

Term 2 Assessment Task 3 2006 Theory
Section A: Multiple Choice (1 mark each)

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

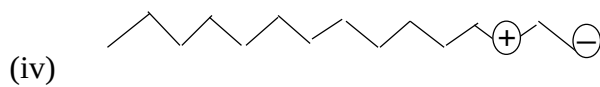
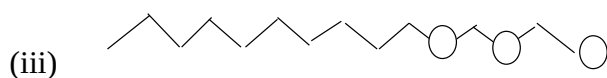
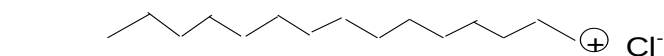
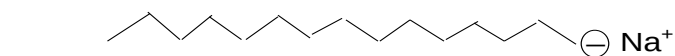
If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐
correct
↑

Indicate your answer on the answer grid on page 3

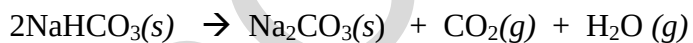
- Fatty acids containing which range of number of carbon atoms are commonly used for soap-making?
(A) from $C_6 - C_{10}$
(B) from $C_{10} - C_{20}$
(C) from $C_{20} - C_{30}$
(D) from $C_{30} - C_{40}$
- The production of sulfuric acid requires the oxidation of sulfur. What is the change in oxidation number of sulfur in sulfur dioxide compared to that in sulfuric acid?
(A) 2 to 4
(B) 4 to 6
(C) 2 to 6
(D) 4 to 8

3. Identify the diagrammatic representation of the shapes and electrical charges of corresponding surfactant molecules



	<i>Anionic</i>	<i>Cationic</i>	<i>Non-ionic</i>
(A)	(i)	(ii)	(iii)
(B)	(ii)	(i)	(iii)
(C)	(iv)	(ii)	(iii)
(D)	(v)	(i)	(iii)

4. 1.0 kg. of sodium hydrogen carbonate was heated and a complete reaction occurred



What volume of carbon dioxide gas would be produced at 100 kPa and 25°C?

- (A) 11.9 L
(B) 147.5 L
 (C) 295 L
 (D) 590.2 L

Section A

Student Number.....

Multiple Choice Answer Grid

1.	A O	B ●	C O	D O
2.	A O	B ●	C O	D O
3.	A ●	B O	C O	D O
4.	A O	B ●	C O	D O

Section B: Short Answer Questions

Question 5 (6 marks)

MARKS

Sulfuric acid is often described as the world's most important industrial chemical because of the great variety and importance of the uses to which it is put.

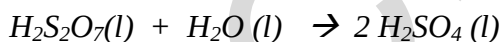
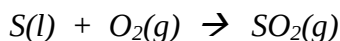
- (a) Identify one important substance which requires sulfuric acid for its production.

1

sulfate of ammonia

- (b) Using equations, only, outline the three main steps in the contact process.

3



- (c) Describe the result for a dehydration experiment using concentrated sulfuric acid and the safe work practices that were employed.

2

The experiment was conducted by the teacher under the fume cupboard. The teacher was wearing protective clothing, gloves and safety glasses.

(1 mark)

When concentrated H_2SO_4 was added to crystals of copper (II) sulfate. pentahydrate in a test tube, the blue crystals turned to a white, powdery solid

(1 mark)

Question 6 (4 marks)

MARKS

The Solvay process has been in use since the 1860's.

- (a) What is the Solvay process used to manufacture?

1

sodium carbonate

- (b) Identify one use for this substance?

1

manufacture of paper, glass and a water softener

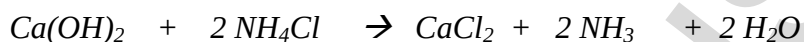
- (c) During this process ammonia is used and converted to ammonium chloride. Name the substance that is mixed with ammonium chloride in order to recover the ammonia?

1

calcium hydroxide or slaked lime

- (d) Write a balanced chemical equation to show the production of ammonia.

1

**Question 7** (6)

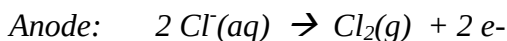
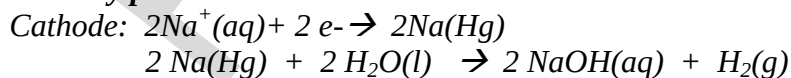
There are three electrolysis methods used to produce sodium hydroxide. Distinguish between the *diaphragm process* and the *mercury process* by identifying the anode and cathode materials, describing the chemical reactions involved and comparing the purity of the products in each process.

6

Criteria	Mark(s)
Chemical reactions for each process	5
Diaphragm	(2)
Mercury	(3)
Purity of product	1

Possible answer:

The diaphragm process uses a steel mesh for cathode and the mercury process uses a mercury cathode. Both the mercury process and the diaphragm process make use of either a graphite or titanium coated with titanium ruthenium oxide as anode. (no credit for this answer)

Reactions at each electrodes:**Mercury process:**

Diaphragm process:

Cathode: $2 \text{H}_2\text{O}(\text{l}) + 2 \text{e}^- \rightarrow \text{H}_2(\text{g}) + 2 \text{OH}^-(\text{aq})$

Anode: $2 \text{Cl}^-(\text{aq}) \rightarrow \text{Cl}_2(\text{g}) + 2 \text{e}^-$

With the diaphragm process, the non-selective nature of the asbestos diaphragm results in a sodium hydroxide product which is highly contaminated with sodium chloride. Relatively purer sodium hydroxide solution is produced in the mercury process because the sodium hydroxide is generated in a separate compartment by reaction of the $\text{Na}(\text{Hg})$ with water.

Question 8 (4 marks)

Imagine you are an organic chemist and you are to design a new laundry detergent for washing oily and soiled clothes. Describe the structure of the detergent molecule you will synthesise and explain how it works.

Criteria	Marks
description of molecule	2
description of how it works	2

Possible answer:

Description of the structure of the molecule:

The surfactant molecule should consist of a straight hydrocarbon chain terminating with a negatively charged end which could be a sulphonic acid group. (an anionic surfactant). This is electrostatically bonded to a potassium or a sodium ion. This part of the molecule is polar while the rest of the molecule is non-polar.

How the surfactant works:

Such a molecule having a polar end and a non-polar end will be capable of interacting with both water and the oily residues on the clothing. The polar end can interact with water through dipole-dipole interaction while the non-polar part can interact with the oil by dispersion forces. The surfactant then is a "bridge" between oil and water and hence enabling the oil to be washed off the clothing by the water.

Other suitable answers will also be considered.

END of TEST