

**Year 11 ATAR Chemistry 2024**

**Test 3 – Organic & Intermolecular Forces**

**Weighting: 3.75%**

**Time: 55 min**

**Marks: / 56 %**

**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Section One: Multiple-choice (10 Marks)**

This section has **10** questions. Circle the most correct answer.

No marks will be given if more than one answer is completed for any question.

Suggested working time: 10 minutes.

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1. What is an unsaturated hydrocarbon?
2. A hydrocarbon which contains only single carbon – carbon bonds.
3. A hydrocarbon which contains at least one double or triple carbon – carbon bond.
4. An alkane.
5. A hydrocarbon which only contains one carbon atom per molecule.
6. **The general formula of cycloalkene is**

(a) CnH2n  
(b) CnH2n+2  
(c) CnH2n-1  
(d) CnH2n-2

3. Which one of the following shows the structural formula of 4-methyl-2-pentyne?

Box and whisker chart

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(a)



(b)

Box and whisker chart

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Chart, box and whisker chart

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(d)

4. Which of the following is the correct equation for the complete combustion of octane?

* 1. 2 C8H18 + 17 O2 → 16 CO + 18 H2O
  2. C3H8 + 5 O2 → 3 CO2 + 4 H2O
  3. 2 C8H18 + 9 O2 → 16 C + 18 H2O
  4. 2 C8H18 + 25 O2 → 16 CO2 + 18 H2O

5. When ethene gas is reacted with bromine water, which of the following gives the correct product

or products?

(a) bromoethene and hydrogen bromide

(b) 1,1-dibromoethane

(c) 1,2- dibromoethane

(d) 1,1-dibromoethene

6. Which one of the following molecules is a polar molecule?

* 1. CO2
  2. O2
  3. NH3
  4. CH4

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Description automatically generated7. Which is the correct electron-dot diagram for ozone (O3)?

(a) (b)

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(c) A picture containing icon

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8. Which of the following properties of water cannot be explained by the formation of hydrogen bonds?

1. The relatively low vapour pressure of water.
2. The molecular shape of water.
3. The relatively high melting point of water.
4. The lower density of solid water compared to liquid water.

9. Which of the following lists substances in **increasing** strength of intermolecular forces?

1. H2 < CH4 < C2H6 < C2H5Cl < H2O
2. C2H4 < C2H5OH < Cl2 < NH3 < H2O
3. Cl2 < NH3  < C2H4 < H2O < C2H5OH
4. NH3 < Cl2 < C2H5OH < C2H4 < H2O

10. Consider the information given in the following table.

|  |  |  |
| --- | --- | --- |
|  | Toluene | Butane-1,4-diol |
| Structural diagram |  |  |
| Molar mass, M (g mol-1) | 92.134 | 90.12 |
| Vapour pressure at 50 °C (kPa) | 12.28 | 0.014 |

Which is the **best** explanation for the difference in vapour pressure of these two compounds?

1. Toluene has a higher molar mass than butane-1,4-diol
2. Butane-1,4-diol has fewer carbon atoms in its structure than toluene
3. Toluene has stronger dispersion forces than butane-1,4,-diol
4. Butane-1,4-diol has stronger intermolecular forces than toluene

**End of Section One**

**Section Two: Short answer (46 Marks)**

This section has **five (5)** questions. Answer all questions. Write your answers in the spaces provided.

Suggested working time: 45 minutes.

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11. Give the correct IUPAC name for the following hydrocarbons: (6 marks)

|  |  |
| --- | --- |
| **Structure** | **Name** |
|  | 3-ethyl- 2-methyl hexane |
|  | 1,1-dibromo ethene |
|  | 1-ethyl-3-methyl benzene |

12. (a) Consider the two **incorrectly** **named** organic substances in the table below. Draw full structural

diagrams, showing all bonds, for the organic substances named, and then give each its correct

IUPAC name. (8 marks)

|  |  |  |
| --- | --- | --- |
| **Incorrect name** | **Full Structural diagram** | **IUPAC name** |
| 2,3-dichloro-4-hexene |  | 4,5-dichloro-2-hexene |
| 1,1-dichloro-2-propyl propene |  | 1,1-dichloro-2-methyl-1-pentene |

(b) The two organic compound in part (a) are isomers. What are isomers? (2 marks)

Isomers are molecules with the same molecular formula (i.e. the same number of

atoms of each element), (1)

but different structural arrangements of the atoms within the molecule. (1)

(c) Draw structural diagrams for two more isomers for the compounds in part (a). (4 marks)

Any two molecules with the molecular formula C6H10Cl2

Examples include:

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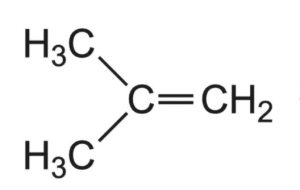
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13. Complete the following equations by adding the missing reactants or products. In each case, draw a structural diagram of the molecules. (5 marks)



(a)

Diagram:

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(1 mark)

+ HCl (g) 🡪

Diagram:

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(1 mark)

Name:

+ Cl2 (aq) 🡪 CH3CH2Cl +

Diagram:

H - Cl

(1 mark)

(b)

Diagram: Any molecule with the molecular formula C6H12

1 mark if molecular formula only

(2 marks)

(c)

+ 9 O2 (g) 🡪 6 CO2 (g) + 6 H2O

14. For each species listed in the table below, Lewis structure, representing all valence shell electron pairs either as : or as –, state or draw the shape of the molecule andstate the polarity of the molecule. (9 marks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| (for example, water |  | or |  | or |  | ) |

|  |  |  |  |
| --- | --- | --- | --- |
| Species | Lewis Structure  (Showing all valence shell electrons) | Shape  (Sketch or name) | Polarity of molecule  (Polar or non-polar) |
| Sulfur monoxide  **S**O |  | linear | polar |
| Sulfur Dichloride  **S**Cl2 |  | V shaped (bent) | polar |
| Sulfur trioxide  **S**O3 | C:\Users\laura.hawdon\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\EAFD1C43.tmp | Trigonal planar | Non- polar |

15. (a) Identify the predominant force of attraction between molecules of the following solids.

(4 marks)

|  |  |
| --- | --- |
| Solid | The **predominant** force |
| CO2 | Dispersion |
| NH3 | Hydrogen bonding |
| CH2O | Dipole-dipole |
| O2 | Dispersion |

(b) For each of the following pairs of molecules

* Circle the one that you would expect to have the highest boiling point, and
* Give a brief explanation for your choice.

(i) Hydrogen chloride OR Hydrogen bromide (4 marks)

Both are polar molecules with dipole-dipole forces between molecules (1)

However, hydrogen bromide has more electrons (1) so therefore it has stronger

dispersion forces than hydrogen chloride and therefore will require more heat energy to disrupt. (1)

(ii) carbon dioxide OR sulfur dioxide (4 marks)

Sulfur dioxide is polar and has dipole-dipole forces between molecules (1)

whereas carbon dioxide is non-polar and only has dispersion forces between

molecules (1)

Dipole-dipole forces are much stronger than dispersion forces and therefore will

require more heat energy to disrupt. (1)

**End of Test**