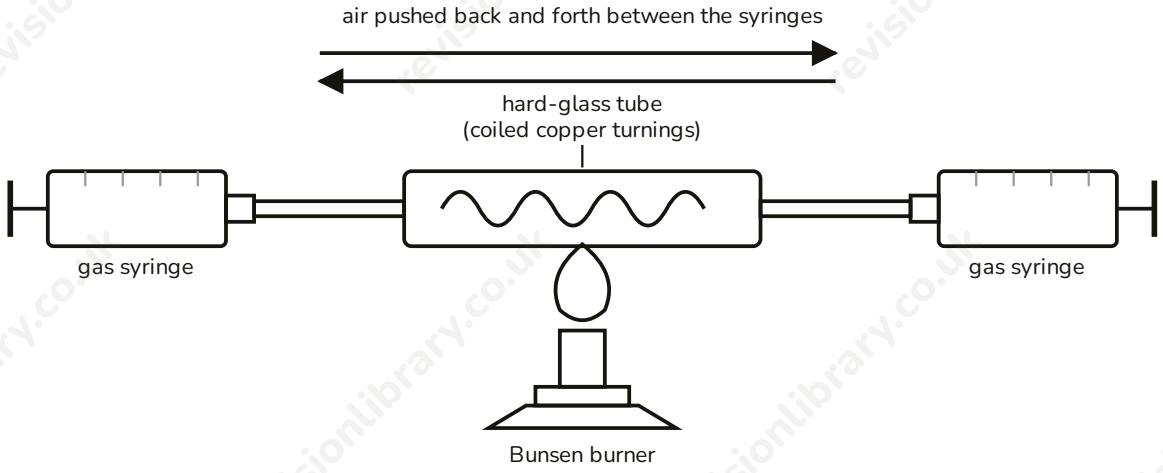
2.5 The Earth and its Atmosphere: Test Pack

Calculator allowed · about 40 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Practical investigation: measuring the percentage of oxygen in air. Aaliyah investigates the percentage of oxygen in air using excess copper heated strongly in a horizontal glass tube connected to two gas syringes. Air is passed back and forth over the heated copper until the volume of gas in the syringes stops changing.



(a) Name the piece of apparatus used to measure the volume of gas in this practical. **(1)**

(b) State the gas that makes up most of the volume of gas remaining in the syringes at the end of the experiment. **(1)**

(c) Complete the word equation for the reaction that occurs: copper + oxygen -> _____ **(1)**

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(d) Explain why the copper is heated strongly and why the air is passed back and forth between the syringes several times. **(2)**

(e) Aaliyah recorded a starting volume of 100 cm^3 of air. Once the tube had cooled fully to room temperature, the final volume of gas remaining was 79 cm^3. Calculate the percentage of oxygen in the air sample. Show your working. **(3)**

(f) Explain, in terms of the gases present, why the volume of gas stops decreasing even though unreacted copper remains in the tube. **(2)**

(g) Aaliyah read the final volume before the apparatus had fully cooled to room temperature. Explain the effect this would have on the calculated percentage of oxygen. **(2)**

(h) Suggest one improvement to the method that would make the calculated percentage of oxygen more accurate. **(2)**

2 Name one example of an air pollutant produced by burning fossil fuels that is not carbon dioxide.

(1)

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3 Describe briefly what is meant by the greenhouse effect on Earth.

(2)

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4 Callum sets up an experiment to test how the amount of water vapour in a sealed container affects the growth of mould on bread. Identify the independent variable, the dependent variable and two control variables Callum should keep the same.

(3)

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5 Priya heats a sample of limestone (a rock made mostly of calcium carbonate) strongly in a test tube. She collects the gas given off and tests it using limewater. The limewater turns cloudy. Name the gas collected and write a simple word equation for the reaction happening when calcium carbonate breaks down on heating.

(a) Name the gas collected. **(1)**

(b) Write a simple word equation for the thermal decomposition of calcium carbonate. **(3)**

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6 A student plans an experiment to test whether acid rain damages marble statues faster than plain rain. Outline a simple practical method they could use in the laboratory. Include: the independent variable, the dependent variable, and two control variables they must keep the same. Also describe briefly one safety or ethical consideration for this experiment.

(a) State the independent variable. **(1)**

(b) State the dependent variable. **(1)**

(c) Give two control variables to keep the same and why. **(1)**

(d) Describe one safety or ethical consideration. **(1)**

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7 24 g of magnesium ribbon is burned completely in oxygen from the air. The magnesium oxide produced has a mass of 40 g.

(a) Calculate the mass of oxygen from the air that reacted with the magnesium. **(2)**

(b) Explain, in terms of the atmosphere, where this oxygen came from. **(1)**

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8 Human activity has increased the concentration of certain gases in the atmosphere since the industrial revolution, enhancing the natural greenhouse effect.

(a) Name two greenhouse gases whose atmospheric concentration has increased mainly due to human activity since the industrial revolution. **(2)**

(b) Explain how increasing the concentration of these gases in the atmosphere leads to global warming (the enhanced greenhouse effect). **(2)**

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Mark scheme · 2.5 The Earth and its Atmosphere: Test Pack

Question 1

(a) gas syringe — **B1**

(a) Answer: **Gas syringe**

(b) nitrogen — **B1**

(b) Answer: **Nitrogen**

(c) copper oxide — **B1**

(c) Answer: **Copper oxide**

(d) heating strongly provides the energy needed for the copper to react with oxygen at a reasonable rate (oe) — **M1**

(d) passing the air back and forth ensures all of the air (and all of the oxygen within it) comes into contact with the hot copper, so the reaction goes to completion (oe) — **M1**

(d) Answer: **Strong heating lets the copper react readily with oxygen; passing the air back and forth repeatedly ensures every part of the air sample contacts the copper so all the oxygen is removed.**

(e) decrease in volume = 100 - 79 = 21 cm^3 — **M1**

(e) percentage = (21 / 100) x 100 — **M1**

(e) 21% cao — **A1**

(e) Answer: **21%**

(f) all of the oxygen originally present in the air has now reacted with the copper — **B1**

(f) the remaining gas is mostly (unreactive) nitrogen, which does not react with copper (oe) — **B1**

(f) Answer: **All the oxygen has already reacted; the leftover gas is mainly nitrogen, which will not react with the copper even though copper remains.**

(g) a warm gas has a larger volume than the same gas at room temperature (gas expands on heating), so the final volume reading would be higher than it should be — **M1**

(g) this gives a smaller calculated decrease in volume, so the calculated percentage of oxygen would be an underestimate (too low) ft from reasoning — **M1**

(g) Answer: **The percentage of oxygen calculated would be too low (an underestimate).**

(h) a valid improvement, e.g. allow the apparatus to cool fully to room temperature before taking the final reading; check the apparatus is gas-tight with no leaks; use a larger starting volume of air and repeat/average results — **B1**

(h) a linked explanation of why this improves accuracy (oe) — **B1**

(h) Answer: **e.g. Allow the tube to cool completely to room temperature before reading the final volume, because this removes the effect of gas expansion on the reading.**

Question 2

eg nitrogen oxides, sulphur dioxide, particulate matter (soot), carbon monoxide, oe — **B1**

Answer: **Nitrogen oxides**

Question 3

greenhouse gases absorb and trap heat radiated from Earth's surface — **B1**

this warms the planet keeping it warmer than it would be without the gases — **B1**

Answer: **Greenhouse gases absorb heat radiated from the surface and trap it, warming the planet.**

Question 4

independent variable: amount of water vapour (eg volume of water or humidity level) — **B1**

dependent variable: amount of mould growth (eg area or mass of mould) — **B1**

two control variables: temperature and type/age of bread or light level or container size; any two named and kept same, oe — **B1**

Answer: **Independent: amount of water vapour in the container. Dependent: amount of mould growth on the bread. Controls: temperature and same type of bread (or light level and container size), eg keep temperature and bread type constant.**

Question 5

(a) carbon dioxide cao — **B1**

(a) Answer: **Carbon dioxide**

(b) calcium carbonate -> calcium oxide + carbon dioxide (correct words in either order) — **M1**

(b) word equation correct cao — **A1**

(b) mention of heating/thermal decomposition (eg 'on heating' or 'decomposes') — **B1**

(b) Answer: **Calcium carbonate -> calcium oxide + carbon dioxide**

Question 6

(a) type of rainwater (acidified sample versus plain rain or water) cao — **B1**

(a) Answer: **Type of rainwater (acidified vs plain).**

(b) amount of marble dissolved or change in mass or visible surface damage measured (eg mass loss in g) cao — **B1**

(b) Answer: **Mass loss of the marble sample (g) or degree of surface damage measured.**

(c) control variable example 1: same size and type of marble sample to ensure comparable surface area — **B1**

(c) Answer: **Keep marble sample size/type the same and keep exposure time the same.**

(d) wear eye protection and gloves and handle acids safely or avoid using real outdoor monuments/obtain permission if field testing — **B1**

(d) Answer: **Wear eye protection and gloves when handling acid solutions; do not test on real monuments without permission.**

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Question 7

(a) use conservation of mass: mass of oxygen = mass of magnesium oxide - mass of magnesium = 40 - 24 **M1**

(a) 16 g cao **A1**

(a) Answer: **16 g**

(b) it was oxygen gas from the air surrounding the magnesium (oxygen makes up about 21% of the air) (oe) **B1**

(b) Answer: **It came from oxygen gas in the surrounding air, which makes up about 21% of the atmosphere.**

Question 8

(a) carbon dioxide **B1**

(a) methane (accept nitrous oxide) **B1**

(a) Answer: **Carbon dioxide and methane**

(b) more greenhouse gas molecules are present, so more of the infrared radiation emitted by the Earth's surface is absorbed **M1**

(b) more of this energy is re-radiated back towards the surface/trapped within the atmosphere-surface system, increasing average global temperature **M1**

(b) Answer: **Higher concentrations of greenhouse gases absorb more outgoing infrared radiation and re-radiate more of it back towards the Earth, trapping extra energy and raising the average global temperature.**

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