



**ALL SAINTS'
COLLEGE**

Science Department

Year 12 Chemistry ATAR

Test 6: Organic Chemistry

Name: _____

Solutions

Instructions to Students:

1. 50 minutes permitted
2. Attempt all questions
3. Write in the spaces provided
4. Show all working when required
5. All answers to be in blue or black pen, diagrams in pencil.

TOTAL
/50

Final Percentage

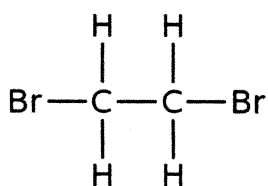
Organic Chemistry Test

Section 1 – Multiple Choice

1. A molecule of a non-cyclic alkane contains 7 carbon atoms. The number of hydrogen atoms in this molecule is:

- a) 7
- b) 14
- c) 16
- d) 28

2. What is the IUPAC systematic name of:

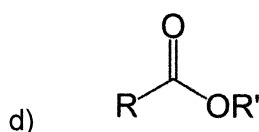
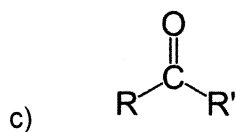
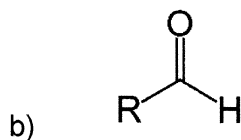
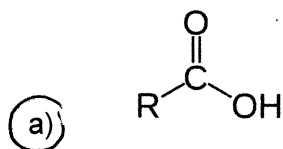


- a) 1,1-dibromoethane
- b) 1,1-dibromoethene
- c) 1,2-dibromoethane
- d) 1,2-dibromoethane

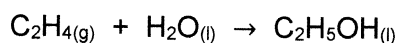
3. Isomers are molecules with:

- a) The same empirical formulae and the same physical and chemical properties.
- b) The same molecular formulae but different structural formulae.
- c) The same molecules but alternating single and double bonds.
- d) The same chemical properties but different empirical formulae.

4. A carboxylic acid has the following type of functional group:



5. Ethene reacts with water to produce ethanol according to the equation:

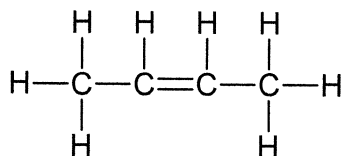


This reaction is described as a:

- a) A condensation reaction
 - b) A substitution reaction
 - c) An acid-base reaction
 - d) An addition reaction
6. Which of the following will produce a non-organic by-product when reacted with fluorine gas?

- a) 3-pentene
- b) cyclohexene
- c) benzene
- d) 2-butyne

7. Which of the following statements are true about the compound represented by the formula below?



- I it decolourises bromine water.
- II it is soluble in water.
- III it undergoes addition reactions with hydrogen chloride to form two different isomers with the formula $\text{C}_4\text{H}_9\text{Cl}$.
- IV its systematic name is trans-2-butene.

- a) I only.
- b) I and III only.
- c) I, III and IV only.
- d) I, II, III and IV.

8. Chlorine gas reacts with hydrocarbons by both addition to multiple bonds and substitution of hydrogen atoms. Excess chlorine gas is mixed with 1 mole of each of the following. Which one will react with the most chlorine?

- a) ethane
- b) ethene
- c) dichloroethane
- d) dichloroethene

9. How many of the following compounds can exhibit geometric (cis-trans) isomerism?

- 1,1 – dibromo propene
- 1,2 – dibromo propene
- 2,3 – dibromo propene
- 3,3 – dibromo propene

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

10. A colourless organic liquid (X) is reacted with an acidified potassium permanganate solution. The product is a liquid (Y). The liquid (X) and liquid (Y) are then reacted to produce a liquid (Z).

Which of the following general formulas represents the liquid (Y)?
[R represents the rest of the molecule.]

- a) RCH_2OH
b) RCOR
c) RCOOR
d) RCOOH



Year 12 Chemistry ATAR

Organic Chemistry Test

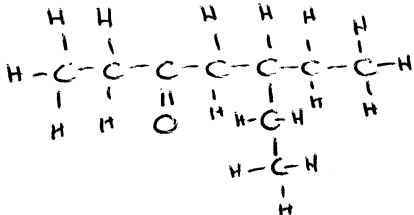
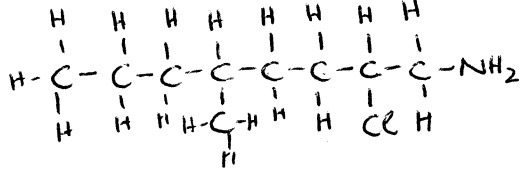
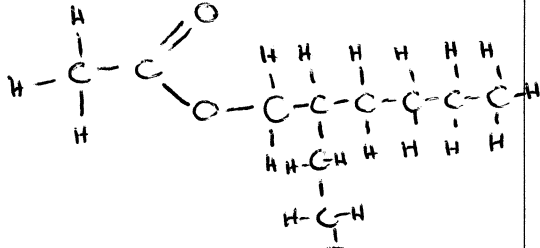
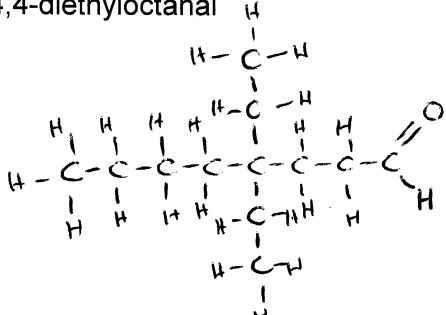
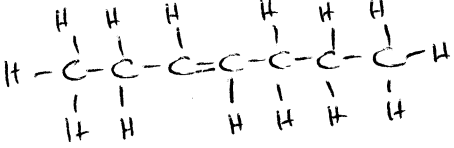
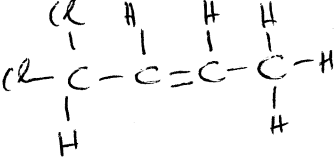
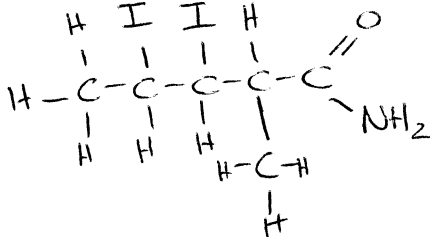
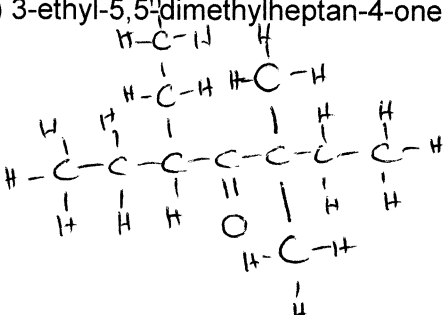
YOU MUST SHOW ALL HYDROGEN ATOMS IN YOUR STRUCTURAL DIAGRAM

1. Give the IUPAC name of the following structures:

<p>(a)</p> <p>Name: <u>4-ethyl-2-methylheptane</u></p>	<p>(b)</p> <p>Name: <u>2,3-dichloropropanoic acid</u></p>
<p>(c)</p> <p>Name: <u>ethyl butanoate</u></p>	<p>(d)</p> <p>Name: <u>1,3-dimethylbenzene</u></p>
<p>(e)</p> <p>Name: <u>cis-pent-2-ene</u></p>	<p>(f)</p> <p>Name: <u>2-methylbutan-1-amine</u></p>

[6 marks]

2. Give the full structural formula for the following organic chemicals (include all Hydrogens):

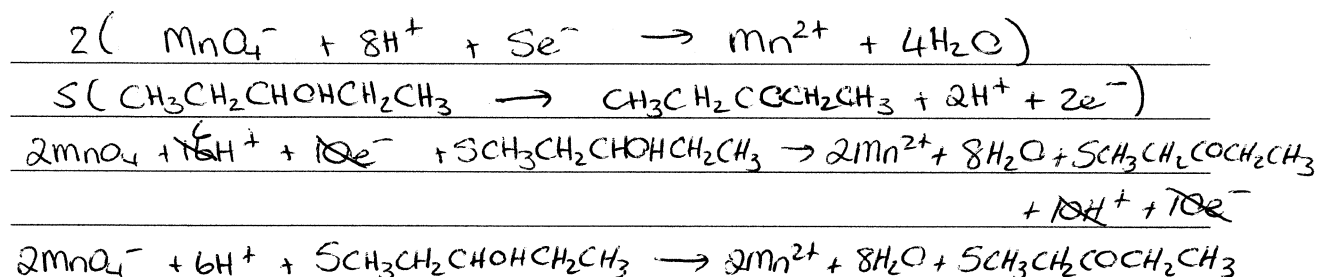
<p>(a) 5-ethyl-3-heptanone</p> 	<p>(b) 2-chloro-5-methyloctanamine</p> 
<p>(c) 2-ethylhexyl ethanoate</p> 	<p>(d) 4,4-diethyloctanal</p> 
<p>(e) trans-3-heptene</p> 	<p>(f) 1,1-dichloro-cis-2-butene</p> 
<p>(g) 3,4-diiodo-2-methyl-1-pentanamide</p> 	<p>(h) 3-ethyl-5,5-dimethylheptan-4-one</p> 

[8 marks]

3. For each of the situations described below, write a balanced redox reaction showing the changes that take place (there is no need to show the phase of the chemicals);

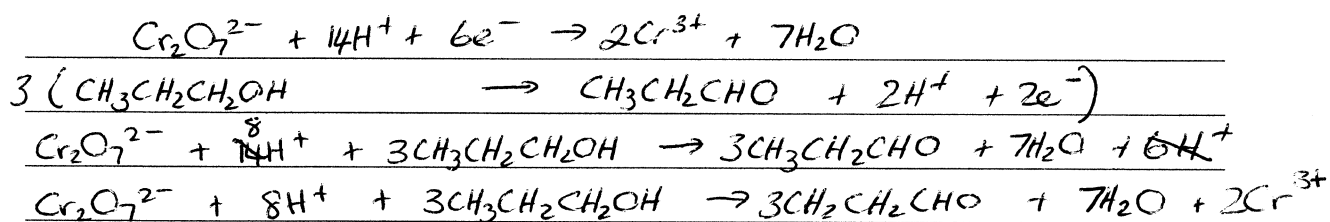
Give a brief observation of any major colour change that would be observed in any of the coloured reagents used to bring about the reaction.

- (a) Acidified potassium permanganate solution is added to pentan-2-ol.



A purple solution is added to a clear, colourless solution. A colourless (pale pink) solution results.

- (b) Limited **dilute** acidified potassium dichromate is added to propan-1-ol (assume incomplete oxidation).

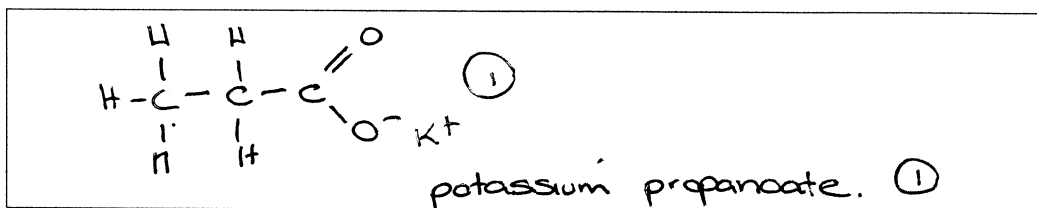


An orange solution is added to a clear, colourless solution. A dark green solution results.

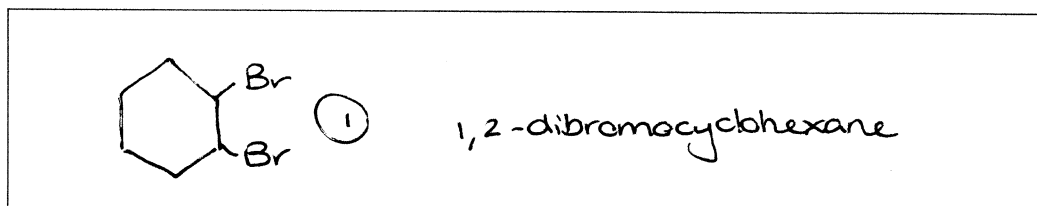
[8 marks]

4. DRAW and NAME the major organic PRODUCT or PRODUCTS in the following reactions assuming appropriate conditions. NB. No balancing is required.

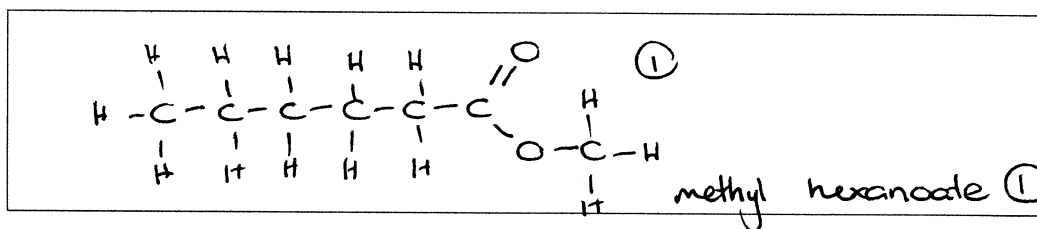
(a) Propanoic acid and potassium hydroxide solution.



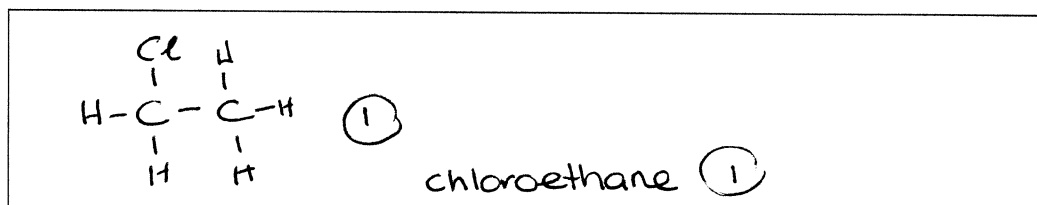
(b) Cyclohexene and bromine.



(c) Methanol and hexanoic acid.



(d) Ethane and chlorine.



[8 marks]

5. (a) An unknown organic compound contains only carbon, hydrogen and oxygen. A 0.275g sample of the compound was combusted in excess oxygen to yield 0.403g of carbon dioxide and 0.165g of water.

Determine the empirical formula of the compound. Given that a 1.50g sample of the same compound, when vapourised, occupied 498.5 mL at 295K and 123.0 kPa, determine the molecular formula of the compound.

$$(R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1})$$

- (b) Had the organic compound turned blue litmus pink, draw its molecular structure and name it.

[6 marks]

a)

$\frac{\text{CO}_2}{n(\text{CO}_2) = \frac{m}{M}}$ $= \frac{0.403}{44.0}$ $= 0.00915 \text{ mol.}$ $n(\text{C}) = n(\text{CO}_2)$ $= 0.00915 \text{ mol.}$ $m(\text{C}) = n \times M$ $= 0.00915 \times 12$ $= 0.1098 \text{ g} \quad (1)$	$\frac{\text{H}_2\text{O}}{n(\text{H}_2\text{O}) = \frac{m}{M}}$ $= \frac{0.165}{18}$ $= 0.0092 \text{ mol}$ $n(\text{H}) = 2 \times n(\text{H}_2\text{O})$ $= 0.0183 \text{ mol.}$ $m(\text{H}) = n \times M$ $= 0.0183 \text{ g} \quad (1)$	$\frac{\text{O}}{m(\text{O}) = m(\text{Comp}) - (m(\text{H}) + m(\text{C}))}$ $= 0.275 - (0.1098 + 0.0183)$ $= 0.1469 \text{ g.}$ $n(\text{O}) = \frac{m}{M} = \frac{0.1469}{16}$ $= 0.00915$
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	C	H	O
n	0.00915	0.0183	0.00915
÷ by smallest	$\frac{0.00915}{0.00915}$	$\frac{0.0183}{0.00915}$	$\frac{0.00915}{0.00915}$
ratio	1	2	1
∴ EF	<u>CH₂O</u> (1)		

$P = 123 \text{ kPa}$
 $V = 0.4985 \text{ L}$
 $n = ?$
 $R = 8.314$
 $T = 295 \text{ K}$

$$n = \frac{PV}{RT}$$

$$= \frac{123 \times 0.4985}{8.314 \times 295}$$

$$= 0.025 \text{ mol.}$$

(1)

$$M = \frac{m}{n}$$

$$= \frac{1.50}{0.025}$$

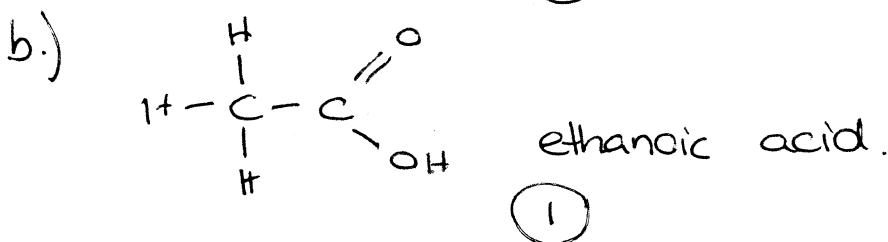
$$= 60. \text{ g. mol}^{-1}$$

$$MF = EF \times \frac{MFW}{EFW}$$

$$= \text{CH}_2\text{O} \times \frac{60}{30}$$

$$= \text{C}_2\text{H}_4\text{O}_2$$

(1)



6. The boiling point of ethanol, $\text{CH}_3\text{CH}_2\text{OH}$, is lower than the boiling point of butan-1-ol, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$, but the solubility of ethanol in water is higher than the solubility of butan-1-ol in water. Explain these observations.

[4 marks]

Boiling point:

H-bonding is the predominant force in both, but equivalent (one -OH per molecule) (1)

Disp forces between butan-1-ol molecules is stronger than for ethanol due to larger size (more electrons) (1)

Solubility:

-OH on end of both molecules can for H-B with H_2O (1)

There are greater disp. forces between 1-butanol molecules. Interactions between H_2O and the non-polar end of the molecule are weaker than those on ethanol, making butan-1-ol less soluble.