

ATAR Chemistry 3+4
 Organic Molecules Test

TOTAL MARKS = 53
DO NOT MARK THIS PAPER

YOU MUST SHOW ALL HYDROGEN ATOMS IN YOUR STRUCTURAL DIAGRAMS

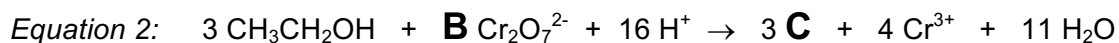
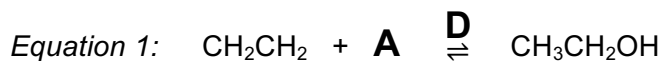
Multiple choice 10 marks

1. Consider the following five (5) organic compounds.

(i)	(ii)	(iii)	(iv)	(v)
<pre> H H H-C---C-H H H </pre>	<pre> H O // H-C-----C \ H OH </pre>	<pre> H O // H-C-----C \ H H </pre>	<pre> H O // H-C-----C \ H NH2 </pre>	<pre> H H H-C---C-OH H H </pre>
CH ₃ CH ₃	CH ₃ COOH	CH ₃ CHO	CH ₃ CONH ₂	CH ₃ CH ₂ OH

Which of the following lists contain compounds that **all** have the ability to form hydrogen bonds?

- (a) all of (i), (ii), (iii), (iv) and (v)
 (b) (ii), (iii), and (iv) only
 (c) (i), (ii), (iii) and (v) only
 (d) (ii), (iv) and (v) only
2. The partially completed equations below show the various chemical reactions involved in the synthesis of ethyl ethanoate.



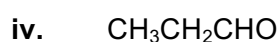
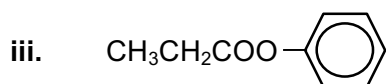
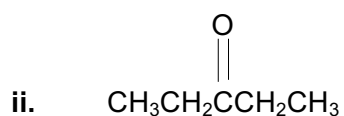
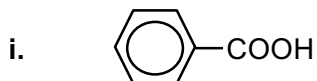
Which of the following correctly identifies the unknowns A, B, C & D?

- | | A | B | C | D |
|-----|------------------|----------|----------------------|------------------|
| (a) | H ₂ O | 2 | CH ₃ COOH | H ⁺ |
| (b) | H ₂ O | 1 | CH ₃ COOH | catalyst |
| (c) | H ₂ O | 2 | CH ₃ CHO | H ⁺ |
| (d) | H ⁺ | 4 | CH ₃ CHO | H ₂ O |

3. An organic substance has an empirical formula of $C_3H_6O_2$. Which of the following is NOT a possible identity of the substance?

- (a) Propanoic acid
- (b) Ethyl methanoate
- (c) Methyl methanoate
- (d) Methyl ethanoate

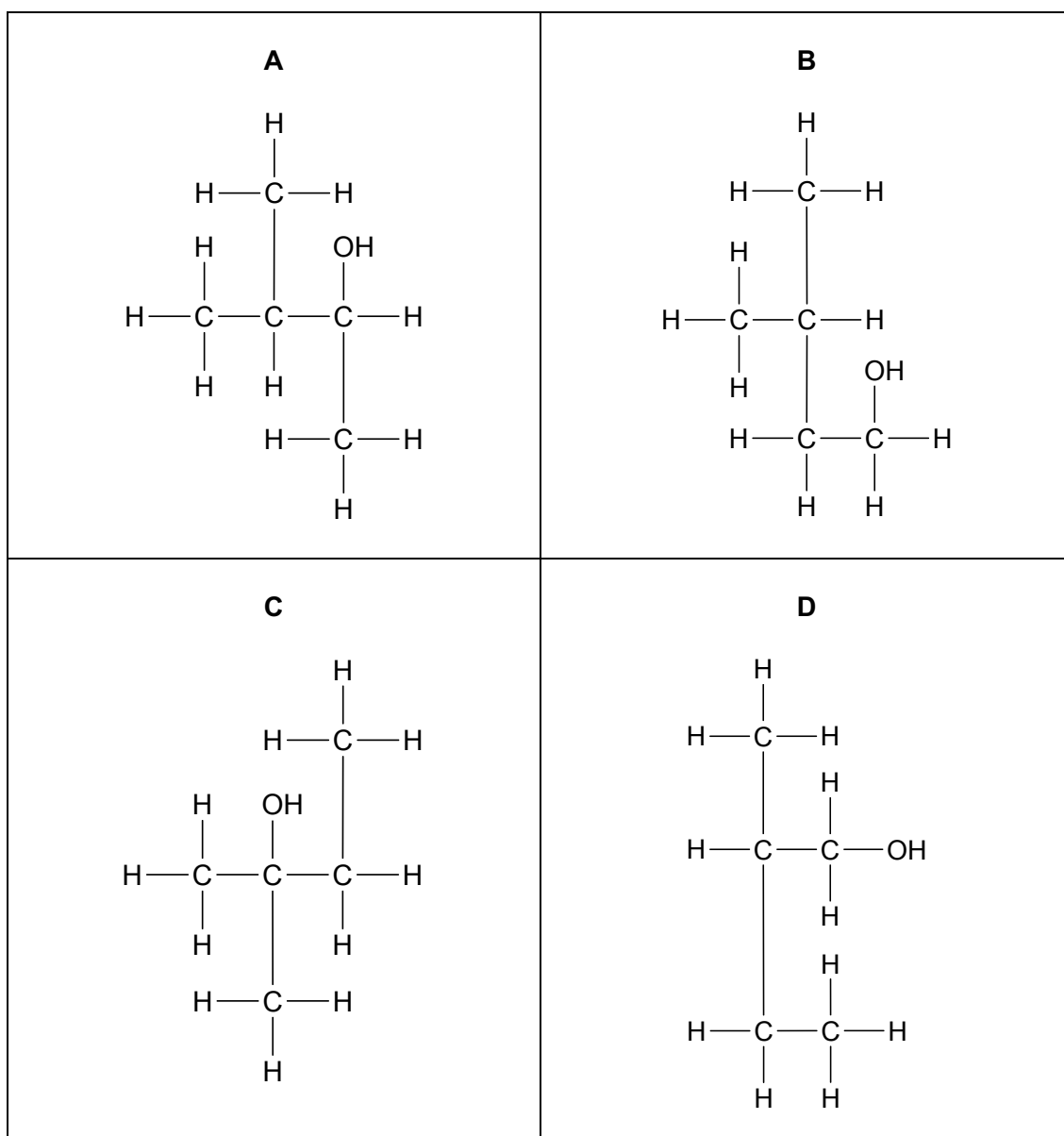
4.



Which one of the following lists places the compounds in their correct class?

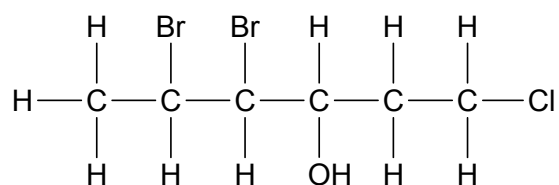
- | | i. | ii | iii | iv |
|-----|-----------------|----------|-----------------|-----------------|
| (a) | Ester | Aldehyde | Ketone | Carboxylic acid |
| (b) | Carboxylic acid | Ketone | Ester | Aldehyde |
| (c) | Carboxylic acid | Ester | Ketone | Aldehyde |
| (d) | Aldehyde | Ketone | Carboxylic acid | Ester |

Questions 5 and 6 relate to the four isomers of $C_5H_{11}OH$ shown below.



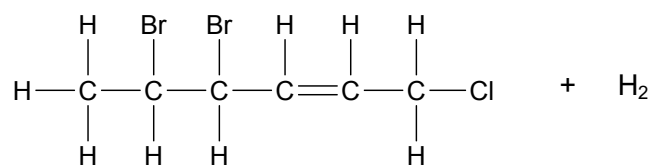
5. Which of the isomers would **not** react when mixed with acidified sodium permanganate solution?
- (a) A
 (b) B
 (c) C
 (d) D
6. Which of the following is **not** a possible organic product resulting from oxidation of the isomers above?
- (a) 3-methylbutanoic acid
 (b) 2-methylbutanoic acid
 (c) 3-methylbutanone
 (d) 2-methylbutanone

7. Consider the organic molecule shown below.

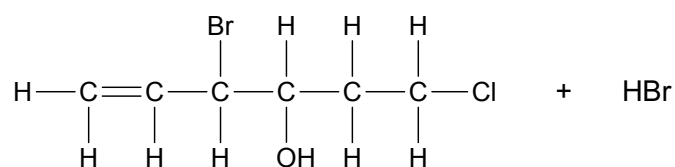


Which of the following reactions is **most likely** to produce this compound?

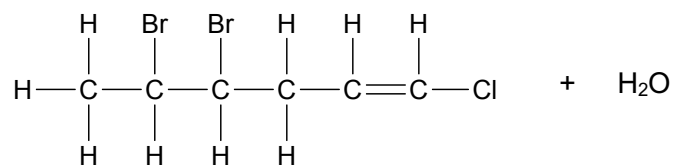
(a)



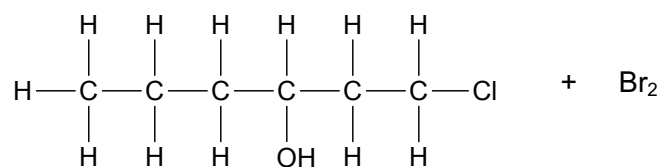
(b)



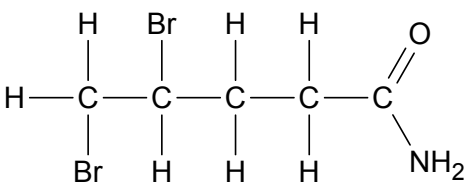
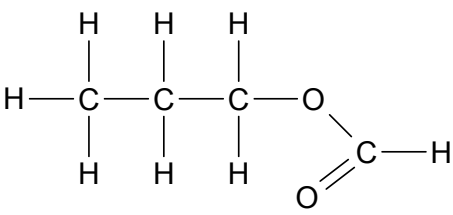
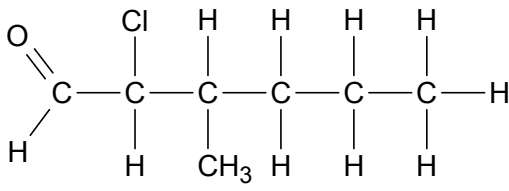
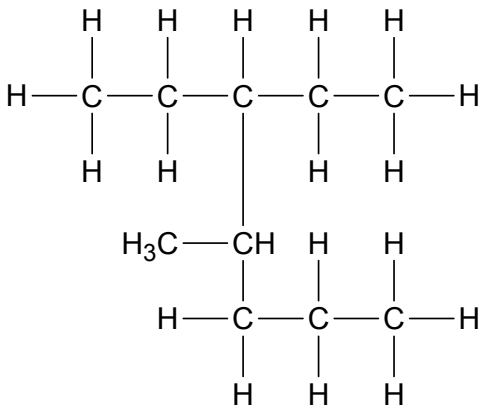
(c)



(d)

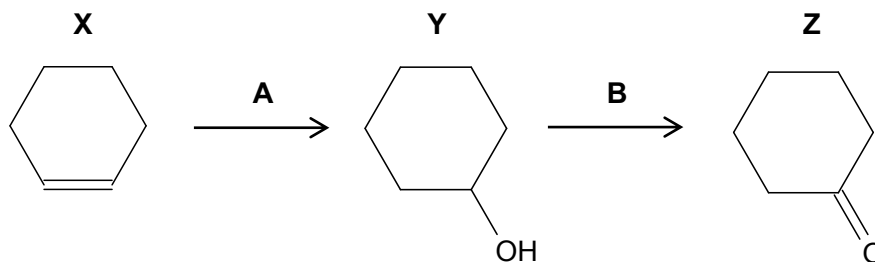


8. Which of the following molecules has **not** been given the correct IUPAC name?

<p>(a) 4,5-dibromopentanamine</p> 	<p>(b) propylmethanoate</p> 
<p>(c) 2-chloro-3-methylhexanal</p> 	<p>(d) 3-ethyl-4-methylheptane</p> 

Questions 9 and 10 relate to the following information.

An overview of a particular reaction sequence is shown below.



9. What functional group is present in each of the substances?

	X	Y	Z
(a)	alkene	alcohol	aldehyde
(b)	alkene	aldehyde	carboxylic acid
(c)	alkene	alcohol	ketone
(d)	alkane	ketone	ester

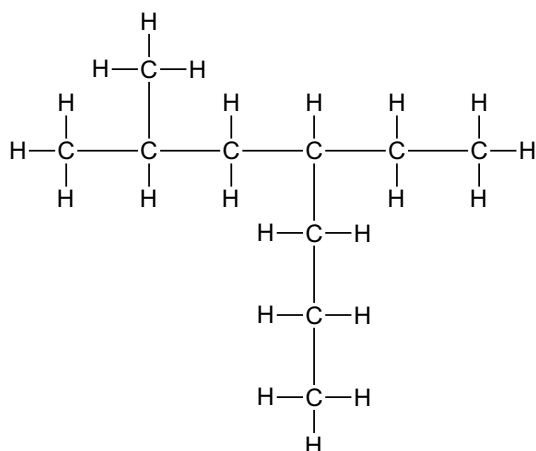
10. What reagents were **most likely** added at steps A and B?

	A	B
(a)	O ₂ (g)	H ₂ (g)
(b)	H ₂ O(l)	O ₂ (g)
(c)	NaOH(aq)	H ⁺ /MnO ₄ ⁻ (aq)
(d)	H ₂ O(l)	H ⁺ /Cr ₂ O ₇ ²⁻ (aq)

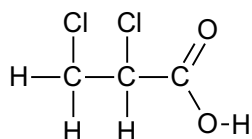
Short Answers 41 marks

11. Give the IUPAC name of the following structures:

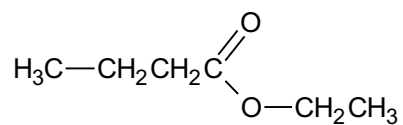
(a)



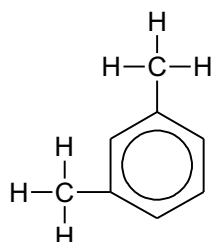
(b)



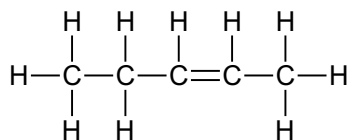
(c)



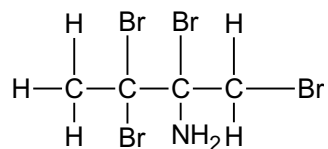
(d)



(e)



(f)



[6 marks]

12. Give the full structural formula for the following organic chemicals:

- (a) 5-ethylheptan-3-one
- (b) 2-chloro-5-methyl-octan-1-amine
- (c) 2-ethylhexyl- ethanoate
- (d) 4,4-diethyloctanal
- (e) trans-hept-3-ene
- (f) 1,1-dichloro-cis-but-2-ene

[6 marks]

13. For each of the situations described below, determine whether or not a redox reaction would be expected and, if so:

- (i) Write a balanced redox reaction showing the changes that take place and show the states in the final equation;
- (ii) Give an observation for the reactions:
 - (a) Acidified potassium permanganate solution is added to pentan-2-ol.
 - (b) Limited dilute acidified potassium dichromate is added to propan-1-ol.

[8 marks]

14. Coconut oil contains an ester which gives the oil its distinctive odour. The ester was extracted and a series of experiments were carried out to determine the formula of this ester, which was known to contain only carbon, hydrogen and oxygen.

A 1.680 g sample was burned in excess oxygen and 4.100 g of carbon dioxide was produced.

A separate 1.990 g sample was burned in excess oxygen and 1.990 g of water was produced.

- (a) Calculate the empirical formula of the ester in the coconut oil. (8 marks)

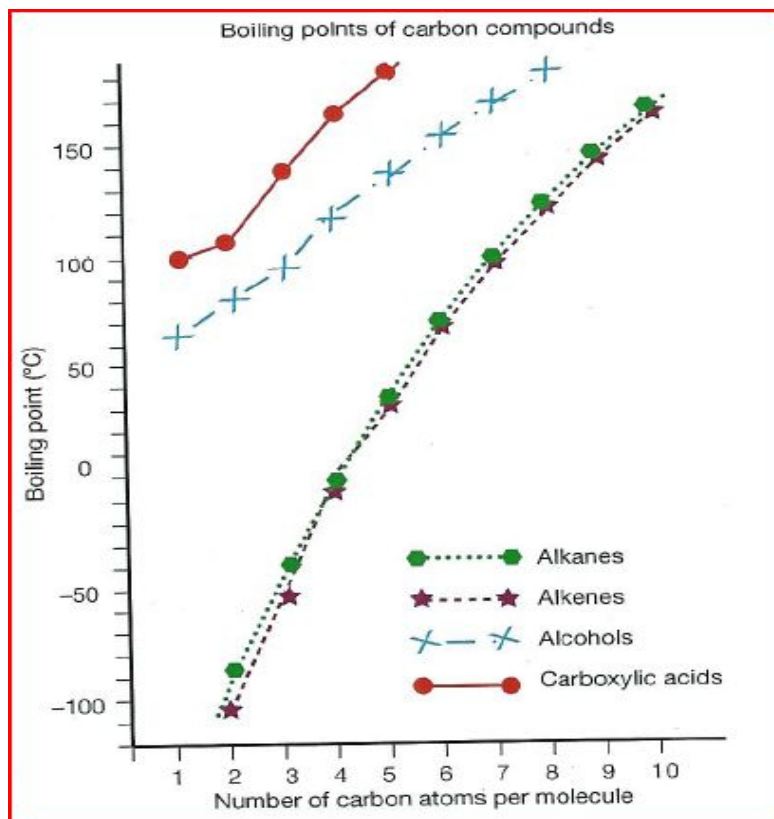
A further sample weighing 0.8100 g was vaporised and the gas produced was found to occupy a volume of 226.0 mL at 140.0 °C and 85.20 kPa.

- (b) From this information, calculate the molecular formula of the ester. (4 marks)
- (c) This same ester can also be synthesised in the laboratory by reacting pentan-1-ol and a carboxylic acid, using sulfuric acid as a catalyst.

Using this information, draw the structural formula of the ester present in coconut oil.

(1 mark)

15.



- a) Looking at the above graph explain in general terms why the boiling point for all the functional groups increases with increasing number of carbon atoms per molecule. [2 marks]
- b) From the graph it is clear that alkanes and alkenes generally have much lower boiling points than alcohols and carboxylic acids. Account for this in terms of forces these different functional groups have. [4 marks]
- c) In terms of solubility explain which groups are more likely to be soluble in a polar solvent and explain briefly? [2 marks]
- c) Within the homologous series of alcohols account for any changes of solubility in a polar solvent, say for example pentan-1-ol? [2 marks]

End of test