Chemistry Department

Christ Church Grammar School

**Year 12**

**2022**

# Organic Topic Test

**Time allowed:** 45 minutes

**Instructions**

Please ensure you enter your name and circle your teacher's initials below. Scientific calculators only.

Chemistry Data Sheet will be provided

**Name:**

_____

**Teacher:** (circle)

MXC NMO BLR

**Mark:**_____ **/ 48**

## Section 1: Multiple Choice (10 marks)

1. How many carboxylic acid isomers exist for $C_4H_8O_2$?

a) 1
b) 2
c) 3
d) 4

2. Which of the following molecules would be most soluble in liquid hexane?

a) Butanol
b) Butanone
c) Butanoic acid
d) Butanamide

3. Which of the following statements regarding geometric isomerism is incorrect?

a) Geometric isomerism is present in some alkenes.
b) *Cis*- and *trans*- isomerism is an example of geometric isomerism.
c) Geometric isomerism is present in some saturated amines.
d) The molecule, 2,3-dichloropent-2-ene would have geometric isomers.

4. Which of the following functional groups could be **reduced** to form an alcohol?

a) amide
b) amine
c) ketone
d) alkene

5. Which of the following is the most appropriate observation for the addition of acidified potassium dichromate solution to liquid 3-methylhexan-3-ol?

a) An orange solution is added to a colourless liquid and the solution turns deep green.
b) An orange solution is added to a colourless liquid and the solution remains orange.
c) A purple solution is added to a colourless liquid and the solution turns pale pink.
d) A purple solution is added to a colourless liquid and the solution remains purple.

6. Which one of the following statements regarding α-helices in proteins is true?

a) The α-helices are a tertiary structure of proteins.
b) Hydrogen bonds are responsible for the formation of the α-helices.
c) The α-helix structure is created when side chains on the protein interact.
d) A protein that contains α-helices cannot also contain ß-pleated sheets.

7. Consider the formation of a disulfide bridge in a protein. Which of the following statements is correct?

a) Disulfide bridges can only be formed between the side chains of cysteine and methionine amino acids and contribute to the protein's tertiary structure.
b) In the formation of a disulfide bridge, the sulfur atom is oxidised.
c) The disulfide bridge is a covalent bond and contributes to a protein's primary structure.
d) A disulfide bridge is important in the formation of ß-pleated sheets in a protein.

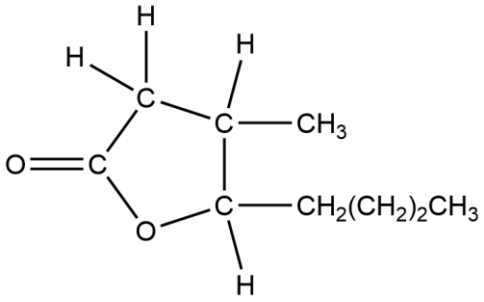
8. A chemist investigates how the equilibrium constant for the hydrolysis of a carboxylic acid in water changes with increasing carbon-chain length. The validity of this experiment can be best improved by:

a) Controlling the initial concentration of carboxylic acid species.
b) Controlling the temperature of the solution.
c) Repeating the experiment three times and taking an average.
d) Removing anomalous results.

9. Heating an egg white on a Teflon® coated frying pan denatures the proteins present in the egg white. Select the best option that describes how the egg white remains visibly different after heating has stopped.

a) The heat applied alters the primary structure of protein by disrupting intermolecular forces.
b) The heat applied alters the primary structure by breaking the peptide bonds.
c) The heat applied alters the secondary and tertiary structure by disrupting intermolecular forces.
d) The heat applied alters the secondary and tertiary structure by breaking covalent bonds between side chains.

10. 5-butyl-4-methyldihydro-2(3H)-furanone, a compound often referred to as 'whisky lactone', is a liquid at room temperature. A concentrated sample of the molecule has a strong 'woody' odour, reminiscent of the smell of the great southern forests of Western Australia in late July. The structure of the compound is shown below.



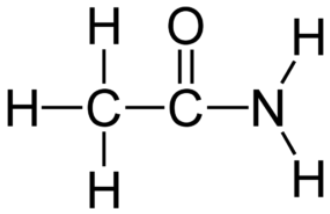

Which of the following states the functional group present in 'whisky lactone'?

a) The structure shown is a *trans*- isomer
b) The functionality is an ester
c) The functionality is a carboxylic acid in a ring structure
d) The functionality is a ketone

## Section 2: Short Answer (38 marks)

**Question 11** **(11 marks)**

a) Complete the following table using structural formula, IUPAC Nomenclature, and listing all intermolecular forces (IMFs) between molecules. (6 marks)

| IUPAC Name | Structural Formula | List all IMFs |
|---|---|---|
| methanoic acid | | |
| pentan-3-one | | |
| |  | |

b) Write a balanced equation and appropriate observation for the reaction of propanal and acidified potassium permanganate. (5 marks)

| | |
|---|---|
| **Equation** | |
| **Observation** | |

**Question 12** **(8 marks)**

Draw the structural formula and write the IUPAC name of all possible organic products of the following reactions.

a) Hydrogen bromide gas was bubbled through a solution containing ethene.

| | |
|---|---|
| **Structural formula of product(s)** | |
| **Name of product(s)** | |

b) Methyl ethanoate was hydrolysed in acidified conditions.

| | |
|---|---|
| **Structural formula of product(s)** | |
| **Name of product(s)** | |

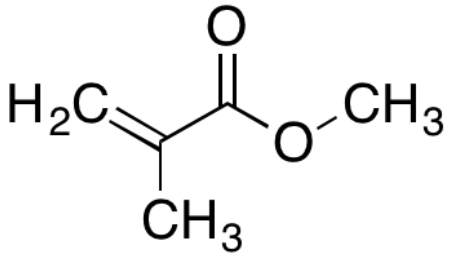
c) Propane gas was bubbled through a solution of iodine water, in presence of UV light.

| | |
|---|---|
| **Structural formula of product(s)** | |
| **Name of product(s)** | |

**Question 13** **(4 marks)**

Lucite acrylic is a classic polymer invented by the Dupont Corporation® in 1931. It is made from a methyl methacrylate monomer, and produces a strong, transparent, UV resistant polymer, that is commonly used in aeroplane windows.

The methyl methacrylate monomer unit is shown below:




a) Draw the structural formula of <u>two</u> repeating units of the polymer. (2 marks)

b) Name this polymer. (1 mark)

c) Name the type of polymerisation reaction used here. (1 mark)

**Question 13** **(8 marks)**

The Irukandji Jellyfish is a type of box jellyfish found in northern Australian waters. Its sting is extremely venomous, and symptoms include excruciating pain and a psychological sense of impending doom.

The venom of the Irukandji Jellyfish contains a protein, which has a segment containing the following amino acids:

**– Asn – Pro – Met –**

a) Draw this segment of the venom protein and circle all peptide bonds. (4 marks)

b) Use this segment of the protein, as an example to define the primary structure of a protein. (1 mark)

c) State the tertiary interactions which could occur in this protein, as contributed by Asn, Pro and Met. (3 marks)

**Question 15** **(7 marks)**

Ethanamine, ethanoic acid and glycine are all molecules that contain two carbons in their chain. However, their boiling points are quite different.

| IUPAC Name | MW (g $mol^{-1}$) | Boiling Point (°C) |
|---|---|---|
| Ethanamine | 45.08 | 17 |
| Ethanoic acid | 60.05 | 118 |
| Glycine (Gly) | 75.07 | 233 |

Explain this observation, with reference to the information in the table above.

## END OF TEST

## Additional Working Paper

## Additional Working Paper