Candidate forename		Candidate surname	

Centre number					Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A171/01

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A

Modules C1 C2 C3 (Foundation Tier)

FRIDAY 15 JUNE 2012: Afternoon
DURATION: 1 hour
plus your additional time allowance

MODIFIED ENLARGED

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

<u>**OCR SUPPLIED MATERIALS:**</u>

None

<u>**OTHER MATERIALS REQUIRED:**</u>

Pencil
Ruler (cm/mm)

<u>**READ INSTRUCTIONS OVERLEAF**</u>

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

- Use black ink. HB pencil may be used for graphs and diagrams only.

- Answer <u>ALL</u> 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).

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✏).

- 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 <u>60</u>.

Answer ALL the questions.

1   This question is about the gases in the air.

(a) Finish the table below to show the percentage of each of the three main gases in the Earth's atmosphere today.

GAS	PERCENTAGE IN THE ATMOSPHERE
oxygen	_____%
_____	78%
argon	_____%

[2]

(b) Many scientists are worried about the rise in carbon dioxide in the air.

One cause of extra carbon dioxide is burning fuels.

Some people grow trees to burn as firewood.

Sue is talking about how growing and burning trees affects the levels of carbon dioxide in the air. She says,

SUE: "Growing and burning trees makes no difference to the total amount of carbon dioxide in the air."

Describe the processes that affect the amount of carbon dioxide in the air when wood burns and when trees grow.

Explain whether you think Sue is correct or not.

The quality of written communication will be assessed in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(c) Human activities can pollute the air.

Two of the pollutant gases are carbon monoxide and sulfur dioxide.

Describe the harmful effects caused by these two gases.
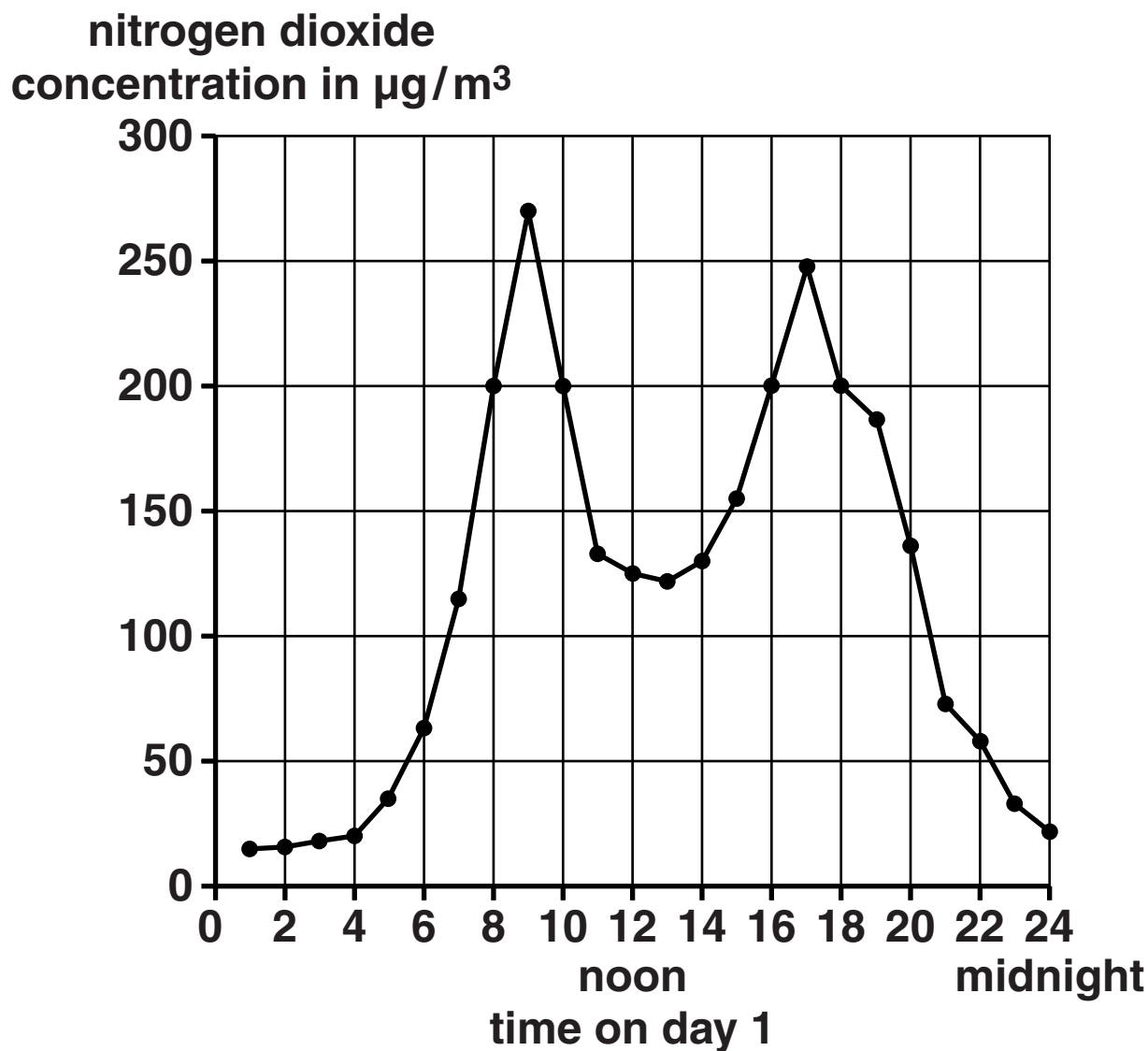
_____

_____

_____

_____

_____ [3]

[Total: 11]

2 **Scientists investigated the nitrogen dioxide concentration in the air next to a city road over a 24-hour period on DAY 1.**

Their results are shown in the graph.

nitrogen dioxide
concentration in µg/m³

time on day 1

(a) The World Health Organisation (WHO) has set guideline limits for nitrogen dioxide concentrations.

These are 200 µg/m^3 for a one-hour average exposure and 40 µg/m^3 for an annual average exposure.

Look at the graph of measurements recorded on DAY 1.

   (i) How many readings were above the one-hour average limit?

   answer _____ [1]

   (ii) How many readings were above the annual average limit?

   answer _____ [1]

(b) The scientists also counted the number of vehicles travelling along the road on DAY 1.

These results are shown in the tables opposite.

Use information from the tables to suggest an explanation for the shape of the graph.

_____

_____

_____

_____

_____ [3]

HOUR OF THE DAY	1	2	3	4	5	6	7	8	9	10	11	12 noon
NUMBER OF VEHICLES	2	3	5	9	31	54	242	461	584	472	287	277

HOUR OF THE DAY	13	14	15	16	17	18	19	20	21	22	23	24 midnight
NUMBER OF VEHICLES	275	285	363	458	566	449	372	163	64	36	22	12

9

(c) The scientists repeated this investigation on DAY 2.

They measured the nitrogen dioxide concentration in four samples at the start of each hour.

The table shows the measurements they took at 9 am.

SAMPLE NUMBER	1	2	3	4
NITROGEN DIOXIDE CONCENTRATION IN $\mu g/m^3$	286	284	285	281

(i) Use the measurements to work out the best estimate of the true value for the nitrogen dioxide concentration at this time on DAY 2.

Show your working.

best estimate = _____ $\mu g/m^3$ [2]

(ii) Look at the nitrogen dioxide concentration for 9 am on the graph for DAY 1.

Compare this with the value that you have calculated for DAY 2.

Suggest reasons for any difference between the two values.

_____

_____

_____ **[2]**

[Total: 9]

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3   A company plans to make a new rope for sailing boats.

The new rope must be strong and quite stretchy.

Scientists working for the company test ropes made from five polymers, A, B, C, D and E.

They want to know which is the best polymer to use.

They measure how much each rope stretches as a load is applied to it.

They do this until the rope breaks.

Each rope has the same thickness and the same length.

Their results are shown in the graph in part (b). Each line ends when the rope breaks.

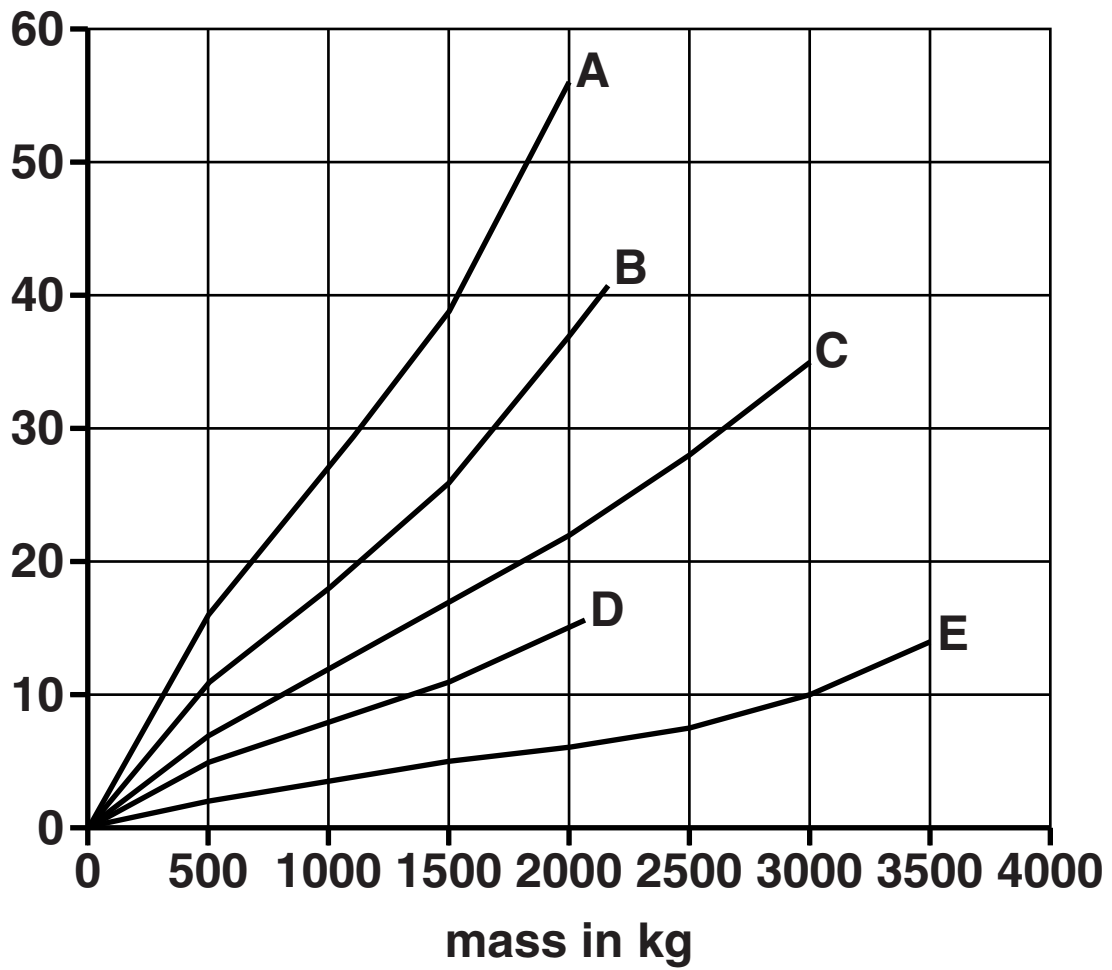(a) Each rope must have the same thickness and length to make it a fair test.

Explain why.

_____

_____

_____

_____ [2]

(b) Use the graph to decide which of the statements opposite are TRUE and which are FALSE.

stretch in cm

mass in kg

Put ticks (✓) in the correct boxes to show your choices.

	TRUE (✓)	FALSE (✓)
None of the polymers stretch.		
The polymer that supports the biggest mass breaks at 3000 kg.		
All of the polymers can support a mass of 1500 kg.		
The polymer that supports the biggest mass stretches the least for a mass of 1500 kg.		

[2]

(c) (i) All five lines on the graph show the same pattern.

Finish this sentence to describe the pattern.

As the mass _____ , the

polymer stretches _____ .   [1]

(ii) **The graph shows differences between the polymers.**

Give TWO differences.

1 _____

2 _____

[2]

(d) **The company chooses to make the new rope from polymer C.**

Suggest why they use this polymer rather than any of the others.

_____

_____

_____

_____

_____ [3]

[Total: 10]

4 Crude oil is a mixture of hydrocarbons.

(a) Which elements are found in a hydrocarbon?

Put (rings) around the names of the two correct elements.

CARBON

HYDROGEN

NITROGEN

OXYGEN

POTASSIUM

SULFUR

[2]

(b) The hydrocarbon molecules in crude oil are of many different sizes and boil at different temperatures.

In a refinery the hydrocarbons in crude oil are separated into fractions (see opposite).

Use the information opposite to describe the link between the size of the molecules in each fraction and the temperature at which the fraction boils.

Explain this pattern using ideas about forces, molecular size and the way in which molecules are arranged in liquids and gases.

The quality of written communication will be assessed in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

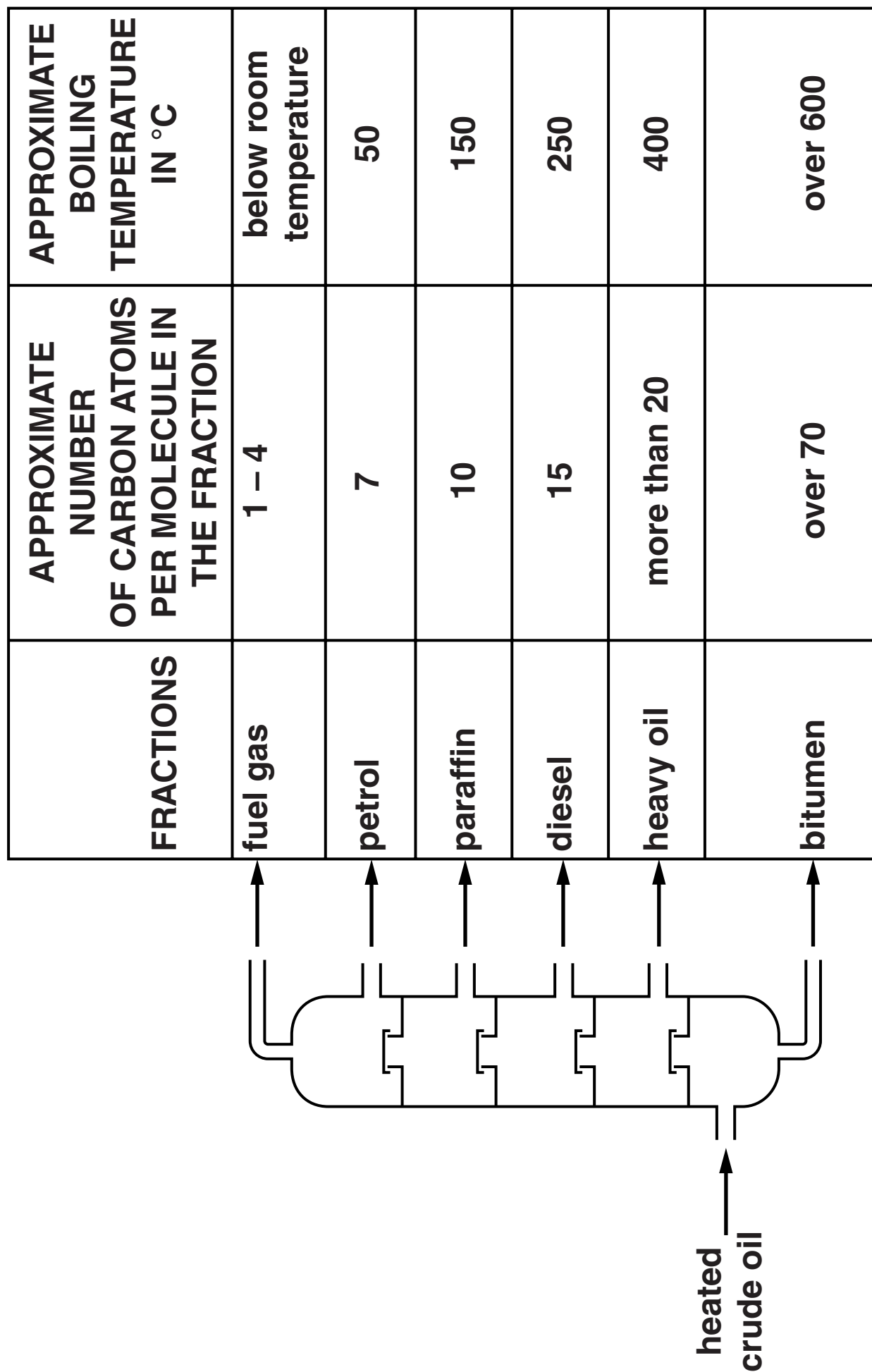| FRACTIONS	APPROXIMATE NUMBER OF CARBON ATOMS PER MOLECULE IN THE FRACTION	APPPROXIMATE BOILING TEMPERATURE IN °C
fuel gas	1 – 4	below room temperature
petrol	7	50
paraffin	10	150
diesel	15	250
heavy oil	more than 20	400
bitumen	over 70	over 600

heated crude oil

(c) The sentences describe how some of the hydrocarbon molecules from crude oil are used.

Put a (ring) around the correct word from each pair in brackets to complete the sentences.

Polymerisation reactions use

many   (SMALL   /   BIG)   molecules

called   (MONOMERS   /   POLYMERS).

They join together to make

(MONOMERS   /   POLYMERS)

which have very   (SHORT   /   LONG)

molecules.   [2]

[Total: 10]

5 The food industry adds salt when processing foods.

People also add salt to food during cooking and as they eat food.

(a) (i) Give TWO reasons why salt is added to food.

1 _____

2 _____ **[2]**

(ii) Give TWO ways in which eating too much salt can be bad for your health.

1 _____

2 _____ **[2]**

(b) The Department of Health recommends that you should not eat more than 6 g of salt in a day.

Packaged food has labels showing the salt content.

Many people eat much more than the Government's recommended amount of salt, despite the risk.

Suggest reasons why.

The quality of written communication will be assessed in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

[Total: 10]

6   During the 19th century the industrial manufacture of alkalis increased greatly.

(a) (i) What were alkalis made from before industrialisation?

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

☐   lemon juice

☐   stale urine

☐   river water

☐   burnt wood

☐   the air

[2]

(ii) What were the uses of alkalis before industrialisation?

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

☐   to kill bacteria in drinking water

☐   to neutralise acid soils

☐   to make bleach

☐   to use as fuels

☐   to make soap

[2]

(b) Traditional supplies of alkalis were not large enough to meet the needs of the new chemical industries.

To solve the shortage of alkali a new industrial process was invented.

This process made the alkali, sodium carbonate (see opposite).

   (i) The process used salt, sulfuric acid, coal and one other raw material, **A**.

   Name this other raw material.
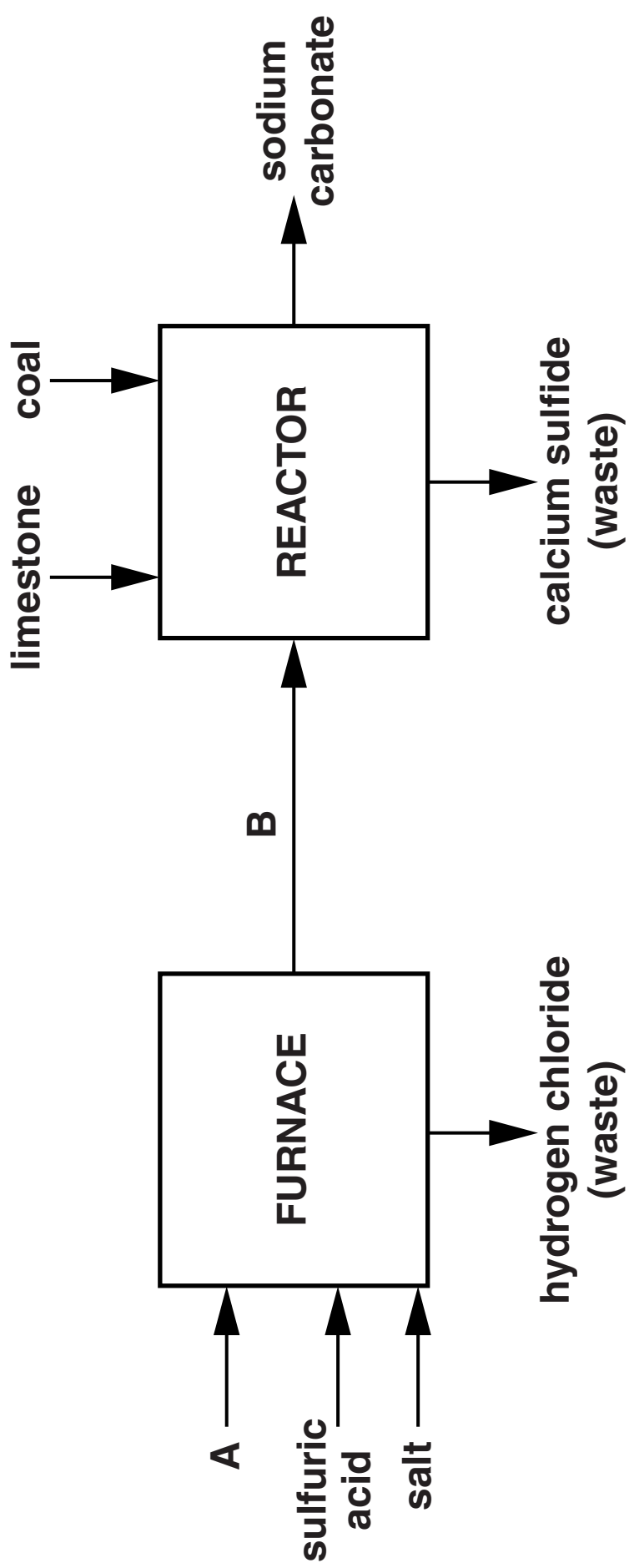
   _____ [1]

   (ii) The furnace produced a waste gas, **B**.

   Identify the gas and suggest why it harmed the environment.

   _____

   _____

   _____ [2]

FURNACE

A →

sulfuric acid →

salt →

→ hydrogen chloride (waste)

B →

REACTOR

limestone →

coal →

→ sodium carbonate

→ calcium sulfide (waste)

25

(iii) This problem was overcome by changing the waste gas into a useful product.

Name this product and give one of its uses.

_____

_____

_____ **[2]**

(iv) Sodium carbonate reacts with sulfuric acid to make a salt.

What is the name of this type of reaction?

Put a (ring) around the correct answer.

COMBUSTION

NEUTRALISATION

OXIDATION

REDUCTION

[1]

[Total: 10]

END OF QUESTION PAPER

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