## **Stage 2 Chemistry**

## **Birdwood**

HIGH SCHOOL **Topic 5: Materials**

**Silicate Properties, Cleaning Agents: Soaps and Bleaches**

**Review Paper 19**

**DUE DATE:**

1 Detergents are able to remove oil and grease from materials because of their ability to act as a surfactant.

The structure of a typical synthetic detergent compound is shown below:

CH3(CHCH2) 3CH O SO3- Na

CH3 CH3

Detergents are able to dissolve grease and oil from clothes because their anions have two sections.

i Circle the section on the above detergent diagram that attracts water. (1 mark)

ii Describe the section of the detergent molecule that is non-polar. (1 mark)

iii Explain why this section of the molecule will be soluble in the oil and grease. (2 marks)

iv Explain why detergents do not function well in an acidic environment.

(2 marks)

2 Chlorine bleaches and disinfectants are produced commercially by bubbling chlorine into sodium hydroxide solution. The resulting solution contains a mixture of hypochlorite ions and chloride ions.

i Write formulae for the hypochlorite ion. (1 mark)

ii State the action of hypochlorite ions that enable them to act as a bleach (1 mark)

iii State the oxidation number of chlorine in the hypochlorite ion. (1 mark)

iv Write an equation for the reaction of hypochlorite ions with water. (2 marks)

v Small amounts of acid are added to hypochlorite bleaches but it is desirable to keep these

solutions above a pH of 7.

Explain why this is the case. (3 marks)

3 Fats and oils are commonly called tri-esters or triglycerides. The structural formula of one such

triglyceride is shown below:

CH2OOC(CH2) 7CH CH(CH2) 7CH3.

CH2OOC(CH2) 7CH CH(CH2) 7CH3.

CH2OOC(CH2) 7CH CH(CH2) 7CH3.

i Would the triglyceride shown above be a liquid or a solid at room temperature? (1 mark)

ii Fats and oils are the raw materials used to manufacture soap.

1. Write the structural formula of the soap anion formed when the triglyceride shown above undergoes alkaline hydrolysis with sodium hydroxide. (2 marks)
2. Systematically name the other product formed during this process. (2 marks)

iii When soap is added to water, soap micelles are formed. The micelles assist in the grease-removing action of soap.

Use a labeled diagram of a typical soap micelle to help explain the action of soap anions in removing grease from clothing. [*Describe the three phases*.] (3 marks)

iv Soap does not function well in hard water.

1. What is meant by the term ‘hard water’? (1 mark)
2. Describe and explain, with the aid of an equation, why soap

does not function well in hard water. (2 marks)

1. Sodium perborate is sometimes an ingredient added to detergents, particularly laundry detergents.

i Is sodium perborate likely to be a liquid or a solid? (1 mark)

ii Identify the oxidizing agent that is released when sodium perborate dissolves in water.

(1 marks)

iii How does the action of hot water affect the function of detergents containing sodium perborate? (2 marks)

5 Phosphates and polyphosphates are frequently listed as components of laundry detergents.

i Write the chemical formula for a phosphate ion. (1 mark)

ii Draw the structural formula of the linear tripolyphosphate ion. (2 marks)

iii State *two* functions of tripolyphosphate ions in detergents. (2 marks)

iv Polyphosphate ions in detergents however, do have unwanted environmental consequences.

State *one* undesirable consequence of a high concentration of phosphates in our waterways.

(1 mark)

6 The following diagram represents part of the structure of the silicate ion in the mineral jadeite,

O- O- O- O- O-

Si Si Si Si Si

O O O O O O

O- O- O- O- O-

i Write the formula of the repeating unit in this silicate.

ii Analysis of a sample of jadeite showed that the only cations were sodium and aluminium and they were present in equal numbers. Write the formula of jadeite.

(3 marks)

7 In some clay minerals, some of the silicon in the silicate anions is replaced by aluminium.

i What special chemical term is given to silicates of this kind?

ii Given that the oxidation state of silicon is +4 and that of aluminium is +3, explain why this substitution causes the clay particles to carry a negative charge.

iii Explain why clay particles suspended in water cannot be removed by allowing them to settle out.

iv Plant nutrients like potassium ions and calcium ions are commonly adsorbed to the surface of clay particles.

Describe how these nutrients can become available to the plant.

(7 marks)