Write your name here

Surname	Other names

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

Centre Number | Candidate Number

Combined Science

Paper 4: Chemistry 2

Foundation Tier

Wednesday 13 June 2018 – Morning
Time: 1 hour 10 minutes

Paper Reference
1SC0/2CF

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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P 5 9 1 8 2 R 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 Students are investigating exothermic and endothermic reactions.
They are finding the temperature change in 50 cm^3 water when a solid dissolves in it.
The apparatus is shown in Figure 1.

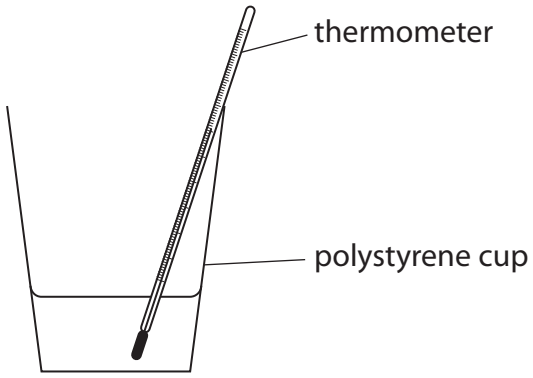

Figure 1

(a) The steps needed to carry out this experiment are **P**, **Q**, **R**, **S** and **T**.
They are shown below.

They are not in the correct order.

P pour the 50 cm^3 water into the polystyrene cup
Q add the solid to the water and stir
R measure 50 cm^3 water using a beaker
S measure the initial temperature of the water
T measure the final temperature of the solution when all the solid has dissolved

Write the steps in the correct order, from left to right.

(2)

☐ ☐ ☐ ☐ ☐

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(b) The dissolving of this solid in water is an exothermic change.
The experiment is repeated a number of times.
Compared with the initial temperature of the water, the final temperature of the solution is

(1)

☒ **A** always higher

☒ **B** always lower

☒ **C** sometimes higher and sometimes lower

☒ **D** always unchanged

(c) State how step **R** could be changed to measure the volume of water more accurately.

(1)

.....

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(d) Figure 2 shows a cold pack.

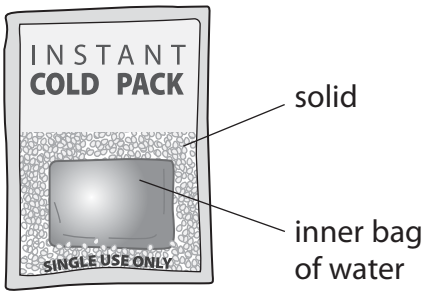

Figure 2

When the pack is squeezed hard the inner bag bursts.
Then the pack goes cold.

(i) Explain why the pack goes cold.

(2)

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.....

.....

.....

(ii) Give the reason why the pack can be used only once.

(1)

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.....

(Total for Question 1 = 7 marks)

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2 Hydrogen peroxide decomposes to form water and oxygen.

The rate of this reaction can be found by measuring the volume of oxygen formed after different time intervals.

Hydrogen peroxide solution is placed in a conical flask.
The apparatus is set up as shown in Figure 3.

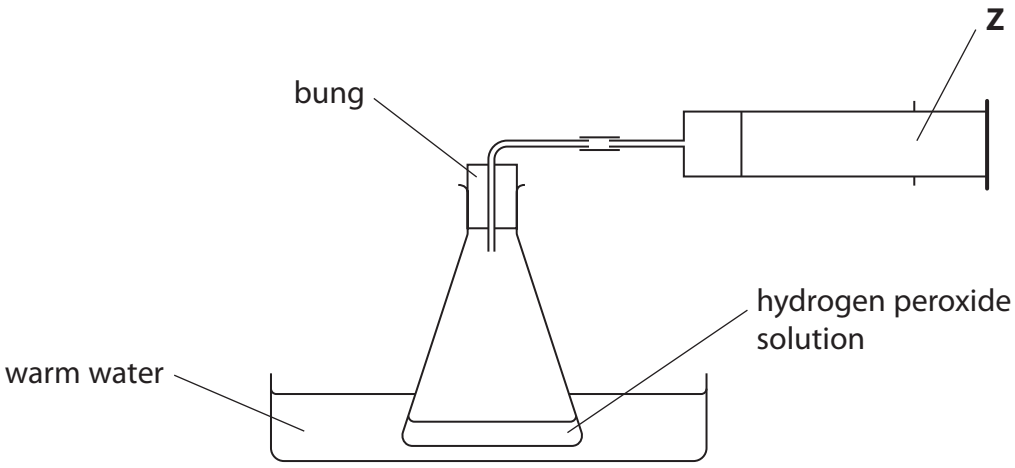

Figure 3

(a) State the name of the piece of apparatus labelled **Z** in Figure 3.

(1)

.....

.....

(b) At the end of the reaction the bung is removed from the conical flask.
A glowing splint is put into the gas in the flask.

State what you would **see**.

(1)

.....

.....

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(c) A solid catalyst can be used for this reaction.

(i) The experiment is repeated under identical conditions but with the catalyst added.

(1)

In the experiment **with** the catalyst added

☒ **A** the rate of reaction is the same as when no catalyst is present

☒ **B** water and oxygen are the only products of the reaction

☒ **C** some of the catalyst is used up

☒ **D** the volume of oxygen produced when all the hydrogen peroxide is decomposed is larger than when no catalyst is present

(ii) At the end of the experiment with the catalyst added, the mass of the catalyst remaining is found.

The method used to find the mass of the catalyst remaining is
filter the mixture of products and catalyst
determine the mass of the filter paper and solid catalyst
subtract the mass of a filter paper from the mass of filter paper and solid catalyst.

This method would not give the accurate mass of catalyst remaining.

Which of the following needs to be done to give a more accurate mass?

(1)

☒ **A** dry the filter paper and catalyst before finding their mass

☒ **B** scrape the catalyst off the filter paper and find the mass of the catalyst

☒ **C** find the mass of the filtrate and not the filter paper and catalyst

☒ **D** repeat the experiment

(iii) A given mass of catalyst is more effective if it has a large surface area.

State how you could increase the surface area of some lumps of solid catalyst.

(1)

.....

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(d) The experiment is repeated three times
once using a more dilute solution of hydrogen peroxide
once using a lower temperature
once using a larger flask

In each case, all other conditions are kept the same.

Circle the word that shows the change in the rate of decomposition in each case.

(2)

	change in rate		
hydrogen peroxide solution is more dilute	faster	slower	unchanged
the temperature used is lower	faster	slower	unchanged
the reaction is carried out in a larger flask	faster	slower	unchanged

(e) Complete the balanced equation for the reaction and fill in the two missing state symbols.

(2)

..... $H_2O_2(aq) \rightarrow 2H_2O($.....$) + O_2($.....$)$

(Total for Question 2 = 9 marks)

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3 Crude oil is found in the Earth's crust.

(a) Which of the statements about crude oil is correct?

(1)

☒ **A** crude oil is a finite resource

☒ **B** crude oil is a mixture of the elements hydrogen and carbon

☒ **C** all of the molecules in crude oil contain rings of carbon atoms

☒ **D** crude oil is used in cars as a fuel

(b) The substances ethane, C_2H_6, octane, C_8H_{18}, and pentadecane, $C_{15}H_{32}$, are all found in crude oil.

These substances

(1)

☒ **A** have the same formula

☒ **B** have the same boiling point

☒ **C** are in the same homologous series

☒ **D** form different products when completely combusted in air

(c) (i) Use a word from the box to complete each of the sentences about the fractional distillation of crude oil.

condensed	heated	melted	solidified	stirred

Each word may be used once, more than once, or not at all.

(2)

The separation of crude oil into fractions occurs in a fractional distillation column.

Before crude oil is passed into the column it is ..... .

During the distillation, vapour rises up the column until it is cold enough for the vapour to form a liquid. The vapour has been ..... .

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(ii) Complete this sentence by underlining the correct answer in the box.

(1)

Compared with the fraction from the top of the column,

the fraction from the bottom of the column

has more carbon atoms per molecule.
has a lower viscosity.
is easier to ignite.

(d) When crude oil is separated into fractions, the amount of each fraction obtained rarely matches the demand for that fraction.

Figure 4 shows the relative amounts of four of the fractions obtained from a crude oil and the relative demand for each of these fractions.

fraction	relative amount obtained from the crude oil	relative demand
gases	5	5
petrol	10	25
kerosene	20	25
fuel oil	45	5

Figure 4

State the fraction for which the relative amount obtained exceeds the relative demand.

(1)

.....

(e) In January 2015 the United Kingdom produced 850 000 barrels of crude oil per day. 45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Give your answer to two significant figures.

(3)

.....

.....

..... barrels

(Total for Question 3 = 9 marks)

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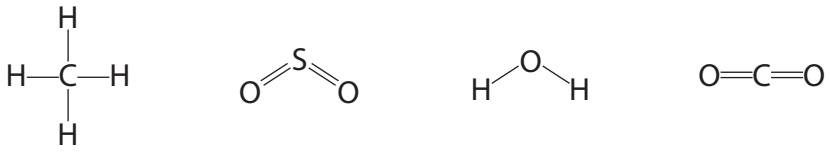
4 Figure 5 shows one molecule of each of four different substances, **A**, **B**, **C** and **D**.



substance A substance B substance C substance D

Figure 5

(a) State the formula of a molecule of substance **B**.

(1)

.....

(b) (i) Substance **C** can be formed by burning an element in oxygen.

Write the word equation for this reaction.

(1)

.....

(ii) Consider substances **A**, **B**, and **D**.

Give the letters of the two substances that can be formed by burning an element in oxygen.

(1)

.....

(c) The amount of oxygen in the atmosphere has increased since the Earth's early atmosphere was formed.

Explain what has caused this change.

(2)

.....

.....

.....

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(d) Carbon dioxide is present in the Earth's atmosphere.

Some processes increase the amount of carbon dioxide in the atmosphere, other processes decrease it.

Draw one straight line from each change in the amount of carbon dioxide in the atmosphere to the process causing the change.

(2)

change in the amount of carbon dioxide in the atmosphere	**process causing the change**
increase	carbon dioxide absorbing the Sun's energy
	carbon dioxide dissolving in oceans
	volcanic emissions
decrease	using argon in light bulbs
	burning hydrogen

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(e) Figure 6 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

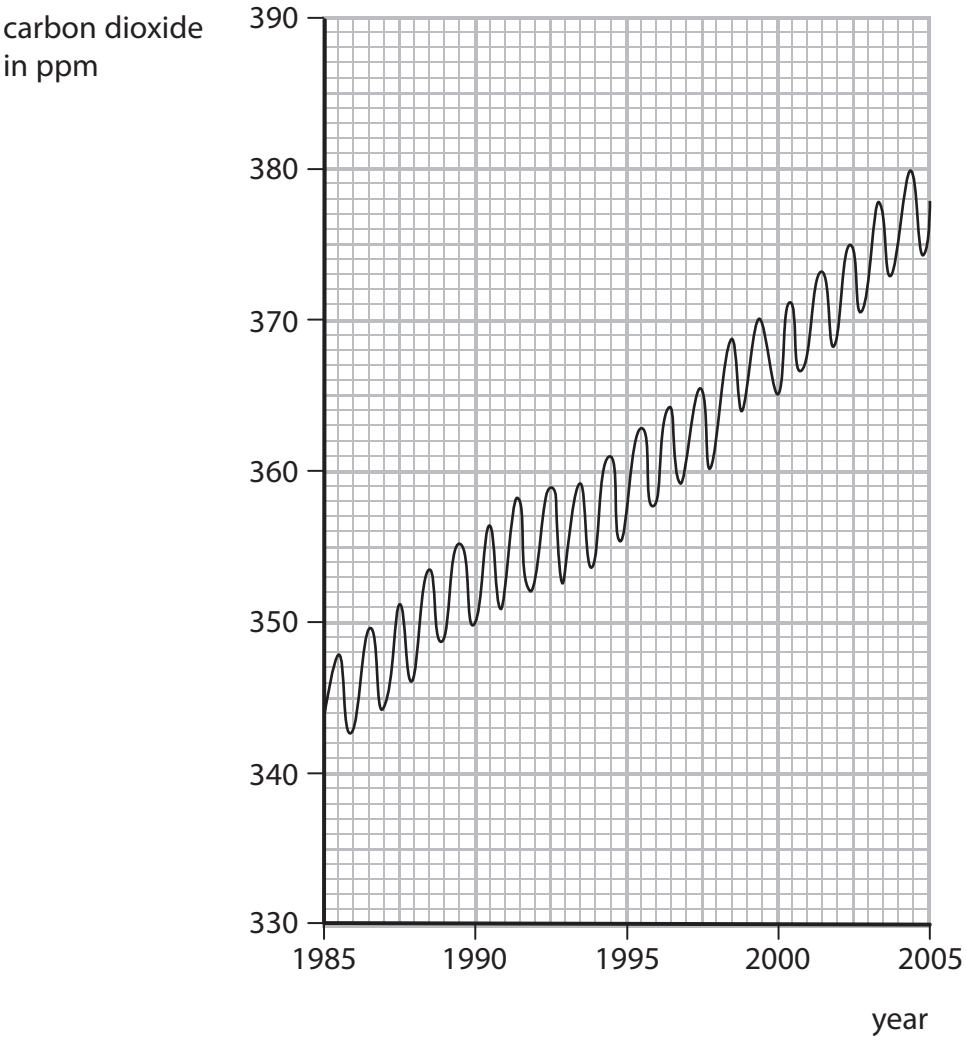

Figure 6

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

.....

.....

.....

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

.....

.....

.....

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(iii) Calculate the change in the amount of carbon dioxide in the Earth's atmosphere from the beginning of 1990 to the beginning of 2000.

(2)

.....

.....

.....

change in amount = ... ppm

(Total for Question 4 = 11 marks)

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5 (a) A chlorine atom contains 17 electrons, 18 neutrons and 17 protons.

(i) State the mass number of this chlorine atom.

(1)

.....

(ii) Give the electronic configuration of this chlorine atom.

(1)

.....

(b) Describe what you would **see** if damp, blue litmus paper is placed into chlorine gas.

(2)

.....

.....

.....

.....

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(c) Chlorine exists as diatomic molecules.

In a molecule, two chlorine atoms are joined by a covalent bond.

(i) Describe what is meant by a **covalent bond**.

(2)

(ii) Explain why chlorine is a gas, rather than a liquid, at room temperature.

(2)

(d) When the gas hydrogen chloride, HCl, is dissolved in water, a solution forms. Blue litmus paper dipped in this solution turns red.

State why the litmus paper turns red.

(1)

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(e) (i) Figure 7 lists the halogens in the order in which they appear in group 7 of the periodic table.

The melting points of four of the halogens are given.

halogen	melting point in °C
fluorine	−220
chlorine	−101
bromine	−7
iodine	
astatine	302

Figure 7

Estimate the melting point of iodine.

(1)

..... °C

(ii) Bromine reacts with heated iron.

Give the name of one halogen that would react with iron more vigorously than bromine.

(1)

.....

(Total for Question 5 = 11 marks)

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6 Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

(a) Sodium metal tarnishes in air to form a layer of sodium oxide on its surface.
0.92 g of sodium combined with 0.32 g of oxygen in this oxide.

Calculate the empirical formula of this sodium oxide.
(relative atomic masses: O = 16, Na = 23)

You must show your working.

(3)

empirical formula of sodium oxide = ...

(b) Sodium reacts with water to form sodium hydroxide in solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)

.....Na(.....) + $2H_2O$(.....) → .....NaOH(.....) + H_2(.....)

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(c) In an experiment equal-sized pieces of lithium, sodium and potassium are added to separate samples of water.

(i) A flame is produced only with potassium because potassium

(1)

☒ **A** is the softest metal

☒ **B** has the lowest melting point

☒ **C** is the most reactive

☒ **D** is the only flammable metal

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 8.

	lithium	sodium	potassium
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 8

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

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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.

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