- (b) Give the names of each of the following compounds. (4 marks)

- (i) BeF_2 _____
- (ii) AlI_3 _____
- (iii) Ca(OH)_2 _____
- (iv) P_4O_{10} _____

- (c) Giving examples, explain the difference between acid salt and a normal salt. (3 marks)

(d) Name the products formed from the following acid reactions

(i) Magnesium + nitric acid (2 marks)

(ii) Sodium carbonate + hydrochloric acid (2 marks)

TOTAL 15 marks

END OF EXAMINATION