AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.1.1 ATOMIC STRUCTURE, SYMBOLS, RELATIVE ATOMIC MASS, CHARGE AND ISOTOPES (PACK 1)

SCORE	PERCENTAGE
/331	%

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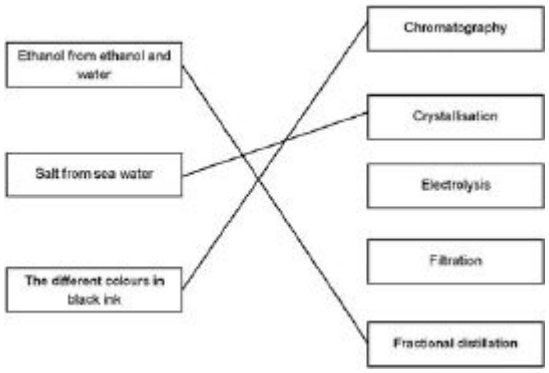
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Q1.

(a)



1
1
1

(b) include a (filter) funnel

allow funnel drawn on the diagram
ignore clamp stand

1

(c) evaporate

1

condense

1

must be this order

(d) $\frac{2}{20} \times 100$

1

= 10 (%)

1

*an answer of 10 (%) scores **2** marks*
*an answer of 11.1(%) **or** 90 (%) scores **1** mark*

(e) an alloy

1

(f) the layers in the mixture are distorted

1

(g) 8000 nm^3

1

[11]

Q2.

(a) 7

1

(b) small molecule

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1

(c) F_2

1

(d) the reactivity decreases (going down Group 7)

allow the reactivity decreases from chlorine to iodine

1

(because) chlorine displaces bromine and iodine

allow (because) chlorine has two reactions

allow (because) neither bromine nor iodine can displace chlorine

1

(and) bromine displaces iodine **or** iodine does not react

allow (and) bromine has one reaction
***or** iodine has no reactions*

allow (and) iodine cannot displace bromine

1

(e) 80

1

(f) (1.2 kg =) 1200 (g)
or (900 g =) 0.9 (kg)

1

$$(\frac{900}{1200} \times 100) = 75(\%)$$

or

$$(\frac{0.9}{1.2} \times 100) = 75(\%)$$

allow an answer correctly calculated from:

$$(\frac{900}{\text{incorrect attempt at conversion of 1.2}} \times 100)$$

or

$$(\frac{\text{conversion of 900}}{1.2} \times 100)$$

1

*an answer of 75 (%) scores **2** marks*

[9]

Q3.

(a) nucleus

1

neutron

1

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neutron

1

electron

1

proton

1

must be in this order

(b) $(A_r)\ \frac{(63 \times 70) + (65 \times 30)}{100}$

1

= 63.6

1

*an answer of 63.6 scores **2** marks*

(c) copper / Cu

*allow ecf from answer to question **(b)***

1

(d) $\frac{1.2 \times 10^{-10}}{10\,000}$

or

$1.2 \times 10^{-10} \times 1 \times 10^{-4}$

1

$= 1.2 \times 10^{-14}$ (m)

1

*an answer of 1.2×10^{-14} (m) scores **2** marks*
*a correct answer not in standard form scores **1** mark*

[10]

Q4.

(a) sodium oxide

allow Na_2O

1

(b) oxidation

1

(c) 13

1

(d) sodium hydroxide

1

(e) OH^-

1

(f) $(\text{volume} =)\ \frac{250}{1000}$ or $\frac{1}{4}$

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or 0.25 (dm^3)

1

or

$(\text{mass per } cm^3 =) \frac{40}{1000}$ (g)

or 0.04 (g)

$(\frac{250}{1000} \times 40 =)$ 10 (g)

1

*an answer of 10 (g) scores **2** marks*

(g) all points correct

allow a tolerance of ±½ a small square
*allow **1** mark for 3 points correct*
ignore any attempt at a line of best fit

2

(h) 39 °C

allow any value from 34 to 46 (°C)

1

[10]

Q5.

(a) FeS_2

*do **not** accept equations*

1

(b) 26

1

30

1

26

1

must be this order

(c) any **two** from:

- iron has a high(er) melting / boiling point
- iron is dense(r)
- iron is hard(er)

allow iron is less malleable / ductile

- iron is strong(er)
- iron is less reactive

allow specific reactions showing difference in reactivity

- iron has ions with different charges
- iron forms coloured compounds
- iron can be a catalyst

allow iron is magnetic

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allow the converse statements for sodium
allow transition metal for iron
allow Group 1 metal for sodium
ignore references to atomic structure
ignore iron rusts

2

(d) carbon is more reactive (than nickel)

allow converse

1

(so) carbon will displace / replace nickel (from nickel oxide)

allow (so) nickel ions gain electrons

or

(so) carbon will remove oxygen (from nickel oxide)

allow (so) carbon transfers electrons to nickel (ions)

1

(e) (total M_r of reactants =) 87

1

(percentage atom economy)

$$= \frac{59}{87} \times 100$$

allow (percentage atom economy)

$$= \frac{59}{\textit{incorrectly calculated } M_r} \times 100$$

1

= 67.8 (%)

allow an answer from an incorrect calculation to 3 sig figs

1

*an answer of 67.8 (%) scores **3** marks*

*an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks*

an incorrect answer for one step does not prevent allocation of marks for subsequent steps

[11]

Q6.

(a) copper, zinc, sodium chloride solution

1

(b) a reactant is used up

allow the reaction stops

allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant

1

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(c) the reaction is not reversible

1

(d) $2H_2 + O_2 \longrightarrow 2H_2O$

allow fractions / multiples

*allow **1** mark for O_2*

2

(e) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3–4

Level 1: Relevant points are made. This is not logically linked.

1–2

No relevant content

0

Indicative content

reasons why fuel cells could be judged as better

from the table	from other knowledge
• time for refuelling a fuel cell is faster than recharging **or** a fuel cell does not need to be recharged • a fuel cell has a greater range	• hydrogen can be renewable if made by electrolysis using renewable energy • lithium-ion batteries can catch fire • produces only water **or** no pollutants produced • lithium-ion batteries may release toxic chemicals on disposal • lithium-ion batteries (eventually cannot be recharged so) have a finite life

reasons why the lithium-ion battery could be judged as better

from the table	from other knowledge
• lithium-ion uses energy more efficiently • cost of lithium-ion car much less • cost of recharging much less than refuelling with hydrogen	• hydrogen is often made from fossil fuels so is not renewable • charging points are more widely available than hydrogen filling stations • hydrogen takes up a lot of space

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	or is difficult to store • hydrogen can be highly flammable / explosive • no emissions produced • (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life

[11]

Q7.

(a) B

1

(b) C

1

(c) A

1

(d) sum of protons and neutrons

allow number of protons and neutrons

1

(e) between 69.5 and 70.0

1

(f) Chadwick provided the evidence to show the existence of neutrons

allow Chadwick discovered neutrons

1

(this was necessary because) isotopes have the same number of protons

allow (this was necessary because) isotopes have the same atomic number

or

(this was necessary because) isotopes are atoms of the same element

ignore isotopes have the same number of electrons

1

but with different numbers of neutrons

allow but with different mass (numbers)

1

[8]

Q8.

(a) reactant

1

(b) reversible

1

(c) blue

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allow shades of blue, e.g. pale blue

1

(d) 1.6 (g)

1

(e) $\frac{0.9}{2.5} \times 100$

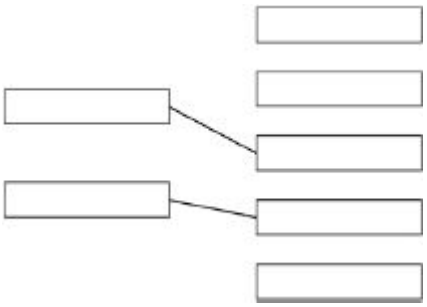
1

= 36 (%)

1

*an answer of 36 (%) scores **2** marks*

(f)



copper sulfate − $CuSO_4$

1

water − H_2O

1

[8]

Q9.

(a) incomplete combustion

1

(because) insufficient / limited oxygen supply

1

(b) any **two** from:

- carbon monoxide toxic / poisonous

  allow description of how carbon monoxide is toxic / poisonous
  ignore carbon monoxide is harmful / dangerous / deadly

- greater public concern / awareness about pollution

  ignore comments about the effects of other pollutants

  ignore unspecified comments about carbon monoxide pollution

- more cars so otherwise there would be more carbon monoxide entering atmosphere

- improved engine technology

- catalytic converters have been introduced

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2

(c) any **one** from:

- (to reduce) health problems

  allow (to reduce) specified health problems e.g. breathing difficulties, asthma, lung cancer

- (to reduce) global dimming

  allow (to reduce) the effects of global dimming e.g. reduced light levels

  allow (to reduce) smog
  allow (to reduce) the formation of particulates

  ignore global warming

  *do **not** accept to reduce soot*

1

(d) nitrogen (from atmosphere) reacts with oxygen (from atmosphere)

1

at high temperature (in engine)

ignore heat / hot

or
with a spark (from spark plug)

1

(e) **2** $NO_2 \longrightarrow N_2$ + **2** O_2

allow multiples

*if incorrect, allow N_2 for **1** mark*

2

(f) any **one** from:

- acid rain

  allow specific effects of acid rain

- respiratory problems

  allow specific respiratory problems e.g. breathing difficulties, asthma

- carbon monoxide

- global dimming **or** smog

2

***max 1** mark if global warming mentioned*

(g) transition metals

1

[12]

Q10.

(a) proton

1

(b) electron

1

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(c) 7

1

4

1

in this order only

(d) isotopes

1

(e) neutron

1

(f) $\frac{(10 \times 20) + (11 \times 80)}{100}$

1

= 10.8

1

*an answer of 10.8 scores **2** marks*

(g) $\frac{0.2}{10000}$

1

= 2×10^{-5} (nm)

allow 0.00002 (nm)

1

an answer of 2×10^{-5} (nm) scores 2 marks

[10]

Q11.

(a) $4\ Na + O_2 \longrightarrow 2Na_2O$

allow multiples

1

(b) (sodium) gains oxygen

1

(c) purple

1

(d) aluminium chloride

1

(e) **Level 2 (3-4 marks):**
Relevant reasons are identified, given in detail and logically linked to form a clear account.

Level 1 (1-2 marks):
Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

Level 0
No relevant content

Indicative content

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conclusion 1
- pH values above 7 are alkaline
- sodium oxide, calcium oxide and magnesium oxide do form alkaline solutions (so correct for those)
- not all metal oxides form solutions (so incorrect for zinc oxide)

conclusion 2
- pH values below 7 are acidic
- carbon dioxide, sulfur dioxide and phosphorus oxide do form acidic solutions (so correct for those)
- not all non-metal oxides form solutions (so incorrect for silicon oxide)]

4

(f) metal oxides produce alkaline solutions if they dissolve in water

*allow **1** mark for most metal oxides produce alkaline solutions*

2

[10]

Q12.

(a) fill burette with sodium hydroxide

1

add sodium hydroxide from the burette to the hydrochloric acid and indicator

1

stop when colour changes

1

measure volume used from burette

1

plus any **two** from:
- stand flask on white tile
- swirl
- add dropwise near the endpoint
- repeat

2

(b) filtration

1

(c) evaporate some of the solution and leave to cool

or

heat with an electric heater

1

[8]

Q13.

(a) precipitate / solid formed

allow colour change

1

(b) total mass before = 257.68 g
total mass after = 257.68 g

1

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so the mass of products equals
the mass of the reactants

1

(c) 0.01 g

1

(d) 207 + (2 × 14) + (6 × 16)
or
207 + 2 × [14 + (3 × 16)]

1

= 331

1

*an answer of 331 scores **2** marks*

(e) CrO_4^{2-}

1

(f) carbon dioxide is a gas
allow a gas is produced

1

the gas escapes during the reaction

1

(so) the mass at the end is less than expected

1

[10]

Q14.

(a) mass number
allow the number of protons + neutrons

1

(b) 6.02×10^{23}

1

(c) **Level 2 (3-4 marks):**
Scientifically relevant features are identified; the ways in which they are similar / different is made clear.

Level 1 (1-2 marks):
Relevant features are identified and differences noted.

Level 0
No relevant content.

Indicative content

similarities
- both have positive charges
- both have (negative) electrons
- neither has neutrons

differences

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plum pudding model	nuclear model
ball of positive charge (spread throughout)	positive charge concentrated at the centre
electrons spread throughout (embedded in the ball of positive charge)	electrons outside the nucleus
no empty space in the atom	most of the atom is empty space
mass spread throughout	mass concentrated at the centre

4

(d) $\frac{(24 \times 78.6) + (25 \times 0.1) + (26 \times 11.3)}{100}$

or
(24 × 0.786) + (25 × 0.101) +
(26 × 0.113)

1

= 24.3

1

*an answer of 24.3 scores **2** marks*

[8]

Q15.

(a) heat with a water bath
or
heat with an electric heater
or
allow to evaporate / crystallise at room temperature

1

(b) to make sure that all the iodine reacts
allow so can see the reaction is complete

1

(as) excess iodine would remain in solution

1

(so) iodine could not be filtered off
allow (whereas) excess zinc could be filtered off
or
(so) the zinc iodide would not be pure
allow (so) would have to separate iodine from zinc iodide

1

(c) $\text{moles } I_2 = \frac{0.5(00)}{254} = (0.00197)$
allow moles I_2 = 0.00197
allow 65 g Zn: 254 g I_2

1

mass Zn = 0.00197 × 65 (g)

1

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mass = 0.128 (g)

1

allow an expression $\frac{0.5(00)\times 65}{254}$ *(g) for the first* ***2*** *marks*

(d) $92.0 = \frac{12.5}{\text{maximum mass}} \times 100$

1

$(\text{maximum mass}=) \frac{100}{92.0} \times 12.5$

1

= 13.6 (g)

allow 13.5869... (g)

1

(e) some product lost on separation

allow incomplete reaction

1

(f) M_r ZnI_2 = 319

1

moles needed

$\left(= 0.1 \times \frac{250}{1000}\right) = 0.025$

or

mass per dm^3 = 31.9 (g)

1

(mass) = 7.98 (g)

allow 7.975 / 8.0 (g)

1

an answer of 7.975, 7.98 or 8.0 (g) scores ***3*** *marks*

[14]

Q16.

(a) the chemical reaction is reversible

1

(b) any **two** from:

- type of electrode
- electrolyte
- concentration of electrolyte
- temperature

2

(c) $H_2 + \mathbf{2}OH^- \rightarrow \mathbf{2}H_2O + \mathbf{2}\ e^-$

allow multiples

1

(d) contains OH^- ions

1

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(e) (bonds broken)

((6 × 412) + (2 × 360) + (2 × 464) + (3 × 498)) = 5614

1

(bonds made)
((4 × 805) + (8 × 464)) = 6932

1

(overall energy change)
(6932 − 5614) = −1318 (kJ / mol)

allow ecf from marking point 1 and / or marking point 2

1

*an answer of 1318 (kJ / mol) scores **3** marks*

[8]

Q17.

(a) any **one** from:

- there was a flame
- energy was given out
- a new substance was formed
- the magnesium turned into a (white) powder

answers must be from the figure

1

(b) Magnesium oxide

1

(c) The reaction has a high activation energy

1

(d) 9

1

(e) They have a high surface area to volume ratio

1

(f) any **one** from:

- Better coverage
- More protection from the Sun's ultraviolet rays

1

(g) any **one** from:

- Potential cell damage to the body
- Harmful effects on the environment

1

(h) indication of $\frac{1}{1.6}$ = 0.625
and
use of indices $10^{-9} - 10^{-6} = 10^{3}$

Both steps must be seen to score first mark

1

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0.625 × 1000 = 625 (times bigger)

1

[9]

Q18.

(a) **B**

1

(b) **D**

1

(c) **E**

1

(d) **C**

1

(e) 92.5 × 6 **and**
7× 7.5

1

$$\frac{607.5}{100}$$

1

6.075

1

6.08

1

*allow 6.08 with no working shown for **4** marks*

[8]

Q19.

(a) 13 (protons)

The answers must be in the correct order.

*if no other marks awarded, award **1** mark if number of protons and electrons are equal*

1

14 (neutrons)

1

13 (electrons)

1

(b) has three electrons in outer energy level / shell

allow electronic structure is 2.8.3

1

(c) **Level 3 (5–6 marks):**
A detailed and coherent comparison is given, which demonstrates a broad knowledge and understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links.

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Level 2 (3–4 marks):
A description is given which demonstrates a reasonable knowledge and understanding of the key scientific ideas. Comparisons are made but may not be fully articulated and / or precise.

Level 1 (1–2 marks):
Simple statements are made which demonstrate a basic knowledge of some of the relevant ideas. The response may fail to make comparisons between the points raised.

0 marks:
No relevant content.

Indicative content

Physical
Transition elements
- high melting points
- high densities
- strong
- hard

Group 1
- low melting points
- low densities
- soft

Chemical
Transition elements
- low reactivity / react slowly (with water or oxygen)
- used as catalysts
- ions with different charges
- coloured compounds

Group 1
- very reactive / react (quickly) with water / non-metals
- not used as catalysts
- white / colourless compounds
- only forms a +1 ion

6

[10]

Q20.

(a) any **one** from:

- heat
- stir

1

(b) filter

accept use a centrifuge

accept leave longer (to settle)

1

(c) any **one** from:

- wear safety spectacles
- wear an apron

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1

(d) evaporation at **A**

1

condensation at **B**

1

(e) 100

1

[6]

Q21.

(a) The forces between iodine molecules are stronger

1

(b) anything in range +30 to +120

1

(c) Brown

1

(d) $2\ I^- + Cl_2 \rightarrow I_2 + 2\ Cl^-$

1

(e) It contains ions which can move

1

(f) hydrogen iodine

1

[6]

Q22.

(a) line goes up before it goes down

1

energy given out correctly labelled

1

activation energy labelled correctly

1

(b) electrostatic force of attraction between shared pair of negatively charged electrons

1

and both positively charged nuclei

1

(c) bonds formed = 348 +4(412) + 2(276) = 2548 kJ / mol

1

bonds broken − bonds formed = 612 + 4(412) + (Br-Br) − 2548 = 95 kJ / mol

1

Alternative approach without using C-H bonds
For step 1 allow = 348 + 2(276) = 900 kJ / mol
Then for step 2 allow 612 + (Br-Br) − 900 = 95 kJ / mol

193 (kJ / mol)

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1

*accept (+)193 (kJ / mol) with no working shown for **3** marks*
*−193(kJ / mol) scores **2** marks*
allow ecf from step 1 and step 2

(d) **Level 3 (5–6 marks):**
A detailed and coherent explanation is given, which demonstrates a broad understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links. A conclusion is reached.

Level 2 (3–4 marks):
An explanation is given which demonstrates a reasonable understanding of the key scientific ideas. A conclusion may be reached but the logic used may not be clear or linked to bond energies.

Level 1 (1–2 marks):
Simple statements are made which demonstrate a basic understanding of some of the relevant ideas. The response may fail to make logical links between the points raised.

0 marks:
No relevant content.

Indicative content

Size and strength
- chlorine atoms have fewer electron energy levels/shells
- chlorine atoms form stronger bonds
- Cl–Cl bond stronger than Br–Br
- C–Cl bond stronger than C–Br

Energies required
- more energy required to break bonds with chlorine
- more energy given out when making bonds with chlorine
- overall energy change depends on sizes of energy changes

Conclusions
- if C−Cl bond changes less, then less exothermic
- if C−Cl bond changes more, then more exothermic
- can't tell how overall energy change will differ as do not know which changes more.

6

[14]

Q23.

(a) Air

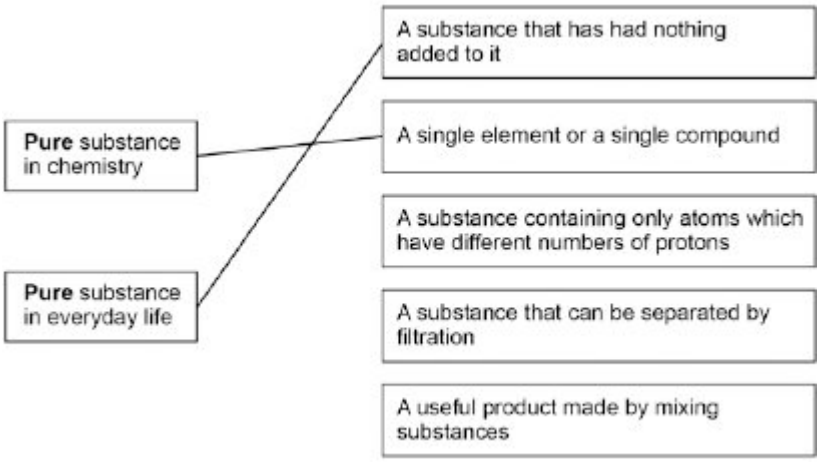
2

Steel

1

(b)

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Allow **1** mark for the correct meanings linked to context but incorrect way around

1

(c) Damp litmus paper turns white

1

(d) Iron(III)

1

[6]

Q24.

(a) 50

1

(b) 5%

1

(c) any **two** from:

- cost (9 carat is cheaper)
- pure gold is soft
  or
  24 carat gold is soft
  or
  9 carat gold is harder
  allow 9 carat gold is stronger
  allow gold is an alloy in 9 carat gold
- can change the colour

2

[4]

Q25.

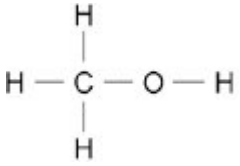
(a) Propanol

1

(b) Butanol has the highest boiling point

1

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(c) 

1

(d) ethene + water (→ ethanol)

allow answers in either order

allow steam for water

1

(e) goes back to reactor

allow is recycled

1

(f) air contains oxygen

1

which oxidises ethanol

allow ethanol reacted with oxygen

1

to produce ethanoic acid

1

[8]

Q26.

(a) C_5H_{12}

1

(b) Alkanes

1

(c) (3) CO_2

1

(4) H_2O

1

*allow for **1** mark*

4 CO_2 + 3 H_2O

(d) contains hydrogen and carbon

1

(hydrogen and carbon) only

1

(e) *(diesel)*

produces more oxides of nitrogen

allow converse answers in terms of petrol

1

produces (more) particulate matter

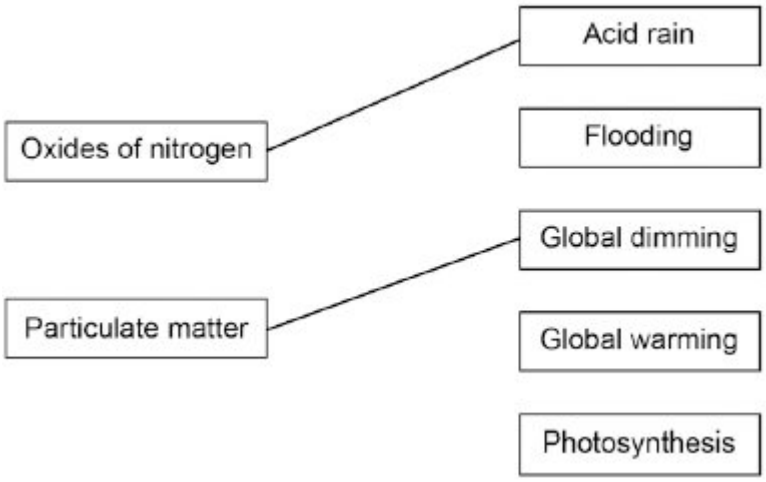
1

produces less carbon dioxide

1

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(f)



2

[11]

Q27.

(a) filtration
or
by passing through filter beds to remove solids

1

sterilisation to kill microbes

allow chlorine / ozone allow ultraviolet light

1

(b) water needs more / different processes

1

because it contains any **two** from:

- more organic matter
- more microbes
- toxic chemicals or detergents

2

(c) *(as part of glassware attached to bung)*
salt solution in (conical) flask

allow suitable alternative equipment, eg boiling tube

1

(at end of delivery tube)
pure water in test tube which must not be sealed

allow suitable alternative equipment, eg, beaker, condenser

1

heat source (to heat container holding salt solution)

1

*if no other mark obtained allow for **1** mark suitable equipment drawn as part of glassware attached to bung **and** at end of delivery tube*

(d) determine boiling point

1

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should be at a fixed temperature 100°C

allow should be 100°C

allow if impure will boil at a temperature over 100°C

1

(e) high energy requirement

1

[11]

Q28.

(a) $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

2

*allow **1** mark for correct formulae*

(b) sensible scales, using at least half the grid for the points

1

all points correct

± ½ small square

*allow **1** mark if 8 or 9 of the points are correct*

2

best fit line

1

(c) steeper line to left of original

1

line finishes at same overall volume of gas collected

1

(d) acid particles used up

allow marble / reactant used up

1

so concentration decreases

allow surface area of marble decreases

1

so less frequent collisions / fewer collisions per second

*do **not** accept fewer collisions unqualified*

1

so rate decreases / reaction slows down

1

(e) mass lost of 2.2 (g)

1

time taken of
270 s

allow values in range 265 − 270

1

$$\frac{2.2}{270} = 0.00814814$$

allow ecf for values given for mass and time

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1

0.00815 (g / s)

or

8.15×10^{-3}

*allow **1** mark for correct calculation of value to 3 sig figs*
*accept 0.00815 or 8.15×10^{-3} with no working shown for **4** marks*

1

(f) correct tangent

1

eg 0.35 / 50

1

0.007

allow values in range of 0.0065 − 0.0075

1

7×10^{-3}

1

*accept 7×10^{-3} with no working shown for **4** marks*

[20]

Q29.

(a) both water vapour and ethanol will condense

allow steam for water vapour
allow they both become liquids
allow ethane condenses at a lower temperature
allow some of the steam hasn't reacted
allow it is a reversible reaction / equilibrium

1

(b) amount will decrease

1

because the equilibrium will move to the left

1

(c) more ethanol will be produced

1

because system moves to least / fewer molecules

1

[5]

Q30.

(a) (i) 7

1

(ii) –1

1

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(iii) neutrons

1

(b) number of protons

1

(c) atom **Y**

1

(d) (i) Ne

allow neon

1

(ii) has a full outer shell

allow in Group 0

allow a noble gas

or

full outer energy level

allow the shells are full

or

has 8 electrons in its outer shell

ignore in Group 8

1

[7]

Q31.

(a) the Earth's (surface) temperature was high **or** at/above 100 °C

*allow the Earth's (surface) temperature was too / very hot **or** water evaporated / boiled **or** turned to steam / gas*

allow because of heat from volcanoes

ignore the Earth's (surface) was covered by volcanoes

ignore water turned to water vapour

1

(b) (i) air ——— mixture

1

carbon dioxide ——— compound

1

argon ——— element

1

allow only one line from each substance

(ii) oxygen

1

(iii) about 80 %

1

(c) (i) 0.03(0) (%)

1

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(ii) increased

1

slowly then rapidly

1

allow figures from graph to indicate increase

(iii) any **two** from:

- use of fossil fuels
- deforestation
  allow less trees / plants
- cars/transport
- industry/factories

ignore more people

2

[11]

Q32.

(a) (i) electronic structure 2,3 drawn

allow any representation of electrons, such as, dots, crosses, or numbers (2,3)

1

(ii) nucleus

1

(iii) protons and neutrons

*do **not** allow electrons in nucleus*

1

(relative charge of proton) +1

allow positive

1

(relative charge of neutron) 0

allow no charge/neutral

1

ignore number of particles

(b) too many electrons in the first energy level or inner shell

allow inner shell can only have a maximum of 2 electrons

1

too few electrons in the second energy level or outer shell

*allow neon has 8 electrons in its outer shell **or** neon does not have 1 electron in its outer shell*

allow neon has a stable arrangement of electrons or a full outer shell

1

neon does not have 9 electrons **or** neon has 10 electrons

allow one electron missing

allow fluorine has 9 electrons

1

ignore second shell can hold (maximum) 8 electrons or 2,8,8 rule or is a noble gas or in Group 0

max 2 marks if the wrong particle, such as atoms instead of electrons

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if no other mark awarded allow 1 mark for the electronic structure of neon is 2,8

[8]

Q33.

(a) add yeast

1

and ferment **or** by fermentation

*allow in a warm place **or** temperatures within the range 20-45°C **or** with an airlock / absence of air*

1

(b) heat (the mixture)

1

ethanol has a lower boiling point than water **or** more ethanol than water vaporises **or** ethanol evaporates first or when the temperature reaches 78°C

allow ethanol and water boil at different temperatures

1

condense (the vapour)

allow condense at different temperatures for the last two marking points

if no other mark is awarded, allow repeat distillation or use fractional distillation apparatus for 1 mark

1

[5]

Q34.

(a) (i) 7 / seven

1

(ii) 1

*do **not** accept –1*

1

Electron

1

(iii) isotopes

1

(b) (i) (sodium +) fluorine → sodium fluoride

1

(ii) compounds

1

(iii) mole

1

(iv) sodium (atom) loses

1

fluorine (atom) gains

1

one electron

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1

ions formed

1

allow sodium forms positive (ion) ***or*** *fluorine forms negative (ion)*
allow form ionic bond
allow to gain a full outer shell of electrons
allow forms noble gas structure
max 3 *if reference to incorrect particle / bonding*

(v) Dissolve in water

1

High melting point

1

[13]

Q35.

(a) (i) (mass number = 16) because there are 8 protons and 8 neutrons (in the nucleus)

accept mass number is total number of protons and neutrons for ***1*** *mark*

2

(ii) same number of protons **or** both have 6 protons

accept same atomic number

1

^{12}C has 6 neutrons

1

^{14}C has 8 neutrons

1

accept different number of neutrons for ***1*** *mark*
numbers, if given, must be correct
incorrect reference to electrons = ***max 2*** *marks*

(b) (i) 2 bonding pairs

1

additional unbonded electrons negates this mark

4 unbonded electrons around oxygen

1

accept dot, cross or e or – or any combination

(ii) covalent

1

(iii) any **one** from:

- no delocalised / free electrons
  ignore mobile electrons
- no overall electric charge
  accept no charge (carriers)
- no ions

1

do ***not*** *accept any implications of the presence of ions*

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(c) (i) larger

accept the size of a few hundred atoms
accept atoms are smaller (than nanoparticles)
allow up to 1000 atoms)

1

(ii) (nanoparticles have) large(r) surface area

1

[11]

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