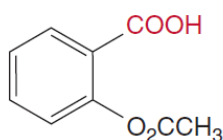


1. A hydrocarbon is a gas at room temperature. When 1 mole of the compound burns in air, 2 mole of CO₂ are produced. When it is bubbled into bromine water, the bromine loses colour. Which of the following compounds could it be?
- a) C₂H₅OH b) CH₂CHCH₃
- c) CH₃CH₃ d) CH₂CH₂

2. Aspirin, whose structure is shown, contains which functional groups?

- a) A ketone and an alcohol
b) An ester and a ketone
c) An ester and a carboxylic acid
d) A ketone, alcohol and ester



3. From the list of 4 compounds below, identify the compound that is NOT an isomer of any other compound in the list.

Butanoic acid, butanal, methylpropanoate, ethylethanoate


- a) Butanoic acid
b) Butanal
c) Methylpropanoate
d) Ethylethanoate


4. Which of the following pure substances will have the highest melting point?


- a) Ethane
b) Ethanal
c) Ethanoic acid
d) Ethanol

5. Which of the following compounds can have geometric isomers?

- a)
-
- C=C(C)=C(C)

- b) 

- c) 

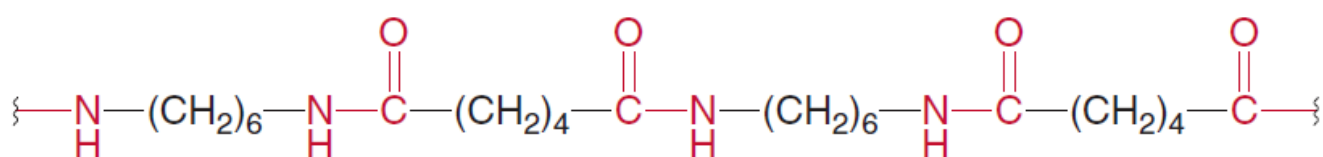
- d) 

6. A student labelled an organic compound 1-bromo-2,2-dimethylethane, but the name was incorrect according to IUPAC standards. The correct name would be

- a) 2-dimethyl – 1 – bromoethane
b) 1-bromo-2-methylpropane
c) 2-methyl-3-bromopropane
d) 1,1-dimethyl-2-bromoethane

7. Which of the following substances would you expect to be most soluble in water?
- 1-butanol
 - Pentane
 - Propanone
 - Methylpropanal
8. Which of the following statements is FALSE?
- Oxidation of 1-butanol with potassium permanganate produces butanal and subsequently butanoic acid
 - Oxidation of 2-butanol with potassium permanganate produces 2-butanone
 - Methane when treated with hydrogen chloride produces chloromethane and hydrogen gas
 - Ethanoic acid reacts with magnesium to produce hydrogen gas.

Study the section of polymer below to answer questions 9 and 10:



9. This segment is probably part of
- A polyester
 - A polyamine
 - A polypeptide
 - A polycarbide
10. A monomer from the polymer could be:

- | | |
|--|--|
| <p>a)</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> $\text{NH}_2 - (\text{CH}_2)_6 - \text{NH}_2$ </div> | <p>b)</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> $\text{NH}_2 - \text{CH}_2 - \text{CH}_2 - \text{COOH}$ </div> |
| <p>c)</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> $\text{COOH} - (\text{CH}_2)_6 - \text{COOH}$ </div> | <p>d)</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> $\text{COOH} - (\text{CH}_2)_5 - \text{NH}_2$ </div> |

END OF MULTIPLE CHOICE



Year 12 Chemistry

Organic Chemistry Test 2016

Student Name:
Teacher:

- 60 minutes working time
- Non-programmable calculator and data sheet allowed.

Multiple Choice	Short Answer	Extended Answer	Total	
10	23	27	60	

Section I – Multiple Choice

Mark your choice with a cross (X). Please do not circle your answer.

1. A B C **D**
2. A B **C** D
3. A **B** C D
4. A B **C** D
5. — A B C **D**
6. A **B** C D
7. **A** B C D
8. A B **C** D
9. A **B** C D
10. **A** B C D

Section II – Short Answer Questions

Question 1

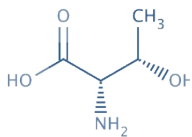
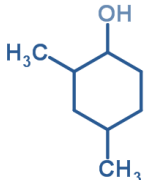
Identify the **organic** reactants that could be used to produce each of the following organic compounds (name or chemical formula):

Compound	Reactants
Butanone	Butan-2-ol (and permanganate / dichromate)
2-bromopropane	Hydrogen bromide and propene
Ethylheptanoate	Ethanol and heptanoic acid

[3 marks]

Question 2

Give the correct IUPAC name or complete structural formula for the following compounds:

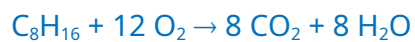
IUPAC Name	Structural Formula
2-amino-3-hydroxy-pentanoic acid	
3-bromo-4-fluorobutanal	$\begin{array}{c} \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CHO} \\ \quad \\ \text{F} \quad \text{Br} \end{array}$
3-ethyl-5-methylhex-1-ene	$\begin{array}{c} \text{CH}_2 = \text{CH} - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ \\ \text{CH}_2 - \text{CH} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
2,4-dimethyl-cyclohexanol	

[4 marks]

Question 3

Write balanced equations for the following reactions:

- a) Combustion of octene in a plentiful supply of air.



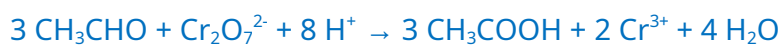
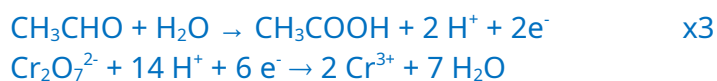
[2 marks]

- b) The reaction between ethanoic acid and solid sodium carbonate.



[2 marks]

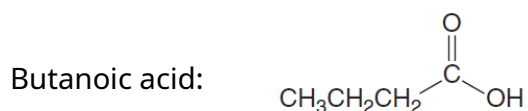
- c) The reaction between potassium dichromate with ethanal.



[3 marks]

Question 4

The molecular formula $C_4H_8O_2$ can represent the molecule shown below:



There are many isomers of this molecule. Draw **two** that are esters and **one** that is a carboxylic acid.

	Structure
Ester	Ethyl ethanoate Methyl propanoate Propyl methanoate
Ester	Any two of the above
Carboxylic acid	Any carboxylic acid with 4 carbons

[3 marks]

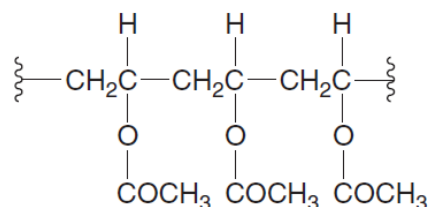
Question 5

a) What is a monomer?

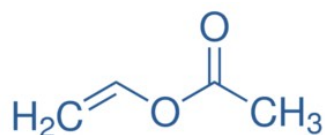
Small molecule that can be joined to others of the same kind to make a polymer.

[1 mark]

b) Poly vinyl acetate is a soluble polymer with the following structure.

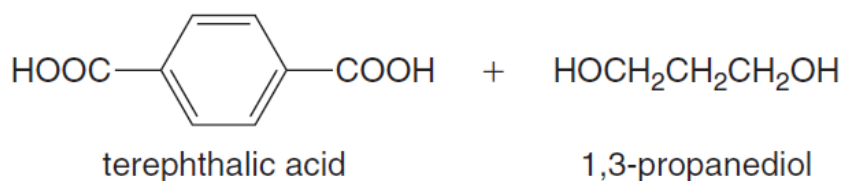


c) Draw the structure of the monomer responsible for the polymer.



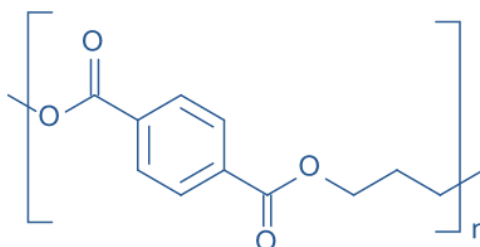
[2 marks]

d) The structural formulae for terephthalic acid and 1,3-propanediol are shown below:



Using these monomers draw a section polymer showing exactly two complete repeating units.

Two units shown



[2 marks]

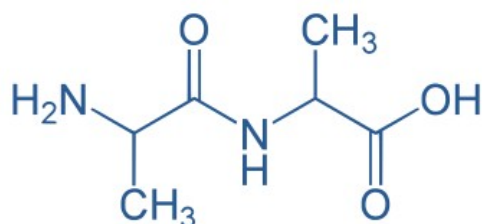
e) State the type of polymerization involved in this reaction:

Section III – Extended Answer Questions

Question 6

Amino acids form polymers through peptide linkages.

- a) Connect two **alanine** molecules with a peptide link.



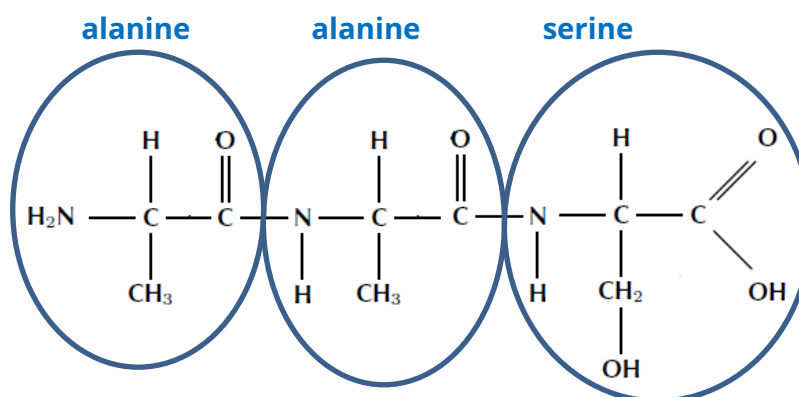
[2 marks]

- b) Amino acids exist as zwitterions. Rewrite **alanine** as it would be found at the pH values indicated below:

pH	Structure of Alanine
3	<chem>C[C@H](N)C(=O)O</chem>
7	<chem>C[C@H](N)C(=O)[O-]</chem>
10	<chem>C[C@H](N)C(=O)[O-]</chem>

[3 marks]

- c) Circle and name the three amino acids that have been used to make the polypeptide shown below.



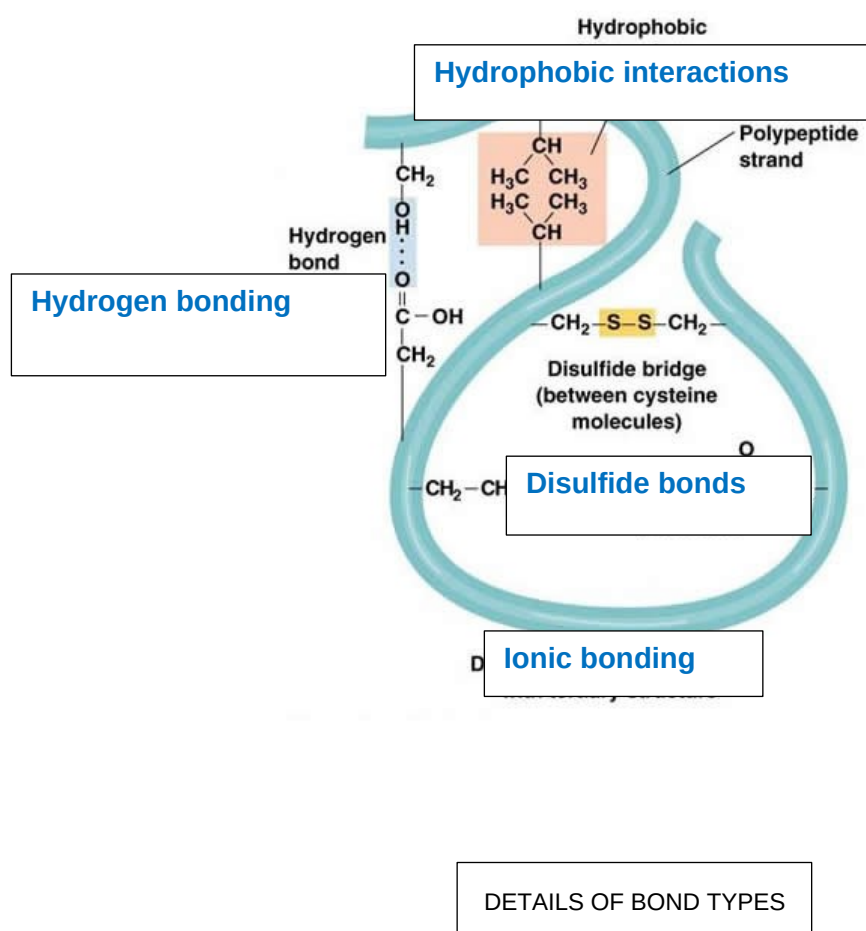
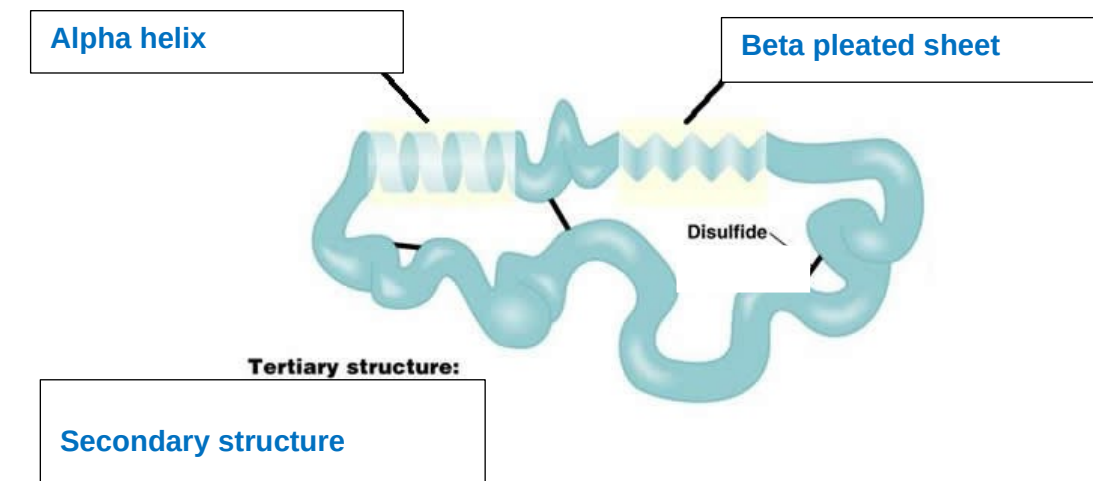
[3 marks]

- d) Explain the following with regard to protein structure and explain how each structure is held together.

Primary	The primary structure of a protein is the sequence of amino acids in the polypeptide chain or chains.
Secondary	The repeated coiling and folding of a polypeptide chain due to hydrogen bonding between the amine hydrogen and acid oxygen atoms on the protein backbone.
Tertiary	3D structure of a protein due to interactions between amino acid side chains (R groups).

[3 marks]

e) Label the different parts of the diagrams below:



f) Explain how heat and pH changes can disrupt protein structure.

- pH too high will convert -NH_3^+ to NH_2 , or too high will convert C-O^- to -C-OH which will disrupt ionic bonds
- Higher kinetic energy can disrupt IM forces within protein
- Protein can 'uncoil' or lose shape

[3 marks]

Question 7

A sample of a compound containing carbon, hydrogen and nitrogen only was burned in oxygen and produced 2.64 g of carbon dioxide, 0.630 g of water and 0.460 g of nitrogen dioxide.

a. $n(\text{CO}_2) = 0.05999 \text{ mol} = n(\text{C}) \text{ in the compound}$ ✓

$$n(\text{H}_2\text{O}) = 0.03497 \text{ mol}$$
 ✓

$$n(\text{H}) \text{ in the compound} = 2 \times 0.03497 = 0.06994 \text{ mol}$$
 ✓

$$n(\text{NO}_2) = 0.009998 \text{ mol} = n(\text{N}) \text{ in the compound}$$
 ✓

	<u>C</u>	<u>H</u>	<u>N</u>
Mole:	0.05999	0.06994	0.009998
Ratio:			✓
=	6	6.995	1
≈	6	7	1

The empirical formula is therefore $\text{C}_6\text{H}_7\text{N}$. ✓

b. $\text{molecular mass} = n \times \text{formula mass}$

$$95 = n \times 93.126$$

$$n \approx 1$$

The molecular formula is therefore $\text{C}_6\text{H}_7\text{N}$. ✓