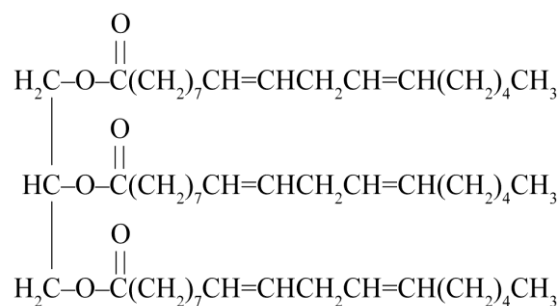


Level 3 Science 90730 Describe selected organic compounds and their uses

Soaps and detergents! In 2007 students were faced with this question.

QUESTION FOUR: FATS AND OILS

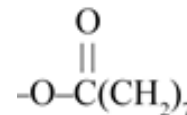
Fats and oils are also known as triglycerides. The following compound represents a triglyceride.



(a) Circle ONE ester functional group on the compound above.

There are 3 to choose from! Look for the  part of the molecule and circle it.

Make sure you don't circle too many atoms!! i.e. this section is not a ester functional group but it contains an ester functional group.

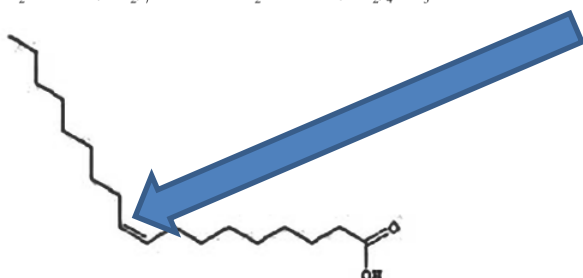
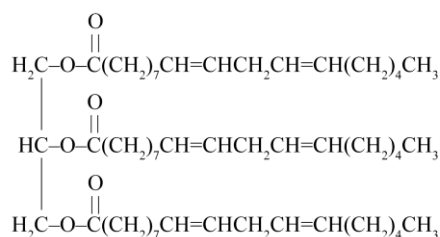


(b) Name the two types of molecules that react together to form a triglyceride.

A triglyceride is another name for an ester. Esters are made in the condensation reaction between an alcohol and a carboxylic acid.

(c) Discuss the reasons why the triglyceride shown above is an oil.

Oils and fats are both triglycerides (esters) but the difference is that fats are solids at room temperature and oils are liquids. Liquids have weaker intermolecular forces than the solids – so you need to look for the factor that prevents molecules from packing as closely together. Molecules that can be squeezed closer together will have stronger intermolecular forces and therefore higher melting points. This is more likely to make them a solid.

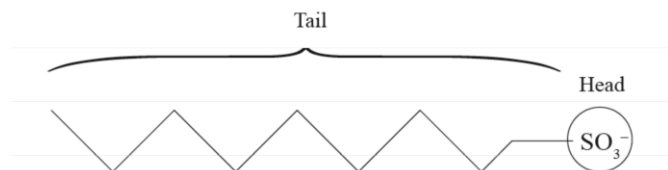


The triglyceride is **unsaturated** – it has a C=C bond somewhere. This molecule has 2 C=C bonds in each hydrocarbon chain. The **effect of these bonds is to introduce a kink**. The molecules **do not pack as closely together** and the intermolecular forces are weaker. They have a **lower melting point i.e. liquid** at room temperature.

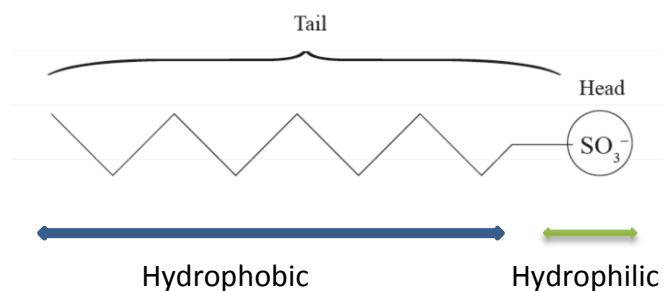
This structure is a cis arrangement if you look closely.

cis alkene arrangement = kink = not so close packing + weaker intermolecular forces = lower melting point = liquid at room temperature.

To remove fat or oil from fabric a detergent is used.
The following diagram represents an anionic detergent molecule.



(d) On the diagram above, label the TWO key parts, showing the different properties of both ends of the detergent molecule.



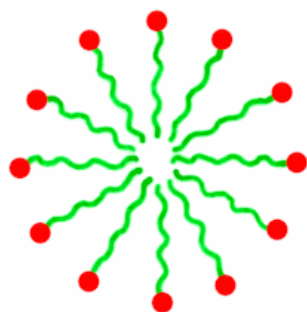
Not a well worded question but students will realise they want you to label the hydrophilic

(Water loving- polar) end and the hydrophobic (non polar - water hating) tail

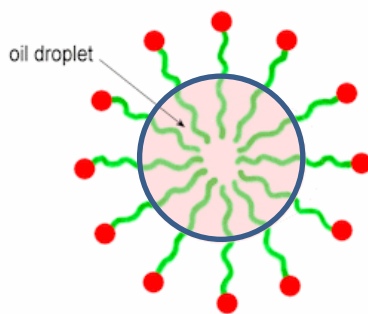
(e) Discuss how detergent molecules like the one shown above would remove the fat or oil from fabric. Labelled diagrams in the box below may help your answer.

- Hydrophobic (non-polar) end of detergent attracted to fat or oil.
- Hydrophilic / polar end dissolves in the (polar) water.
- Micelles form which interact to cause fats and oils to be removed.

(a) micelle of detergent (surfactant) molecules



(b) oil droplet in a detergent solution



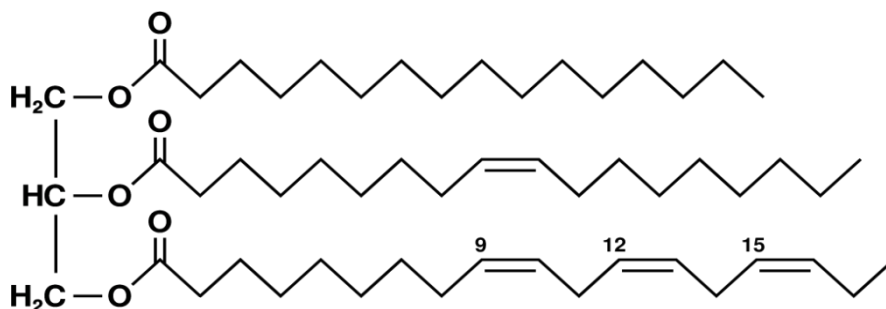
non-polar (hydrocarbon) tail ——— detergent (surfactant) molecule ——— ionic or polar head

2009 QUESTION TWO: FATS AND OILS

The chocolate coating of pineapple lumps includes cocoa powder and vegetable oil.

(a) Describe the structure of fats and oils. A labelled diagram may assist your answer.

A fat and oil is a triglyceride. The tri part of the name means that three alcohol groups have reacted with 3 carboxylic acid groups in an esterification reaction. The carboxylic acid groups come from 3 long chain carboxylic acids called fatty acids. The alcohol is called glycerol (propan-1,2,3-triol).



(b) Discuss the chemical reasons for the different effects of oils and fats on human health. Include in your answer:

- effects of excess fats or oils

As triglycerides contain a lot of energy per gram, excess triglycerides are stored as fat, which can lead to obesity. This can lead to heart disease.

- degree of saturation

Saturation refers to the amount of C=C.

Saturated means no C=C. Unsaturated means C=C (can be monounsaturated 1 × C=C or polyunsaturated 2 or more C=C).

Fats are saturated, oils are unsaturated. Saturated fats are harder for the body to break down, unsaturated oils are easier to break down due to C=C.

- cis and trans structures.

Trans isomers not natural / act like saturated fat due to fact they pack closer together as the molecules have no “kink” in the structure. The packing can actually increase bad cholesterol and decrease good cholesterol. Bad cholesterol can lead to atherosclerosis / hardening of the arteries leading to high blood pressure - increasing stroke risk and heart disease.