K10D The Earth and its Atmosphere: Exam Drill

AQA AQA KS3 Science · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Name the two main gases that make up most of Earth's atmosphere.

(1)

2 Give one reason why oxygen is essential for most animals on Earth.

(3)

3 Priya collects samples of air from a school lab and from a busy road. She tests both samples for the presence of carbon dioxide, oxygen and nitrogen. Write which gas you would expect to be higher in the busy road sample compared with the lab sample, and give a short reason for each of the three gases listed.

(3)

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

(2)

5 The table shows average atmospheric carbon dioxide concentration (parts per million, ppm) measured at a remote site over three years.

Year: 2018, 2019, 2020

CO2 concentration (ppm): 405.0, 408.2, 412.5

a) Calculate the increase in ppm from 2018 to 2020. b) Calculate the average yearly increase over the two-year period (give your answer to one decimal place).

(a) Increase in ppm from 2018 to 2020. **(1)**

.....

(b) Average yearly increase over the two years. **(2)**

.....

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6 A scientist plots a line graph of global average temperature anomaly (degrees C) against year for a 20-year period and finds the line slopes upward. Describe two conclusions that can be drawn from an upward sloping line in this context. Each conclusion must relate to the data shown.

(4)

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7 A sealed 2.0 L bottle contains air weighing 2.8 g at room temperature. Calculate the density of the air in g/L and in kg/m^3. (1 L = 0.001 m^3). Give both answers with correct units.

(a) Density in g per L. **(1)**

.....

(b) Density in kg per m^3. **(2)**

.....

8 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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9 Explain how condensation in the atmosphere leads to cloud formation. Include what happens to water vapour and any key steps.

(3)

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10 Write down the simple word equation for the combustion of methane (natural gas).

(2)

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11 Evaluate whether governments should prioritise reducing carbon dioxide emissions or protecting forests when trying to limit climate change. In your answer, give evidence for both sides and reach a supported conclusion.

(6)

12 List three stages of the carbon cycle that move carbon between the atmosphere and living organisms. Give a short phrase for each stage.

(3)

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13 Between 1990 and 2010 a country reduced its coal use and cut CO2 emissions from 800 million tonnes to 640 million tonnes. Calculate the percentage reduction in CO2 emissions to the nearest whole percent.

(3)

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14 A long-term monitoring station records the following average monthly CO2 values (ppm) for four months: April 412.0, May 410.5, June 411.0, July 416.5. One value appears anomalous compared with a seasonal pattern of spring decreases then a gradual summer increase. Identify the anomalous value and give one possible experimental reason for this anomaly.

(2)

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15 Design a simple fair test to investigate how the temperature of water affects the rate at which carbon dioxide is released from a solution of effervescent tablet in water. In your answer state the independent variable, dependent variable, two controls and a step-by-step outline of the method (4 steps).

(4)

16 A factory releases 1200 kg of CO_2 in one week. If a nearby project plants trees that absorb 50 kg of CO_2 each per year, how many trees are needed to absorb the factory's weekly CO_2 release in one year? Assume tree uptake is constant and ignore other sinks.

(2)

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

(1)

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18 Stretch: Explain how the composition of the atmosphere has changed since the early Earth and one consequence of that change for life on the planet.

(4)

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Question 1

- **B1** Nitrogen and oxygen, or N2 and O2, cao
- Answer: **Nitrogen and oxygen**

Question 2

- **M1** statement that animals use oxygen for respiration (cellular respiration)
- **A1** explanation that respiration releases energy from food for movement and body processes
- **B1** example linking oxygen use to a named process or effect, eg breathing or muscles working, oe
- Answer: **Animals use oxygen for respiration; respiration releases energy from food so animals can move and keep warm; for example breathing supplies oxygen so muscles can work.**

Question 3

- **B1** carbon dioxide higher at busy road with reason: vehicle exhausts release CO2
- **B1** oxygen slightly lower at busy road with reason: oxygen used in combustion in engines
- **B1** nitrogen about the same with reason: nitrogen is not greatly changed by traffic emissions
- Answer: **CO2 higher (car exhausts release CO2); O2 slightly lower (combustion uses O2 in engines); N2 about the same (nitrogen is abundant and not greatly affected by traffic).**

Question 4

- **B1** 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
- Answer: **Greenhouse gases absorb heat radiated from the surface and trap it, warming the planet.**

Question 5

- (a) **B1** 412.5 - 405.0 = 7.5 ppm cao
- (a) Answer: **7.5 ppm**
- (b) **M1** method: 7.5 / 2
- (b) **A1** 3.8 ppm per year cao
- (b) Answer: **3.8 ppm per year**

Question 6

- **M1** conclusion that temperature anomaly increases over the 20-year period (trend upward)
- **A1** explain that average temperatures are becoming higher compared with the baseline
- **M1** conclusion that recent years are generally warmer than earlier years in the plot
- **A1** explain that this may indicate a warming trend in the climate record shown
- Answer: **The temperature anomaly rises over the period, showing average temperatures are higher than earlier years; recent years are generally warmer than earlier ones, indicating a warming trend.**

Question 7

- (a) **B1** 2.8 g / 2.0 L = 1.4 g/L cao
- (a) Answer: **1.4 g/L**
- (b) **M1** convert 1.4 g/L to kg/m^3: 1.4 g/L = 1.4 kg/m^3 or show conversion via 1.4 g/L -> 1.4 g per 0.001 m^3
- (b) **A1** 1.4 g/L = 1.4 kg/m^3 (since 1 g/L = 1 kg/m^3) cao
- (b) Answer: **1.4 kg/m^3**

Question 8

- **B1** 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
- 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 9

- **M1** water vapour cools as air rises or moves to cooler regions
- **M1** vapour condenses into tiny water droplets on condensation nuclei (dust or salt)
- **A1** these droplets cluster to form visible clouds
- Answer: **Water vapour cools as air rises, causing the vapour to condense onto dust or salt particles; many tiny droplets form and cluster together to make visible clouds.**

Question 10

- **M1** methane + oxygen -> carbon dioxide + water or equivalent word order
- **A1** statement that combustion produces CO2 and water (accept: methane + oxygen -> carbon dioxide + water)
- Answer: **methane + oxygen -> carbon dioxide + water**

Question 11

- **Level 3** (5-6): A balanced evaluation with clear evidence for both reducing CO2 emissions and protecting forests, showing understanding of strengths and limits of each approach and a justified conclusion.
- **Level 2** (3-4): Some evaluation with evidence for both sides but limited linkage or a weak conclusion.
- **Level 1** (1-2): Simple statements or assertions about one or both options with little evidence and no clear conclusion.
- **Indicative content:**
  - Points for reducing CO2 emissions: direct reduction of greenhouse gas sources, policies on energy efficiency, transport electrification; evidence could include reduced emissions leading to lower atmospheric CO2 growth.
  - Points for protecting forests: forests absorb CO2 (carbon sink), protect biodiversity, prevent soil erosion; evidence includes amount of carbon stored in trees and soil and faster impact locally.
  - Limits: reducing emissions can be costly and slow to implement; protecting forests can be undermined by deforestation and fires and does not stop ongoing emissions from fossil fuels.
  - Consider combined approach: both are important together; short-term measures to cut emissions plus long-term forest protection and restoring ecosystems.
  - Supported conclusion should weigh evidence and justify a recommended priority or argue for integrated policies.

Question 12

- **B1** photosynthesis: plants take in CO2 to make sugars
- **B1** respiration: organisms release CO2 when they respire
- **B1** decomposition: dead organisms and waste are broken down, releasing CO2
- Answer: **Photosynthesis (plants take in CO2); respiration (organisms release CO2); decomposition (dead matter broken down releasing CO2).**

Question 13

- **M1** method: (800 - 640) / 800 x 100
- **A1** 20% cao
- **B1** work shown or statement of calculation to nearest whole percent
- Answer: **20%**

Question 14

- **B1** identify anomalous value: July 416.5 (an unexpectedly large jump that does not fit the gradual increase seen from May to June)
- **B1** give experimental reason: instrument calibration error, local contamination near sampling inlet, or data entry error, oe
- Answer: **Anomalous value: July 416.5 ppm. Possible reason: instrument calibration error or local contamination at sampling causing an unexpectedly high reading.**

Question 15

- **B1** independent variable: temperature of water named with range or values
- **B1** dependent variable: rate of CO2 release measured as time to finish fizzing or volume of gas per time
- **M1** two controls named such as same mass of tablet, same volume of water, same container size, same stirring
- **A1** method with 4 clear steps that would produce fair comparable results
- Answer: **Independent: water temperature. Dependent: rate of CO2 release (eg time for tablet to dissolve). Controls: same mass of tablet and same volume of water. Method: 1) Measure and pour equal volumes of water at set temperatures into identical beakers. 2) Add a tablet of identical mass and start a stopwatch. 3) Record time until fizzing stops or CO2 collection amount each 10 s. 4) Repeat for each temperature and average results.**

Question 16

- **M1** convert weekly release to annual: 1200 kg x 52 = 62400 kg
- **A1** divide by 50 -> 1248 trees cao
- Answer: **1248 trees**

Question 17

- **B1** eg nitrogen oxides, sulphur dioxide, particulate matter (soot), carbon monoxide, oe
- Answer: **Nitrogen oxides**

Question 18

- **M1** statement that early atmosphere had little oxygen and more volcanic gases like CO2, water vapour and nitrogen
- **M1** statement that photosynthetic organisms increased oxygen and reduced CO2 over time
- **A1** consequence: oxygen allowed evolution of aerobic respiration and more complex life
- **A1** consequence: reduction in CO2 helped climate stabilise or allowed formation of ozone protecting life from UV, oe
- Answer: **Early atmosphere had little oxygen and more CO2 and water vapour from volcanoes; photosynthesis increased oxygen and lowered CO2 over time, allowing aerobic respiration and the evolution of more complex life and contributing to ozone formation that protected life from UV.**