Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Chemistry (1CH0) Higher

Resource Set Topic M: Earth and atmospheric science

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1 The Earth's atmosphere contains several gases.

(a) Figure 1 shows the relative amounts of gases thought to be in the Earth's early atmosphere.

gas	relative amount in Earth's early atmosphere
oxygen	small
carbon dioxide	large
nitrogen	small
water vapour	large

Figure 1

The amount of water vapour in today's atmosphere is much less than the amount in the Earth's early atmosphere.

Explain why the amount of water vapour in the atmosphere has decreased.

(2)

The Earth's early atmosphere is hot. When the atmosphere cooled down, the water vapour condensed into liquid.

(b) The apparatus shown in Figure 2 is used to find the percentage of oxygen in dry air.

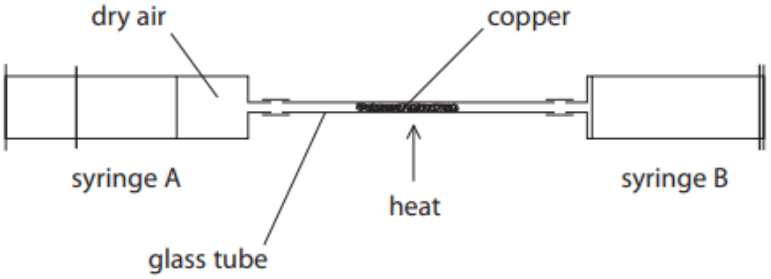

Figure 2

Syringe A contains 50 cm^3 of dry air and syringe B contains no air.
The copper in the glass tube is heated strongly.
The air in the apparatus is passed backwards and forwards over the copper until all the oxygen has been removed.

(i) The following results were obtained

initial volume of air in apparatus = 50 cm^3

final volume of gas in apparatus = 40 cm^3

Calculate the percentage of oxygen in this sample of dry air.

(2)

$\frac{50-40}{50} \times 100 = 20\%$

percentage oxygen in the air = 20 %

(ii) At the end of the experiment, the apparatus and its contents are allowed to cool before the final volume of gas is measured.

(1)

The apparatus and its contents must be allowed to cool because

☒ **A** reading the volume while the apparatus is hot is dangerous

☒ **B** the glass tube may crack when it is hot and allow air into the apparatus

☒ **C** the gas has expanded when it is hot

☒ **D** the copper reacts with other gases in the air when it is hot

(c) The Earth's earliest rocks contained iron sulfide and no iron oxide.
Later the rocks contained iron oxide as well as iron sulfide.

Explain what happened to allow this change to occur.

(2)

In the early atmosphere oxygen is not present in air. Later, iron reacts with oxygen in the air to form iron oxide.

5 (a) Carbon dioxide is one of the gases in the Earth's atmosphere.
The percentage of carbon dioxide in the Earth's atmosphere has changed over time.

(i) Which row of the table shows the approximate percentage of carbon dioxide thought to be in the Earth's early atmosphere and how this percentage changed to form the Earth's atmosphere today?

(1)

	approximate percentage of carbon dioxide in the Earth's early atmosphere	change in percentage carbon dioxide to form the Earth's atmosphere today.
☒ **A**	5	increased
☒ **B**	5	decreased
☒ **C**	95	increased
☒ **D**	95	decreased

(ii) The actual percentage of carbon dioxide in the Earth's atmosphere today varies.

Explain **two** factors that cause the percentage of carbon dioxide in today's atmosphere to vary.

(4)

factor 1 human activities such as combustion release carbon dioxide

factor 2 carbon dioxide is constantly taken up by photosynthetic organisms and released by organisms respiring aerobically.

7 (a) Air contains several gaseous elements.

Which of these shows the three most common gaseous elements in air, listed in order from the most common to the least common?

(1)

- ☐ **A** oxygen, chlorine, nitrogen
- ☐ **B** nitrogen, oxygen, hydrogen
- ☐ **C** oxygen, nitrogen, helium
- ☒ **D** nitrogen, oxygen, argon

(d) Much of the carbon dioxide present in the Earth's early atmosphere dissolved into the oceans.

This led to the formation of compounds including calcium carbonate, $CaCO_3$.

Some of the calcium carbonate reacted with magnesium ions to form dolomite, $CaMg(CO_3)_2$.

Complete the **ionic** equation for the reaction of calcium carbonate with magnesium ions.

(2)

2 $CaCO_3$ + Mg^{2+} → $CaMg(CO_3)_2$ + Ca^{2+}

dolomite

(e) **P** and **Q** are both mixtures of gases.
One has the same composition as the early atmosphere and the other has the same composition as the current atmosphere.

Tests are carried out on gas mixtures **P** and **Q**.

The test for carbon dioxide is to bubble the gas into limewater; if carbon dioxide is present calcium carbonate is formed.

The results of the tests are shown in Figure 6.

test	result with gas mixture P	result with gas mixture Q
bubble gas into limewater	white precipitate forms after 4 minutes	white precipitate forms after 10 seconds
place burning splint into gas mixture	splint continues to burn	splint immediately goes out

Figure 6

Explain, using the data in Figure 6, which gas mixture represents the early atmosphere.

(2)

Mixture Q. Carbon dioxide turns limewater milky. In the early atmosphere there is a high percentage of CO_2, so the rate of reaction for a gas mixture representing the early tmosphere should be faster. Burning splint will continue to burn in oxygen but goes off in the absence of oxygen. The early atmosphere has little or no oxygen.

*(c) Petrol and diesel are used as fuels for cars.
The emissions from three similar sized cars were investigated.
The first car was the oldest, had no catalytic converter and used petrol.
The other two cars were only a few years old.
One of these was fitted with a catalytic converter and used petrol and the other car used diesel.

Figure 9 shows the emissions in grams for each kilometre travelled by these three cars.

	emissions in g km^{-1}			
	carbon monoxide	**nitrogen oxides**	**carbon dioxide**	**carbon particulates**
car with no catalytic converter using petrol	1.60	0.09	180	0.00
car with catalytic converter using petrol	0.67	0.02	180	0.00
car using diesel	0.05	0.19	130	0.02

Figure 9

Discuss and compare the impact on the environment of the emissions from these three cars using the information from Figure 9.

(6)

Cars using petrol release more carbon dioxide than cars using diesel. CO_2 is a greenhouse gas which can cause global warming. Carbon monoxide is also released, which binds to haemoglobin and affect the ability of carrying oxygen. A catalytic converter can reduce emission from 1.60 g km^{-1} to 0.67 g km^{-1}. In the car using diesel, emission of CO_2 and CO are lower but carbon particulates are emitted. Carbon particulates can cause global dimming and affect human health by irritating linings of the lungs and causing asthma. Nitrogen oxides, which cause acid rain and photochemical smog, is released the most in the car using diesel.

TOTAL FOR PAPER IS 23 MARKS