AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.5.1 EXOTHERMIC AND ENDOTHERMIC REACTIONS (PACK 2)

SCORE	PERCENTAGE
/256	%

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) (i) aluminium oxide

ignore (III) after aluminium

1

(ii) (because it provides) heat / energy (to overcome activation energy)

1

(b) (i) contains only one sort of atom

1

(ii) the atoms (in cast iron) are different sizes

*any mention of molecules, maximum **1** mark*

*accept layers are distorted **or** structure is disrupted*

1

which prevents the layers / rows sliding

accept an answer in terms of pure iron being softer than cast iron for both marks

1

(c) (i) because aluminium is more reactive than carbon

'it' = aluminium must be a comparison between the elements

or

because aluminium is above carbon in the reactivity series

*do **not** accept any comparison of the reactivity of aluminium and iron*

1

(ii) reduces / lowers the temperature for the process **or** lowers the operating temperature **or** allows ions to move

ignore any temperature values

allow reduces the (effective) melting point (of Al_2O_3)

1

(iii) 3

accept multiples

1

(iv) electrons are gained (by Al^{3+})

ignore any numbers

ignore any reference to oxygen

1

(v) electrodes are made of carbon

allow graphite / coke

1

oxygen is produced (at the positive electrode / anode)

accept $2O^{2-} \rightarrow O_2 + 4e^-$

1

STEMUP.CO.UK

so the electrodes react with the oxygen / are oxidised

1

producing carbon dioxide (gas)

accept $C + O_2 \rightarrow CO_2$ for marking points 3 and 4.

1

[13]

Q2.

(a) neutron(s)

answers can be in either order

1

proton(s)

1

(b) same number (17) protons **or** same number electrons

if candidate chooses to quote numbers, they must be correct

1

different numbers of neutrons (^{35}Cl has 18 and ^{37}Cl has 20)

1

(c) (i) −184kJ / mol

*correct answer with or without working gains **3** marks*

*allow **2** marks for 184 kJ / mol*

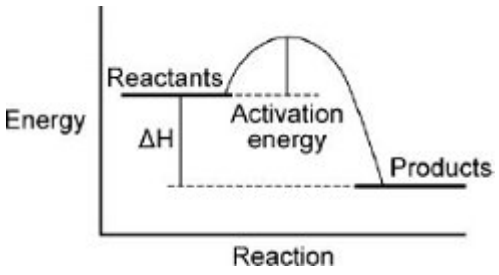
*If answer incorrect award up to **2** marks for any two of the steps below:*

- *bonds broken: (436 + 242) = 678 (kJ)*
- *bonds formed: (2 × 431) = 862 (kJ)*
- *bonds broken − bonds formed*

allow ecf for arithmetical errors

3

(ii)



the reactants and the products at the correct level

ignore labels on the axes

1

ΔH correctly labelled

allow −538 if in correct place

1

E_a correctly labelled

*correctly labelled endothermic reaction gains max. **2** marks*

1

STEMUP.CO.UK

[10]

Q3.

(a) (i) endothermic

could be answered by indicating the correct word in the box

1

(ii) final temperatures got lower **or** temperature went down

ignore comments on energy

1

(b) polystyrene / plastic cup **or** description of insulation / lagging container

ignore references to a lid

1

because (polystyrene) is an insulator **or** prevents heat / energy gain (and so temperature is more accurate)

*allow references to heat loss **or** glass conducts / absorbs heat*

1

(c) **variable**: volume **or** mass **or** amount of water

***1** mark for variable and **1** mark for reason linked to that variable*

*maximum of **4** marks for two variables and two explanations*

reason: the greater the volume / mass of water, the more heat energy it contains **or** the smaller the temperature change will be

*do **not** allow 'time taken to heat'*

variable: start temperature **or** temperature of water

reason: the higher the start temperature, the more heat energy it contains **or** the higher the final temperature will be

*do **not** allow higher temperature change*

variable: the time at which the temperature is measured

reason: if left longer may gain heat energy from surroundings **or** warm up **or** if measured too soon not all ammonium chloride will have dissolved so less temperature change

variable: rate of dissolution **or** speed of dissolving **or** amount of stirring

reason: if it dissolves faster **or** is stirred faster then it will cool more quickly **or** small particles dissolve faster

max. 4

(d) (i) all 7 points correct

*at least 4 points plotted correctly scores **1** mark*

2

(ii) straight line through first 3 or 4 points

lines must be drawn with a ruler

1

STEMUP.CO.UK

straight line through last three points

*if no other marks awarded allow curve joining lines for **1** mark*

1

(iii) valid extrapolation of line back to mass of 0 g

1

correct value read from graph

*award **1** mark for 20 − 21 if no extrapolation shown*

1

(e) not all of the ammonium chloride would dissolve

*allow water limiting factor **or** all water used*

1

so no more heat would be absorbed

or

the solution is saturated (1)

*allow water limiting factor **or** all water used*

so some ammonium chloride remains solid **or** not all will dissolve (1)

1

(f) greater volume of water was used **or** volume was twice as large

allow different volume of water

1

so temperature decrease was less than the first student's result

allow so final temperature was higher

or

starting temperature / room temperature was higher (1)

so final temperature was greater than the first student's result (1)

*accept by 6 °C **or** was any value in range 26 − 27°C*

1

[18]

Q4.

(a) (i) the more sodium hydrogencarbonate the greater the temperature change

accept examples from the table

1

up to 8 spatula measures

accept any correct indication of when change occurs

1

then the temperature change is constant

*if no marks awarded allow **1** mark for:*
the more sodium hydrogencarbonate the lower the final temperature

1

STEMUP.CO.UK

(ii) energy is taken in from the surroundings **or** endothermic

1

(b) (i) gas / carbon dioxide / steam / water is produced

*accept carbon dioxide is a gas **or** steam / water is a gas*

allow gas / air expands when heated

1

(ii) no, because (reaction) is exothermic

or

yes, to start the reaction

allow no, because (reactants) were formed by heating

ignore references to cooling

1

(c) (i) 84

*correct answer with or without working gains **2** marks*

*if no answer or incorrect answer then evidence of 23 +1 + 12 + (3 × 16) gains **1** mark*

2

(ii) 14.29

accept rounding to 14.3 or 14

allow ecf from (c)(i)

1

[9]

Q5.

(a) (i) 42 000

*correct answer gains **2** marks with or without working*

allow 42 kJ

*if answer incorrect : correct substitution 500 x 4.2 x 20 gains **1** mark*

2

(ii) any **two** from:

- eye protection
- lab coat
- heat-proof mat
- (heat-proof) gloves
- (long) hair tied back
- stand up
- secure the beaker

2

(iii) Stir the water before measuring the temperature.

1

STEMUP.CO.UK

Place a lid on the beaker.

1

(b) the products → S

1

the activation energy → Q

1

the energy released by the reaction → P

1

(c) carbon dioxide produced

it = propane

allow converse arguments

allow greenhouse gas / global warming / atmospheric pollution

(crude oil / propane) non-renewable

1

allow crude oil running out

1

[11]

Q6.

(a) air

1

(b) recycle

allow re-use

1

(unreacted) nitrogen and hydrogen

allow N_2 and H_2

1

(c) $N_2 + \mathbf{3}H_2 \rightarrow \mathbf{2}NH_3$

allow correct multiples

1

(d) *allow converse arguments*
ignore references to compromise

because a higher temperature would reduce (equilibrium) yield

allow higher temperature favours backward reaction

1

because a lower temperature would reduce rate

1

(e) (i) (energy of) reactants greater than (energy of) products

allow converse

allow (overall) energy decreases

allow energy required to break bonds is less than the energy released making bonds

1

STEMUP.CO.UK

(ii) line starting and finishing at same levels but with lower peak

1

[8]

Q7.

(a) (i) $\Delta T = (64 - 17) = 47$ °C

1

750 x 4.2 x 47

allow ecf using their ΔT

1

148 050

*correct answer gains **3 marks** with **or** without working*
ignore sign
allow 148.05 kJ
allow 148 kJ

1

(ii) 1085.7

*correct answer gains **2** marks with or without working.*
*allow answer in range 1080 – 1089 for **2 marks***
*allow answer in range 1080000 – 1089000 for **1 mark***
*if answer is incorrect allow 6/44 = 0.136 mol for **1 mark***
*allow (44 x their (a)(i))/(6 x 1000) correctly calculated for **2 marks***
*allow (44 x their (a)(i))/6 correctly calculated for **1 mark***
If they have used the given value of 144 000:
*Allow any answer in range 1051 - 1059 for **2 marks** with or without working.*
*allow any answer in range 1051000 – 1059000 for **1 mark***

2

(iii) repeat the experiment and then calculate the mean

1

any **one** from:

- use a lid
- insulate the beaker
  *do **not** allow flammable insulation*
- stir
- prevent draughts

1

(iv) inaccuracies likely to have similar effects

allow systematic errors

1

(b) (i) 8530

correct answer gains 3 marks with or without working.

STEMUP.CO.UK

If answer is incorrect;
(6 x 803) = <u>4818</u> gains 1 mark
(8 x 464) = <u>3712</u> gains 1 mark
correct addition of their calculated values gains 1 mark (ecf)

3

(ii) 6481 – 8530) = (-) 2049
ignore sign
allow ecf from (b)(i)

1

[12]

Q8.

(a) any **one** from:

- no method / electrolysis / equipment / technology
  *allow 'didn't know how to' **or** 'no knowledge'*
- aluminium is a very reactive metal
- high melting point
  allow 'couldn't heat it enough'
- potassium had not been discovered

1

(b) because <u>others</u> / <u>scientists</u> / <u>they</u> could not repeat the experiment
ignore he could not repeat the experiment

or
<u>others</u> / <u>they</u> could not obtain the same results

1

(c) reaction is endothermic **or**
reaction <u>takes in</u> heat / energy
accept activation energy
ignore rate / high temperature
ignore bonds broken

1

(d) (aluminium chloride + potassium) → aluminium + potassium chloride
in either order
accept correct formulae
ignore metal
ignore balancing

1

(e) when tested it had the properties of a metal
accept a test for a metal property eg conductivity / reaction with acid

1

properties were different (from other known metals)

STEMUP.CO.UK

accept properties compared with other metals

1

[6]

Q9.

(a) 22

1

(b) (i) exothermic

1

(ii) C

1

gives out most heat energy

accept has largest temperature change / increase

*allow has highest (final) temperature **or** hottest*

1

(c) (i) increases

1

(ii) blue

ignore pale / dark etc

1

(iii) reversible (reaction)

*allow goes both ways **or** two / either way*

1

(iv) anhydrous copper sulfate

1

[8]

Q10.

(a) gives out energy **or** heat

1

(b) (i) *accept qualified answers in terms of volume of gas related to time*

fast initially

1

slows down

1

reaction stops

accept reaction is now very slow

1

(b) (ii) 21

1

(iii) 84

STEMUP.CO.UK

*correct answer with or without working = **2** marks*
*allow ecf from (b)(ii) correctly calculated for **2** marks*
*allow evidence of 21/25 **or** (b)(ii)/25 for **1** mark*

2

(c) because they / particles have more energy / move faster
ignore particles move more / vibrate

1

(and so) particles collide more often / more frequently **or** particles more likely to collide
ignore collide faster
ignore more collisions

1

(and) more of the collisions are successful **or** particles collide with more energy / harder **or** more of the particles have the activation energy
accept more successful collisions

1

[10]

Q11.

(a) (i) the temperature at start
ignore reference to bubbles / heat

1

the temperature at end
*(measure) the temperature rise / change = **2** marks*
*(measure) the temperature **1** mark*

1

(ii) temperature would increase
allow it gets hot(ter) / warm(er) or heat given off
allow energy released / transferred

1

(b) any **one** from:

- volume of acid
allow amount
allow liquid
- temperature of acid
- size of magnesium ribbon
allow volume / mass / amount
- surface area of magnesium
ignore size of test tube and reference to water

1

(c) (i) (Test tube) B

1

STEMUP.CO.UK

(ii) produces bubbles faster

accept more bubbles

or

faster rate of reaction

allow most reactive

1

(d) The particles move faster

1

The particles collide more often

1

[8]

Q12.

(a) (i) 4

1

(ii) (Make) 3

1

biggest temperature rise

1

(b) (i) 1008 (kJ)

*correct answer with or without working gains **2** marks*

*if incorrect answer given allow evidence of 240 × 4.2 for **1** mark*

2

(ii) crisps have a high energy content

allow crisps have lots of calories / kilojoules / fat / one ninth of daily energy intake

1

so if you take in more energy than you need the excess is stored as fat

accept consequences: obesity; heart disease; high blood pressure; diabetes; arthritis

or

crisps contain salt (1)

too much salt can cause high blood pressure **or** heart problems or kidney problems (1)

1

[7]

Q13.

(a) (i) (-)810

ignore sign

STEMUP.CO.UK

*correct answer gains **3** marks with or without working*

*if the answer is incorrect look at the working up to a maximum of **two***

- *bonds broken = (4 × 414) + (2×498) = 2652 kJ*
- *bonds formed = (2x803) + (4x464) = 3462 kJ*
- *correct subtraction of their bonds formed from their bonds broken*

3

(ii) because energy needed to break the bonds

1

is less than the energy released when bonds are formed

1

(b) to provide activation energy

or

to break bonds

1

[6]

Q14.

(a) (i) increase

1

(ii) energy is given out to the surroundings

1

(b) (i) NO

allow 2NO

ignore nitrogen oxide

*do **not** allow equations*

1

(ii) harmful / poisonous (owtte)

allow dangerous

ignore reference to pollution / global warming

*do **not** accept references to ozone layer*

1

(c) a catalyst can speed up a chemical reaction

1

different reactions need different catalysts

1

(d) (i) smaller

accept less / tiny / very small

allow 10^{-9}

*do **not** allow small unless qualified*

1

STEMUP.CO.UK

(ii) reduce cost (owtte) **or**

ignore references to energy

save resources / raw materials (owtte)

1

[8]

Q15.

(a) gives out heat / energy

allow release / loses

allow the products have less energy

or

energy / heat transferred to the surroundings

ignore temperature rises

allow more energy given out in forming bonds than taken in to break bonds

1

(b) (i) speed up the reaction (owtte)

accept changes the rate

accept lowers activation energy

accept increases <u>successful</u> collisions

accept allows reaction to take place at a lower temperature

1

(ii) nitrogen (N_2) / oxygen (O_2) / products are safe **or** not harmful / pollutant / toxic / dangerous / damaging

ignore releases nitrogen / oxygen unless qualified

or

(harmful) nitrogen monoxide / NO is not released into the air.

accept prevents / less acid rain

ignore greenhouse gas / ozone layer

1

(iii) 2 and 2

accept correct multiples or fractions

1

(iv) idea of catalyst not being used up

allow not changed by reaction

ignore catalyst does not take part

ignore catalyst not used in the reaction

1

(v) idea of different reactions (require different catalysts)

accept catalysts work for specific reactions

allow different gases

1

STEMUP.CO.UK

(c) • smaller / very small / or any indication of very small / 1–100 nanometres / a few (hundred) atoms

ignore just small

ignore size of the converter

1

• big(ger) surface area

1

• less (catalyst) needed / small amount of catalyst needed

1

[9]

Q16.

(a) A = <u>energy</u> / <u>enthalpy</u> change / difference

*allow heat change **or** ΔH*

allow energy released

1

B = activation energy / EA

allow definition of activation energy

1

C = carbon dioxide and water

accept products

1

(b) exothermic

allow combustion / redox / oxidation

ignore reduction / burning

1

[4]

Q17.

(a) *correct answer with or without working = **3** marks*

M1: (bonds broken) = 2148 (kJ)

1

M2: (bonds made) = 2354 (kJ)

1

M3: change in energy
= (-) 206 (kJ)

ecf

ignore sign

1

(b) energy released from forming new bonds is greater than energy needed to break existing bonds

allow the energy needed to break bonds is less than the energy released in forming bonds

*do **not** accept energy needed to form bonds*

1

STEMUP.CO.UK

[4]

Q18.

(a) gives out / releases / transfers to surroundings heat / energy

ignore light / burns

ignore the wire gets hot

1

(b) activation energy

1

(c) (aluminium +) oxygen (→) aluminium oxide

accept correct formulae

1

(d) C

1

(e) (i) a negative

1

(ii) loses

1

(iii) gains

1

two

1

[8]

Q19.

(a) gives out heat / energy

allow more energy given out in making bonds than is used in breaking bonds

or

energy / heat transferred to surroundings

ignore light

1

(b) activation

allow phonetic spelling

1

(c) (i) 2 crosses on inner circle **and**

8 crosses on outer circle

accepts dots / e / – for electrons

1

(ii) opposite charges (attract)

allow electrostatic forces (attract)

STEMUP.CO.UK

*do **not** accept intermolecular attraction / shared electrons*

1

[4]

Q20.

(a) goes up

1

(b) (i) B

1

(ii) A

1

(iii) a catalyst

1

activation energy

1

(c) (i) eg (ensures) complete reaction

allow spread heat / energy

or even heating

allow mixes properly or mix them together or to get correct temperature

ignore dissolves

1

(ii) lid (on beaker)

accept cover beaker

or

insulate (beaker) / use a plastic cup

1

[7]

Q21.

(a) energy released from making (new) bonds is greater than the energy needed to break (existing) bonds

accept the energy needed to break (existing) bonds is less than the energy released in making (new) bonds

*do **not** accept energy needed to make bonds*

1

(b) (i) energy / heat of products less than energy of reactants

accept products are lower than reactants

***or** reactants higher than products*

accept more energy / heat given out than taken in

***or** less energy / heat taken in than given out*

accept energy / heat is given out / lost (to the surroundings)

allow produce heat

STEMUP.CO.UK

ignore produce energy
accept ∆H is negative
***or** energy change / **A** is negative*
or B** is less than **C

1

(ii) **B** is (very) high / large
*it = **B***
*ignore energy change **C** is high*

1

(iii) *it = MnO_2*

(MnO_2) catalyst (is added)
accept it is a catalyst

or reaction catalysed (by MnO_2)
*do **not** accept MgO / magnesium oxide*

1

which lowers activation energy
accept provides alternative / lower energy pathway

or which lowers (energy change) **B**
if hydrogen peroxide is given as a catalyst instead of MnO_2 penalise once only in question

1

(c) any **two** from:

- (chemicals) not mixed / stirred
- heat / energy lost (from apparatus)
- (apparatus) not insulated **or** no lid
- low amount / mass / not enough MnO_2 **or** low concentration H_2O_2
- thermometer read incorrectly
ignore other experimental error

2

[7]

Q22.

(a) (i) 48

1

(ii) 3

1

(b) heat / energy

1

given out / transfers to surroundings

STEMUP.CO.UK

the mark for given out / transfers to cannot be awarded without heat / energy
allow given off

1

(c) it has a low boiling point

1

it is made of small molecules

1

[6]

Q23.

(a) electricity / (high) temperatures
allow lightning / heat
ignore energy

1

(b) nitrogen + oxygen → nitrogen oxide/ monoxide
allow any oxide of nitrogen

1

(c) more than

1

(d) (i) A

1

(ii) C

1

[5]

Q24.

(a) energy of product greater than energy of reactants
allow converse
allow energy = heat
*do **not** accept temperature for energy*
allow product / nitrogen oxide is higher than reactants
allow less energy / heat given out than taken in
allow energy / heat is taken in / gained
allow ∆ H is positive

1

(b) (minimum) energy needed to start the reaction / overcome energy barrier
accept (minimum) energy needed for a collision to be successful

1

(c) (i) *correct answer with or without working= **3** marks*

bonds broken = 945 + 498 = 1443 (kJ)

1

bonds made = 2 × 630 = 1260 (kJ)

STEMUP.CO.UK

1

energy change = 1443 - 1260 = (+) 183

ignore sign

allow ecf

1

(ii) energy released forming new bonds is less than energy needed to break existing bonds owtte

allow converse

accept energy change (∆H) is + / positive

*do **not** accept energy <u>needed to form new bonds</u> is less than energy needed to break existing bonds*

1

[6]

Q25.

(a) (i) (different) properties

allow ideas of different property / behaviour / element

1

(ii) any **one** from:

they = Crawford + Cruikshank

- they had high status

  or

  they were lecturers / doctors / professors / famous scientists

- other scientists repeated experiments

  allow experiment could be repeated

  allow other scientists showed they had different properties

- they had proof

  or

  lots of / strong / conclusive / enough / clear evidence

  ignore evidence unqualified

1

(iii) other scientists obtained similar results / proved it

or

experiments were repeated

1

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

- mass of solid / strontium (chloride) / barium (chloride)

  allow amount / volume

- volume of water

STEMUP.CO.UK

allow amount / mass

- type of container
  allow initial / starting temperature (of water)
  ignore room temperature / time / concentration
  ignore reference to hydrochloric acid

1

(ii) 2 **and** takes in heat / energy

or

2 **and** temperature goes down (owtte)

1

(iii) temperature increased for one experiment and decreased for the other (owtte)

or

one was exothermic and one was endothermic (owtte)
accept experiment 1 was exothermic

1

(c) any **one** from

- positive / + (charge)
  *do **not** accept incorrect further qualification eg electrons / atoms / electrodes*
- opposite (charges) attract

1

[7]

Q26.

(a) (i) increase

1

(ii) high melting point

1

(b) (i) decreases

1

increases

1

(ii) it gives the particles more energy

1

it makes the particles move faster

1

[6]

Q27.

(a) eg plastic (beaker) / insulation / lid / cover **or** any mention of enclosed

STEMUP.CO.UK

any sensible modification to reduce heat loss

ignore prevent draughts

ignore references to gas loss

1

(b) all the substances react **or** all (the substances) react fully / completely **or** heat evolved quickly **or** distribute heat

accept to mix them

'so they react' is insufficient for the mark

accept increase chances of (successful) collisions / collision rate increase

*do **not** accept rate of reaction increase / make reaction faster*

1

(c) experiment 2 **and** different / higher / initial / starting temperature

*accept experiment 2 **and** the room is hotter / at higher temperature*

*do **not** accept temperature change / results higher*

1

(d) temperature change does not fit pattern

*accept anomalous / odd **or** it is the lowest **or** it is lower than the others **or** it is different to the others*

'results are different' is insufficient

1

(e) 7 / 7.0

1

(f) (100 × 4.2 × 7) = 2940

ecf from (e)

1

(g) diagram A **and** reaction exothermic / heat evolved / Δ H is negative / temperature rises

accept energy is lost (to the surroundings)

1

[7]

Q28.

(a) carbon dioxide

must be name

*do **not** accept carbon oxide*

1

(b) (i) the temperature of the solution will decrease

(list principle)

1

(ii) energy is taken in from the surroundings

(list principle)

STEMUP.CO.UK

1

[3]

Q29.

(a) hydrogen + oxygen → water

accept $2H_2 + O_2 \rightarrow 2H_2O$ or balanced multiples or fractions
allow 1 or 2 correct formulae substituted for words
*allow hydrogen oxide **or** steam for water*

1

(b) supplied

released

both needed, must be in this order

1

(c) (i) B

1

(ii) A

1

(iii) to overcome activation energy to react **or** (activation) energy needed to start reaction

allow to provide energy

1

[5]

Q30.

(a) (bonds broken) = 1370 (kJ)

1

(bonds made) = 1856 (kJ)

1

change in energy = (–) 486

ecf
ignore sign
*correct answer with **or** without working = **3** marks*

1

(b) energy released from forming new bonds is greater than the energy needed to break existing bonds

allow the energy needed to break bonds is less than the energy released in forming bonds
*do **not** accept energy needed to form bonds*

1

(c) (i) energy barrier needs to be overcome

or

activation energy supplied / needed

*allow energy needed to start reaction **or** energy needed to break bonds*

STEMUP.CO.UK

accept high activation energy

1

(ii) lowers activation energy(*)

or

provides lower energy pathway / route(*)

*(*)**2** mark answers*

*allow provides alternative pathway **or** platinum / it is a catalyst for **1** mark*

2

[7]

Q31.

(a) gives out (heat)

1

(b) D

1

(c) L

1

(d) magnesium chloride

1

[4]

Q32.

(a) either:
calculations: all correct (ethanol = 6, methanol = 3, peanut oil = 10, vegetable oil = 15)

ignore repetition of data from table unqualified

or

implication of correct calculation

(vegetable oil) gives largest temperature / heat increase <u>per gram</u> (owtte)

allow 'produced most heat in proportion to the fuel used'
*owtte for **1** mark*

2

(b) any **one** from:

owtte

- smoke

  ignore references to crops/food

- soot

- carbon

STEMUP.CO.UK

- carbon monoxide
- carbon dioxide
- global warming / climate change / greenhouse gases
- (air) pollution
- harmful/poisonous

1

scrub / wash the gases owtte

filter / remove (gases / fumes / appropriate named substance) owtte
(add extra oxygen) can burn more efficiently owtte
use a cleaner fuel owtte
plant more trees or similar linked to CO_2
any sensible answer
'don't burn so much fuel' insufficient alone
ignore extractor fans / air conditioning

1

(c) (i) A

1

(ii) B

1

[6]

Q33.

(a) the bag gets cold because heat energy is taken in from the surroundings

1

(b) endothermic

1

(c) any **two** from:

- mix / spread (the ammonium nitrate and water)
- dissolve faster(*)
- get cold faster **or** so the whole bag gets cold(*)
  *(*)allow increase rate **or** quicker reaction*
- particles collide more **or** more collisions

2

[4]

Q34.

(a) (i) floated / (moved on) surface
accept does not sink
ignore it melted

1

STEMUP.CO.UK

(ii) melted / molten

ignore heat is given off

1

(iii) hydrogen

allow H_2

1

(b) (i) potassium / rubidium / caesium / francium

accept: K / Rb / Cs / Fr

1

(ii) they are metals

1

they form ions with a 1+ charge

1

(c) (i) atomic weight

1

(ii) similar

1

(iii) groups

1

(d) left gaps owtte

1

[10]

Q35.

(a) endothermic **and** because it takes in heat / energy

both *for one mark*

1

(b) (i) reversible reaction (or explanation)

1

(ii) add water

*do **not** accept cooling **or** reverse the reaction*

1

[3]

STEMUP.CO.UK