Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

Wednesday 10 June 2020

Morning (Time: 1 hour 10 minutes) | Paper Reference **1SC0/2CF**

Combined Science

Paper 5

Foundation Tier

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- A periodic table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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1/

P 6 2 0 9 8 A 0 1 2 4

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) The two most common gases in today's atmosphere are nitrogen and oxygen.

(i) What is the third most common gas in today's atmosphere?

(1)

☒ **A** argon

☐ **B** butane

☐ **C** chlorine

☐ **D** hydrogen

(ii) What is the percentage of oxygen in today's atmosphere?

(1)

☐ **A** 0.04

☐ **B** 1

☒ **C** 21

☐ **D** 78

(b) Give the name of the most common gas in the Earth's **early** atmosphere.

(1)

CarbonDioxide

(c) This early atmosphere was hot and contained water vapour.
The atmosphere today contains less water vapour.

Explain what caused the amount of water vapour in the atmosphere to decrease.

(2)

Earth cooled
• water (vapour) condensed
•oceans formed /seas formed/ rainfall

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(d) The concentration of carbon dioxide in the atmosphere can be measured in parts per million (ppm).

Figure 1 shows the measurements in January 2018 and January 2019.

	concentration of carbon dioxide in ppm
January 2018	407.96
January 2019	410.83

Figure 1

(i) Calculate the increase in the concentration, in ppm, of carbon dioxide from January 2018 to January 2019.

Give your answer to the nearest whole number.

(2)

allow 2 for correct answer with or without working
change in concentration = 410.83 - 407.96 (= 2.87)
= 3

increase in concentration of carbon dioxide = ... ppm

(ii) Give a possible cause for this increase in the concentration of carbon dioxide.

(1)

volcanic activity / burning of
fossil fuels / deforestation /
respiration

(Total for Question 1 = 8 marks)

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2 (a) A student investigated the reaction between potassium iodide and lead nitrate.

(i) Solutions of potassium iodide and lead nitrate were mixed together.
Lead iodide and potassium nitrate were formed.

Complete the word equation.

(2)

potassium iodide + lead (1) nitrate. → lead iodide. + potassium (1) nitrate

(ii) The student recorded the total mass of the reactants and the total mass of the products.

The results are shown in Figure 2.

	reactants	products
total mass in g	21.7	21.7

Figure 2

State how the results in Figure 2 show that mass is conserved in this reaction.

(1)

(mass conserved because) the numbers are the same/nothing is lost/nothing is gained

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(b) In another experiment, a student investigated the temperature decrease when different amounts of ammonium nitrate crystals were dissolved in 100 cm^3 of water.

The apparatus used is shown in Figure 3.

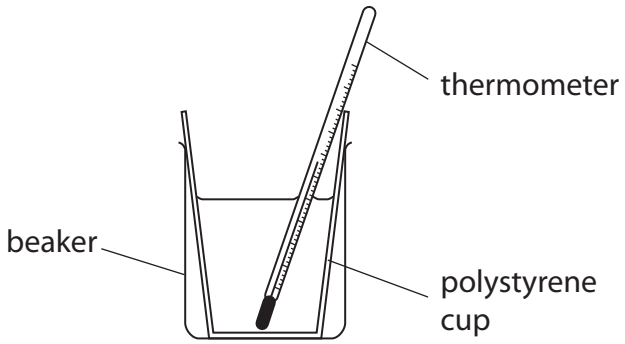

Figure 3

The student used the following method.

step 1 pour 100 cm^3 of water into the polystyrene cup

step 2 add one spatula of ammonium nitrate crystals to the water

step 3 stir the mixture

step 4 use the thermometer to record the lowest temperature reached by the mixture

step 5 repeat steps 1 to 4 using different amounts of ammonium nitrate

(i) Name a piece of apparatus that should be used to measure the 100 cm^3 of water in **step 1**.

(1)

measuring cylinder / (volumetric) pipette / burett

(ii) The student cannot work out the temperature decrease using the method described.

State what the student must do before **step 2** to be able to work out the temperature decrease.

(1)

measure the initial temperature (of the water)

(iii) State why a polystyrene cup is used in this experiment.

(1)

insulator / reduces heat transfer / poor conductor of heat

(iv) Figure 4 shows the reaction profile for this reaction.

Use the words from the box to complete the labels on Figure 4.

activation energy	products	reactants

(2)

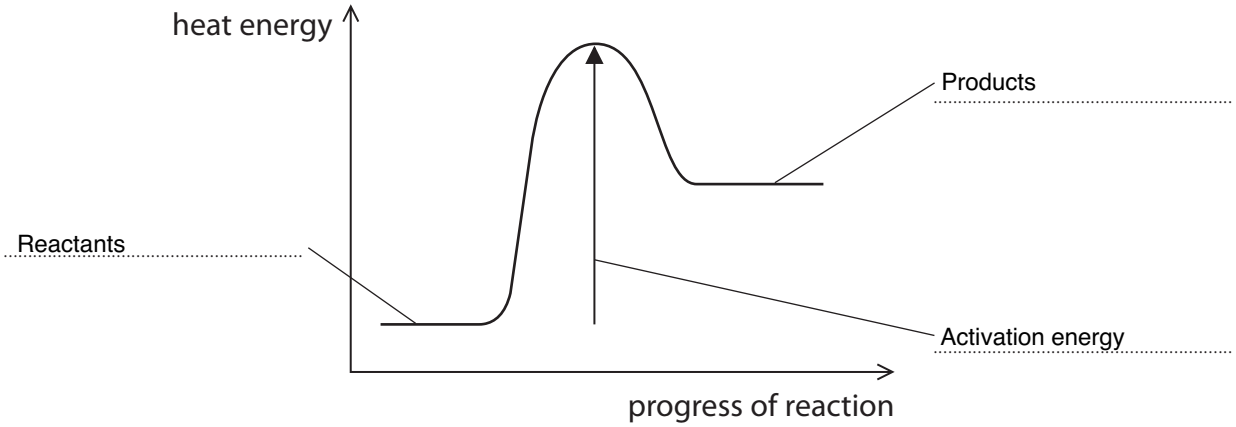

Figure 4

(Total for Question 2 = 8 marks)

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3 Chlorine, bromine and iodine are elements in group 7 of the periodic table.

(a) Chlorine is toxic.

State **one** safety precaution that should be taken when using chlorine in the laboratory.

(1)

use of fume-cupboard / fume hood

(b) Chlorine reacts with hydrogen to form hydrogen chloride.

(i) Write the word equation for this reaction.

(1)

Hydrogen + chloride → Hydrogen chloride

(ii) Hydrogen chloride dissolves in water to form an acidic solution.

State what is **seen** when blue litmus paper is placed into this solution.

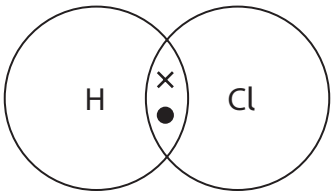
(1)

turns) red / pink

(iii) A chlorine atom has seven electrons in its outer shell.
A hydrogen atom has one electron in its outer shell.

Complete the dot and cross diagram of a molecule of hydrogen chloride.
Show outer shell electrons only.

(1)



(iv) Name the type of bonding in a molecule of hydrogen chloride.

(1)

Covalent

(c) If chlorine solution is added to sodium bromide solution a reaction occurs.

chlorine + sodium bromide → sodium chloride + bromine

Give a reason why this reaction occurs.

(1)

chlorine is more reactive than bromine / chlorine can displace bromine

(d) Figure 5 shows apparatus used to find out if a solution conducts electricity.

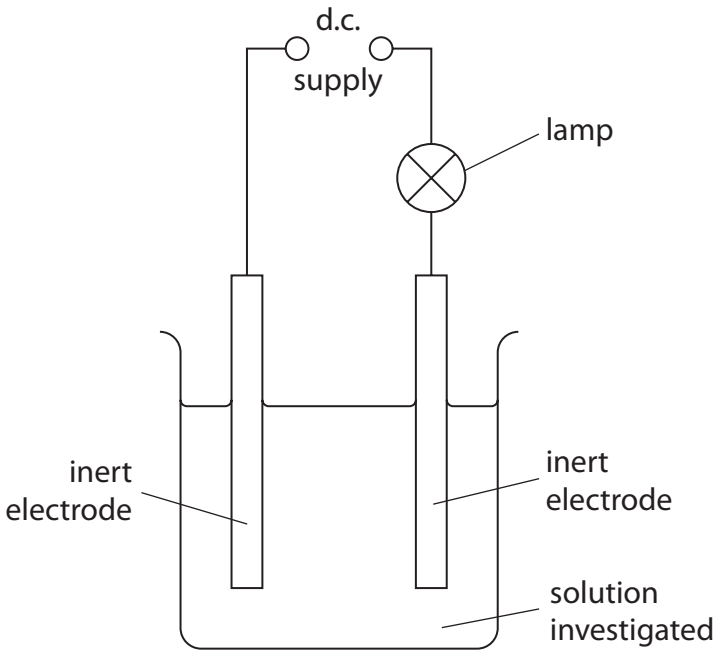


Figure 5

Glucose solution and sodium chloride solution are tested.
Glucose is a typical simple molecular covalent compound.
Sodium chloride is an ionic compound.

(i) State what would happen to the lamp when glucose solution is tested.

(1)

lamp) does not light up / unlit / 'nothing'

(ii) State what would happen to the lamp when sodium chloride solution is tested.

(1)

Lights up

(e) Figure 6 shows how the conductivity of one solution changes as its concentration increases.

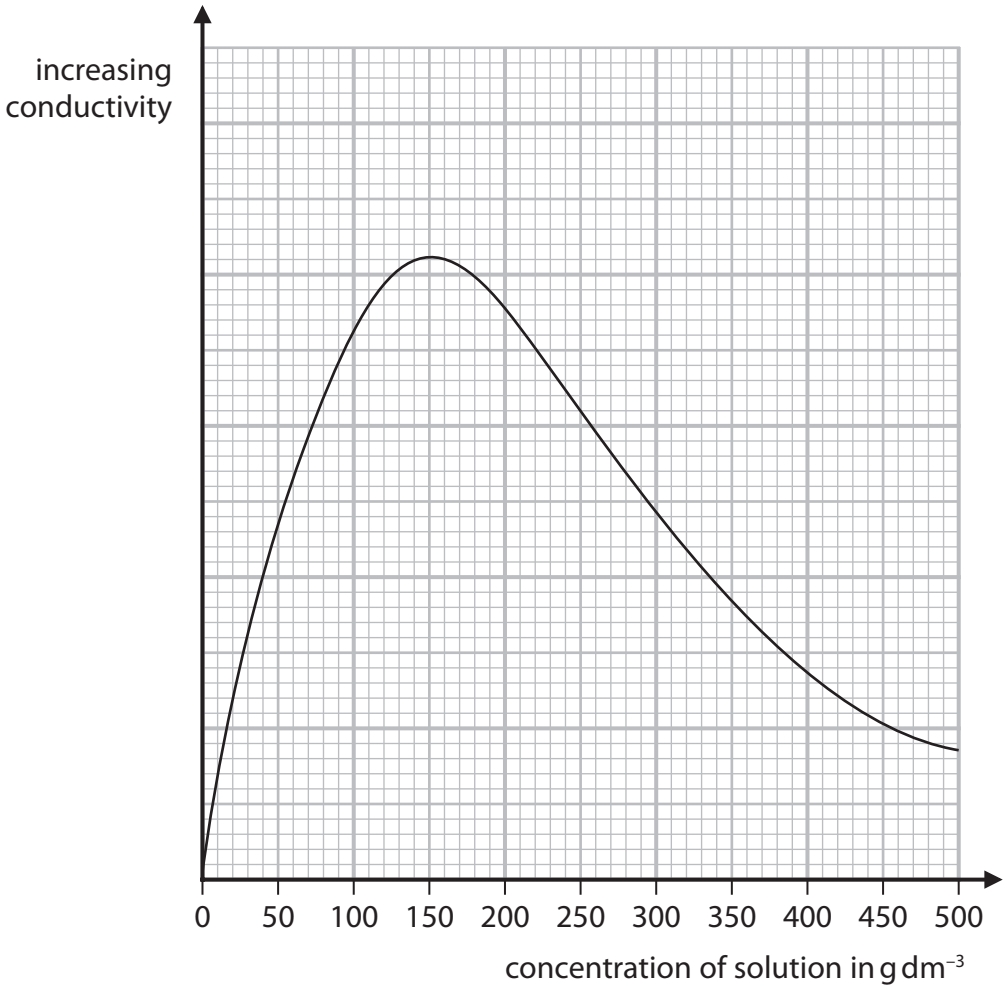


Figure 6

Describe how the conductivity of this solution changes as its concentration increases from 0 to 500 g dm^{-3}.

(2)

• conductivity increases and then decreases
AND any one quantitative description from
• conductivity increases (from 0) to 150 (g dm-3)

(Total for Question 3 = 10 marks)

4 (a) Methane is a hydrocarbon fuel.

(i) Complete the word equation for the **complete** combustion of methane in oxygen.

(2)

methane + Oxygen → water + Carbon dioxide

(ii) The **incomplete** combustion of methane can produce carbon and carbon monoxide.

Give the reason why carbon and carbon monoxide are produced in the **incomplete** combustion of methane.

(1)

limited supply of oxygen

(b) Crude oil is a complex mixture of hydrocarbons.
Crude oil can be separated into useful fractions by fractional distillation.

Figure 7 shows a fractional distillation column and the fractions produced when crude oil is distilled.

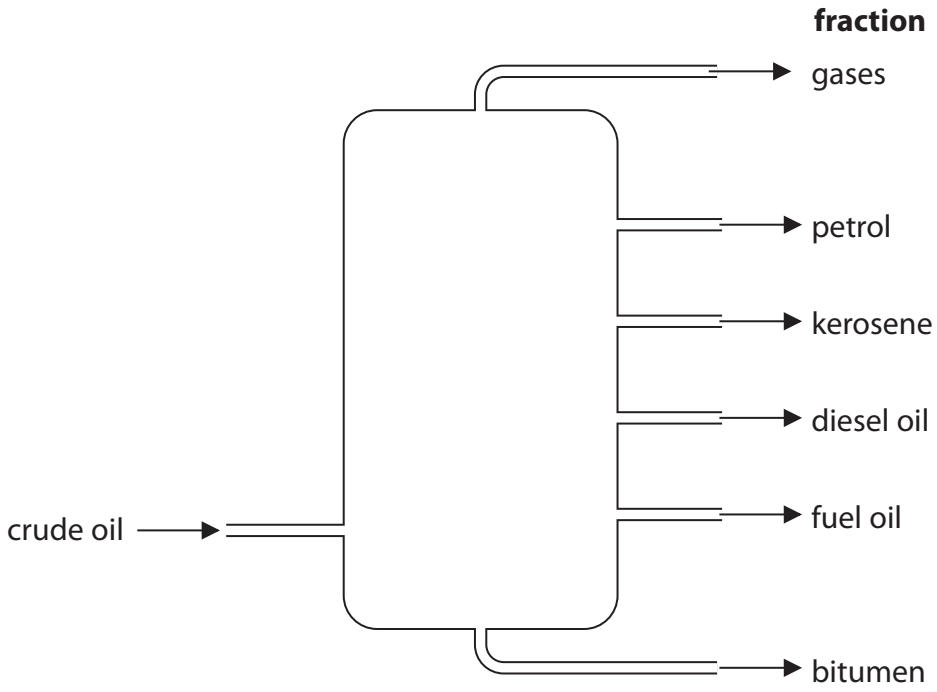


Figure 7

(i) Name the fraction in Figure 7 that is used to surface roads.

(1)

Bitumin

(ii) Name the fraction in Figure 7 that contains hydrocarbons with the lowest boiling point.

(1)

Gases

(c) When crude oil is fractionally distilled, the demand for some fractions is more than the amount produced.

Figure 8 shows the relative amounts of each fraction in a crude oil and the relative demand for each of these fractions.

fraction	relative amount	relative demand
gases	2	6
petrol	12	29
kerosene	16	11
diesel oil	24	29
fuel oil	37	21
bitumen	9	4

Figure 8

Which of the following shows the fractions where the relative demand is greater than the relative amount in the crude oil?

(1)

☒ **A** kerosene, diesel oil, bitumen

☒ **B** gases, petrol, diesel oil

☒ **C** gases, petrol, kerosene

☒ **D** petrol, diesel oil, fuel oil

(d) Cracking involves the breaking down of large hydrocarbon molecules into smaller hydrocarbon molecules.

(i) Octane, C_8H_{18}, can be cracked to produce one molecule of ethene, C_2H_4, and one molecule of C_xH_{14}.

$$C_8H_{18} \rightarrow C_2H_4 + C_xH_{14}$$

Determine the value of x in the molecule of C_xH_{14}.

(1)

x = 6

(ii) Dodecane is a large hydrocarbon molecule.
When one molecule of dodecane is cracked the products are one molecule of octane and one molecule of butene.

dodecane → octane + butene

Calculate the maximum mass of octane that could be produced when 340 g of dodecane is cracked in this reaction.

(relative formula masses: dodecane = 170, octane = 114)

(2)

allow 2 for correct answer with or without working
170 (g) dodecane forms 114 (g) octane
1 (g) dodecane forms 114 (g) octane
170
340 (g) dodecane forms 114 x 340
170
(= 228(g))

mass of octane = ... g

(Total for Question 4 = 9 marks)

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5 (a) An atom of potassium has atomic number 19 and mass number 39.

(i) Give the electronic configuration of this potassium atom.

(1)

2.8.8.1

(ii) This potassium atom forms the ion K^+.

Which row shows the number of protons and the number of neutrons in this potassium ion, K^+?

(1)

	number of protons	number of neutrons
☒ **A**	19	19
☒ **B**	19	20
☒ **C**	20	19
☒ **D**	20	20

(b) Potassium and caesium are in the same group of the periodic table.

Explain, in terms of electrons, why potassium and caesium are in the same group.

(2)

outer (electron) shell
• (both have) {same number / electron(s)}

(c) Fluorine boils at –188 °C.
There are forces between fluorine molecules.

Explain, in terms of these forces, why the boiling point of fluorine is low.

(2)

(intermolecular) forces are weak
• little energy needed (to overcome forces)

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(d) Potassium reacts with fluorine to form potassium fluoride.
Potassium fluoride is a solid.

Complete the balanced equation for this reaction and add the state symbols.

(3)

2. K (s) + F_2(g) → 2. KF (s)

(e) What are the elements in group 1 of the periodic table called?

(1)

☒ **A** alkali metals

☒ **B** fullerenes

☒ **C** halogens

☒ **D** noble gases

(f) Figure 9 shows the melting points and boiling points of elements in group 7 of the periodic table.

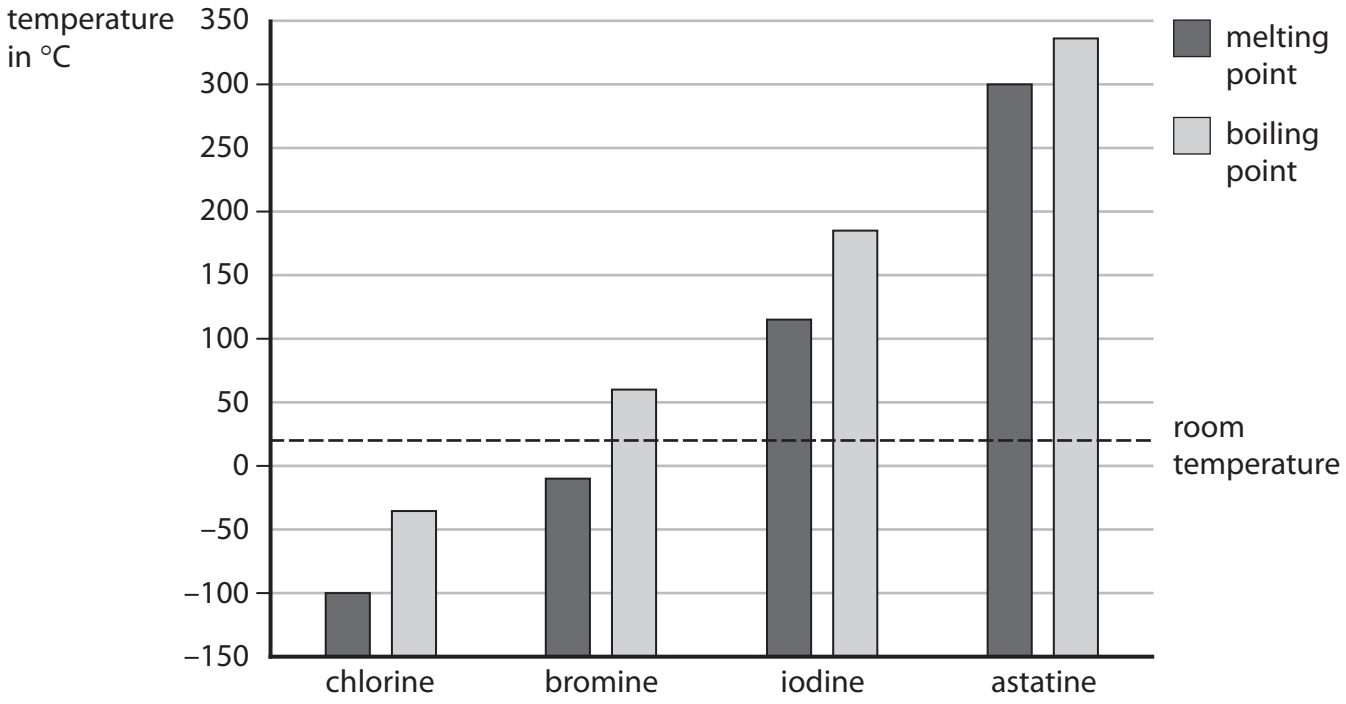

Figure 9

(i) Give, using Figure 9, the boiling point of bromine.

(1)

boiling point of bromine = any value between 51 (°C) and 70 (°C) °C

(ii) State which **two** elements from Figure 9 are solids at room temperature.

(1)

Iodine and astatine

(Total for Question 5 = 12 marks)

6 (a) Calcium carbonate reacts with dilute hydrochloric acid to produce carbon dioxide gas.

The rate of reaction between calcium carbonate and dilute hydrochloric acid at room temperature was investigated.

(i) The investigation was carried out with different sized calcium carbonate pieces.

The mass of calcium carbonate and all other conditions were kept the same.

The results are shown in Figure 10.

size of calcium carbonate pieces used	volume of carbon dioxide gas produced in five minutes in cm^3
large	16
small	48
powder	90

Figure 10

State, using the information in Figure 10, the effect of the surface area of the calcium carbonate on the rate of this reaction.

(1)

larger surface area {higher /faster} rate /ORA

(ii) The calcium carbonate powder produced 90 cm^3 of carbon dioxide in five minutes.

Calculate the average rate of reaction in $cm^3\ s^{-1}$.

(3)

final answer of 0.3 with or without working scores 3
MP1 : conversion of time from minutes into seconds
5 x 60 = 300 (seconds)
MP2 : rate = volume / time
rate = 90 / 300
MP3 : evaluation of the fraction
= 0.3 (cm3 s-1)

average rate of reaction = ... $cm^3\ s^{-1}$

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(iii) The experiments were repeated at a higher temperature.
The rate of reaction for each experiment increased.

Explain, in terms of particles, why the rate of reaction increased when the temperature was increased.

(3)

An explanation linking three of the following
• particles have more energy
• so (particles) move faster
• (so) there are more frequent collisions between particles

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*(b) Zinc metal reacts with dilute hydrochloric acid to produce hydrogen gas.

zinc + hydrochloric acid → zinc chloride + hydrogen

A student investigated the effect of doubling the concentration of the hydrochloric acid on this reaction.

The student made the following prediction.

> When the concentration of the hydrochloric acid is doubled the rate of reaction will double and the reaction will be more exothermic.

Devise a plan, including the apparatus you would use, to test the student's prediction.

You are provided with pieces of zinc and two bottles of dilute hydrochloric acid. One bottle of hydrochloric acid is double the concentration of the other.

(6)

A plan to include some of the following points
• measure equal masses of zinc using balance
• measure equal volumes of acid using measuring cylinder/pipette/suitable named piece of apparatus
• pour acid in suitable container
• record initial temperature
• use of thermometer
• add zinc to acid
• place bung with delivery tube in container / reaction vessel immediately after the zinc is added
• use of timer
• start timer on addition of zinc
• measure volume of gas evolved using a delivery tube and inverted measuring cylinder/burette over water OR delivery tube and (gas) syringe
• record time to collect fixed volume of gas
• record final/highest temperature
• calculate the temperature increase
• repeat for procedure
• same initial temperature
• same size pieces of zinc
• same volume of acid
credit use a suitable labelled diagram of apparatus for rate measurement/ temperature of acid

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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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The periodic table of the elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.