AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.9.1 THE COMPOSITION AND EVOLUTION OF THE EARTH'S ATMOSPHERE (PACK 1)

SCORE	PERCENTAGE
/163	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

(a) 80

1

(b) volcanoes

allow ammonia
allow meteorites

1

(c) ⇌

ignore any extra words

1

(d) rate

allow speed
allow pace

*do **not** accept time*
*do **not** accept amount*
*do **not** accept level*
*do **not** accept point*

1

(e) a mixture designed as a useful product

1

(f) bar for K to 5.8%

allow ± ½ a small square

1

(g) $\frac{0.225 \times 100}{3.0}$

1

(h) use has increased

1

(increase is) less in country B
or (increase is) less in country D

allow (increase is) more in country A
***or** (increase is) more in country C*

1

example of data

1

[10]

Q2.

(a) methane

1

(b) any **two** examples from:

allow effects from the same bullet point

STEMUP.CO.UK

- rising sea levels
- melting ice
- agricultural problems
- extremes of weather
- loss of habitats

ignore global warming
ignore acid rain
ignore global dimming
*do **not** accept reference to ozone*

2

(c) $\frac{6.0}{4.1} \times 0.0235$

1

= 0.0344(kg)

allow correct rounding
allow calculator reading

if no mark awarded:
*allow **1** mark for 34.4 or 0.344*
*allow **2** marks for 34.4 g*

1

*an answer of 0.0344(kg) scores **2** marks*

(d) use less plastic
or
use recycled plastic

allow carbon capture
ignore any reference to energy / fuels

1

(e) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to give a clear account.

5–6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

nitrogen increased
- because volcanoes produced nitrogen
- because (denitrifying) bacteria produced nitrogen
- because ammonia was converted to nitrogen

oxygen increased
- because algae and plants produced oxygen
- by photosynthesis

STEMUP.CO.UK

carbon dioxide decreased

- because algae and plants used carbon dioxide
- by photosynthesis
- because oceans formed and carbon dioxide dissolved in the water
- because carbon dioxide formed carbonates, which precipitate as sediments or formed sedimentary limestone rocks
- because algae / plants and animals formed fossil fuels / coal / crude oil / natural gas

[12]

Q3.

(a) 4.6×10^9 years

1

(b) $$\frac{780\,000 - 27\,000}{27\,000} \times 100$$

1

$$= 2788.\dot{8}$$

1

= 2800 (%)

allow an answer from an incorrect calculation correctly given to 2 significant figures

1

*an answer of 2800 (%) scores **3** marks*
*allow 2788.88889 (%) or correctly rounded answer for **2** marks*

(c) incomplete combustion

1

(d) volcanoes (on early Earth) released water vapour

1

(water vapour then) condensed (to form the oceans)

1

allow steam for water vapour

(e) ice caps have melted

[8]

Q4.

(a) 0.1%

1

(b) bar correctly drawn to ±½ square

1

(c) argon

1

(d) increased

1

STEMUP.CO.UK

data values to justify

1

(e) electricity and industry are equal

1

electricity and industry are highest

1

transport is lowest

1

electricity or industry is double transport

1

(f) use of renewable energy sources
or
specific example

1

(g) limited investment in renewable technology
or
disagreement between countries

accept specific reason which relates to response to (f), eg insufficient sunlight

1

[11]

Q5.

(a) any **two** from:

- Earth's atmosphere more / mostly nitrogen

  allow converse
- Earth has more oxygen

  allow Venus has no oxygen
- Earth has (much) less carbon dioxide

  allow converse

2

(b) (carbon dioxide) respiration / combustion / volcanic eruptions / decomposition / animals

allow (carbon dioxide) breathed out

1

(oxygen) plants / algae / producers / photosynthesis

1

(c) evaporation / transpiration

allow (enters atmosphere through) exhalation

1

precipitation / rain / snow / sleet / condensation / freezing

1

(d) global warming

1

(e) any **two** from:

STEMUP.CO.UK

- sea-level rise **or** high tides travel further inland
- melting ice caps
- flooding
- less land for farming
- changes to which plants will grow (due to climate change)
- (increased) coastal erosion
- extreme weather
- change in rainfall
- drought
- desertification
- loss of habitat
- temperature stress (for humans and wildlife)
- decreased food-producing capacity of some regions

ignore global warming

ignore temperature change unqualified

2

[9]

Q6.

(a) both have 6 electrons

1

both have 6 protons

1

carbon-12 contains 6 neutrons **but** carbon-14 contains 8 neutrons

allow carbon-14 has 2 more neutrons

1

(b) $\frac{17\,190}{5730} = 3$ (half lives)

1

(20 × 2 × 2 × 2 =) 160

*an answer of 160 scores **2** marks*

1

(c) carbon-14 is in (some) carbon dioxide (in air)

1

carbon-14 / carbon dioxide taken in (by plants) in photosynthesis

1

becomes part of glucose / starch / carbohydrate

1

plant eaten by humans / herbivores / passed up food chain

allow carbon compounds passed up food chain

1

starch is digested
or
glucose diffuses into cells
or
glucose stored as glycogen in cells

1

STEMUP.CO.UK

[10]

Q7.

(a) dissolved

in this order

1

carbonates

1

(b) Photosynthesis

1

(c) water

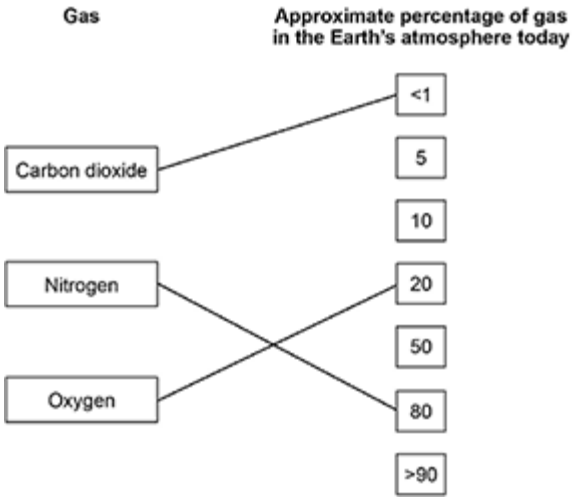
In this order

oxygen

both needed for the mark

1

(d)



Extra lines from Gas negate the mark

3

(e) increases global temperatures

1

(f) use renewable energy supplies

1

(g) correct reason, eg:

- renewable technology underdeveloped
- disagreement between countries

1

[10]

Q8.

(a) sediment / limestone formation from carbonates

1

(b) short wavelength radiation

STEMUP.CO.UK

1

passes through atmosphere to Earth's surface

1

Earth's surface radiates different wavelengths

1

which are absorbed by greenhouse gases to produce temperature increase

allow CH_4 H_2O or CO_2

1

(c) 13.8 %

allow values in the range 13.0 to 15.0

1

(d) 15.08 (°C)

allow values in the range 15.05 – 15.10

1

(e) correlation between CO_2 levels and temperature

1

despite short-term variations of temperature

1

supported by values from graph which show correlation

1

cannot determine causality from this data or possible causality as increasing use of fossil fuels since 1900 has caused accelerated temperature increase

1

[11]

Q9.

(a) carbon dioxide (decreased) **one** from:

1 *mark for one reason for each gas*

- photosynthesis
- formation of (sedimentary) rocks
- formation of fossil fuels
- dissolved in oceans

ignore respiration

1

nitrogen (increased) **one** from:

- volcanoes / volcanic activity
- ammonia reacted with oxygen

1

oxygen (increase):

- photosynthesis

1

(b) 1960

1

STEMUP.CO.UK

because the rise became much steeper

1

(c) 362 − 320 = 42 (ppm)

both readings from graph

1

42 ÷ 320 × 100

1

= 13(%)

1

(d) **Level 2 (3–4 marks):**
A detailed and coherent explanation of how the rise in carbon dioxide levels affect the environment.

Level 1 (1–2 marks):
Simple relevant statements are made about the effects of rise in carbon dioxide levels
on the environment. The account is incomplete or inaccurate and lacks coherence.

0 marks:
No relevant content.

Indicative content

consequences of rise in carbon dioxide levels

- carbon dioxide is a greenhouse gas
- it stops infrared radiation escaping from the Earth
- warming up the atmosphere
- rise in level warms atmosphere up more
- so leads to global warming
- leading to climate change

effects on environment:

- extreme weather fluctuations
- rise in sea levels
- effects on human habitats
- effects on animal habitats
- decrease in biodiversity
- effects on food producing capacity.

4

[12]

Q40.

(a) burning fossil fuels

1

(b) point correctly plotted at 2020, 430

allow ± ½ square

1

suitable curve drawn through *most of* the points

allow ecf for plotted point

1

STEMUP.CO.UK

(c) amount of carbon dioxide increases

ignore references to figures unqualified

if carbon dioxide is given as CO_2 it must be written correctly

1

(so) amount of coral decreases

accept coral is killed

ignore references to other organisms

1

[5]

Q41.

(a) magnesium + nitrogen (→)

allow Mg for magnesium

allow N_2 for nitrogen

1

(→) magnesium nitride

allow Mg_3N_2 for magnesium nitride

maximum of one mark if arrow not represented correctly

1

(b) noble gas

allow argon / neon / helium / krypton / xenon / radon

ignore inert gases

1

(c) no evidence / no proof

allow insufficient evidence

allow couldn't identify the gas

1

[4]

Q42.

(a) (i) 78 %

1

(ii) A – nitrogen

allow N_2

N must be uppercase and 2 must be subscript

ignore N

1

B – oxygen

allow O_2

O must be uppercase and 2 must be subscript

ignore O

1

(b) (i) any **two** from:

- level *up* to 1900 (allow 1890 to 1910)

STEMUP.CO.UK

- increasing from 1900 to today (*allow 1890 to 1910*)
  allow increased by 90 (ppm), allow answers in the range 88 – 92

- increased more rapidly in last 50 years
  *if no other marks gained allow **1** mark for it has increased*

2

(ii) (fossil) fuels
accept coal / oil / (natural) gas / peat
allow petrol / diesel / methane

1

[6]

Q43.

(a) (i) oxygen
allow O_2
must have uppercase O and subscript 2
ignore O

1

(ii) 20 (cm^3)
allow 18–22 (cm^3)

1

(iii) copper + oxygen → copper oxide
ignore any attempts at balancing words take precedence reactants in either order ignore di, tri etc
allow Cu for Copper
allow O_2 for Oxygen
allow CuO for copper oxide

1

(b) (i) nitrogen
allow N_2
must have uppercase N and subscript 2 ignore N

1

(ii) any **one** from:

- carbon dioxide
  allow CO_2
  must have uppercase letters and subscript 2

- argon
  accept named noble gas or correct symbol
  allow Ar
  *do **not** allow Ar_2*

- water vapour
  ignore steam
  allow nitrogen / N_2 if not given in (b)(i)

STEMUP.CO.UK

1

[5]

Q44.

(a) any **two** from:

(Earth has)

ignore figures unless qualified
allow converse responses

- smaller percentage carbon dioxide
  allow less
- larger percentage nitrogen
  allow more
- larger percentage oxygen
  allow more

2

(b) (Mars) temperature below freezing point of water

allow too cold (for liquid water to form)
allow water will freeze or ice will form

1

(Venus) temperature above boiling point of water

allow too hot (for liquid water to form)
allow water would boil or would be steam / gas
if no other mark awarded allow one mark for not enough water vapour

1

[4]

Q45.

(a) (i) 80(%)

allow answers in range 78–80(%)

1

(ii) any **five** from:

*max **4** marks if no reference to oxygen*
ignore changes due to combustion of fossil fuels

- (green) plants / algae photosynthesise
- take in carbon dioxide (for photosynthesis)
- release oxygen (in photosynthesis)
  *do **not** accept for / in respiration*
  *accept carbon dioxide has decreased and oxygen has increased for **1** mark*
- carbon dioxide dissolved in oceans

STEMUP.CO.UK

accept oceans act as reservoir

- carbon dioxide locked up in (sedimentary) rocks / carbonates / limestone
- carbon dioxide locked up in fossil fuels
  allow locked up in biomass

5

(b) any **two** from:

- on Mars the temperature is below freezing point of water / 0°C
  allow water is frozen / ice on Mars
- on Venus the temperature is above boiling point of water / 100°C
  allow water is a gas / steam or has boiled / evaporated on Venus
- not enough water vapour (in atmosphere) on Venus
  ignore references to water vapour on Mars

2

[8]

Q46.

carbon dioxide / noble gas / named noble gas

accept CO_2 for carbon dioxide

accept correct symbol for noble gases

1

nitrogen

accept N_2

1

oxygen / water vapour

accept O_2 / H_2O

1

[3]

Q47.

(i) 12

1

(ii) (oxygen) produced by algae / plants

1

during photosynthesis

1

[3]

Q48.

(a) (i) water vapour

allow steam

1

STEMUP.CO.UK

condensed

allow cooled to form a liquid / water

second marking point can only be awarded if first marking point correct

1

(ii) carbon dioxide

allow CO_2

C and O must be upper case

numbers in formulae must be subscript

*do **not** accept carbon (mon)oxide / CO*

1

(iii) ammonia

1

methane

1

(b) nitrogen

1

oxygen

1

(c) (i) combustion

1

(ii) in calcium carbonate

1

in fossil fuels

1

[10]

Q49.

(a) *if only formula given it must be correct*

any **three** from:

- ammonia

  accept NH_3

- methane

  accept CH_4

  allow ethane / butane / propane

- hydrogen

  accept H_2

- water vapour

  accept H_2O vapour / steam

- carbon dioxide

  accept CO_2

STEMUP.CO.UK

- carbon monoxide

accept CO
allow oxygen / O_2
allow nitrogen / N_2
ignore nitrogen oxide
ignore carbon

3

(b) (in atmosphere today)

ignore references to water vapour
allow converse

(much) less carbon dioxide / CO_2

allow carbon dioxide was the <u>main</u> gas (in Earth's early atmosphere)

1

more nitrogen / N_2

allow nitrogen is now the <u>main</u> gas (in the atmosphere today)
or
nitrogen is now 78 × 80%

1

<u>more</u> oxygen / O_2

1

no ammonia / NH_3 or less methane / CH_4 or more argon / Ar or more noble gases

allow less ammonia / NH_3

1

(c) (fractional) distillation

1

gases have different boiling points

allow gases condense at different temperatures
ignore condensing points / levels
ignore evaporating points / levels

1

[9]

Q50.

(a) (i) carbon dioxide

1

(ii) because water boils at 100°C and the temperature on Venus is 460°C

1

therefore any water on the surface would boil to form steam / water vapour / gas

1

(b) any **three** from:

- by photosynthesis

STEMUP.CO.UK

- by dissolving in oceans
- by the formation of (calcium) carbonate **or** limestone
- by the formation of oil **or** coal

  accept by the formation of fossil fuels

3

(c) (i) 0.0317 (%)

1

(ii) the percentage of carbon dioxide has increased

1

(iii) any **one** from:

- burning of fossil fuels
- deforestation
- release of 'locked up' carbon dioxide

1

[9]

Q51.

(a) ammonia

accept NH_3

1

(b) (i) because the gases are unreactive

accept because the measuring equipment was not very precise

1

(ii) by fractional distillation

1

(iii) argon has a density greater than the density of nitrogen

1

[4]

STEMUP.CO.UK

Q1.

(a) A majority of students indicated that nitrogen makes up 20% of the Earth's atmosphere, suggesting confusion with oxygen. 32% of students correctly ticked the box for 80%.

(b) 24% of students knew a source of nitrogen in the first billion years of the Earth's existence, most suggesting volcanoes. The students who did not gain credit often forgot that they were asked to consider this time period and gave an answer from modern times, e.g. fertiliser, plants, animals, or human activity such as transport.

Some students revealed a misunderstanding of basic chemical principles in giving answers such as oxygen, argon, carbon dioxide or water. These elements and compounds contain no nitrogen, so cannot be its source.

(c) 35% of students achieved this mark by giving an acceptable symbol for a reversible reaction. Some students added further reactants or products, which were ignored. Incorrect responses included ↔ and ≡

(d) 'Time' was a frequently seen incorrect response. 16% of students achieved credit for a response such as rate, speed or pace.

(e) There were some very creative attempts at this question, however, the definition of a formulation was not well known. 4% of students were awarded this mark. There were a small number of accurate, succinct responses, but although a larger proportion of students realised that a formulation is a mixture, few were able to add that it has a use or purpose.

Some students were able to give examples, but not a definition. Others confused formulation with formula, defined a compound, or suggested that a formulation is a compound designed as a useful product.

(f) 82% of students achieved this mark with a clearly drawn bar to 5.8%. A tolerance of ± ½ square was allowed, but rarely needed. Some students appeared to mistake the scale and counted down two small squares from the 6.0% line, giving a bar to 5.6%, rather than the 5.8% they expected. A very small minority of students drew bars which finished a long way from the 5.8% line.

(g) Most students were aware that $\frac{3.0 \times 100}{0.225}$ was **not** a correct calculation for the percentage of iron in the fertilizer. However, the other three options proved almost equally popular, suggesting that many students find percentage calculations challenging. 39% of students achieved a mark here.

(h) This question discriminated well. 92% of students were able to access this question and achieve at least one mark by agreeing that the use of fertilizer increased.

Many students continued to provide some data from Figure 2, with 51% achieving two marks. A large proportion of students gave data from a country chosen to exemplify this, while others added the totals for 2003 and 2015.

10% of students went on to recognise that the increase in fertiliser use differed between the countries in Figure 2, and that in countries A or C the difference was 'much larger' but that it wasn't 'much larger' in countries B or D.

STEMUP.CO.UK

Q2.

Foundation

(a) 63% of students recognised methane as a greenhouse gas. Nitrogen was the most commonly seen incorrect response.

(b) This question discriminated well. 29% of students were able to name two effects of climate change, with the next 33% naming one effect.

Students who did not gain credit were sometimes too vague, for example giving responses such as unspecified changes in the weather, or unspecified effects on people. Others gave causes rather than effects of climate change, or referred to acid rain, pollution or ozone.

(c) Many students found this calculation challenging with 3% of students able to give the correct answer. 70% of students managed a single division or multiplication with two of the numbers given, but were unable to continue to complete the calculation required. Some of those who knew the correct method failed to convert from grams to kilograms, but were still able to access one of the two marks. Some students were able to apply the correct method, but did the calculation in two parts, and their rounding after the first part gave rise to an incorrect final answer. Students should be aware that they should not do any rounding until they reach their final answer.

(d) 13% of students suggested using less plastic or recycled plastic, or gave a reference to carbon capture. Some incorrect responses focussed on the disposal, including burning, rather than the manufacture of plastic. Planting trees to capture the carbon proved a popular idea.

(e) This 'extended response' question discriminated well. It asked for an explanation of how the levels of three gases have changed since the Earth's early atmosphere. To achieve marks in level 1, statements of change for the three main gases in the Earth's atmosphere was required. When explanations were linked to the changes, marks in levels 2 or 3 were awarded. The clearer, more logical and more detailed accounts achieved level 3 marks.

4% of students achieved a level 3 mark on this standard demand question. Some accurate and well expressed responses were seen, succinctly explaining the changes to all three gases. The most logically sequenced of these discussed each of the three gases in turn, resulting in very readable and accessible accounts. A further 12% of students achieved a level 2 mark, and a further 32% achieved a level 1 mark.

Many of the lower-attaining students discussed modern day changes to the Earth's atmosphere, rather than addressing the changes since the Earth's early atmosphere. These students attempted to explain increases in carbon dioxide levels due to industrial or other human activity, and decreases in oxygen due to increasing population. Some students included mention of the ozone layer. Some of these accounts were less logically sequenced and suggest that lower-attaining students are more challenged by the concept of evolutionary timescales, or are failing to read the question carefully.

As mentioned in the general comments for this paper, students should note the command word for an extended response question carefully. In this question students were asked to 'Explain'. Many students qualitatively described the changes in amounts of nitrogen, oxygen or carbon dioxide since the Earth's early atmosphere, but were not successful at linking these changes to explanations. When students did attempt an explanation, the effects of photosynthesis on changes

STEMUP.CO.UK

in the percentages of oxygen and carbon dioxide were better known than those of volcanic action on the change in percentage of nitrogen.

Higher

(a) Methane was recognised by 85% of students as a greenhouse gas. Nitrogen was the most commonly seen incorrect response.

(b) 60% of students were able to name two effects of climate change, with a further 29% of students able to name one effect. Students give a wide range of creditworthy responses; melting polar ice caps, named extremes of weather and / or desertification.

Students who did not gain credit were sometimes too vague, for example giving responses such as unspecified changes in the weather, or unspecified effects on people. Others gave causes rather than effects of climate change or referred to acid rain.

(c) 51% of students achieved some credit on this question. Many of those who knew the correct method failed to convert from grams to kilograms and consequently achieved only one mark for the calculation. The remainder of students attempted a single division or multiplication with two of the numbers given but were unable to continue to complete the calculation required.

Some students were able to apply the correct method, but did the calculation in two parts, and their rounding after the initial calculation gave rise to an incorrect final answer. Students should be aware that they should not undertake any rounding until they reach their final answer.

(d) 27% of students suggested using less plastic or recycled plastic in the manufacture of plastic bottles or gave a reference to carbon capture. Some incorrect responses focussed on the disposal, including burning plastic, rather than the manufacture of plastic or transportation of the plastic bottles, releasing carbon dioxide in to the air. Planting trees to capture the carbon or using renewable energy sources to provide energy for manufacturing the bottles proved popular ideas.

(e) This ‘extended response’ question discriminated well. It asked for an explanation of how the levels of three gases have changed since the Earth’s early atmosphere. To achieve marks in level 1, statements of change for the three main gases in the Earth’s atmosphere was required. When explanations were linked to the changes, marks in levels 2 or 3 were awarded. The clearer, more logical and more detailed accounts achieved level 3 marks.

19% of students achieved a level 3 mark on this standard demand question. Some accurate and well-expressed responses were seen, succinctly explaining the changes to all three gases. Many students gave detailed responses that showed a greater depth and understanding, giving numerous linked explanations for the changes in composition of the gases in the Earth’s atmosphere. The most logically sequenced of these discussed each of the three gases in turn, resulting in very readable and accessible accounts. 33% of students achieved a level 2 mark, and a further 27% achieved a level 1 mark.

However, many of the lower-attaining students discussed post Industrial Revolution changes to the Earth’s atmosphere, rather than addressing the changes since the formation of the Earth’s early atmosphere. These students attempted to explain increases in carbon dioxide levels due to industrial manufacturing or other human activity; decreases in oxygen due to increasing population or deforestation. Some of these accounts were less logically sequenced and suggest that lower-attaining

STEMUP.CO.UK

students are challenged by the concept of evolutionary timescales or are failing to read the question carefully.

As mentioned in the general comments for this paper, students should note the command word for an extended response question carefully. In this question students were asked to 'Explain'. Many students qualitatively described the changes in amounts of nitrogen, oxygen or carbon dioxide since the formation of the Earth's early atmosphere but were not successful at linking these changes to explanations. The most popular explanation was the effects of photosynthesis on changes in the percentages of both oxygen and carbon dioxide. The dissolving of carbon dioxide into the newly formed oceans was better known than those of the volcanic action on the change in percentage of nitrogen.

Q3.

(a) 79% of students could recall the correct age of the Earth in standard form.

(b) 79% of students were not able to calculate a percentage change. Many did not give their answer to two significant figures. Incorrect rounding was frequently seen.

(c) 80% of students recalled that carbon monoxide is released by incomplete combustion.

(d) Few students described volcanoes releasing water vapour. Misconceptions were frequent, such as volcanoes releasing carbon dioxide that changed to water vapour. More students could describe water vapour condensing, although recall of the water cycle was frequent, not always relevant, and often confused between evaporation and condensation. 295 of students achieved one or two marks for this question.

(e) 35% of students could describe melting ice caps as a result of increasing greenhouse gases. Misconceptions included that carbon dioxide dissolving in oceans increases the volume of water, and that increased rainfall is responsible for sea level rise.

Q40.

(a) The majority of students knew that the main reason for the change on carbon dioxide concentration is the burning of fossil fuels.

(b) Most students plotted the point correctly, but many then drew a straight line, rather than a curve, through the data. Students need to be aware that in science lines of best fit can be curved, whereas in maths they are instructed to draw a curved line of best fit. In science, students need to look at the points and decide whether a curve or a line best fits the data. When plotting points, X should be drawn. There is only an error of ± ½ a square allowed when plotting the point as the centre of the X. Lines drawn with a ruler, dot-to-dot, or feathery lines did not gain credit. Pencil can be used when asked to draw on the paper, as it scans well and can be erased if an error is made.

(c) The question was well answered and well over half of the students gained 2 marks for identifying the two trends. Some students only mentioned either carbon dioxide or coral, perhaps because they had not read the question carefully. Some represented carbon dioxide with its formula, but the formula had to be written correctly to gain the mark. A few students lost marks because they only talked about 'it', which could have referred either to the amount of carbon dioxide or to the amount of coral, and therefore was unclear.

STEMUP.CO.UK

Q41.

(a) Students who followed the instruction to write a word equation scored more highly than those who tried to write a symbol equation as, not only did they not know the formula for magnesium nitride, but only a few students gave the correct formula for nitrogen. A lot of students did not know the basic rules of writing equations – to draw an arrow between the reactants and products, and to keep the names of the reactants on the left and the products on the right. Students who did not draw an arrow, but drew an equals sign, dash or double-headed arrow could only gain a maximum of 1 mark. Similarly students who wound the text across the page, mixing up the reactants with the name of the product, were limited to 1 mark. Many students gained the mark for the reactants, magnesium and nitrogen, but the product was often misnamed as magnesium nitrate or magnesium nitrate. A few showed a sequence of steps linked by a series of arrows.

(b) Less than a fifth of students gained the mark for saying that the type of gas that Ramsey discovered was a noble gas, or gave a named noble gas, all of which were allowed. Helium and argon were often named. The range of incorrect gases was vast, but solids such as sulfur, carbon and boron were also named, as well as the names of various salts.

(c) Some students gained the mark by saying there was not enough evidence or no proof. A few said that he couldn't identify the gas. Frequently seen incorrect responses included that he didn't have enough of the gas, no-one would have believed him, he wanted to keep the discovery to himself and it was only a prediction. Many students thought the gas was unreactive so it would have no use or it was not important.

Q42.

(a) (ii) The names and percentages of gases in the air were not well known.

(b) (i) There were many good responses that included all three marking points. A few did not describe the change in carbon dioxide concentration in detail, but gained the compensation mark for saying it increased. Some students had not read the question properly and gave reasons for the increase, which was not asked for.

Q43.

(a) (i) The most common answers were oxygen, which was the correct response, carbon dioxide or nitrogen. Hydrogen and water vapour were also seen. Some had not read the question and gave carbon as the answer, which is not a gas.

(ii) Very few students knew the volume of oxygen that would react with the copper.

(iii) Students who attempted to write a symbol equation usually wrote the wrong formula for copper oxide so did not gain credit. If a word equation is asked for it is better to use words. Some students had the copper reacting with carbon dioxide or air, and often showed carbon dioxide as a product.

(b) (i) Quite a lot of students did not attempt this question. It is always worth a guess, particularly if the name of a gas is all that is required. Some responses did not include the name of a gas, for example carbon or copper oxide. The most common incorrect answers were oxygen and carbon dioxide.

STEMUP.CO.UK

(ii) The most common answer was oxygen. Students had not realised that all the oxygen would have reacted with the copper. Quite a lot gained the mark for nitrogen, if they had not given this as their answer to 4bi. Other correct answers given were carbon dioxide and argon.

Q44.

(a) Whenever differences are asked for comparative statements must be given in the response. Just quoting figures from the table without qualification does not gain a mark.

(b) The required answers were that on Mars the temperature is below the freezing point of water, and on Venus it is above the boiling point of water. These were not seen, but as minimum statements, Mars is too cold and Venus is too hot were allowed. Students should be encouraged to write scientific responses. Some students mixed up the data and said that Venus was too cold and Mars was too hot.

Q45.

(a) (i) This question was at standard demand and was testing basic recall from the specification. Less than half of the students had learnt the percentage of nitrogen in the earth's atmosphere.

(ii) Students made a good attempt at this question. Many responses covered the effect of photosynthesis saying: plants take in carbon dioxide and release oxygen during photosynthesis, which gained 3 marks. Plants and photosynthesis had to be mentioned to gain the first marking point. Other students went down the more chemical route saying: carbon dioxide dissolves in seas and is locked up in sedimentary rocks and fossil fuels, also for 3 marks. Some got confused and explained that carbon dioxide levels are rising due to the burning of fossil fuels, which did not answer the question.

(b) Many students said that Mars is too cold and Venus is too hot, but the mark could only be awarded if these were qualified in terms of the effect of the temperatures on water.

Q46.

Most students were able to interpret the bar chart and realised that carbon dioxide was the main gas on Mars. 'Noble gases' was the most common distracter for the other two answers, with gravity being the most frequent response that was not a gas. Almost all students did gain at least one mark.

Q47.

(i) Most students read the graph correctly, but only half of the students followed this up by doing a correct calculation.

(ii) Many students referred to plants or to photosynthesis but relatively few connected the two. This was reflected in only a fifth of students gaining full marks.

Q48.

STEMUP.CO.UK

(a) (i) Many students gained a mark for saying water vapour was released from the volcanoes, with many going on to say that this condensed to form water. Many students did not realise that anything had to happen to the vapour for it to form water, or thought that water could be formed from carbon dioxide.

(ii) Three-quarters of students correctly identified the main gas in the Earth's early atmosphere as nitrogen.

(iii) Identifying methane as a gas present in Earth's early atmosphere was the most common correct answer. Almost half the students gained two marks for also knowing that ammonia was present as well.

(b) Almost all students identified oxygen as one of the main gases in the atmosphere today. Over half gained full marks for also selecting nitrogen. Just under half of all students thought that hydrogen was present in today's atmosphere.

(c) (i) Approximately three-quarters of students correctly selected combustion as being the main process causing an increase in the amount of carbon dioxide in the atmosphere.

(ii) Just under a third of students gained full marks for identifying two ways that carbon is locked up in sedimentary rocks. Given that only two types of sedimentary rock were listed in the choices this highlights a lack of knowledge of the rock cycle from Key Stage 3. The most common correct choice by students was fossil fuels.

Q49.

(a) A well answered question with almost all students gaining at least two marks. However, a surprising number of students think that carbon is a gas. Some did not relate their answers to the formula shown, saying argon and helium were present. Only the most able students responded in terms of ammonia and methane.

(b) The question asked students to describe the differences between the Earth's early atmosphere and the atmosphere today. However, many students did not give comparative statements about the gases but tried to explain why the levels of gases changed, which they were not asked to do. Students could gain marks for saying carbon dioxide was the main gas in the early atmosphere and nitrogen is the main gas today, but comparative statements would have been much better. Some students talked about carbon rather than carbon dioxide. Most students were able to gain at least one mark.

(c) The most common process given was distillation, although combustion and cracking were often named. Students who knew that the process was fractional distillation usually understood that the separation was due to the different boiling points, although some did answer in terms of condensing points. A fifth of students scored full marks for this question.

STEMUP.CO.UK