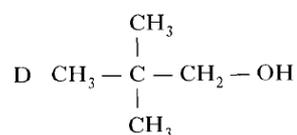
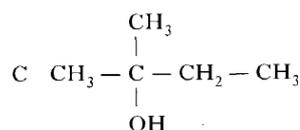
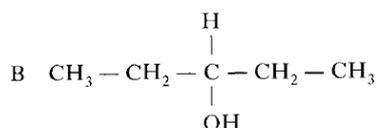
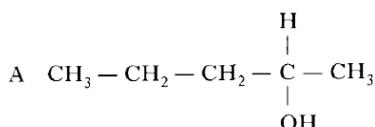


CfE Higher Chemistry Homework

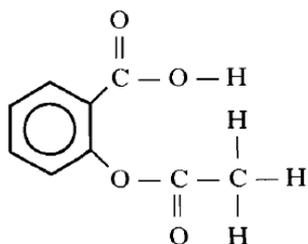
Unit 2: Nature's Chemistry

Esters, Fats, Oils and Soaps

1. Which of the following structural formulae represents a primary alcohol?



2. Aspirin is one of the most widely used pain relievers in the world. It has the structure:



Which **two** functional groups are present in an aspirin molecules?

- | | | | |
|---|---------------------|---|-----------------------|
| A | Aldehyde and Ketone | C | Ester and Aldehyde |
| B | Carboxyl and Ester | D | Hydroxyl and Carbonyl |

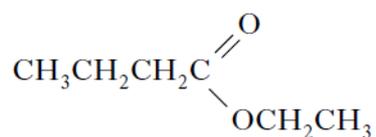
3. An ester has the following structural formula;



The name of this ester is

- A propyl propanoate
- B ethyl butanoate
- C butyl ethanoate
- D ethyl propanoate

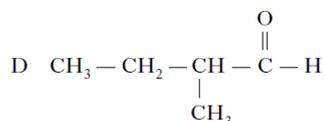
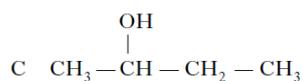
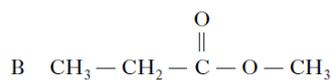
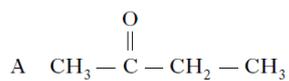
4. Rum flavour is based on the compound with the formula shown



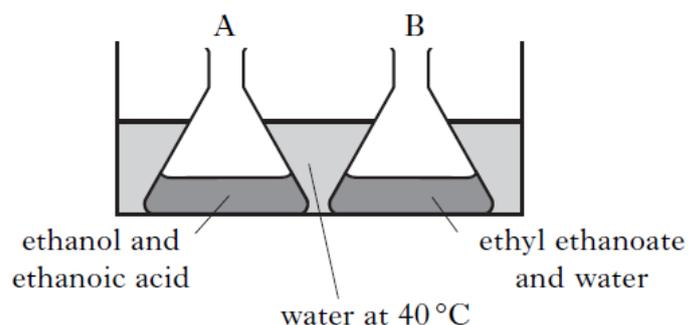
It can be made from

- A ethanol and butanoic acid
- B propanol and ethanoic acid
- C butanol and methanoic acid
- D propanol and propanoic acid

5. Which of the following compounds is hydrolysed when warmed with sodium hydroxide solution?



6. Two flasks, A and B, were placed in a water bath at 40 °C



After several days the content of both flasks were analysed.

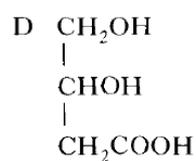
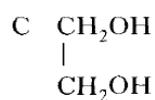
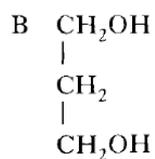
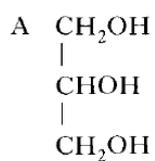
Which results would be expected.

- A Flask A contains ethyl ethanoate, water, ethanol and ethanoic acid; Flask B is unchanged.
- B Flask A contains only ethyl ethanoate and water; Flask b is unchanged.
- C Flask A contains only ethyl ethanoate and water; Flask B contains ethyl ethanoate, water, ethanol and ethanoic acid.
- D Flask A and Flask B contains ethyl ethanoate, water, ethanol and ethanoic acid.

7. Which of the following is most likely to be used as flavourings?

- A $\text{CH}_3\text{CH}_2\text{CHO}$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- C $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$
- D $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$

8. Which of the following represents the structural formula for glycerol?



9. Fats have higher melting points than oils because comparing fats to oils:

- A Fats have more hydrogen bonds
- B Fat molecules are more saturated
- C Fat molecules are more loosely packed
- D Fats have more cross-links between their molecules.

10. In the formation of 'hardened' fats from vegetable oils, the hydrogen

- A causes cross-linking between chains
- B caused hydrolysis to occur
- C increases the carbon chain length
- D reduces the number of carbon - carbon double bonds

11. Ethyl pentanoate is an ester formed in a condensation reaction between ethanol and pentanoic acid.

(a) Draw the full structural formula for ethyl pentanoate. (1)

Ethyl pentanoate can be prepared in a laboratory in a process known as esterification.

(b)(i) Draw a labelled diagram of the assembled apparatus that could be used to prepare ethyl pentanoate in the laboratory (2)

(ii) What is the purpose of the condenser (wet paper towel)? (1)

(iii) Explain why a water bath is used to heat the reaction mixture? (1)

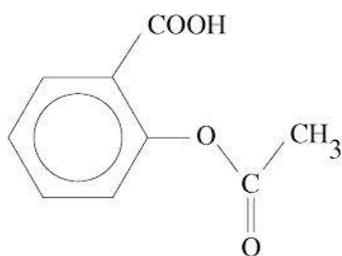
(iv) State two further precautions that should be adopted when carrying out this experiment? (1)

The test-tube (from part (b)(i)) containing the reaction mixture is removed from the hot water bath and its contents poured into a beaker containing sodium hydrogencarbonate solution.

I(i) Explain why the reaction mixture is added to a solution of sodium hydrogencarbonate. (1)

(ii) State two pieces of evidence that indicate that an ester has been formed (2)

12. A compound in the headache tablet aspirin has the following structure;

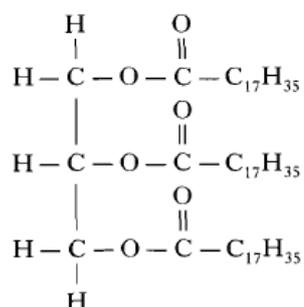


(a) What is meant by hydrolysis? (1)

Headache tablets which are kept for many months, especially in hot and humid climates, often smell of vinegar (ethanoic acid)

(b) Draw the products of the hydrolysis of aspirin. (2)

13. Fats and oils are ester molecules known as triglycerides. The structure of a fat molecule is shown below



(a) When this triglyceride is hydrolysed, a fatty acid is obtained. Name the other product obtained in this reaction. (1)

(b) Oils are liquid at room temperature; fats are solids. Why do oils have lower melting points than fats. (1)

A fatty acid is a long chained carboxylic acid. Examples of fatty acids are shown in the table below

Common name	Systematic name	Structure
stearic acid	octadecanoic acid	$\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$
oleic acid	octadec-9-enoic acid	$\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
linoleic acid	octadec-9,12-dienoic acid	$\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$

(c) Describe a test, with expected results, that could be used to distinguish between stearic acid and oleic acid.

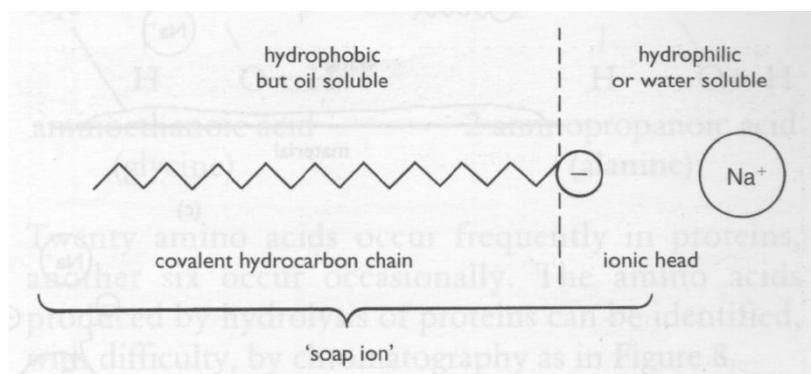
(2)

Stearic acid can be reacted with sodium hydroxide to make a salt of the fatty acid.

(d) Give a commercial use for salts of fatty acids.

(1)

14. The structure of a soap molecule is represented below



This representation of a soap molecule illustrates that soaps have two parts to them:

1. An ionic head which is water soluble
2. A covalent hydrocarbon tail that is soluble in oil or grease

With the aid of a diagram and the above information, explain how soaps can clean grease from clothing such as your school shirt.

(3)

Total 30 marks