2.29 Climate Change and Atmospheric Pollutants: 30-minute Pack

AQA 8464 · Calculator allowed · about 30 minutes

Total Marks

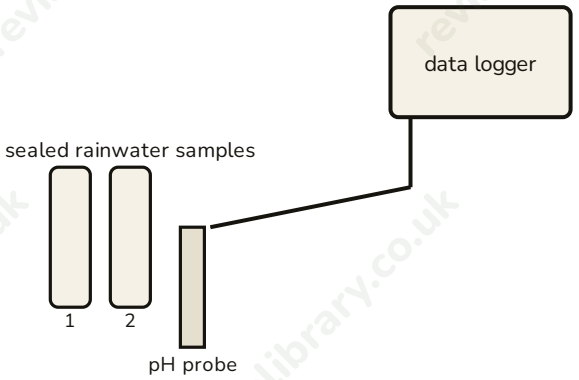
Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Aaliyah investigated whether rainwater collected near a busy road is more acidic than rainwater collected in a rural area, away from traffic. She used a calibrated pH probe to measure the pH of five rainwater samples from each location. Her results are shown in Table 1.

Table 1

Sample	Busy road pH	Rural area pH
1	5.1	6.2
2	5.3	6.1
3	3.9	6.3
4	5.2	6.0
5	5.0	6.2



(a) State the independent variable in this investigation. **(1)**

(b) State one variable that should be controlled to make this a valid comparison between the two locations. **(1)**

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(c) Identify the anomalous result in Table 1, and calculate the mean pH of the busy-road samples, excluding this anomaly. Give your answer to 2 decimal places. **(3)**

(d) Explain why Aaliyah took five repeat readings at each location. **(2)**

(e) The mean pH of the rural samples was higher than the mean pH of the busy-road samples. Explain why rainwater near a busy road is more acidic, referring to a pollutant gas released by vehicle engines. **(2)**

(Total for Question 1 is 9 marks)

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2 Particulates (soot) are solid particles released when fuels burn, especially during incomplete combustion.

(a) State one health problem that can be caused by breathing in particulates from burning fuels. **(1)**

(b) Explain what is meant by 'global dimming', and how particulates cause it. **(2)**

(Total for Question 2 is 3 marks)

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3 The high temperatures inside a car engine can cause a pollutant gas to form that is not present in significant amounts in unburnt fuel or clean air.

(a) Explain how oxides of nitrogen are formed inside a car engine when fuel is burned. **(2)**

(b) Write a balanced symbol equation for nitrogen reacting with oxygen to form nitrogen monoxide. **(1)**

(c) State one health problem associated with breathing air polluted with oxides of nitrogen. **(1)**

(d) Explain one environmental problem, other than acid rain, caused by oxides of nitrogen in the atmosphere. **(2)**

(Total for Question 3 is 6 marks)

4 Rising global temperatures can affect where species live and how successfully crops can be grown.

(a) Explain how climate change could affect the distribution of species (living organisms) in the UK. **(3)**

(b) Explain one way climate change could affect agriculture (crop growing) in the UK. **(2)**

(Total for Question 4 is 5 marks)

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Mark scheme · 2.29 Climate Change and Atmospheric Pollutants: 30-minute Pack

Question 1

(a) the location where the rainwater sample was collected (busy road or rural area) oe **B1**

(a) Answer: The location where the rainwater sample was collected

(b) any sensible control variable, e.g. same type of collection container; same collection time period; samples tested using the same calibrated pH probe; same volume of sample tested oe **B1**

(b) Answer: Any sensible control variable, e.g. using the same type of collection container and the same calibrated pH probe for every sample

(c) sample 3 (pH 3.9) identified as the anomalous result oe **M1**

(c) (5.1 + 5.3 + 5.2 + 5.0) / 4 oe **M1**

(c) 5.15 cao **A1**

(c) Answer: Anomaly: sample 3 (pH 3.9). Mean pH of remaining samples = 5.15

(d) repeats allow anomalous results to be identified (and excluded) oe **B1**

(d) they allow a mean to be calculated, which is more reliable than relying on a single reading oe **B1**

(d) Answer: Repeats allow anomalous results to be spotted and excluded, and allow a mean to be calculated, which is more reliable than a single reading

(e) vehicle engines burn fuel and release oxides of nitrogen (accept sulfur dioxide from impurities in the fuel) oe **B1**

(e) these gases dissolve in atmospheric water and react (with oxygen) to form dilute nitric acid (and/or sulfuric acid), lowering the pH of the rainwater oe **B1**

(e) Answer: Vehicle engines release oxides of nitrogen (and sulfur dioxide), which dissolve in atmospheric water and react to form dilute nitric acid (and/or sulfuric acid), lowering the pH of the rainwater

Question 2

(a) respiratory problems/damage to the lungs oe (accept named example, e.g. asthma, bronchitis) **B1**

(a) Answer: Respiratory problems/lung damage (e.g. asthma or bronchitis)

(b) particulates released into the atmosphere reflect/absorb sunlight back into space oe **B1**

(b) this reduces the amount of sunlight reaching the Earth's surface, an effect called global dimming oe **B1**

(b) Answer: Particulates in the atmosphere reflect sunlight back into space, reducing the amount reaching the Earth's surface; this effect is called global dimming

Question 3

(a) the high temperature inside the engine (from burning fuel) causes nitrogen and oxygen from the air to react together oe **B1**

(a) forming oxides of nitrogen, e.g. nitrogen monoxide (NO) oe **B1**

(a) Answer: The high temperature inside the engine causes nitrogen and oxygen from the air to react together, forming oxides of nitrogen such as nitrogen monoxide

(b) $N_2 + O_2$ -> 2NO cao **B1**

(b) Answer: $N_2 + O_2$ -> 2NO

(c) respiratory problems/irritation of the lungs and airways oe (accept worsens asthma) **B1**

(c) Answer: Respiratory problems/irritation of the lungs and airways (can worsen asthma)

(d) oxides of nitrogen react with other pollutants/hydrocarbons in sunlight oe **B1**

(d) forming photochemical smog, which reduces air quality oe (accept contributes to ground-level ozone formation) **B1**

(d) Answer: Oxides of nitrogen react with other pollutants in sunlight, forming photochemical smog, which reduces air quality

Question 4

(a) as temperatures rise, the climate further north/at higher latitudes becomes suitable for species that previously could only survive further south oe **B1**

(a) so the range of some species, e.g. certain insects, birds or plants, shifts or expands northwards (or to higher altitudes) oe **B1**

(a) species that cannot migrate or adapt quickly enough may decline in number or become locally extinct oe **B1**

(a) Answer: As temperatures rise, conditions further north become suitable for species previously limited to warmer areas, so their range shifts north; species that cannot migrate or adapt may decline or die out locally

(b) changes in temperature and rainfall patterns affect which crops can be successfully grown in a given region oe **B1**

(b) e.g. increased frequency of drought or flooding can reduce crop yields, or warmer temperatures could allow new crops to be grown that previously could not survive oe **B1**

(b) Answer: Changing temperature and rainfall patterns affect which crops grow well; for example, more frequent drought or flooding can reduce yields, though warmer conditions might allow new crops to be grown

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