



SIR ARTHUR LEWIS COMMUNITY COLLEGE
ACADEMIC YEAR (2024/2025) – SEMESTER TWO
END OF SEMESTER EXAMINATION

ALTERNATE

COURSE TITLE : **Fundamentals of Chemistry I**
COURSE CODE : **CHM002**
LECTURER : **Lyndelle Lubruin**
DATE :
TIME :
DURATION : **2 Hours**
STUDENT ID # : _____

INSTRUCTIONS

1. This is a TWO hour examination consisting of TWO Sections and a Periodic Table.
Section A – 30 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		15 marks
	2		25 marks
	3		20 marks
	4		15 marks
	TOTAL		100 marks

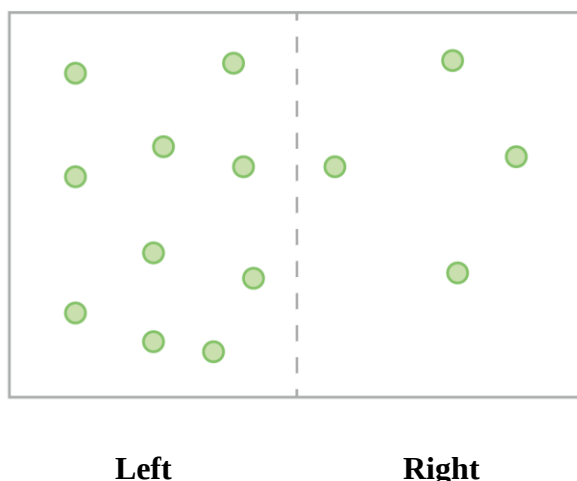
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SECTION A – MULTIPLE CHOICE

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

- Which of the following is NOT a characteristic of a **Pure Substance**?
 - Shows only one spot when analyzed by chromatography
 - Fixed melting points and boiling points
 - Can be either an element or a compound
 - Indefinite composition
- All the following are examples of matter **EXCEPT**
 - Wood
 - Light
 - Air
 - Oxygen Atom
- Which of the following substances is **NOT a heterogeneous** mixture?
 - Sand and water
 - Vinegar and water
 - Sugar and water
 - Oil and water
- To which **period** of the Periodic table does the element **Sulphur** ($^{32}_{16}\text{S}$) belong?
 - 6
 - 3
 - 2
 - 1
- Atoms are **Neutral**. This means that:
 - the number of positive charges in the atom equals the number of negative charges.
 - they have the same number of neutrons and protons
 - their valence shells have the same number of electrons as an inert gas
 - they have no charged particles
- When **combining** with **metallic atoms**, **non-metallic atoms** will
 - lose electrons and form negative ions
 - gain electrons and form negative ions
 - lose electrons and form positive ions
 - gain electrons and form positive ions

7. The diagram shows atoms of neon in a container. The container is divided into two sections of equal volume by a **membrane** which is **fully permeable** to **neon**.



- Which of the following scenarios is most likely to occur?
- A. There will be a net movement of the neon atoms from the top of the box to the bottom of the container
 - B. There will be a net movement of neon atoms from left to right
 - C. There will be no net movement of neon atoms
 - D. There will be a net movement of neon atoms from right to left
8. In which one of the given reactions is a salt reacting with a base?
- A. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 - B. $\text{Cu}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{H}_2\text{O}$
 - C. $6\text{NH}_4\text{OH} + \text{Al}(\text{SO}_4)_3 \rightarrow 2\text{Al}(\text{OH})_3 + 3(\text{NH}_4)_2\text{SO}_4$
 - D. $\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$
9. The correct formula for the compound **iron (III) oxide** is:
- A. FeO_3
 - B. Fe_3O_2
 - C. Fe_2O
 - D. Fe_2O_3
10. **Electronegativity** is a concept that is useful along with other concepts in
- A. determining the charge on a polyatomic ion
 - B. deciding how many electrons are involved in a bond
 - C. formulating a statement of the octet rule
 - D. predicting the polarity of a bond
11. What is the charge of **sulphate ion** in the following compound: $\text{Fe}_2(\text{SO}_4)_3$?
- A. +6
 - B. -2
 - C. +3
 - D. +4
12. What is the name given to the compound with the formula Al_2O_3 ?
- A. Aluminum(II) oxide
 - B. Aluminum oxide
 - C. Dialuminum trioxide
 - D. Aluminum trioxide

13. Which of the chemical formulae shown below is **CORRECT**?
- A. KI
 - B. $\text{Na}(\text{NO}_3)_2$
 - C. CaCl
 - D. $\text{Mg}(\text{SO}_4)_2$
14. Which of the following BEST identifies the steps in using the **Scientific Method** in the most logical order?
- A. Observe phenomena
Formulate hypothesis
Design an investigation
Collect and analyze experimental data
Draw conclusions
Share results
 - B. Design an investigation
Formulate hypothesis
Observe phenomena
Draw conclusions
Collect and analyze experimental data
Share results
 - C. Formulate hypothesis
Observe phenomena
Collect and analyze experimental data
Share results
Draw conclusions
Design an investigation
 - D. Observe phenomena
Collect and analyze experimental data
Formulate hypothesis
Draw conclusions
Share results
Design an investigation
15. _____ is the branch of chemistry that uses **qualitative** and **quantitative** observation to identify and measure the physical and chemical properties of substances.
- A. Biochemistry
 - B. Organic Chemistry
 - C. Analytical Chemistry
 - D. Inorganic Chemistry

The diagram shows a 10x10 grid representing a 2D array. The grid is mostly gray, with some cells highlighted in black and labeled with letters. Cell A is at row 2, column 1. Cell B is at row 2, column 10. Cell C is at row 4, column 7. Cell D is at row 4, column 9. Cell E is at row 6, column 8. Cell F is at row 8, column 9. There is also a single black cell at row 1, column 5.

Figure 1: The Periodic Table

Questions 11 – 13 are based on the Periodic Table shown in Figure 1 above.

16. Which element is an **inert monoatomic gas** at **room temperature**?

- A. A
B. B
C. C
D. D

17. Which **two elements** are NOT in the **same period**?

- A. A and B
B. C and D
C. D and F
D. E and F

18. Which **two elements** will form an **ionic bond**?

- A. E and D
B. C and D
C. A and E
D. B and F

19. To which **period** does element ${}^{20}_{10}\text{Z}$ belong?

- A. 3
B. 2
C. 4
D. 1

20. What is the total number of valence electrons in an atom with the **electronic configuration 2.8.6?**

- A. 2
B. 8
C. 6
D. 15

21. Which of the following are properties of **acids**?

- I Sour Taste
II pH level less than 7
III Turns red litmus blue
IV Turns blue litmus red
- A. I and II only
B. I, II and III only
C. II and IV only
D. I, II and IV only

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

- A. Phenolphthalein
- B. Litmus paper
- C. Methyl orange
- D. Universal indicator

23. Which of the following salts can be made by **titration method**?

- A. calcium carbonate
- B. sodium chloride
- C. copper (II) oxide
- D. ammonia

24. Mary tested **substance Y** with **red litmus paper** and **universal indicator**. The substance Y **did not change the colour** of the **litmus paper** and **turned green** in the presence of the **universal indicator** solution indicating a **pH of 5**.

Which of the following substances is MOST likely substance Y?

- A. HCl
- B. CH_3COOH
- C. NaOH
- D. NH_3

25. Which of the four substances described below is MOST likely consistent of a **giant covalent structure**?

- A. Melting point 1500°C , molten substance is a poor electrical conductor
- B. Melting point 1150° , molten substance readily conducts electricity
- C. Melting point 480°C , molten substance readily conducts electricity
- D. Melting point 20°C , molten substance does not conduct electricity

TOTAL 25 MARKS

END OF MULTIPLE-CHOICE QUESTIONS
MOVE ON TO SECTION B

SECTION B

Answer ALL questions in the spaces provided

1. A chemistry student planned an experiment to test a hypothesis. The procedure used in the experiment is identified in **Figure 2** below.

1. Place 25 ml of tap water in a glass beaker and label the beaker A
2. Place 25 ml of hot water in another glass beaker and label the beaker B
3. Place 25 ml of cold water in a third beaker and label beaker C
4. Place one drop of red dye in each beaker and start the timer
5. Measure the time taken for the water to turn completely pink in each beaker. Do not stir, just observe, and record the time taken

Figure 2: Experimental Procedure

- (a) (i) What process is being investigated in the experiment? (1 mark)

- (ii) State ONE other example of this process in everyday living (1 mark)

- (b) Identify based on the procedure shown in **Figure 2** above:

- (i) THREE variables to be controlled (3 marks)

- (ii) The manipulating variable (1 mark)

- (iii) The responding variable (1 mark)

- (c) (i) Suggest a possible hypothesis for the experiment (2 marks)

- (ii) Giving a reason for your answer, suggest one way that the experimental procedure in **Figure 2** above could be improved. (2 marks)

- (d) (i) Identify an instrument that could be used to **measure the volume of water** needed in the experiment. (1 mark)

- (ii) If the temperature of the hot water is **65°F**, Calculate its temperature in Kelvin. (3 marks)

TOTAL 15 MARKS

2. All matter is composed of elements. Elements are made up of one kind of atom and are the building blocks of matter.

- (a) Complete the table below with information on some common elements (8 marks)

Element	Symbol	Group Number	Mass Number	Atomic Number	Number of Neutrons	Electronic configuration
	N		14		7	
	He		4			2.
Flourine				9	10	
Sodium			23	11		

- (b) **Group 2 Metals** are called the **Alkali Metals**.

- (i) State FOUR properties of **Group 1** elements (4 marks)

Explain the following trends in properties **DOWN** Group 1:

- a) The atomic radius increases **DOWN** Group 1 (2 marks)

- b) Chemical reactivity increases **DOWN** Group 1 (2 marks)

(ii) **Sodium**, the **second Alkali metal** has three isotopes with the following natural abundance as shown in the table below

Isotope	Natural Abundance
$^{23}_{11}\text{Na}$	69%
$^{24}_{11}\text{Na}$	11%
$^{25}_{11}\text{Na}$	20%

a) What is an **isotope**? (1 mark)

b) Give **ONE example** of a **radioactive isotope** and its use. (2 marks)

c) Using the information from the table above, calculate the **relative atomic mass** for **Sodium**. (3 marks)

(iii) Draw a labelled diagram showing the structure of a **Sodium atom** with the chemical notation $^{23}_{11}\text{Na}$. Your diagram should show the number of protons, neutrons, and electrons and where they are found in the atom.

(3 marks)

TOTAL 25 MARKS

3. The chemistry of many elements is to attain an outer electron structure like that of the chemically stable noble gases.

(a) How is **covalent bonding** different from **ionic bonding**? (2 marks)

(b) Classify the bond between these pair of elements as **ionic** or **covalent**. (5 marks)

- (i) Sodium and bromine _____
(ii) Sulfur and oxygen _____
(iii) Carbon and fluorine _____
(iv) Zinc and oxygen _____
(v) Nitrogen and chlorine _____

(c) Classify the bonding in the following molecules as **polar covalent** or **non-polar covalent**. (4 marks)

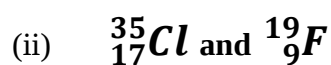
- (i) H₂O _____
(ii) N₂ _____
(iii) CH₄ _____
(iv) HF _____

(d) Draw **dot and cross diagrams** to **show bonding** between the following pairs of elements. Write the **chemical formula** and **name** of the compound in each case.

(i) ${}^{23}_{11}\text{Na}$ and ${}^{16}_8\text{O}$ (5 marks)

Chemical Formula: _____

Name of Compound: _____



(4 marks)

Chemical Formula: _____

Name of Compound: _____

TOTAL 20 MARKS

4. Most inorganic compounds can be classified as **acids, bases, or salts**.

(a) Write the chemical formula of the following inorganic compounds (5 marks)

(i) Sulphur trioxide _____

(ii) Ammonium nitrate _____

(iii) Iron (III)chloride _____

(iv) Hydrochloric acid _____

(v) Lithium phosphate _____

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

(i) Magnesium + hydrochloric acid (2 marks)

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

(c) You have been asked to prepare a sample of the soluble salt, sodium chloride

(i) Identify the solutions needed to make this salt (2 marks)

(ii) Identify the apparatus needed to prepare sodium chloride (3 marks)

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- (iii) State the technique used for preparing the sodium chloride (1 mark)
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TOTAL 15 MARKS

END OF EXAMINATION