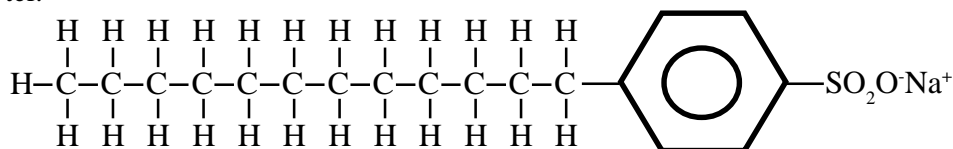




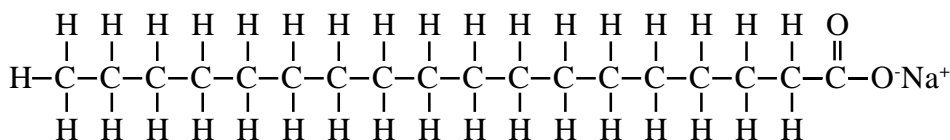
## 2. Soapless Detergents

Soaps have been used for washing for thousands of years but they always had one disadvantage. If used in hard water, i.e. water containing dissolved minerals such as  $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$ , they produced an insoluble scum.

Soapless detergents have similar structures to soaps but are manufactured from aromatic hydrocarbons obtained from crude oil. They wash just as efficiently as soap but they do not produce scum with hard water.

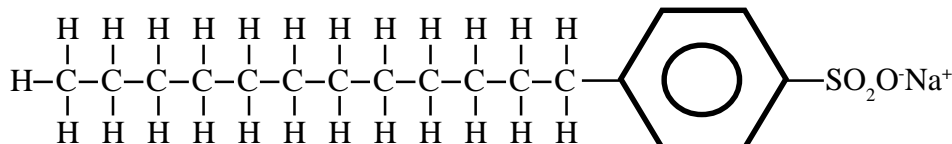


The aromatic hydrocarbons are first reacted with very concentrated sulphuric acid and the product is then neutralised with sodium hydroxide.



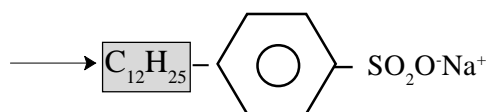
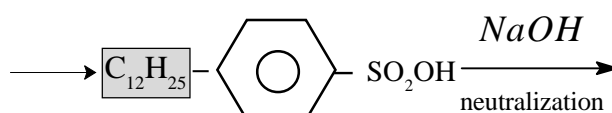
covalent tail

ionic head



You should be able to know:

1. Draw the structural formula of a typical soap molecule.
2. Describe briefly the main stages involved in soap manufacture.
3. State the meaning of saponification and explain what advantage it has over ordinary hydrolysis of an ester.
4. Draw the structural formula of a typical soapless detergent molecule.
5. Describe briefly the main stages involved in the manufacture of soapless detergents.
6. Explain why soapless detergents are more useful than soap in certain areas.
7. Describe similarities and differences in structure between soap and soapless detergents.
8. Explain what is meant by the term detergent.
9. Describe how detergents remove grease and act as emulsifying agents.



## 3. Cleansing Action

Both soap and soapless detergents are examples of detergents, substances which have a cleansing action when added to water. These compounds are able to do this because of their structures.

Questions:

1. What is a detergent and which properties must it possess?
2. Which part of a detergent molecule dissolves in grease and which part in water?
3. Why does it happen?
4. How is the grease loosened from a fabric?
5. Why can the tiny droplets of grease not form a larger blob?
6. What name is given to the type of "mixture" formed?

## CHECK TEST

### (Soaps and Detergents)

1. Which of the following is a typical soap molecule?

$\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^-\text{Na}^+$	$\text{C}_{17}\text{H}_{35}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^-\text{Na}^+$
$\text{C}_{17}\text{H}_{35}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^-\text{Na}^+$	$\text{C}_{17}\text{H}_{35}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Na}^+$

2. The main stages in soap manufacture are

A. heating with sodium hydroxide followed by adding salt solution.

B. heating with salt followed by adding sodium hydroxide solution.

C. adding salt solution followed by adding sodium hydroxide.

D. heating with sugar solution followed by adding salt solution.

3. Which of the following is an example of saponification?

A. Hydrolysis of a fat with alkali

B. Hydrolysis of a fat with acid

C. Hydrolysis of a fatty acid with alkali

D. Hydrolysis of a fatty acid with acid

4. Which of the following is a soapless detergent?

$\text{C}_{17}\text{H}_{35}\text{COO}\cdot\text{Na}^+$	$\text{COO}-\text{C}_6\text{H}_4-\text{SO}_2\cdot\text{Na}^+$
$\text{C}_{12}\text{H}_{25}-\text{C}_6\text{H}_4-\text{SO}_2\cdot\text{Na}^+$	$\text{C}_6\text{H}_5-\text{SO}_2\cdot\text{Na}^+$

6. A soapless detergent is manufactured by treating  
A. a fat with concentrated sulphuric acid followed by a neutralization

B. an aromatic hydrocarbon with concentrated sulphuric acid followed by a neutralization

C. a fat with heat and concentrated acid

D. any hydrocarbon with heat and concentrated acid

7. A major advantage of soapless detergents is

A. they form an insoluble scum with  $\text{Ca}^{2+}$  ions

B. they are manufactured from natural raw materials

C. they do not contain sodium ions

D. they do not form an insoluble scum with  $\text{Ca}^{2+}$  ions

8. A detergent is a

A. solid soap

B. liquid soap

C. substance which makes hard water soft

D. substance which has a cleansing action when added to water

9. When a detergent is added to a mixture of grease and water which part of the molecule is attracted to the grease?

A. The sodium ion

B. The carbonyl group

C. The hydrocarbon tail

D. The oxygen atoms

10. After adding a detergent to grease, agitation produces tiny globules which

A. cannot join together because they are positively charged

B. turn into a gas and form bubbles

C. separate as a precipitate

D. are negatively charged and so repel each other