

EXAMINATION SESSION : End of Semester Final Examination

SEMESTER : One (Alternate Paper)

PROGRAMME TITLE : Kickstart

COURSE TITLE : Fundamentals of Chemistry I

COURSE CODE : CHM002

LEVEL : Access

DATE : 15<sup>th</sup> January 2025

PAPER : Two

COMMENCEMENT TIME : 9:00 a.m.

DURATION : 2 Hours

INVIGILATORS: :

ROOMS (S) :

| STUDENT ID NUMBER | UNIT/PROGRAMME |
|-------------------|----------------|
|                   |                |

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.

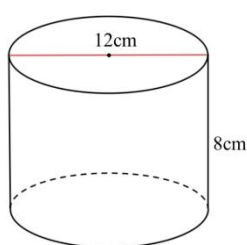
| Section                               | Number | Marks Earned | Maximum Marks |
|---------------------------------------|--------|--------------|---------------|
| Section A<br>Multiple choice          | 1 – 25 |              | 25 marks      |
| Section B<br><br>Structured Questions | 1      |    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

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

## SECTION A – MULTIPLE CHOICE

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

- Which of the following statements about Science is FALSE?
  - Scientific knowledge is the product of scientific methods of inquiry
  - Science is a collection of facts and figures
  - Science is based on empirical data
  - Science is a particular way of studying the world around us.
- The number 15400 rounded off to one significant figure is \_\_\_\_\_.
  - 200
  - 2
  - 20000
  - 10000
- The metal cylinder shown above, has a density of  $7.28\text{g/cm}^3$ . Determine its mass in Kg.  
(Use  $\pi = 3.14$ )



- 26,334 Kg
  - 26.3 Kg
  - 6.6 Kg
  - 124 Kg
- Jack accidentally threw some sand into a glass of water that was left on the counter in the kitchen. Which separation technique is MOST appropriate for removing the sand from the water?
    - Chromatography
    - Sublimation
    - Filtration
    - Separating Funnel
  - A substance has a fixed shape and volume. It is most likely a \_\_\_\_\_.
    - Liquid
    - Solid
    - Gas
    - Plasma
  - Which of the following substances is a homogeneous mixture?
    - Milk
    - Air
    - Toothpaste
    - Muddy water
  - Atoms are neutral. This means that:
    - they have no charged particles.
    - they have the same number of neutrons and protons.
    - their valence shells have the same number of electrons as an inert gas.
    - the number of positive charges in the atom equals the number of negative charges.
  - Solve  $\frac{0.639 \times 12.3}{0.30}$  and express to correct number of significant figures.
    - 26.199
    - 26
    - 26.2
    - 26.20

9. To which period of the Periodic table does the element Sulphur ( $^{32}_{16}\text{S}$ ) belong?

- (a) 6                      (b) 3                      (c) 2                      (d) 1

10. Element X has a mass number of 35 and atomic number of 17. Thus, element X has \_\_\_\_\_ neutrons.

- (a) 35                      (b) 17                      (c) 52                      (d) 18

11. Which of the following processes describes the following observations: cucumber slices become soft and leak water after salt and pepper are added?

- (a) Osmosis  
(b) Brownian motion  
(c) Diffusion  
(d) Sublimation

12. Which of the following represents an isotope of carbon  $^{12}_6\text{C}$ ?

- (a)  ${}_{12}^{13}\text{C}$                       (b)  ${}_6^{13}\text{C}$                       (c)  ${}_{13}^6\text{C}$                       (d)  ${}_{13}^{12}\text{C}$

13. What is the name given to the compound with the formula  $\text{N}_2\text{O}_5$ ?

- (a) Nitrogen pentoxide                      (c) dinitrogen pentoxide  
(b) Pentanitrogen dioxide                  (d) dihydrogen pentoxide

### Figure 1: The Periodic Table

Questions 14 – 16 are based on the Periodic Table shown in Figure 1 above.

14. Which element is a transition metal?

- (a) A                      (b) B                      (c) C                      (d) E

15. Which two elements are in the same group?

- (a) A and B  
(b) C and D  
(c) D and F  
(d) E and F

16. Which two elements will form an ionic bond?

- (a) E and D
- (b) C and D
- (c) A and E
- (d) B and F

17. When combining 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

18. Which of the following is NOT a covalent compound?

- (a) MnO
- (b) NO
- (c) H<sub>2</sub>O
- (d) CO

19. What is the charge of iron in the following compound: Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>?

- (a) +1
- (b) +2
- (c) +3
- (d) +4

20. Electronegativity is a concept that is useful along with other concepts in

- (a) predicting the polarity of a bond.
- (b) deciding how many electrons are involved in a bond.
- (c) formulating a statement of the octet rule.
- (d) determining the charge on a polyatomic ion

21. Which of the chemical formulae shown below is INCORRECT?

- (a) KI
- (b) Na(NO<sub>3</sub>)<sub>2</sub>
- (c) CaCl<sub>2</sub>
- (d) MgSO<sub>4</sub>

22. Solution A has a pH of 8 and reacts with ethanoic acid to produce a salt and water. Which of the following BEST identifies solution A?

- (a) Strong Acid
- (b) Weak Acid
- (c) Strong Base
- (d) Weak Base

23. Which of the following is NOT a property of bases?

- (a) Bitter taste
- (b) pH level greater than 7
- (c) Turns red litmus paper blue.
- (d) Turns blue litmus paper red.

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

- (a) Phenolphthalein
- (b) Methyl orange
- (c) Litmus paper
- (d) Universal indicator

25. John tested substance X with red litmus paper and universal indicator. The substance X 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 X?

- (a)  $\text{CH}_3\text{COOH}$
- (b)  $\text{HCl}$
- (c)  $\text{NaOH}$
- (d)  $\text{NH}_3$

**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 1 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 amount of water needed in the experiment. (1 mark)

(ii) If the temperature of the hot water is **50°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 |
|-----------|--------|--------------|-------------|---------------|--------------------|--------------------------|
|           | Si     |              | 28          |               | 14                 |                          |
|           | Ne     |              | 20          |               |                    | 2.8                      |
| Chlorine  |        |              |             | 17            | 18                 |                          |
| Potassium |        |              | 39          | 19            |                    |                          |

(b) Group 2 Metals are called the Alkaline Earth Metals.

(i) State FOUR properties of group 2 elements (4 marks)

(ii) Explain the following trends in properties down group 2:

a) The atomic radius increases down group 2 (2 marks)

b) Chemical reactivity increases down group 2 (2 marks)

(iii) Magnesium, the second alkaline earth metal has three isotopes with the following natural abundance as shown in the table below

| Isotope               | Natural Abundance |
|-----------------------|-------------------|
| $^{24}_{12}\text{Mg}$ | 79%               |
| $^{25}_{12}\text{Mg}$ | 10%               |
| $^{26}_{12}\text{Mg}$ | 11%               |

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 Magnesium. (3 marks)

---

---

---

- (iv) Draw a diagram showing the structure of a Calcium atom with the chemical notation  ${}^{40}_{20}\text{Ca}$ . 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) (i) 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) Sulfur and oxygen \_\_\_\_\_  
(ii) Potassium and bromine \_\_\_\_\_  
(iii) Zinc and sulphur \_\_\_\_\_  
(iv) Carbon and Chlorine \_\_\_\_\_  
(v) Phosphorus and chlorine \_\_\_\_\_

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

- (i)  $\text{H}_2\text{O}$  \_\_\_\_\_  
(ii)  $\text{H}_2$  \_\_\_\_\_  
(iii)  $\text{CH}_4$  \_\_\_\_\_  
(iv)  $\text{HF}$  \_\_\_\_\_

- (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)  ${}^7_3\text{Li}$  and  ${}^{16}_8\text{O}$  (5 marks)



Chemical Formula: \_\_\_\_\_

Name of Compound: \_\_\_\_\_

- (ii)  ${}^{35}_{17}\text{Cl}$  and  ${}^{19}_9\text{F}$  (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) Carbon disulfide \_\_\_\_\_

(ii) Ammonium nitrate \_\_\_\_\_

(iii) Iron (II) Chloride \_\_\_\_\_

(iv) Sulfuric acid \_\_\_\_\_

(v) Lithium Sulfate \_\_\_\_\_

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

(i) Magnesium + nitric acid (2 marks)

\_\_\_\_\_

(ii) Sodium carbonate + hydrochloric 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)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(iii) State the technique used for preparing the sodium chloride. (1 mark)

\_\_\_\_\_

**TOTAL 15 MARKS**

**END OF EXAMINATION!!**