Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

General Certificate of Secondary Education
Foundation Tier

Chemistry

Unit Chemistry C3

Chemistry 3F

F

For this paper you must have:
- the Data Sheet (as an insert).

You may use a calculator.

Time allowed
- 60 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 9(b) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

1 In 1869, a scientist put the 60 known elements into his periodic table.

Draw a ring around the correct answer to complete each sentence.

1 (a) The scientist who put these elements into a periodic table was

Boyle.

Mendeleev.

Newlands.

(1 mark)

1 (b) First he put the 60 known elements in order of their

atomic weight.

boiling point.

electrical conductivity.

(1 mark)

1 (c) Then he put elements with similar chemical properties in columns, known as

groups.

periods.

rows.

(1 mark)

1 (d) His periodic table had gaps for elements that were

- uncommon.
- undiscovered.
- unreactive.

(1 mark)

1 (e) From 1900 onwards, the modern periodic table was produced.

The modern periodic table is an arrangement of elements

in terms of their

- electronic structures.
- neutron numbers.
- atomic weights.

(1 mark)

5

Turn over for the next question

2 Sodium is in Group 1 of the periodic table.

2 (a) Here are some statements about sodium.

Which **two** of these statements are correct?

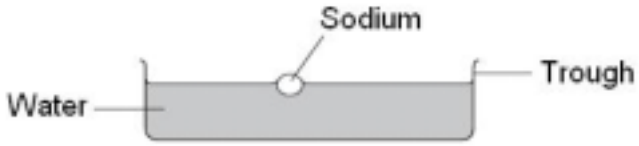
Tick (✓) **two** boxes.

Statement	Tick (✓)
Sodium is a metal.	
Sodium is a halogen.	
Sodium forms an ion with a +1 charge.	
Sodium forms covalent compounds.	

(2 marks)

2 (b) Sodium reacts with water.

A student drew this diagram and wrote the observations **A**, **B**, **C** and **D** about the reaction between sodium and water.



A The sodium floated and started giving off a gas.

B The sodium melted.

C The piece of sodium became smaller until all the sodium had gone.

D A colourless solution was left.

Use these observations to answer parts (i) and (ii).

2 (b) (i) Which observation, **A**, **B**, **C** or **D**, shows that sodium has a low density?

(1 mark)

2 (b) (ii) Which observation, **A**, **B**, **C** or **D**, shows that the reaction is exothermic?

☐

(1 mark)

2 (b) (iii) What is the name of the gas given off in this reaction?

.....

(1 mark)

5

Turn over for the next question

3 Water is a natural resource.

3 (a) Water in some parts of the UK is hard, but in other parts of the UK it is soft.

Draw a ring around the correct answer to complete each sentence.

3 (a) (i) Water becomes hard because ions in rocks

condense
dissolve
evaporate

into the water.

(1 mark)

3 (a) (ii) Hardness in water is caused by

calcium
hydrogen
sodium

ions.

(1 mark)

3 (b) There are two types of hard water, permanent hard water and temporary hard water.

Draw a straight line from each statement to the correct type of water.

Statement	**Type of water**
	Permanent hard water
Easily makes a lather with soap	
	Temporary hard water
Can be made soft by boiling	
	Soft water

(2 marks)

3 (c) Water of the correct quality is essential for life.

In many parts of the world the water used for drinking contains solid particles and harmful bacteria.

Suggest **two** methods that could be used to improve the quality of this water.

1 .....

2 .....

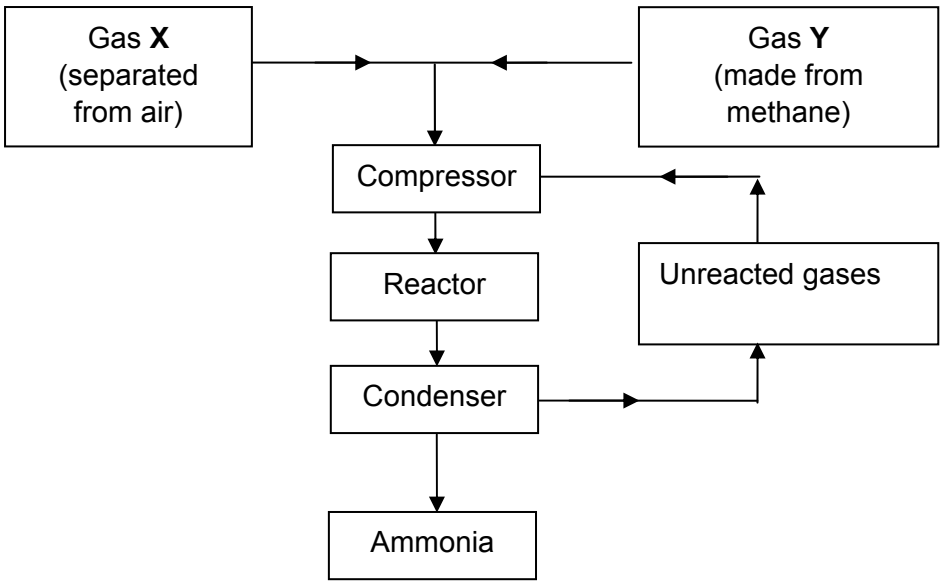
(2 marks)

6

Turn over for the next question

4 Ammonia is used in the production of fertilisers. The flow diagram shows the main stages in the manufacture of ammonia.

Study the flow diagram and then answer the questions.



4 (a) (i) Name gas **X** and name gas **Y**.

Gas **X** is……..Gas **Y** is…….….

(2 marks)

4 (a) (ii) Draw a ring around the correct answer to complete the sentence.

In the condenser the mixture is [cooled / heated / oxidised] to separate ammonia as a liquid.

(1 mark)

4 (b) The ammonia is separated as a liquid from the unreacted gases.

Suggest **two** reasons why the unreacted gases are recycled.

.....

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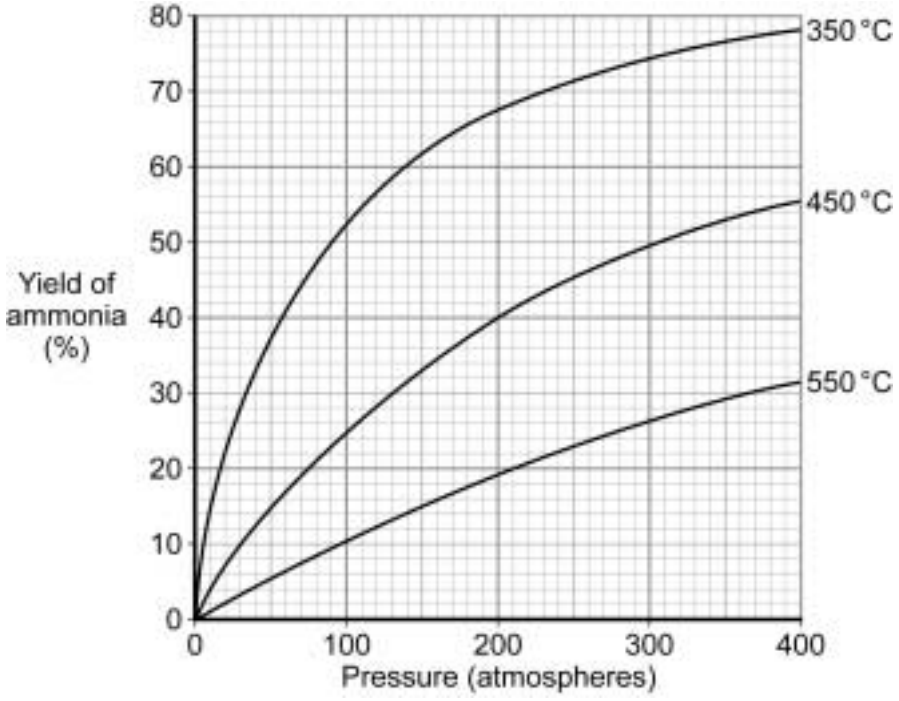
(2 marks)

4 (c) The graph shows the percentage of ammonia made at different temperatures and pressures.

Study the graph and then answer the questions.



4 (c) (i) Draw a ring around the correct answers to complete the sentence.

To make the greatest percentage yield of ammonia

the temperature should be | low | medium | high | and the pressure should be | low. | medium. | high. |

(2 marks)

4 (c) (ii) What is the percentage yield of ammonia at a temperature of 450°C and at a pressure of 200 atmospheres?

..... %

(1 mark)

Question 4 continues on the next page

4 (c) (iii) Ammonia is often made at a temperature of 450°C and at a pressure of 200 atmospheres.

Suggest **two** reasons why it is economical to make ammonia using these conditions.

.....

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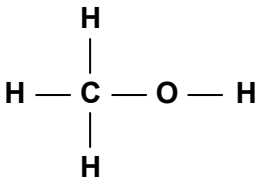
.....

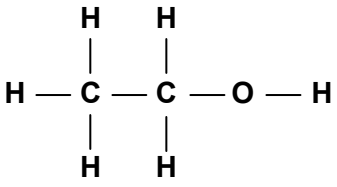
(2 marks)

10

5 The structures shown are of the first two members of a homologous series of organic compounds.



Methanol



Ethanol

5 (a) (i) Complete the diagram for propanol, the next member of the homologous series.

Propanol

(1 mark)

5 (a) (ii) Which **one** of the statements about ethanol is correct?

Tick (✓) **one** box.

Statement	Tick (✓)
Ethanol dissolves in water to form a neutral solution.	
Ethanol reacts with sodium to produce chlorine.	
Ethanol does **not** burn in air.	

(1 mark)

5 (b) Ethanoic acid (CH_3COOH) can be produced from ethanol (CH_3CH_2OH).

5 (b) (i) What type of reaction happens when ethanoic acid is produced from ethanol?

.....

(1 mark)

5 (b) (ii) State **one** use of ethanoic acid.

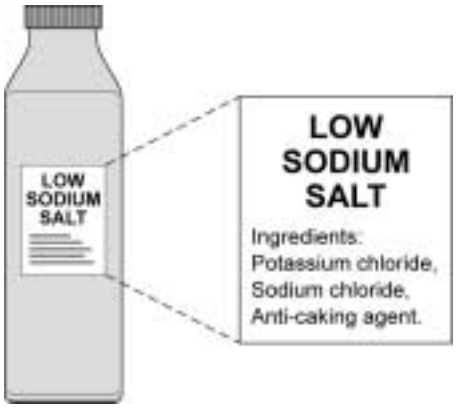
.....

(1 mark)

4

Turn over ▶

6 The use of too much common salt (sodium chloride) in our diet increases the risk of heart problems. One way to reduce sodium chloride in our diet is to use Low Sodium Salt instead of common salt.



A student tested Low Sodium Salt to find out if it contained all of the compounds on the list of ingredients.

6 (a) The student added dilute hydrochloric acid to Low Sodium Salt to show that it contains carbonate ions. Carbon dioxide gas was given off.

6 (a) (i) What would the student **see** that shows a gas is given off?

.....

.....

(1 mark)

6 (a) (ii) The student tested the gas given off to show that the gas was carbon dioxide.

Complete the sentence.

When carbon dioxide gas is mixed with limewater

the solution turns ..... .

(1 mark)

6 (b) The student tested for magnesium ions. The student added sodium hydroxide solution to a solution of Low Sodium Salt.

What is the colour of the precipitate that the student would see?

.....

(1 mark)

6 (c) The student did a flame test using Low Sodium Salt.

6 (c) (i) The flame colour the student saw was yellow. Which compound in Low Sodium Salt produces this flame colour?

.....

(1 mark)

6 (c) (ii) The student did **not** observe the colour in the flame which would show that there were potassium ions in the Low Sodium Salt.

Suggest why.

(You will need to state the flame colour of the potassium ions in your answer.)

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

7 The table shows information about the halogens in Group 7 of the periodic table.

Name of halogen	Melting point in °C	Boiling point in °C	Electronic structure
Fluorine	–220	–188	.....
Chlorine	–101	–35	2,8,7
Bromine	–7	+58	2,8,18,7
Iodine	+114	+183	2,8,18,18,7

7 (a) Use information from the table to help you to answer these questions.

7 (a) (i) Name **one** halogen that is a solid at 25 °C.

.....

(1 mark)

7 (a) (ii) Name **one** halogen that is a gas at 25 °C.

.....

(1 mark)

7 (a) (iii) Use the periodic table on the Data Sheet to help you to work out the correct electronic structure for fluorine. Write your answer in the table above.

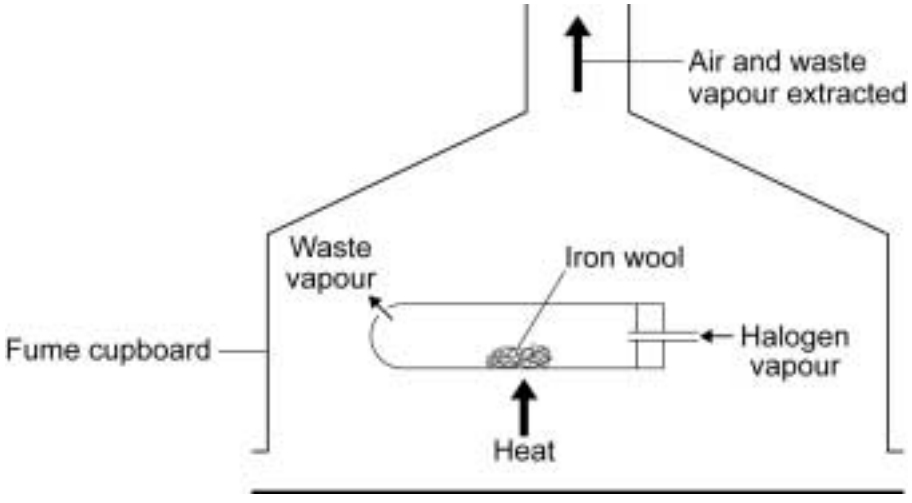
(1 mark)

7 (a) (iv) Use the periodic table on the Data Sheet to name **one** Group 7 element that is **not** shown in the table above.

.....

(1 mark)

7 (b) A teacher demonstrated the reactivity of the halogens to some students.
Halogen vapour was passed over heated iron wool in a fume cupboard.



The teacher's observations are shown in the table below.

	Observations	
	During the reaction	**After the reaction**
Bromine	The iron wool glowed	A red–brown solid had been produced
Chlorine	The iron wool glowed brightly	A dark brown solid had been produced
Iodine	The iron wool did not glow	A black solid had been produced

7 (b) (i) What is the order of reactivity of these three halogens?

Order of reactivity: *most reactive halogen 1* .....

2 .....

least reactive halogen 3 .....

(1 mark)

7 (b) (ii) Explain how you used the teacher's observations to decide your order of reactivity.

.....

.....

.....

.....

(2 marks)

7

Turn over for the next question

There are no questions printed on this page

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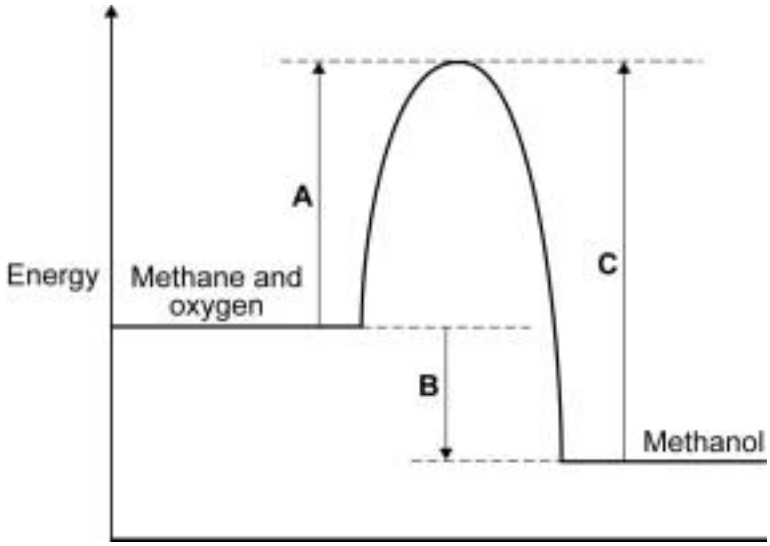
ANSWER IN THE SPACES PROVIDED

8 Methanol can be made when methane reacts with oxygen.

8 (a) The energy level diagram for this reaction is shown below.



8 (a) (i) What is the energy change represented by **A**?

.....

(1 mark)

8 (a) (ii) Use the energy level diagram to explain how it shows that this reaction is exothermic.

.....

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.....

.....

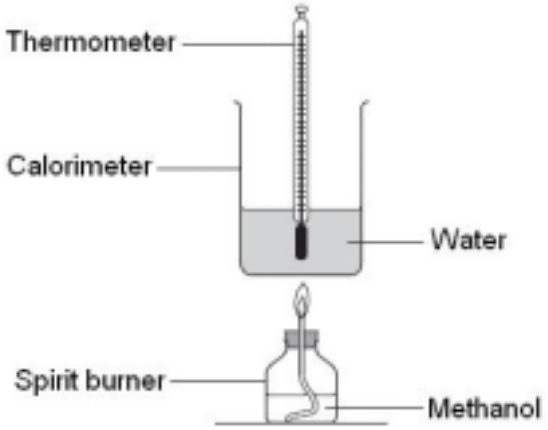
(2 marks)

Question 8 continues on the next page

8 (b) A student did an experiment to find the energy released when methanol burns in air.

The student:

- weighed a spirit burner containing methanol
- set up the equipment as shown in the diagram
- recorded the initial temperature



- lit the spirit burner
- put out the flame when the temperature of the water had risen by about 20 °C
- stirred the water and recorded the highest temperature of the water
- reweighed the spirit burner containing the methanol.

The student repeated the experiment and recorded his results.

	Experiment 1	**Experiment 2**	**Experiment 3**
Initial mass of spirit burner and methanol in g	299.3	298.3	296.9
Final mass of spirit burner and methanol in g	298.3	297.1	295.9
Initial temperature in °C	23	22	23
Highest temperature in °C	45	50	43
Temperature change in °C	22	28	20

Use the diagram and the information in the table to answer the questions.

8 (b) (i) The main error in this experiment is energy loss.

Suggest **one** way that the equipment could be changed to reduce energy loss.

.....

(1 mark)

8 (b) (ii) The temperature change in Experiment 2 is greater than the temperature change in Experiment 1 **and** Experiment 3.

Explain why.

.....

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.....

(2 marks)

8 (b) (iii) Suggest **one** reason why the student repeated the experiment.

.....

.....

(1 mark)

8 (b) (iv) Use the temperature change in Experiments 1 **and** 3 to calculate how much energy is released when 1g of methanol burns. The equation that you need to use is:

Energy released in joules = 100 x 4.2 x mean temperature change

Show clearly how you work out your answer.

.....

.....

.....

Burning 1g of methanol releases ..... J

(2 marks)

9

Turn over for the next question

9 *Drain Buster* is used to clear and degrease drains. Sodium hydroxide is the main chemical substance in *Drain Buster*.

9 (a) A student planned an experiment to find the concentration of the sodium hydroxide solution in *Drain Buster.*

The teacher had to dilute the *Drain Buster* before the student could use it.

Explain why.

.....

.....

.....

.....

(2 marks)

9 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The student wanted to find the volume of hydrochloric acid that reacts with a known volume of diluted *Drain Buster.*

Describe how the student could do this by titration.
In your description you should include:

- the names of pieces of apparatus used
- the names of the substances used
- a risk assessment.

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(6 marks)

8

END OF QUESTIONS

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