ALEXANDER ROAD HIGH SCHOOL

AUGUST 2016 1 HOUR

PHYSICAL SCIENCES CONTROLLED TEST (ORGANICS, FERTILISERS)

CO TOTAL = 50

GRADE 12

1.1 $C_nH_{2n}O_2$ is the general formula for

A both an ester and a carboxylic acid

B an ester only

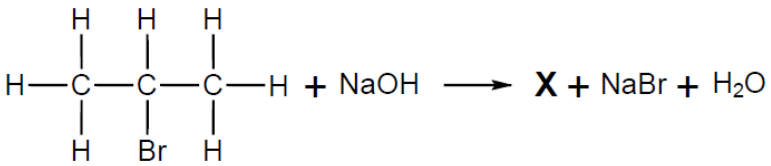
C a carboxylic acid only

D both an alcohol and an ester

1.2 In the reaction $X + HBr \longrightarrow C_2H_5Br$, X is most probably

A an alkane B an alkene C an alkyne D a cycloalkane

1.3 The equation below represents the reaction that takes place when an organic compound and concentrated sodium hydroxide are strongly heated. **X** represents the major organic product formed.



Which ONE of the following is the correct IUPAC name for compound **X**?

A Prop-1-ene

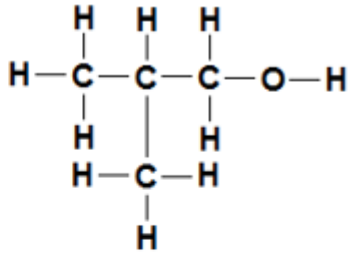
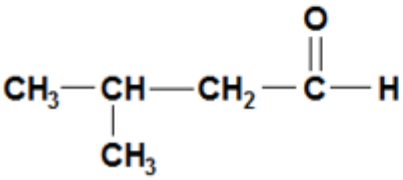
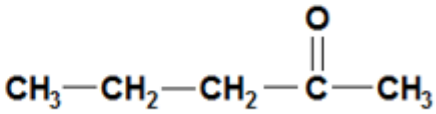
B Prop-2-ene

C Propan-1-ol

D Propan-2-ol

[6]

2. Answer the questions based on the following table of organic substances.

A	**Hex-3-yne**	**B**	
C	**Hexylethanoate**	**D**	**4-ethyl-2-methyloctane**
E		**F**	

2.1 Write down the letter(s) representing the compound(s) which:

(note: A compound may be used more than once)

2.1.1 is an aldehyde (1)

2.1.2 has the general formula C_nH_{2n-2} (1)

2.1.3 is unsaturated (1)

2.1.4 is a saturated hydrocarbon (1)

2.1.5 can be prepared by the reaction of an alcohol with a carboxylic acid (1)

2.1.6 are isomers. (1)

2.2 Write down the <u>structural formula</u> of…

2.2.1 compound A (1)

2.2.2 the functional group of compound F (1)

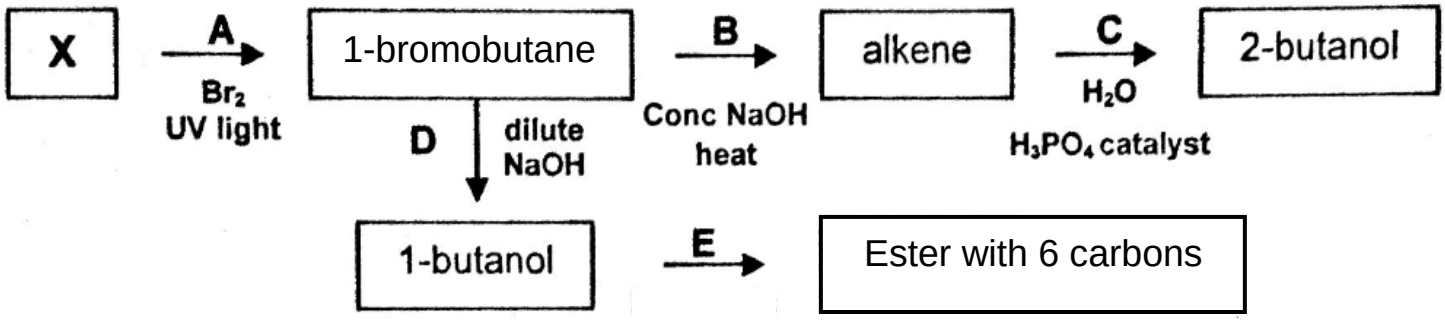
2.3 Give the IUPAC name of compound B (2)

2.4 Is compound B primary, secondary or tertiary compound? (1)

2.5 Give the balanced equation (in molecular form) of the combustion of compound D. (3)

[14]

3. Some organic reactions are shown below:



3.1 Identify the type of reaction which takes place in each of A, B, C, D and E. (5)

3.2 Identify substance X and explain why UV light is needed for reaction A. (2)

3.3 Use structural formulae to show how reaction C takes place and explain why the product is butan-2-ol and not butan-1-ol. (4)

3.4 Is reaction C a hydration or a hydrolysis reaction? Motivate your answer. (2)

3.5 Use structural formulae to show how reaction E takes place and give the IUPAC name for the ester which formed. (4)

3.6 What are esters used for? (1)

[18]

4. Bromine is used to distinguish between 2 unknown organic substances. If bromine water is added to an alkane sample and to an alkene sample, different outcomes are observed.

4.1 Give the chemical formula for this form of bromine. (1)

4.2 What is the difference between the outcomes of these reactions? (2)

[3]

5. Study the table below with information about the first few members of a homologous series:

Name	formula	bp °C	solubility in H_2O g/100g at 20 °C
Methanol	CH_3OH	65	completely miscible
Ethanol	CH_3CH_2OH	78,5	completely miscible
1– propanol	$CH_3CH_2CH_2OH$	97	completely miscible
1– butanol	$CH_3CH_2CH_2CH_2OH$	117,7	7,9
1– pentanol	$CH_3CH_2CH_2CH_2CH_2OH$	137,91	2,7

5.1 Which homologous series is represented here? (1)

5.2 Explain, in terms of intermolecular forces, why:

5.2.1 the boiling points of these compounds steadily increase (2)

5.2.2 the lower members of this series are completely miscible with (soluble in) water. (2)

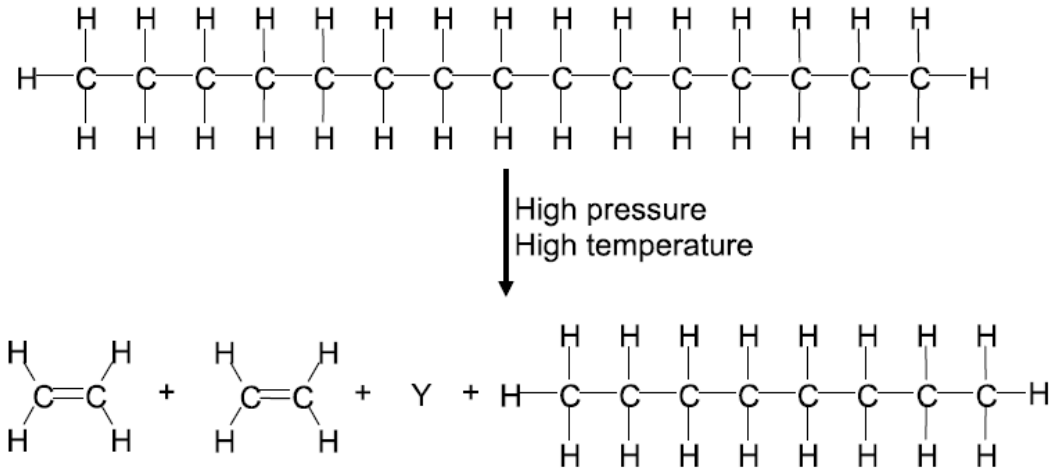
5.2.3 as the size of the molecules increases, the solubility decreases. (2)

5.2.4 ethane and ethanol both contain 2 carbon atoms in the chain, but ethane is a gas at normal room temperature whereas ethanol is a liquid. (2)

[9]

6. Petrol requires alkanes in the range from C_5 to C_{10}. Cracking is the process that is used to convert longer chains into shorter chains.

The diagram below illustrates one of the possible cracking reactions of $C_{15}H_{32}$.



6.1 Write down the STRUCTURAL FORMULA and NAME for the hydrocarbon represented by Y. (2)

6.2 Is this a SUBSTITUTION, ELIMINATION, ADDITION or POLYMERISATION reaction? (1)

[3]

7. The following information is printed on a 5 kg bag of fertiliser: **3:1:5 (34).**

7.1 What does 3:1:5 indicate? (1)

7.2 How does potassium, in fertilisers, contribute to plant growth? (1)

7.3.1 Give one advantage of using inorganic fertilisers and (1)

7.3.2 one disadvantage. (1)

7.4 Calculate the mass (in kg, rounded to 2 decimals) of phosphorous in this bag of fertiliser. (3)

[7]

<u>Bonus Questions</u>

Give the meaning of:

8.1 IUPAC (1)

8.2 IUPAC nomenclature (1)