

**Task 4: Bonding and Organic Chemistry Topic Test**

**Question/Answer Booklet**

**CHEMISTRY UNIT 1**

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher’s Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# TIME ALLOWED FOR THIS PAPER

Reading time before commencing work: 5 minutes

Working time for the paper: 45 minutes

# MARKS ALLOWED FOR EACH SECTION

Section One: Multiple-Choice: 10 marks

Section Two: Short Answer: 23 marks

Section Three: Extended Response: 12 marks

Total: 45 marks

# MATERIALS REQUIRED/RECOMMENDED FOR THIS PAPER

**To be provided by the supervisor:**

This Question/Answer Booklet

Multiple-choice Zipgrade Answer Sheet

Chemistry Data Book

**To be provided by the candidate:**

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, eraser, correction tape/fluid, ruler, highlighters

Special items: up to three non-programmable calculators approved for use in the WACE examinations

# IMPORTANT NOTE TO CANDIDATES

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

**Section One: Multiple-Choice(10 marks)**

Suggested working time: 10 minutes.

1. Which of the following substances is most likely to be the best electrical conductor in the molten state?

a) potassium fluoride

b) magnesium chloride

c) aluminium bromide

d) sodium iodide

1. A characteristic of metallic elements is that

a) their atoms have only a small number of electrons in the valence shell and these can be removed relatively easily.

b) their valences are high which means they lose electrons easily.

c) their atoms usually share electrons with atoms of non-metals.

1. in the solid state electrostatic forces are not important since strong metallic bonds

hold the atoms together.

1. The low melting and boiling points of covalent molecular compounds are best explained by:
2. The weak intermolecular forces between molecules
3. The fact that covalent molecular compounds are discrete
4. Non-metals elemental forms usually existing in the gaseous state
5. The electrons not being delocalised in covalent bonding
6. An ionic substance can be distinguished from metallic and molecular substances by measuring the electrical conductivity of the substance in
7. the solid state only.
8. the liquid state only.
9. an aqueous solution only.
10. the solid and liquid states.
11. To determine the type of bonding in sand, a group of year 11 chemistry students tested its hardness, melting point, and electrical conductivity. It was found that the sand was not brittle, had a high melting point, and did not conduct electricity in the solid phase or when mixed into water. What type of bonding would you expect the chemicals in the sand to possess?

1. Covalent molecular
2. Covalent network
3. Ionic
4. Metallic

**Questions 6-8 refer to the information in the table below**

Three different substances were put through a series of tests to determine their material properties. The results of those tests are included in the table below

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
|  | Hit a small lump of the substance with a hammer | Place substance in a crucible and heat gently | Test some of the substance for electrical conductivity |
| Result for  substance I | flattened | melted easily | non-conductor in both the solid and liquid state |
| Result for  substance II | shattered | no visible change | non-conductor in the solid state: conducted electricity in the liquid state |
| Result for  substance III | shattered | melted easily | non-conductor in both the solid and liquid state |

1. The most probable chemical structure for solid substance I is
2. metallic lattice
3. discrete (individual) molecules
4. covalent network lattice
5. ionic lattice
6. The most probable chemical structure for solid substance II is
7. metallic lattice
8. discrete (individual) molecules
9. covalent network lattice
10. ionic lattice
11. The most probable chemical structure for solid substance III is
12. metallic lattice
13. discrete (individual) molecules
14. covalent network lattice
15. ionic lattice
16. Which one of the following combinations of atoms would form an ionic compound in a one-to-one ratio?

Element Electron configuration of atoms

I 2, 8, 1

II 2, 4

III 2, 8

IV 2, 8, 7

V 2, 8, 5

1. I and IV
2. II and III
3. II and V
4. IV and V
5. When sugar (C12H22O11) is gently heated in a saucepan, it eventually melts to form a thick liquid sugar syrup. When this syrup cools down, it forms hard sheets of toffee.

Classify the liquid sugar syrup according to the properties below.

**Type of bonding Electrical conductor**

1. covalent network no
2. covalent molecular no
3. covalent network yes
4. covalent molecular yes

**End of Section Two**

This page has been left blank intentionally

**Section Two: Short Answer(23 marks)**

Suggested working time: 20 minutes.

**Question 11(10 marks)**

Complete the following table:

|  |  |  |
| --- | --- | --- |
| **Name** | **Formula** | **Type of bonding**  **(ionic / covalent)** |
| potassium iodide |  |  |
|  | CO2 |  |
| copper (II) chloride |  |  |
|  | HCN |  |
| silicon tetrachloride |  |  |

**Question 12(4 marks)**

Explain why ionic substances are only able to conduct electricity in their liquid phase while metals are able to do so in their liquid *and* solid phase.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Question 13(6 marks)**

Consider the organic compounds (A to C) shown in the table below.

(a) Complete the table below by writing the IUPAC name of each compound.(3 marks)

|  |  |  |
| --- | --- | --- |
|  | Structure | IUPAC Name |
| **A** |  |  |
| **B** |  |  |
| **C** |  |  |

(b) Write a chemical equation for the catalysed reaction that occurs between benzene and aqueous chlorine.(3 marks)

|  |
| --- |
|  |

**Question 14(3 marks)**

Consider the key below, which refers to three (3) common allotropes of carbon; graphite, diamond and buckyballs.

No

A

Is the substance a covalent network?

Yes

B

Is the substance an electrical conductor?

Yes

No

C

Complete the key above, by writing the labels ‘graphite’, ‘diamond’ and ‘buckyballs’ in the appropriate boxes labelled A, B and C.

**End of Section Two**

This page has been left blank intentionally

**Section Three: Extended Response(12 marks)**

Suggested working time: 15 minutes.

**Question 15(12 marks)**

A chemistry student had two unlabelled beakers, each containing a different colourless liquid. One contained hexane, CH3CH2CH2CH2CH2CH3(l), and the other hex-1-ene, CH2CHCH2CH2CH2CH3(l).

The student added a few drops of liquid bromine, Br2(l), to each beaker in order to distinguish the liquids.

1. Why is it important that the liquid bromine be limiting (i.e. only a few drops are added) for this distinguishing test to be effective?(2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Whilst no immediate or visible reaction was observed to occur with the hexane, in the presence of an appropriate catalyst, a slow reaction has the potential to take place.

1. Write a balanced equation for this reaction, including phase symbols, and name the type of reaction that is occurring.(4 marks)

|  |
| --- |
| Equation:  Type of reaction: |

The equation for the reaction with liquid hex-1-ene is shown below.



If hex-3-ene had been used in place of hex-1-ene in the reaction above;

1. Draw and name the product of the reaction.(2 marks)

|  |
| --- |
| Structural diagram: |
| IUPAC name: |

Because removal of organic waste can be costly, the chemistry students decided to dispose of the hexane by using a combustion process.

1. The students had to ensure that complete combustion occurred for health reasons. What is the potentially dangerous product in incomplete combustion that is not present in complete combustion?(1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write a balanced equation that describes the complete combustion of the hexane, making sure to include states.(3 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**End of questions**