

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel**

**Level 1/Level 2 GCSE (9 - 1)**

# 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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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  $50\text{ cm}^3$  water when a solid dissolves in it. The apparatus is shown in Figure 1.

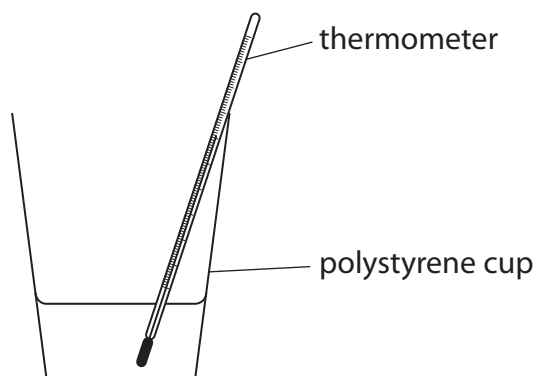


Figure 1

- (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  $50\text{ cm}^3$  water into the polystyrene cup
- Q** add the solid to the water and stir
- R** measure  $50\text{ cm}^3$  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)

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|



(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)



(d) Figure 2 shows a cold pack.

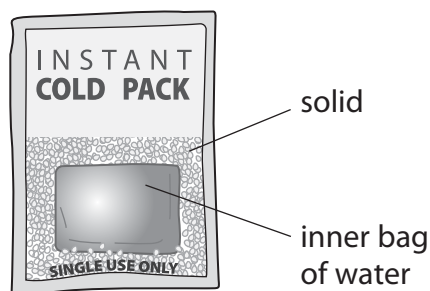


**Figure 2**

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

(i) Explain why the pack goes cold.

(2)

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

(1)

**(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.

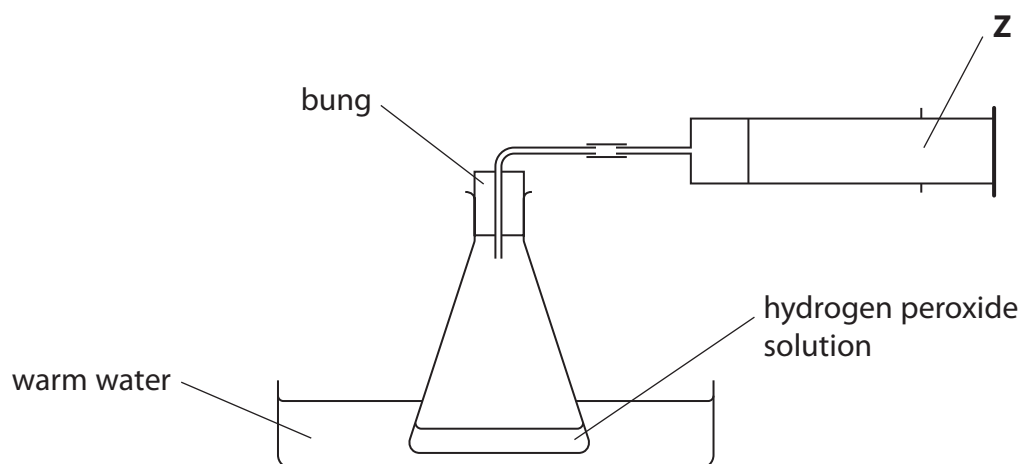


**Figure 3**

(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)



(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)



- (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.

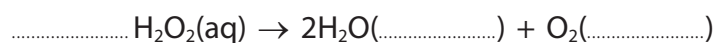
Circle the word that shows the change in the rate of decomposition in each case.

(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)



(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 .....



(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)**



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

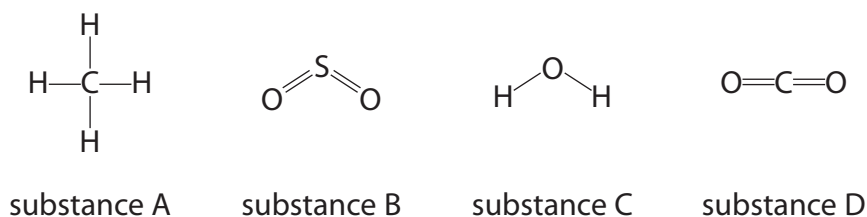


Figure 5

(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)



(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**

increase

decrease

**process causing the change**

carbon dioxide absorbing  
the Sun's energy

carbon dioxide dissolving  
in oceans

volcanic emissions

using argon in light bulbs

burning hydrogen



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

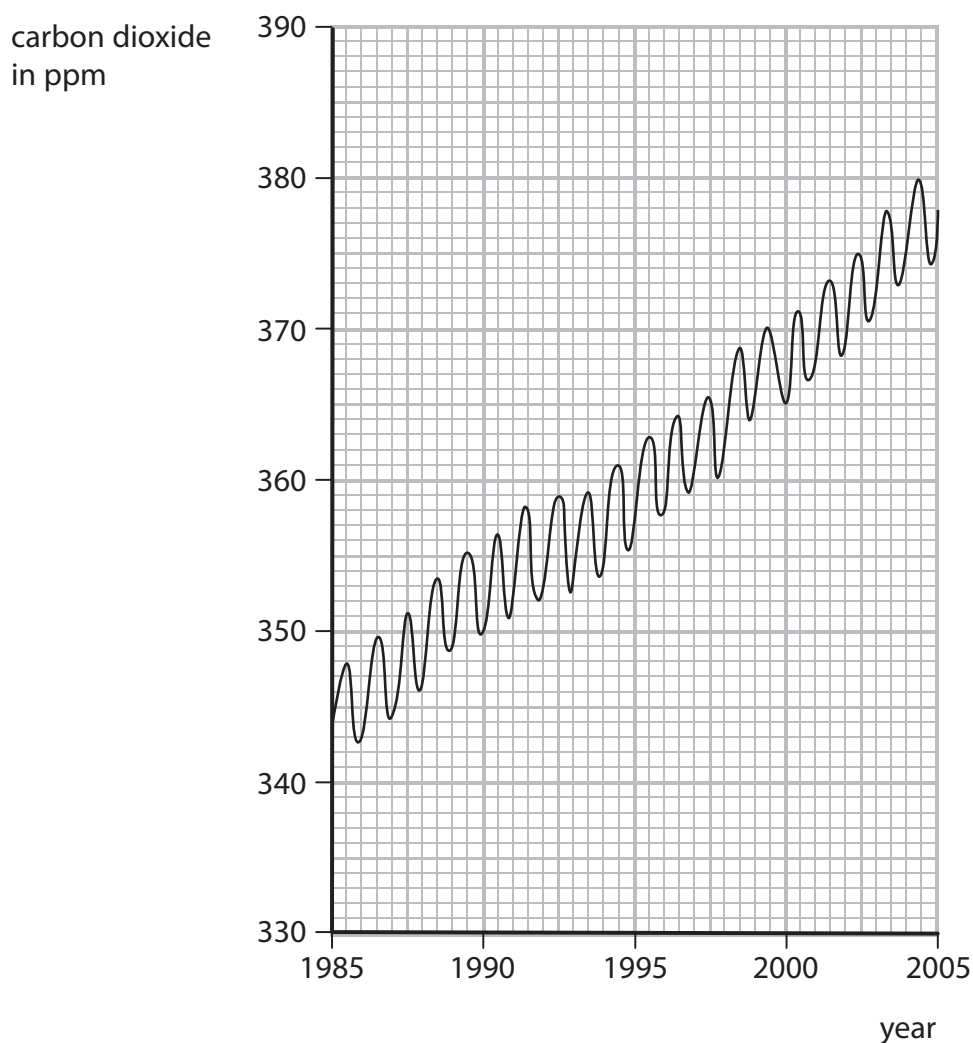


**Figure 6**

- (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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P 5 9 1 8 2 R A 0 1 5 2 4

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)



(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)



- (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)



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)



(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.

|                            | <b>lithium</b> | <b>sodium</b> | <b>potassium</b> |
|----------------------------|----------------|---------------|------------------|
| 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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P 5 9 1 8 2 R A 0 2 3 2 4

P 5 9 1 8 2 R A 0 2 4 2 4

$$1 \quad \text{H} \quad 1$$

hydrogen

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