Paper Reference(s) 1SC0/2CF
Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Total Marks

Combined Science
Paper 5
Foundation Tier

Wednesday 10 June 2020 – Morning

Time: 1 hour 10 minutes plus your additional time allowance

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

Y62098A

Pearson

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Diagram Booklet, Periodic Table

INSTRUCTIONS

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 provided as a separate insert.

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.

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 mark)

☐ **A argon**

☐ **B butane**

☐ **C chlorine**

☐ **D hydrogen**

(continued on the next page)

1 continued.

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

☐ 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 mark)

_____

(continued on the next page)

1 continued.

(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 marks)

(continued on the next page)

1 continued.

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

Look at Figure 1 for Question 1(d) in the Diagram Booklet. It shows the measurements in January 2018 and January 2019.

(continued on the next page)

1 continued.

(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 marks)

increase in concentration of carbon dioxide = _____ ppm

(continued on the next page)

1 continued.

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

(Total for Question 1 = 8 marks)

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.

Look at the diagram for Question 2(a)(i) in the Diagram Booklet. Complete the word equation.
(2 marks)

(continued on the next page)

2 continued.

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

The results are shown in Figure 2.

FIGURE 2

	reactants	products
total mass in g	21·7	21·7

State how the results in Figure 2 show that mass is conserved in this reaction.
(1 mark)

(continued on the next page)

2 continued.

(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.

Look at Figure 3 for Question 2(b) in the Diagram Booklet. The apparatus used is shown.

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

(continued on the next page)

2 continued.

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 mark)

(continued on the next page)

2 continued.

(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 mark)

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

(continued on the next page)

2 continued.

(iv) Look at Figure 4 for Question 2(b)(iv) in the Diagram Booklet. It shows the reaction profile for this reaction.

Use the words below to complete the labels on Figure 4.
(2 marks)

activation energy

products

reactants

(Total for Question 2 = 8 marks)

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 mark)

(continued on the next page)

3 continued.

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

(i) Write the word equation for this reaction.
(1 mark)

_____ →

_____

(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 mark)

_____

_____

(continued on the next page)

3 continued.

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

Look at the diagram for Question 3(b)(iii) in the Diagram Booklet. Complete the dot and cross diagram of a molecule of hydrogen chloride.
Show outer shell electrons only.
(1 mark)

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

(continued on the next page)

3 continued.

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

chlorine + sodium bromide $\longrightarrow$

sodium chloride + bromine

Give a reason why this reaction occurs. (1 mark)

_____

_____

_____

(continued on the next page)

3 continued.

(d) Look at Figure 5 for Question 3(d) in the Diagram Booklet. It shows apparatus used to find out if a solution conducts electricity.

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 mark)

(continued on the next page)

3 continued.

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

(continued on the next page)

3 continued.

(e) Look at Figure 6 for Question 3(e) in the Diagram Booklet. It shows how the conductivity of one solution changes as its concentration increases.

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

(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 marks)

methane + _____ ⟶

water + _____

(continued on the next page)

4 continued.

(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 mark)

(continued on the next page)

4 continued.

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

Look at Figure 7 for Question 4(b) in the Diagram Booklet. It shows a fractional distillation column and the fractions produced when crude oil is distilled.

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

_____

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

_____

(continued on the next page)

4 continued.

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

Look at Figure 8 for Question 4(c) in the Diagram Booklet. It shows the relative amounts of each fraction in a crude oil and the relative demand for each of these fractions.

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

☐ A kerosene, diesel oil, bitumen

☐ B gases, petrol, diesel oil

☐ C gases, petrol, kerosene

☐ D petrol, diesel oil, fuel oil

(continued on the next page)

4 continued.

(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}.

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

Determine the value of x in the molecule of C_xH_{14}.
(1 mark)

x = _____

(continued on the next page)

4 continued.

(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.
(2 marks)

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

(continued on the next page)

4 continued.

mass of octane = _____ g

(Total for Question 4 = 9 marks)

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

(i) Give the electronic configuration of this potassium atom. (1 mark)

(continued on the next page)

5 continued.

(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 mark)

	number of protons	number of neutrons
☐ A	19	19
☐ B	19	20
☐ C	20	19
☐ D	20	20

(continued on the next page)

5 continued.

(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 marks)

(continued on the next page)

5 continued.

(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 marks)

(continued on the next page)

5 continued.

(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 marks)

_____K (_____) + $F_2(g)$ ⟶ _____KF (_____)

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

☐ A alkali metals

☐ B fullerenes

☐ C halogens

☐ D noble gases

(continued on the next page)

5 continued.

(f) Look at Figure 9 for Question 5(f) in the Diagram Booklet. It shows the melting points and boiling points of elements in group 7 of the periodic table.

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

boiling point of bromine = _____ °C

(ii) State which TWO elements from Figure 9 are solids at room temperature.
(1 mark)

_____

_____

(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.

(continued on the next page)

6 continued.

(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.

Look at Figure 10 for Question 6(a)(i) in the Diagram Booklet. The results are shown.

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

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(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 marks)

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

(continued on the next page)

6 continued.

(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 marks)

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

*(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.

(continued on the next page)

6 continued.

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 marks)

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(continued on the next page)

6 continued.

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER