Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/02

CHEMISTRY

CHEMISTRY 3
HIGHER TIER

A.M. THURSDAY, 15 May 2014

1 hour

Suitable for Modified Language Candidates

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**10**	
2.	**8**	
3.	**6**	
4.	**6**	
5.	**8**	
6.	**10**	
7.	**6**	
8.	**6**	
Total	**60**	

4493 020001

ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

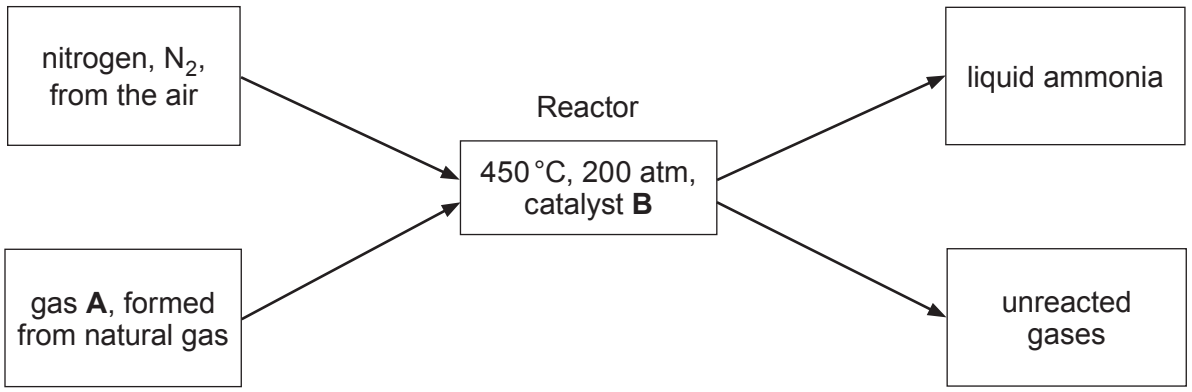
Assessment will take into account the quality of written communication (QWC) used in your answers to questions **3** and **8**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

Examiner only

Answer **all** *questions.*

1. Ammonia is produced during the Haber process. The reaction is summarised in the diagram below.



(a) Give the name of gas **A**. ..... [1]

(b) Name catalyst **B** and state why it is used. [2]

.....

.....

(c) The yield of ammonia is only 28 % therefore 72 % of the gases remain unreacted.

Describe what happens to these unreacted gases and state why this is important. [2]

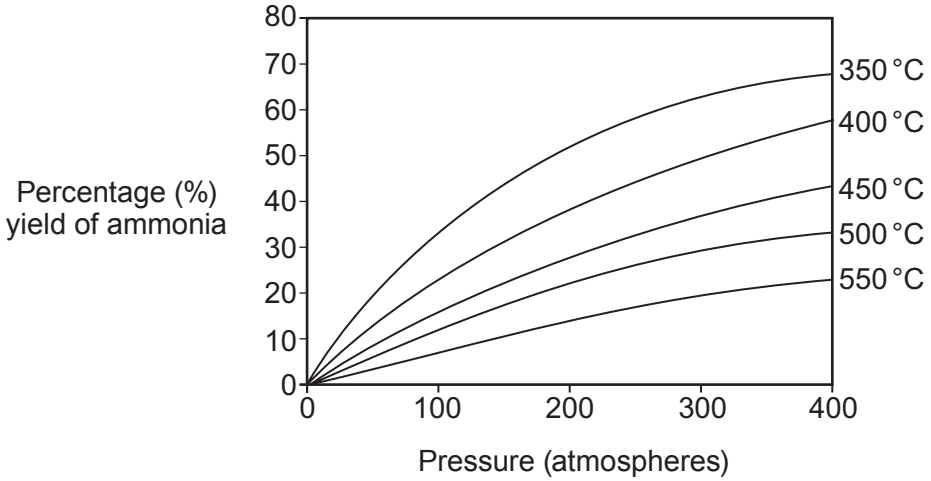
.....

.....

.....

Examiner only

(d) The following graph shows the effect of temperature and pressure on the yield of ammonia during the Haber process.



Describe how the yield of ammonia varies with temperature and pressure. [2]

Temperature

.....

.....

Pressure

.....

.....

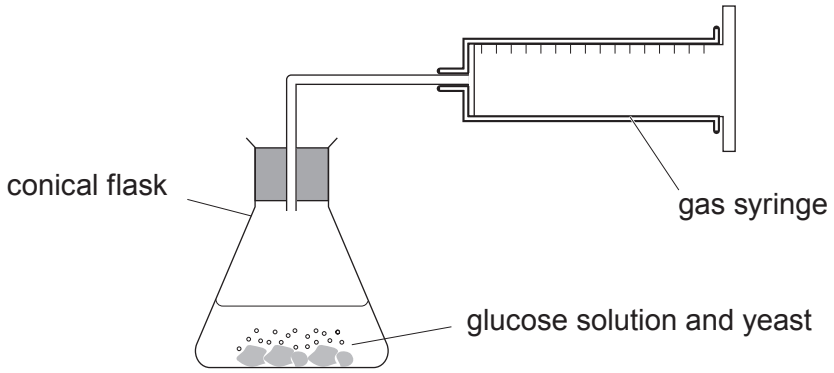
(e) Write a balanced **symbol** equation for the production of ammonia. [3]

..... + ... ⇌ .....

10

Examiner only

2. A pupil investigated the effect of temperature on the rate of fermentation using the apparatus shown below.



The experiment was carried out three times at five different temperatures. The volume of gas collected after 10 minutes was recorded each time. The results are shown below.

Temperature (°C)	Volume of gas collected after 10 minutes (cm^3)			
	1	2	3	Mean
20	9	8	7	8
30	38	40	(32)	39
40	52	53	54	53
50	35	32	33	33
60	12	11	12	12

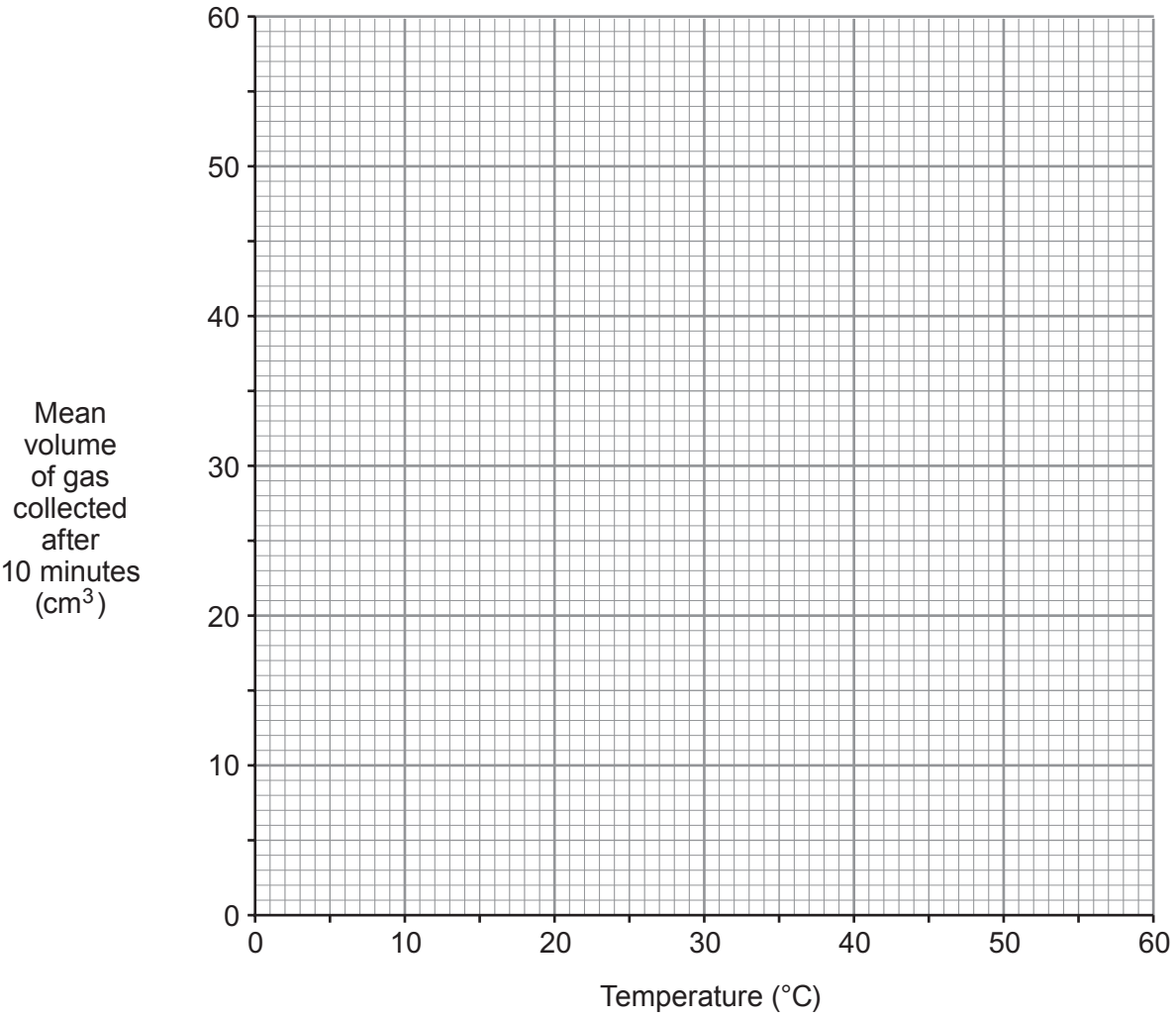
(a) Suggest why the circled value is considered to be anomalous. [1]

.....

.....

(b) Plot a graph of the **mean** volume of gas collected against temperature on the grid opposite. [2]

Examiner only



(c) State what conclusions can be drawn from the graph. [2]

.....

.....

.....

.....

(d) Write a **word** equation for the reaction taking place. [2]

..... ⟶ ..... + ...

(e) Yeast produces a catalyst that allows this reaction to take place. Name the **type** of catalyst produced by yeast. [1]

.....

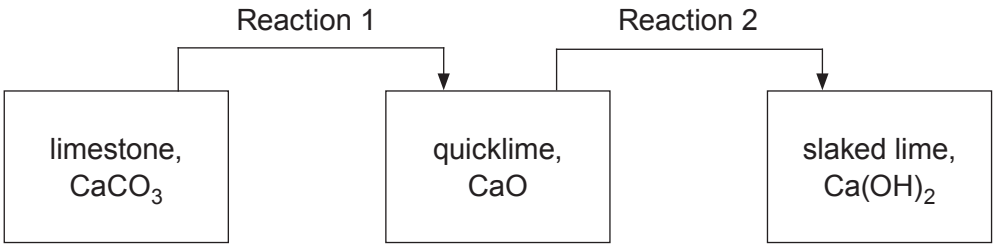
4493 020005

8

Turn over.

Examiner only

3. Limestone, $CaCO_3$, is an important raw material. It can be converted into other useful materials as shown in the diagram below.



Describe how these reactions can be carried out in a laboratory.
Your answer should include:

- the conditions required for each reaction;
- observations at each stage;
- equations for the reactions taking place. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

Examiner only

4. Sulfuric acid is produced in industry by the contact process.

(a) The contact process involves four stages. The first two are shown below.

Stage 1 sulfur + oxygen $\longrightarrow$ sulfur dioxide

Stage 2 sulfur dioxide + oxygen $\rightleftharpoons$ sulfur trioxide

(i) Name the **raw material** that provides oxygen in stage 1. [1]

.....

(ii) Describe the last two stages in the contact process (stages 3 and 4). [2]

Stage 3 .....

.....

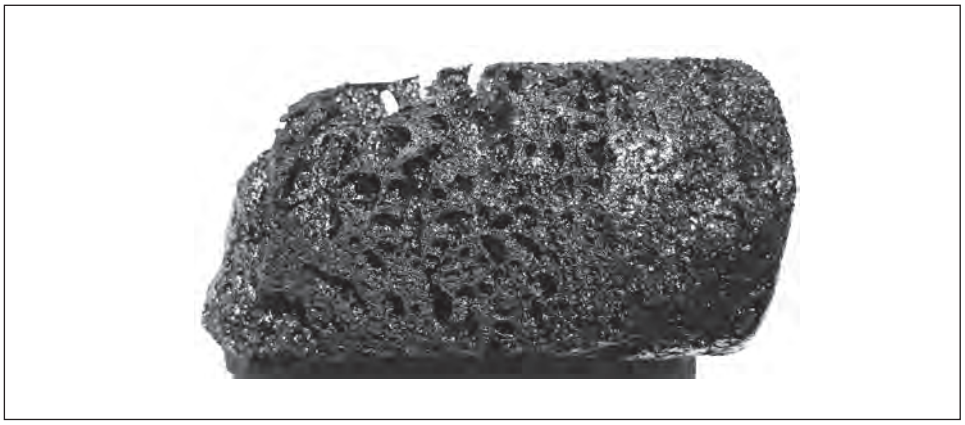
Stage 4 .....

.....

(iii) Name the catalyst used in stage 2. [1]

.....

(b) When concentrated sulfuric acid is added to sugar a black solid is formed.



Describe what happens during this reaction. Think about the elements present in sugar and what happens to them. [2]

.....

.....

.....

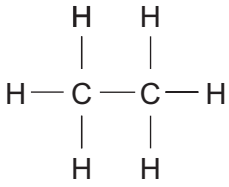
4493 020007

6

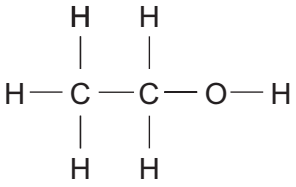
Turn over.

Examiner only

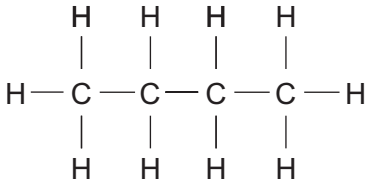
5. The following diagram shows the structures of six organic compounds.



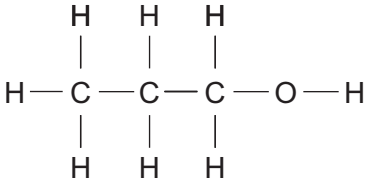
A



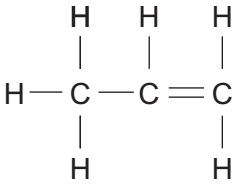
B



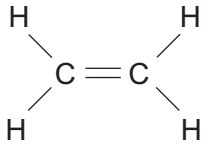
C



D



E



F

(a) Name the family to which each of the following pairs of compounds belong. [2]

B *and* **D** .....

E *and* **F** .....

(b) Describe a chemical test that could be carried out to distinguish between compounds **C** and **E**. Give the expected result for **both** compounds. [2]

.....

.....

.....

.....

Examiner only

(c) Compound **C** is one of two isomers that have the molecular formula C_4H_{10}.

(i) Give the meaning of the term *isomer*. [1]

.....

.....

(ii) Draw in the space below the structure of the other isomer of C_4H_{10}. [1]

(d) Give the letter, **A**-**F**, of **one** *other* compound that has an isomer. Draw the structure of its isomer. [2]

Compound .....

Structure

Examiner only

6. *(a)* The following box contains the names of six ionic compounds.

sodium chloride	**sodium carbonate**	**copper(II) sulfate**
ammonium chloride	**potassium sulfate**	**lithium carbonate**

Which of the compounds in the box would you expect to

(i) give a yellow flame in a flame test, [1]

.....

(ii) produce bubbles when reacting with hydrochloric acid? [1]

.....

(b) A student has two colourless solutions in unlabelled bottles. He knows that one is potassium chloride and that the other is potassium iodide. Describe a test that could be carried out to show which is potassium chloride and which is potassium iodide. Give the observations expected in **both** cases. [3]

.....

.....

.....

(c) Compounds containing ammonium ions can be identified by heating gently with sodium hydroxide solution and testing the gas produced.

Name the gas produced. Describe how you would positively identify this gas. [2]

.....

.....

(d) Iron(III) chloride solution produces a brown precipitate when it reacts with sodium hydroxide solution.

Write a balanced **ionic** equation for this reaction. You should include state symbols. [3]

..... + ... ⟶ .....

10

BLANK PAGE

Examiner only

7. A laboratory technician prepared a solution of sodium hydroxide, NaOH, in the following way.

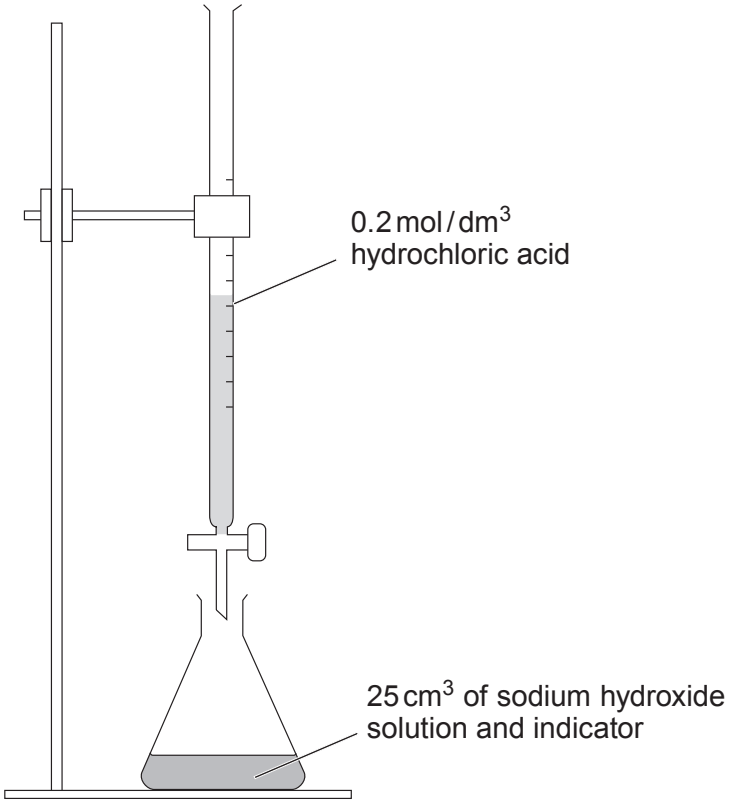
- He weighed out accurately 2.0 g of sodium hydroxide.
- He dissolved the sodium hydroxide in 250 cm^3 of water.

The relative formula mass (M_r) of sodium hydroxide is 40.

(a) Use this information to calculate the concentration of this sodium hydroxide solution in mol/dm^3. [2]

Concentration of sodium hydroxide solution = ... mol/dm^3

(b) A student was asked to carry out a titration to check the concentration of the sodium hydroxide solution. She carried out the titration using the apparatus shown below.



Examiner only

The equation for the reaction taking place is as follows.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

The titration was carried out three times and the results obtained are shown below.

	Titration		
	1	2	3
Volume of hydrochloric acid added (cm^3)	22.2	22.7	22.6

Calculate the number of moles of hydrochloric acid that reacted. Use that to calculate the concentration of the sodium hydroxide solution. [4]

Concentration of sodium hydroxide solution = ... mol / dm^3

6

Turn over.

Examiner only

8. Describe the similarities in the reactions of ethanoic acid and sulfuric acid with metals, carbonates and bases. Describe and explain any differences observed. You should include relevant equations in your answer. [6 QWC]

6

END OF PAPER

FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulfur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key: