THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

H

Wednesday 30 May 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE ADDITIONAL APPLIED SCIENCE A

A335/02 Unit 4: Harnessing Chemicals (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 45 minutes

A314390612

A335021

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **36**.
- This document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Florika wants to make some common salt by titration.

This is her report of the experiment.

- I measured 25.0 cm^3 of sodium hydroxide solution into a conical flask.
- I added a few drops of an indicator to the flask.
- I took a long glass tube with a tap on the bottom and filled it with hydrochloric acid.
- I added acid to the flask until the solution was no longer alkaline.
- I washed out the flask with water and repeated the experiment with the same quantities of acid and alkali, but without using the indicator.

(a) (i) Name the piece of apparatus that Florika should use to measure 25.0 cm^3 of sodium hydroxide accurately.

..... **[1]**

(ii) Give the correct name for the "long glass tube with a tap on the bottom".

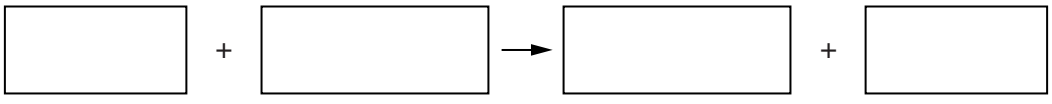
..... **[1]**

(iii) Suggest a suitable indicator that Florika could use and describe the colour change for this indicator when the alkali has been neutralised.

indicator .....

colour changes from ..... to ..... **[2]**

(b) (i) Write the **word equation** for the reaction between sodium hydroxide and hydrochloric acid.



[2]

(ii) Florika needs to make sure that the acid and alkali mix together continuously.
Describe the **extra** apparatus that she could use to keep the solutions well mixed throughout the experiment.

.....

..... **[2]**

(iii) Explain how Florika could keep the solutions mixed without needing the extra apparatus.

.....

..... **[1]**

(c) This reaction produces a solution of salt.
Describe how crystals of pure salt can be obtained from this solution.

.....

.....

.....

.....

.....

..... **[3]**

(d) Many salts can be made by mixing an acid with an alkali.
The table shows that potassium sulfate (K_2SO_4) can be made from sulfuric acid (H_2SO_4) and potassium carbonate (K_2CO_3).

Complete the table below by filling in the correct **formulas** for the three missing salts.

		alkali	
		NaOH	**K_2CO_3**
acid	**HNO_3**		
	H_2SO_4		K_2SO_4

[2]

(e) This table shows some general rules about solubility of some chemicals.

	soluble	**insoluble**
nitrates	all	none
chlorides	most	only silver & lead chlorides
sulfates	most	only barium & lead sulfates
carbonates	only sodium & potassium carbonates	most
oxides	only sodium, potassium & calcium oxides	most
hydroxides	only sodium, potassium & calcium hydroxide	most

(i) Only **insoluble** salts can be made by precipitation.
Which **one** of these salts could be made by precipitation?

Put a tick (✓) in the box next to the correct answer.

sodium chloride ☐

potassium carbonate ☐

silver chloride ☐

zinc nitrate ☐

magnesium sulfate ☐ **[1]**

(ii) Some **soluble** salts can be made using an **insoluble** metal oxide or carbonate.
Which **two** of these salts could be made by this method?

Put ticks (✓) in the boxes next to the correct answers.

sodium chloride ☐

potassium carbonate ☐

silver chloride ☐

zinc nitrate ☐

magnesium sulfate ☐ **[2]**

[Total: 17]

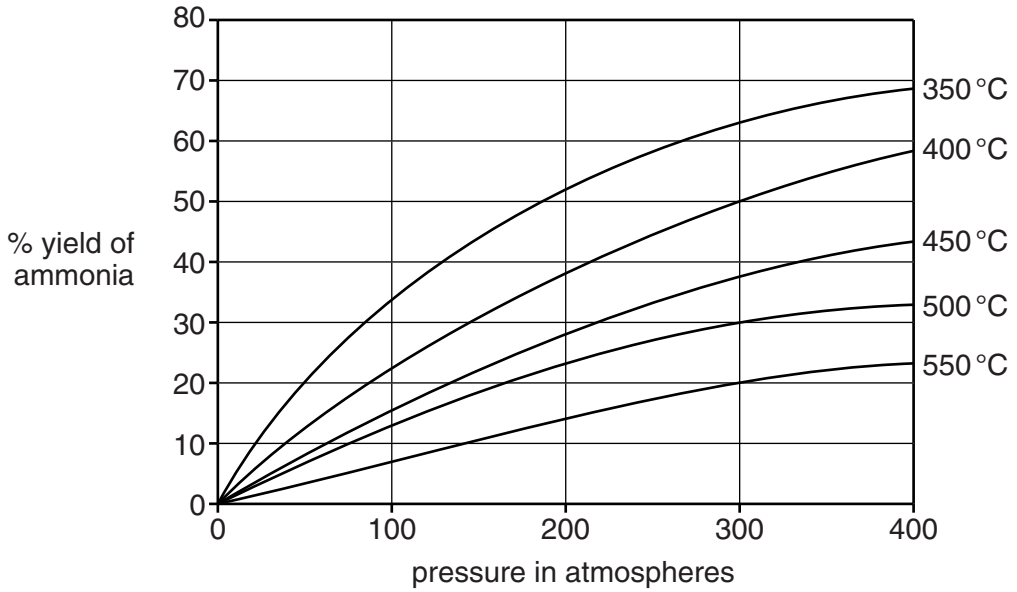
BLANK PAGE

Question 2 begins on page 6

PLEASE DO NOT WRITE ON THIS PAGE

2 The Haber process has been used for about 100 years to make ammonia from nitrogen and hydrogen.

The graph below shows the percentage of nitrogen converted to ammonia (yield) at different conditions of temperature and pressure.



(a) (i) Describe how the yield changes with pressure.

.....

.....

..... **[1]**

(ii) Give an advantage and a disadvantage of using a high temperature.

advantage .....

.....

disadvantage .....

..... **[2]**

(b) (i) Using the data below, calculate the mass of ammonia which could be produced from 84 tonnes of nitrogen if the process had a 100% yield.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

relative formula masses		
N_2	H_2	NH_3
28	2	17

Show your working.

answer ..... tonnes **[2]**

(ii) Use the graph to work out how much ammonia would be made from 84 tonnes of nitrogen if the process was carried out at 400 °C and 300 atmospheres.
Show your working.

answer ..... tonnes **[2]**

(c) When Fritz Haber first did experiments on this reaction, he used a very small pressure tube to make a tiny batch of ammonia.
Describe a problem of scaling this process up to make many tonnes of ammonia.

.....

.....

..... **[1]**

(d) Some bacteria contain an enzyme called **nitrogenase**. This catalyst helps the bacteria make nitrogen from the air into ammonia at room temperature and pressure.

This process has less impact on the environment than the Haber Process.
Explain why this is so.

.....

.....

.....

..... **[2]**

[Total: 10]

3 Modern fuels are usually organic substances.

They can be obtained from either **living** or **non-living** sources.
They cannot be obtained from **never-lived** sources.

For instance, palm oil can be extracted from coconut trees, which are a living source.

(a) (i) Give **another** example of a useful product obtained directly from a **living** source.

living source .....

useful product ..... **[1]**

(ii) Crude oil is obtained from a non-living source.
Explain what a **non-living source** means.

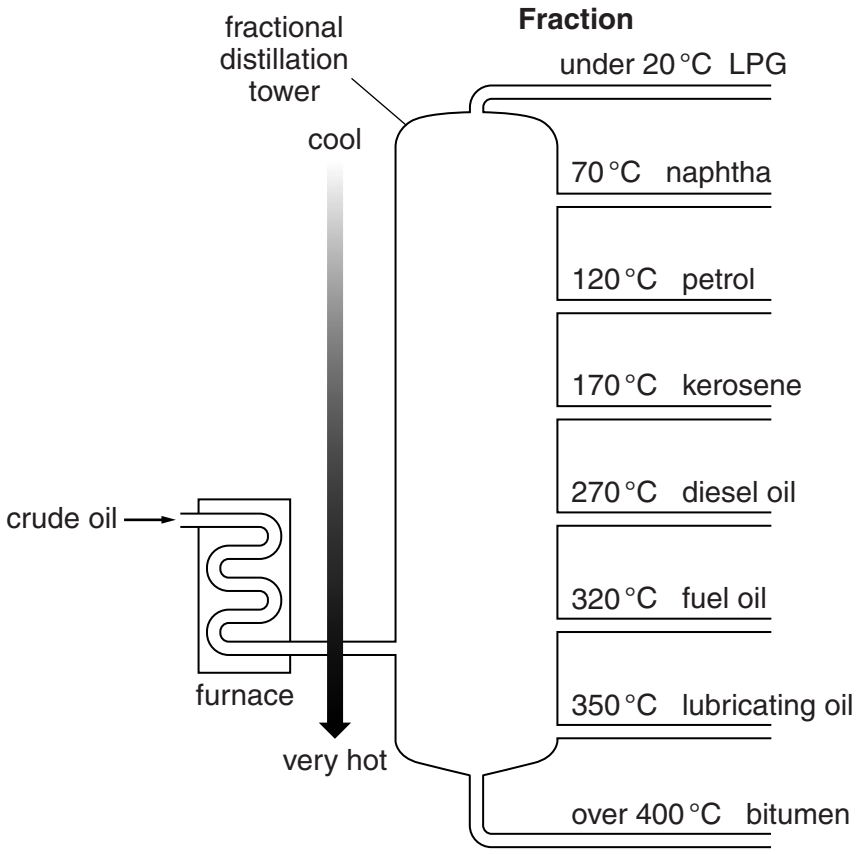
.....

..... **[2]**

(iii) Crude oil is a complex mixture of hydrocarbons.
Which two elements are present in all hydrocarbon molecules?

..... and ..... **[1]**

(b) Crude oil goes through a process called **fractional distillation** to separate the different hydrocarbons in the mixture.



(i) In which fraction would you expect to find propane (C_3H_8) which boils at –42 °C?

..... **[1]**

(ii) This is a continuous process.
Explain why a batch process would be less cost effective.

.....

.....

..... **[2]**

(c) If crude oil leaks into the ocean, great damage to wildlife is caused.
The oil floats on the surface of the ocean as an 'oil slick'.
An emulsifier, such as detergent solution, is sprayed onto the oil.
Explain what happens to the oil slick when this is done.

.....

.....

..... **[2]**

[Total: 9]

END OF QUESTION PAPER

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

PLEASE DO NOT WRITE ON THIS PAGE