Mark schemes

1

(a) any **one** from:

- not enough evidence or proof

  allow no evidence or no proof
- (life and the Earth were created) billions of years ago

  allow a long time ago

  ignore different beliefs or no one was there.

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best–fit' approach to the marking.

0 marks
No relevant content

Level 1 (1−2 marks)
Statements based on diagrams

Level 2 (3−4 marks)
Description of how one change occurred

Level 3 (5−6 marks)
Descriptions of how at least two changes occurred

Examples of chemistry points made in the response could include:

Main changes

- oxygen increased because plants / algae developed and used carbon dioxide for photosynthesis / growth producing oxygen; carbon dioxide decreased because of this
- carbon dioxide decreased because oceans formed and dissolved / absorbed carbon dioxide; carbon dioxide became locked up in sedimentary / carbonate rocks and / or fossil fuels
- oceans formed because the Earth / water vapour cooled and water vapour in the atmosphere condensed
- continents formed because the Earth cooled forming a supercontinent / Pangaea which formed the separate continents
- volcanoes reduced because the Earth cooled forming a crust.

Other changes

- nitrogen has formed because ammonia in the Earth's early atmosphere reacted with oxygen / denitrifying bacteria.

6

[7]

2

(a) argon / Ar

1

(b) (i) 0

1

(ii) unreactive

1

(c) (i) 94.96(%)

1

(ii) any **two** from:

- plants or photosynthesis
- absorbed in oceans / *seas*

  *allow oceans store **or** take in **or** dissolve carbon dioxide*
- locked up in (sedimentary) rocks
- locked up in fossil fuels

2

[6]

3 (a) any **two** from:

asks for cause therefore no marks for just describing the change

must link reason to a correct change in a gas

carbon dioxide has decreased due to:

accept idea of 'used' to indicate a decrease

- plants / microorganisms / bacteria / vegetation / trees
- photosynthesis

  ignore respiration
- 'locked up' in (sedimentary) rocks / carbonates / fossil fuels
- dissolved in oceans

  ignore volcanoes

oxygen has increased due to:

accept idea of 'given out / produced'

- plants / bacteria / microorganisms / vegetation / trees
- photosynthesis

  ignore respiration

nitrogen increased due to:

accept idea of 'given out / produced'

- ammonia reacted with oxygen
- bacteria / micro organisms

  ignore (increase in) use of fossil fuels / deforestation

2

(b) (because methane's) boiling point is greater than the average / surface temperature **or** Titan's (average / surface) temperature is below methane's boiling point

*ignore references to nitrogen **or** water*

1

any methane that evaporates will condense

accept boils for evaporates

accept cooling and produce rain for condensing

1

(c) C_nH_{2n}

1

[5]

4 (a) (i) H_2O

must be formula

1

CaO

must be formula

1

(ii) carbon dioxide from the air / (Earth's early) atmosphere

it = carbon (dioxide)

accept carbon dioxide from millions of years ago

1

formed (sedimentary) rocks **or** fossil fuels

ignore trapped / stored

1

(b) (i) decreases rapidly at first

it = carbon (dioxide)

1

then slowly **or** levels off

*allow both marks if the description is correct using either 'rapidly' **or** 'slowly'*

allow correct use of figures for either marking point

*if no other mark awarded, allow CO_2 decreased for **1** mark*

1

(ii) any **two** from:

it = carbon (dioxide)

accept photosynthesis

- used by plants
- dissolved in oceans
- 'locked up' in fossil fuels **or** formed fossil fuels
- 'locked up' in rocks **or** formed rocks

2

(c) (yes)

it = percentage of carbon (dioxide)

ignore yes or no

because the percentage of carbon dioxide is increasing

1

which causes global warming (to increase)

allow (carbon dioxide) causes greenhouse effect/climate change

1

or

(no)

because the percentage of carbon dioxide is low (1)

compared to millions of years ago (1)

allow global warming can be caused by other factors (e.g. Sun / water vapour / methane)

[10]

5 (a) carbon dioxide <u>decreased (by plants / trees)</u>

allow plants / trees absorbed carbon dioxide

1

oxygen <u>increased</u> (by plants / trees)

allow plants / trees released oxygen

if neither of these marks awarded

allow plants / trees

*photosynthesise for **1** mark*

1

because coal 'locks up' / traps / stores carbon dioxide / carbon

allow trees 'locked up' carbon dioxide / carbon

1

(b) carbon / C

hydrogen / H

sulfur / S

*all 3 correct **2** marks*
*1 or 2 correct **1** mark*
allow H_2
ignore oxygen

2

(c) (i) 2 2

balancing must be correct
*do **not** accept changed formulae*

1

(ii) <u>increases atmospheric pollution</u>

carbon dioxide / CO_2 released

1

from the (thermal) decomposition of calcium carbonate **or**
*accept causes global warming **or** CO_2 is a greenhouse gas*

description of this decomposition **or** equation
ignore sulfur dioxide and effects in this part

1

<u>decreases atmospheric pollution</u>

sulfur dioxide / SO_2 is removed
accept less acid rain produced

1

by reaction with calcium oxide **or** calcium carbonate
*accept neutralisation **or** forms calcium sulfate*

1

[10]

6 (a) bar drawn correctly 78 – 80 (%)

1

(b) (i) (Mars has) no (green / living) plants / trees

1

(ii) (argon) is unreactive / inert
accept argon is a noble gas
ignore it is in Group 0

1

(c) (the amount of carbon dioxide has decreased because it has been) absorbed / used by (green / living) plants / trees **or** used for photosynthesis

accept dissolved / absorbed by oceans or locked up in fossil fuels / carbonate rocks

1

(d) the eruption of volcanoes

1

[5]

7

(a) crust

ignore Earth's

1

core

ignore inner and/or outer

1

(b) bar chart

1

all heights are correct

accept correctly plotted points

1

all labels are correct for nitrogen, oxygen and other / argon

1

(c) (i) decomposed

1

(ii) global warming

1

[7]

8

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

- used by plants
  allow specific plants and algae
- used for photosynthesis
  ignore oxygen released / respiration
- absorbed / dissolved in oceans
  ignore oceans formed
- locked up in fossil fuels / limestone / sedimentary rocks

2

(ii) calcium carbonate / $CaCO_3$

1

decomposed / thermal decomposition
*do **not** allow reaction with oxygen*
accept quicklime / calcium oxide produced
*$CaCO_3 \rightarrow CaO + CO_2$ gains **2** marks*

1

(b) increasing (CO_2 or global warming)

1

<u>more rapid</u> increase recently

1

carbon dioxide causes global warming
*accept greenhouse gas **or***
climate change / sea level rising
***or** ice caps melting*
*do **not** accept ozone layer or acid rain or global dimming*

1

(c) (i) any **one** from:

- Wegener had no evidence / proof
  accept movement too slow to measure
- other scientists had different ideas / views
  accept continents / plates fixed or land bridge
- did not respect Wegener as a scientist / geologist

1

(ii) any **three** from:

- plates (move)
  ignore continents
- heat energy / radioactivity (causes)
- convection currents
- in mantle

3

[11]

9 (a) complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond)

1

(b) (i) the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa

allow as the (carbon) chain gets longer the boiling point increases
ignore melting points
*do **not** accept reference to greater number of molecules*

1

(ii) *they = hydrocarbons from the graph*
it = $C_{30}H_{62}$

any **two** from:

- low boiling point / volatile
  accept they are gases or liquids
- low viscosity
- high flammability
  accept easier to burn / ignite
- small molecules
  accept short chains
  ignore number of carbon atoms
- burn completely
  ignore speed of burning

2

(c) (i) 16 (CO_2) + 18 (H_2O)

1

(ii) (carbon dioxide in the Earth's early) atmosphere

accept from volcanoes (millions of years ago)

or *from <u>dead</u> plants / animals*

allow dead sea creatures

ignore shells

1

(iii) <u>increase</u> in burning / use of fossil fuels

1

locked up carbon (carbon dioxide) is released

allow carbon / carbon dioxide from millions of years ago is released

accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)

1

[8]

10 (a) (thought to cause) global warming / green house (effect) / climate change

ignore other consequences of global warming

*do **not** accept acid rain / ozone layer / global dimming*

1

(b) any **three** from:

- replant trees / renewable / sustainable

  ignore reusable

- carbon (dioxide) used by trees / photosynthesis

  accept trees absorb carbon (dioxide) as they grow

  ignore respiration

- it is a (continuous / carbon) cycle

  accept burning wood is carbon neutral

  or

  carbon (dioxide) goes back into the air

  *for the **second** and **third** bullet points: accept trees use carbon dioxide which is released when (trees / wood are / is) burnt for **2** marks*

- no new carbon (dioxide) is produced

  or

  no locked up carbon (dioxide) is released

  or

  the carbon (dioxide) was absorbed millions of years ago

3

[4]

11 (a) (i) *it = water vapour*

condensed

accept temperature went <u>below</u> <u>100</u>°C / boiling point of water

allow <u>cooled to form liquid</u> / water / rain

*do **not** accept evaporated*

1

formed the oceans / seas

ignore rain

*accept (water vapour) cooled and formed the ocean / sea for **2** marks*

1

(ii) any **two** from:

ignore oxygen / nitrogen increased

ignore reference to volcanoes / respiration

- used by (green) plants / *algae*
  accept photosynthesis / plants give out oxygen
- changed into oxygen
- dissolved in oceans / seas
  accept (locked up) in shells / skeletons (of animals)
- (locked up) in carbonates / sedimentary rocks
- (locked up) in fossil fuels / named fossil fuel

2

(b) (i) cannot get to / reach / drill to / see the core

accept the core is (too) far down (into the Earth) / do not know what happens under the crust / Earth's surface

accept it is (too) hot / radioactive

ignore lack of evidence unqualified

1

(ii) any **three** from:

- heat / *energy* released
- from radioactive decay / processes
  accept radioactivity / nuclear reactions
- (causing) convection currents
- in the mantle

3

[8]

12 (a) (i) (thermal) decomposition

allow it breaks down

accept symbol equation or in words

allow reaction with SO_2 (to form CO_2)

1

(ii) calcium carbonate / calcium oxide / limestone / quicklime / it reacts with sulfur dioxide / forms calcium sulfate

accept it neutralises sulfur dioxide / neutralisation

ignore references to sulfur

do not accept 'calcium reacts with...'

1

(b) by incomplete / partial combustion (of the fuel)

1

insufficient oxygen / *air* (to burn fuel)

*accept insufficient oxygen / air to burn fuel completely for **2** marks*
if no other marks awarded
accept $C + CO_2 \rightarrow 2CO$ ***or***
$2C + O_2 \rightarrow 2CO$ ***or*** *in words for **1** mark*

1

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

- (CO_2) from the atmosphere
- (CO_2) taken in millions of years ago **or** early (atmosphere)
  allow thousands / billions
  allow rocks formed millions of years ago
- (CO_2) was used to form the shells / skeletons of marine organisms / fossil fuels
  accept sedimentary rocks
  allow used to form correct named fossil fuel
  ignore limestone

2

(ii) any **one** from:

- (increases / enhances) global warming
  allow greenhouse gas / effect
  *do **not** accept ozone layer / acid rain / global dimming*
  ignore consequences of global warming
- is additional carbon dioxide **or** not able to be absorbed by oceans / seas **or** used by (green) plants
- acidification of sea water

1

[7]

13 (a) (i) nitrogen / N_2

1

(ii) carbon dioxide / CO_2

1

(b) (i) humans / scientists had not evolved

accept it was billions / millions of years ago
allow too long ago

1

(ii) temperature is above 100°C **or** any water would evaporate / boil

accept Venus is too hot

1

(c) any **three** from:

- used by plants
- used for photosynthesis

  *accept plants take in carbon dioxide and give out oxygen for the first two bullet points ie **2** marks*
- dissolves in oceans / seas

  allow absorbs into oceans / seas
- used to form the shells / skeletons of marine organisms
- locked up as limestone / carbonates
- locked up as fossil fuels / oil / coal

3

[7]

14 (a) (i) (gases from) volcanoes

1

(ii) 100 allow 99

1

(iii) any **two** from:

- photosynthesis
- carbon dioxide used

  allow carbon dioxide decreased
- oxygen produced

  allow oxygen increased

  ignore nitrogen / respiration

  they = plants

2

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

- sea floor spreading
  accept oceanic ridges / magnetic stripes
- periodic measurements between continents
  accept continents move a few centimetres each year
- evidence from rocks / fossils on different continents
  accept continents fit together
- new mountain ranges
  accept new islands

1

(ii) in the mantle

any **two** from:

- convection (currents) / movement
  *do **not** accept movement of the plates*
- radioactivity / radioactive decay / nuclear reactions

1

- releases heat / thermal energy
  accept heat from core

2

[8]

15 (a) any **two** from:

asks for cause therefore no marks for just describing the change

must link reason to a correct change in a gas

carbon dioxide has <u>decreased</u> due to:

accept idea of 'used' to indicate a decrease

- plants / micro organisms / bacteria / vegetation / trees
- photosynthesis

  ignore respiration
- 'locked up' in (sedimentary) rocks / carbonates / fossil <u>fuels</u>
- dissolved in oceans

  ignore volcanoes

oxygen has <u>increased</u> due to:

accept idea of 'given out / produced'

- plants / bacteria / micro organisms / vegetation / trees
- photosynthesis

  ignore respiration

nitrogen <u>increased</u> due to:

accept idea of 'given out / produced'

- ammonia reacted with oxygen
- bacteria / micro organisms

  ignore (increase in) use of fossil fuels / deforestation

2

(b) (because methane's) boiling point is greater than the average / surface temperature **or** Titan's (average / surface) temperature is below methane's boiling point

*ignore references to nitrogen **or** water*

1

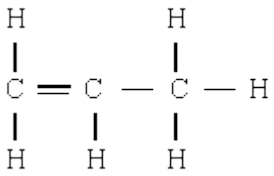
any methane that evaporates will condense

accept boils for evaporates

accept cooling and produce rain for condensing

1

(c) (i)



bonds must be displayed correctly

ignore bond angles

1

(ii) poly(propene) / polypropene / polypropylene

*do **not** allow polypropane*

any **two** from:

- double bonds open up / break / become single(*)
- propene molecules / monomers / they join / undergo addition polymerisation(*)

1

- form chains / long molecules(*)

*(*)correct chemical equation gains **2** marks*

ignore large

*using monomer incorrectly max **2** marks*

2

[8]

16 (a) oxygen **and** nitrogen

1

20 – 21 % and 78 – 80 %

*accept any two correct responses in the correct space for **one** mark*

1

(b) (i) acid rain

accept toxic gas or consequence of acid rain

1

(ii) idea of the removal or use of sulfur dioxide gas (from the waste gases)

*do **not** accept remove sulfur from coal*

1

(iii) oxygen

accept O_2

1

water

accept H_2O
accept hydrogen oxide / steam

1

(c) any **two** from:

- it's a 'greenhouse gas' or increase greenhouse effect

  accept action of a 'greenhouse gas'

- causes global warming or increase in the Earth's temperature
- sea-levels rise or flooding
- climate change
- (polar) ice-caps melt
- extension of deserts

  *mention of ozone / acid rain / global dimming = max **1** mark*

2

(d) idea trap / store / lock the carbon dioxide

1

in the oil reservoir or under the sea bed

*do **not** accept 'into the oil' / 'under the sea'*

1

[10]

17 (a) core

ignore outer or inner

1

mantle

1

(b) (i) carbon dioxide

accept formula CO_2

1

oxygen

accept formulae O_2 / O

1

(ii) 4%

1

(iii) carbon dioxide has <u>decreased</u> / from 95% to 0%

1

oxygen has <u>increased</u> / from 0% to 21%

1

any **one** from:

(carbon dioxide decrease)

- carbon dioxide used during photosynthesis / by plants
- carbon dioxide dissolves in oceans
- carbon dioxide is locked up in rocks / carbonates / fossil fuels

(oxygen increase)

- oxygen released during photosynthesis / by plants

1

[8]

18 (a) (i) core

1

(ii) plate (boundaries)

accept parts of the crust

ignore crust alone

1

sudden movement / colliding

accept movement but ignore movement apart

or

normally move a few centimetres per year

accept continental drift

1

convection currents / driven by heat from radioactive processes / decay

idea of source of energy for the movement

1

the idea of uncertainty with an explanation

eg scientists do not know (with any certainty)

- what happens under the crust
- where the forces / pressure are building up
- we cannot measure the forces
- when the forces reach their limit

ignore references to volcanoes

1

(b) (i) 78

(ii) marks awarded for any 2 gases from the following 3 gases

*max **3** marks from CO_2*

1

any **four** from:

ignore references to respiration

carbon dioxide has decreased:

- used by plants / bacteria (stromatolites)
- during photosynthesis (must be linked to CO_2 decrease)
- 'locked up' in (sedimentary) rocks / carbonates / fossil fuels
- dissolved in oceans

and / **or**

oxygen has increased because:

- released by plants / bacteria (stromatolites)
- during photosynthesis (must be linked to O_2 increase)

and / **or**

nitrogen has increased because

- ammonia reacted with oxygen (to release nitrogen)
- nitrogen is released by bacteria

4

[10]

19 (a) any **three** from:

accept reverse answers if unambiguous
*do **not** accept just different throughout*

3

less / little / not much carbon dioxide **or** give a %age < 1%

more / a lot of nitrogen **or** give 78-80%

(more) / (some) oxygen or give a %age 20-21%
*do **not** accept more "other gases"*

references to pollutant gases in general **or** named examples
e.g. CO, SO_2, NO, NOX etc.

more / some water (vapour)

some / 1% argon
ignore other noble gases

ozone (layer) on earth

(b) any **two** from:

removed carbon dioxide

ignore reference to respiration / photosynthesis unless qualified

released oxygen

caused carbon from carbon dioxide to become locked in sedimentary rocks

the oxygen they produced reacted with methane and ammonia

produced nitrogen (must be linked to fourth point)

*accept correct word / symbol equation for photosynthesis for **2** marks*

*converted / changed CO_2 to oxygen for **2** marks*

2

[5]

20 (a) (i) water <u>vapour</u> given out from volcano

accept steam
not hydrogen and oxygen combining to form water

1

condensed

accept rain / clouds formed just 'cools' is insufficient

1

(b) nitrogen (left) N_2

*do **not** accept N*

1

oxygen (right) O_2

*do **not** accept O*

1

[4]

21 (a) **Quality of written communication**

for any two ideas sensibly stated

1

any **three** from:

- plants take in (CO_2)

  accept photosynthesis uses (CO_2)

- converted to glucose / starch / carbohydrates

  ignore carbon compounds by itself

- CO_2 locked up in fossil fuels

  accept coal / oil / natural gas / methane for fossil fuels

- CO_2 reacts with / dissolves (sea)water

  accept ocean removes CO_2

- producing hydrogencarbonates

  accept carbonic acid

- producing carbonates

  accept named carbonates

- marine animals use carbonates to make shells

  *do **not** accept bones*

- forms sedimentary rocks

  accept limestone / chalk
  accept marble
  *do **not** accept sediments alone*

3

(b) any **two** from:

- burning of fossil fuels **or** cars / industry / air travel / power stations

  ignore increase in population
  ignore more use of electricity

- natural processes cannot absorb all the extra CO_2

- deforestation

  accept less photosynthesis
  ignore volcanic activity
  accept burn trees

2

[6]

22 (a) respiration

combustion

1 *mark each*

2

(b) methane

water

1 *mark each*

accept steam

do ***not*** *accept natural gas for methane*

do ***not*** *accept hydrogen oxide*

2

(c) greenhouse effect (increased)

accept (global) warming

accept polar ice caps melt

accept rising sea levels

accept problems with climatic change

do ***not*** *accept changes to the weather* ***or*** *acid rain*

1

[5]

23 (a) 95% (1 mark for working)

2

(b) Much less carbon dioxide
Much more nitrogen

2

(c) Plants take up CO_2
plants give out oxygen
when they die trap CO_2 in rocks and fossil fuels
methane and ammonia reacted with oxygen
nitrogen gas produced
by reaction of oxygen and ammonia
and by denitryfying bacteria
formation of ozone layer

any 4 for 1 mark each

4

[8]

24 nitrogen – Gas A (or N_2) (N) = 1)
oxygen – Gas B (or O_2) (O)

for 1 mark each

[2]

25 (a) amount of CO_2 (much) lower
amount of O_2 (much) higher
amount of N_2 (much) higher (owtte.)
less other gases/less NH_3/less CH_4

any 2 for 2 marks

2

(b) 4 points from:
plants (evolved)/photosynthesis/algae
take in CO_2
give out O_2
water vapour condensed
ozone formed from oxygen
less CO_2 is produced now from volcanic activity
CO_2 from air trapped in sedimentary rocks or fossil fuels
nitrogen produced by bacteria/living organisms/microbes/decay of dead organisms (**not** nitrifying bacteria, nitrogen fixing 4 bacteria)
nitrogen produced by reaction of NH_3 with O_2/decomposition of NH_3
nitrogen builds up because it is unreactive
(Assume answer refers to today's atmosphere)

any 4 for 1 mark each

4

[6]

26 (a) (i) burning / breathing / respiration / fuels / food

for 1 mark each

2

(ii) 1. rock is heated / subducted (owtte) / close to magma / melted
1. rock is decomposed / carbon dioxide released through volcanoes

for 1 mark each

2

(b) carbon dioxide reacts / dissolves in sea-water / dissolves in rain water
insoluble carbonates / calcium carbonate are / is formed carbon dioxide turned into shells / coral / limestone / chalk / sediments also soluble hydrogencarbonates (calcium / magnesium) are formed photosynthesis by plants

any three for 1 mark each

3

(c) (i) sea unable to absorb all the extra carbon dioxide being produced
more trees being cut down / deforestation increased burning of fuels / more cars / more industry (*not* more people)

any one for 1 mark

1

(ii) global warming / greenhouse effect or effects such as melting ice caps / rising sea levels / climatic change / more deserts
(*not* changes to ozone layer)

for one mark

1

[9]

27 (a) any **two** 1 mark each

burning / combustion

fossil fuels **or** (locked up) carbon

accept fuel / named fuel

oxygen used

2

(b) any **three** from

produces (calcium) carbonate

which is insoluble

produces (calcium) hydrogencarbonate

which is soluble

photosynthesis

releases oxygen

3

[5]

28 (a) (i) nitrogen (gas) **or** N_2

if only the formula is given it must be correct in every detail

1

(ii) argon (gas) **or** Ar

1

(iii) oxygen (gas) **or** O_2

1

(b) vapour

1

evaporating

1

sea(s)

1

condenses

1

(c) volcanoes **or** volcanic activity **or** the sea(s)

allow carbonates(s) (rocks)

do not credit inside

1

[8]

-

29 (a) **either** any **two** points (1) each from

* (surface) below 100 °C (the surface) below the boiling point of water

* (allowed the) condensation (of water vapour)

accept (rate of) condensation greater than (the rate of) evaporation

* from the atmosphere

accept from the air

or condensed water (vapour) (1)
was pulled by gravity into depressions (1)

***or** idea of impervious sea bed*

or from comets (which crashed on the Earth) (1)

ice (from these) melted (1)

2

(b) any **two** processes (1) each from

* dissolving in (sea) water

* (taken in during) photosynthesis

*accept taken in by algae **or** plants*

- formation of carbonate(s)
  or calcium carbonate **or** chalk **or**
  calcite

*accept formation of shells **or** bones **or** corals*

2

[4]

30 (a) nitrogen and oxygen

both required either order

1

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

(atmosphere) is now cooler water vapour has condensed
to form sea(s) / ocean(s)

2

(ii) any **two** from

has dissolved in / reacted with seawater has formed carbonates
(evolution of green) plants removed by photosynthesis
has formed fossil fuels

2

(c) (i) 225

accept any date in the Triassic period
225 – 191 (mya)
do not credit 190 (mya)

1

(ii) on different (tectonic) plates

***or** answer refers to African and South American plates*

1

(movement) due to convection currents in the mantle

1

due to energy / heat from the core

***or** due to radioactivity*

1

[9]