Student Name: _____

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# CHEMISTRY 2021

## Unit 4

## Key Topic Test 2 – Organic chemistry - pathways

Recommended writing time*: 50 minutes

Total number of marks available: 50 marks

**QUESTION BOOK**

*The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

**Conditions and restrictions**

- Students are permitted to bring into the room for this test: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the room for this test: blank sheets of paper and/or white out liquid/tape.
- A scientific calculator is permitted in this test.
- VCAA Chemistry data booklet will be provided

**Materials supplied**

- Question and answer book of 10 pages.

**Instructions**

- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.**

## SECTION A – Multiple-choice questions

**Instructions for Section A**

Answer **all** questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks are **not** deducted for incorrect answers.
If more than one answer is completed for any question, no mark will be given.

### Question 1

A Chemistry student compares the boiling points of hexane, 2-methylpentane and 2,3-dimethylbutane. The boiling points in increasing order would be;

**A.** hexane, 2-methylpentane, 2,3-dimethylbutane
**B.** 2-methylpentane, hexane, 2,3-dimethylbutane
**C.** 2,3-dimethylbutane, 2-methylpentane, hexane
**D.** 2,3-dimethylbutane, hexane, 2-methylpentane

### Question 2

When ethane is reacted with chlorine in the presence of ultraviolet light;

**A.** 1,2-dichloroethane is formed
**B.** chloroethane is formed
**C.** 6 different organic compounds are formed
**D.** 9 different organic compounds are formed

### Question 3

Butan-2-amine is formed by the reaction between;

**A.** Butane and ammonia
**B.** Methylpropane and ammonia
**C.** Butan-1-ol and ammonia
**D.** Butan-2-ol and ammonia

### Question 4

A chemical has the empirical formula of $C_3H_6O$. It is formed from the reaction of a primary alcohol and a chemical that has a sharp strong odour and forms a solution with a low pH when dissolved in water. Sulfuric acid is used to catalyse the reaction. The name of this chemical could be;

**A.** propanol
**B.** ethyl methanoate
**C.** methyl pentanoate
**D.** propanone

**Question 5**

When a clear sample of cyclohexene is mixed with a small amount of brown liquid bromine;

**A.** the final sample is clear as an addition reaction has occurred and a single compound is produced

**B.** the final sample is brown as an addition reaction has occurred and a single bromine atom is added to the cyclohexene

**C.** a reaction occurs and the mixture turns brown when two bromine atoms are added to the cyclohexene

**D.** the final sample is clear and a bromine atom replaces a hydrogen atom

**Question 6**

When a propanol is added to methanoic acid in the presence of a suitable catalyst the product(s) of the reaction are;

**A.** propyl methanoate and water

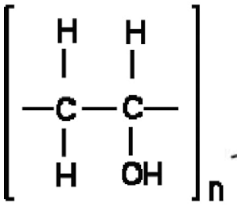
**B.** propanmethanate and water

**C.** methylpropane

**D.** methyl propanoate and water

**Question 7**

The polymer shown below is soluble in water and called polyvinyl alcohol. It can be concluded that;



**A.** the monomer is a non-polar molecule

**B.** the monomer has the empirical formula of $CH_3O$

**C.** hydrogen bonding will occur between polymer molecules

**D.** a small molecule is produced as a by-product when the monomers are joined

**Question 8**

When 1.80 g of chloroethane reacts with ammonia, 1.20g of ethanol is formed. The percentage yield is approximately;

**A.** 67%

**B.** 70%

**C.** 80%

**D.** 94%

**Question 9**

Ethane can react with $Br_2$ to produce bromoethane and hydrogen bromide. The atom economy for the reaction is closest to;

**A.** 57%

**B.** 73%

**C.** 80%

**D.** 100%

**Question 10**

Green Chemistry involves;

**A.** Using an excess of a reactant

**B.** Maximising atom economy

**C.** Using the shortest reaction pathway

**D.** Increasing the temperature and pressure to increase the rate of reaction

## SECTION B- Short-answer questions

**Instructions for Section B**

Questions must be answered in the spaces provided in this book.
To obtain full marks for your responses you should:

- Give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
- Show all workings in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.

Make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, $H_2(g)$; NaCl(s).

### Question 1

Give reasons for the following;

**a.** Ethanol is a liquid while ethane is a gas

_____

_____

2 marks

**b.** Ethanoic acid has a higher boiling point than ethanol

_____

_____

2 marks

**c.** Octane has a higher viscosity than hexane.

_____

_____

2 marks

**d.** Methanol is more soluble than octanol.

_____

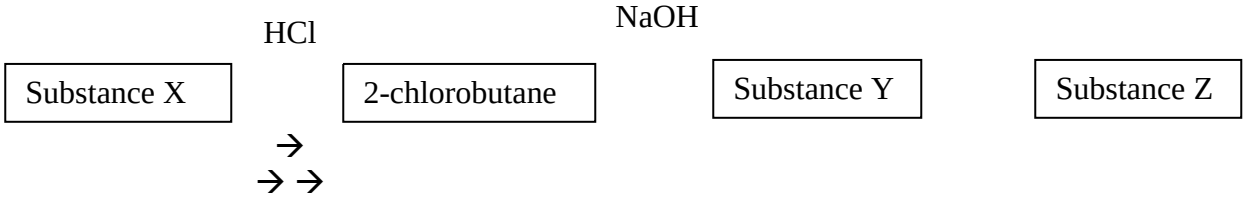
_____

2 marks

Total 8 marks

**Question 2**

Examine the reaction pathway below




**a.** There are 2 possible structures of substance X. Draw the full structure of each and name each of these structures.

4 marks

**b.** **i**. Draw the structure of substance Y.

**ii.** What type of reaction that occurs during the formation of substance Y.

1 + 1 = 2 marks

**c.** Substance Z is formed from the oxidation of substance Y.

**i.** Suggest a suitable chemical or chemicals that could be used to carry out the oxidation.

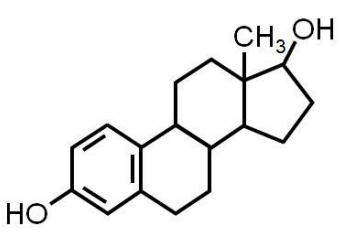
**ii.** What functional group is present in substance Z? _____

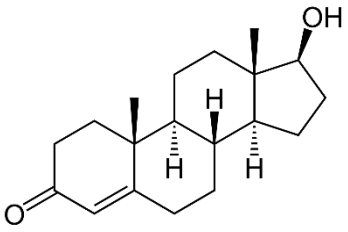
**iii.** Draw the full structure of substance Z.

1 + 1 + 2 = 4 marks
Total 10 marks

**Question 3 (4 marks)**

The molecules below are oestrogen (left) and testosterone (right).




**a.** How many carbon atoms are present in oestrogen? _____

1 mark

**b.** **i.** What functional group is found in both molecules? _____

**ii.** What functional group is present in testosterone but not oestrogen?

_____

1 + 1 = 2 marks

**c.** Why are both these molecules highly soluble in alkanes but virtually insoluble in water?

_____

_____

2 marks

**d.** When testosterone is oxidised with potassium dichromate and a strong acid, what functional group would react, and what functional group would be formed?

_____

_____

2 marks
Total 7 marks

**Question 4**

**a.** **i.** What functional group is present in propyl butanoate?

_____

**ii.** Describe a property that chemicals with this functional group have.

_____

1 + 1 = 2 marks

**b.** Propyl butanoate undergoes hydrolysis to produce 2 molecules. Draw the full structural formula and name the product that;

**i.** has a low pH

**ii.** is a strong solvent

2 + 2 = 4 marks

Total 6 marks

**Question 5**

**a.** Complete the flow chart to show how propanamide can be prepared from an alkene. Give the semi-structural formula of each reactant and name it.

| Semi structure | | Semi structure | Semi structure |
|---|---|---|---|
| | **$H_2O$**<br>**$MnO_4^-$**<br>**($H_3PO_4$)** **$H^+$** ⟶ | | |

**Name; _____** **Name; _____** **Name; _____**

**$NH_3$** ↓

| Semi structure |
|---|
| $CH_3CH_2CONH_2$ |

**Name; propanamide**

6 marks

**b.** Using a diagram, describe the bonding that forms between two propanamide molecules.

_____

_____

_____

_____

3 marks

Total 9 marks

**END OF KEY TOPIC TEST**