



K10E The Earth and its Atmosphere: Depth and Practice

AQA AQA KS3 Science - Chemistry · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Name the two main gases in Earth's atmosphere by percentage of volume.

(1)

- 2** Complete the sentence. Carbon dioxide is important in the atmosphere because it absorbs and helps to trap thermal energy from the Sun. Give two other reasons why carbon dioxide is important on Earth.

(3)

- 3** Priya heats a sample of limestone (a rock made mostly of calcium carbonate) gently 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)

4 A student measures the percentage of oxygen in a sealed container before and after placing a small lit candle inside until the flame goes out. Before the candle the oxygen level is 21.0%. After it goes out the oxygen level is 19.2%. Calculate the percentage of oxygen used and suggest one reason the measurement might not be perfectly accurate.

(a) Calculate the percentage of oxygen used. (2)

(b) Suggest one reason the measurement might not be perfectly accurate. (2)

5 State what is meant by the greenhouse effect in one sentence.

(2)

6 Kwame investigates how adding water to a jar of soil affects the release of carbon dioxide from the soil over one hour. He keeps the soil mass the same and measures CO₂ with a sensor every 15 minutes. Identify the independent variable, the dependent variable and two control variables Kwame should keep the same.

(3)

7 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)

8 Human activities have changed the composition of the atmosphere over the last 200 years. Evaluate the statement: "Reducing the use of fossil fuels is the most effective way to slow down harmful changes in the atmosphere." In your answer, consider at least two human activities that change atmospheric composition and give reasons for and against the statement before reaching a conclusion.

(6)

Mark scheme · K10E The Earth and its Atmosphere: Depth and Practice

Question 1

- **B1** nitrogen and oxygen cao
- Answer: **Nitrogen and oxygen**

Question 2

- **B1** used by plants for photosynthesis
- **B1** produced by respiration/combustion (accept either as a reason for cycling)
- **B1** dissolves in oceans and affects acidity/part of carbon cycle
- Answer: **It is used by plants for photosynthesis; it is produced by respiration and burning fuels; it dissolves in oceans and affects acidity.**

Question 3

- (a) **B1** carbon dioxide cao
- (a) Answer: **Carbon dioxide**
- (b) **M1** calcium carbonate → calcium oxide + carbon dioxide (correct words in either order)
- (b) **A1** word equation correct cao
- (b) **B1** mention of heating/thermal decomposition (eg 'on heating' or 'decomposes')
- (b) Answer: **Calcium carbonate → calcium oxide + carbon dioxide**

Question 4

- (a) **M1** subtraction 21.0 - 19.2
- (a) **A1** 1.8% cao
- (a) Answer: **1.8%**
- (b) **B1** sensor calibration drift or sensor not accurate
- (b) **B1** some oxygen dissolved in water or escaped or flame did not consume uniformly (any reasonable experimental error)
- (b) Answer: **Possible sensor inaccuracy or oxygen loss to the environment such as dissolving into water or leaking.**

Question 5

- **B1** greenhouse gases trap heat/thermal energy radiated from Earth leading to warming of the surface
- **B1** must mention trapping or absorbing outgoing infrared or warming effect
- Answer: **Greenhouse gases absorb and trap infrared radiation from Earth, causing the surface to be warmer than it would be otherwise.**

Question 6

- **B1** independent variable = volume/amount of water added to the soil
- **B1** dependent variable = concentration or amount of carbon dioxide measured (eg CO₂ reading)
- **B1** two control variables = keep soil mass the same and keep temperature constant (accept eg same soil type and same temperature or same container and same measurement interval)
- Answer: **Independent variable: amount of water added. Dependent variable: CO₂ concentration measured. Controls: soil mass kept the same and temperature kept constant (also same soil type and same measurement times).**

Question 7

- (a) **B1** type of rainwater (acidified sample versus plain rain or water) cao
- (a) Answer: **Type of rainwater (acidified vs plain).**
- (b) **B1** amount of marble dissolved or change in mass or visible surface damage measured (eg mass loss in g) cao
- (b) Answer: **Mass loss of the marble sample (g) or degree of surface damage measured.**
- (c) **B1** control variable example 1: same size and type of marble sample to ensure comparable surface area
- (c) Answer: **Keep marble sample size/type the same and keep exposure time the same.**
- (d) **B1** wear eye protection and gloves and handle acids safely or avoid using real outdoor monuments/obtain permission if field testing
- (d) Answer: **Wear eye protection and gloves when handling acid solutions; do not test on real monuments without permission.**

Question 8

- **Level 1** (1-2): Basic points about human activities and one relevant effect on the atmosphere. Limited reasoning and a simple or unsupported conclusion if present.
- **Level 2** (3-4): Clear description of at least two human activities that change the atmosphere and some balanced reasoning for and against the statement. A partially supported conclusion is given.
- **Level 3** (5-6): Detailed evaluation showing understanding of how activities (for example burning fossil fuels, deforestation, agriculture) alter atmospheric gases, well balanced weighing of arguments for and against reducing fossil fuel use, and a justified conclusion with suggestions of other effective measures where appropriate.
- **Indicative content:**
 - Human activities that change composition: burning fossil fuels increases CO₂; deforestation reduces CO₂ uptake; intensive agriculture releases methane and nitrous oxide; industry and transport emit pollutants and particulates.
 - Arguments for reducing fossil fuel use: directly reduces CO₂ emissions which drive global warming; reduces air pollutants that harm health; large-scale impact if adopted widely.
 - Arguments against it being the only solution: other gases like methane and nitrous oxide are significant and come from agriculture and waste; existing emissions already in atmosphere; need for adaptation and carbon sinks; economic and practical barriers.
 - Possible other measures: restoring forests, reducing methane from agriculture, improving energy efficiency, developing carbon capture, policy and lifestyle changes.
 - Expected conclusion: reducing fossil fuels is very important but most effective as part of a suite of measures; best answers weigh evidence and propose combined strategies.