



General Certificate of Secondary Education

Science: Double Award 3462/2H *Specification B (Co-ordinated)*

Mark Scheme

2005 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Double Award Higher Tier 3462/2H

3462/2H Q1

question	answers	extra information	mark
(a)	6	accept 5.8 – 6	1
(b)	hydrochloric acid used up / reacted / combined / or fewer particles (of hydrochloric acid) or fewer hydrogen ions owtte	accept reactants used up accept less calcium carbonate or smaller surface area of calcium carbonate accept lower concentration / less crowded do not accept atoms / molecules ignore references to energy do not accept references to atoms or molecules	1
	fewer collisions owtte	independent mark	1
(c)	steeper curve initially	independent marks	1
	levels out at same volume	<ul style="list-style-type: none"> • must indicate levelling out • if line goes higher than 66 do not award this mark • diagonal line only = 0 marks • if steeper initially and then crosses the line and finishes correctly, then loses one 	1
total			5

3462/2H Q2

question	answers	extra information	mark
(a)	(very) small percentage / amount (in the Earth's crust)	any indication that there is a small amount, eg not much (left) accept rare (elements) / rarer accept not commonly found ignore cannot find easily ignore hard to extract	1
(b)(i)	oxygen / O ₂ / O	do not accept O ²	1
(ii)	any one from: <ul style="list-style-type: none"> • potassium / K • sodium / Na • calcium / Ca • magnesium / Mg 	symbols must be correct write name and incorrect symbol, ignore symbol	1
(c)(i)	heating (with) or hot air blown into furnace	accept high temperatures or (very) hot	1
	carbon / carbon monoxide / coke / coking coal	do not accept coal / charcoal accept balanced equation only	1
	or: carbon reacts with O ₂ or carbon / coke burning (1)	accept balanced equation only CO / CO ₂	
	CO reacts with the ore (1)	for naming the reducing agent	
(ii)	cost of melting ore / electricity makes aluminium expensive (owtte) or (large amount of) electricity used or because you have to use electrolysis or aluminium is higher in the reactivity series or aluminium is harder to <u>reduce</u> or unable to reduce with carbon or the cost of purifying the bauxite	do not accept harder to extract / produce more energy is not enough	1
total			6

3462/2H Q3

question	answers	extra information	mark
(a)	fractional distillation / fractionation	accept distillation accept refining do not accept cracking	1
(b)	<p>Quality of written communication</p> <p>any three from:</p> <ul style="list-style-type: none"> crude oil is heated to high temperature or heated to 340°C or above (most of the) oil is evaporated / turns into gas / vapour heavier molecules do not boil heavier molecules sink to the bottom or lighter molecules rise up (the tower) oil vapours / gases go up the tower vapours condense at different points (up the tower) separation depends on their boiling points owtte oil separated into fractions which have similar numbers of carbon atoms or similar chain lengths or similar boiling points temperature gradient up the tower 	<p>for technical words correctly used two from: evaporat(ion) / condensat(ion) / boiling points / gas / vapour / molecules / fraction / vaporised QoWC mark can be awarded for cracking described</p> <p>accept oil is boiled</p> <p>accept converse accept particles instead of molecules</p> <p>accept particles instead of molecules</p> <p>accept heavier molecules condense first / at the bottom accept lighter molecules condense last / at the top</p> <p>vapours condense at different temperatures</p> <p>accept in terms of similar chains</p>	<p>1</p> <p>3</p>
total			5

3462/2H Q4

question	answers	extra information	mark
(a)(i)	(actual value 2403°C)	accept values between 2100 and 2450	1
(ii)	(actual value is 5.9 g/cm ³)	accept values between 3.5 and 6.5	1
(b)(i)	<p>any two sensible ideas such as:</p> <ul style="list-style-type: none"> • (why) put in order of mass • he left gaps or table not complete • no evidence for undiscovered elements or they believed all the elements had been discovered • he changed the order of some elements or there were exceptions to the rule(s) • he put metals and non-metals together • he did not explain his ideas clearly (owtte) 	<p>accept other equally valid orders, eg alphabetical</p> <p>accept predictions could not be backed by evidence accept why change previous ideas</p> <p>accept they didn't like his groupings / groups</p> <p>do not accept modern explanations, eg proton number etc</p>	2
(ii)	(the properties of gallium) fitted the predictions (owtte) or predictions were correct or (properties) would make it fit in the gap or (properties) would make it fit in group 3	<p>do not accept gallium fitted his theory</p> <p>accept finding gallium proved there were new elements to be discovered</p>	1
total			5

3462/2H Q5

question	answers	extra information	mark
(a)	harmful / noxious / nocif	accept <u>less</u> dangerous than a toxic substance do not accept irritant	1
(b)	gives oxygen needed for burning (must be linked to oxygen)	accept oxidising accept 'it oxidises' accept 'it contains oxygen' oxidising <u>agent</u> scores 2 marks oxidising agent because it is flammable = 1 mark flammable loses a mark when both marks awarded accept oxygen makes the flame burn stronger or oxygen helps combustion for 2 marks	1 1
(c)(i)	122.5 or 123	accept $39 + 35.5 + (3 \times 16)$ for 1 mark 122 with no working scores 1 mark	2
(ii)	39% (39.18.... or 39.02....)	allow ecf accept $48/122.5 \times 100$ for 1 mark	2
total			7

3462/2H Q6

question	answers	extra information	mark
(a)	colour		1
(b)	Fe_2O_3 or $(\text{Fe}^{3+})_2 (\text{O}^{2-})_3$	2 and 3 should be below halfway on Fe and O	1
(c)(i)	4 4	or correct multiples	1
(ii)	any two from: <ul style="list-style-type: none"> • high melting point • strong / tough • hard • not (very) reactive 	ignore references to malleable / ductile / conductivity / stiff / boiling point / density accept can withstand high temperatures accept <u>not</u> brittle do not accept flexible	2
total			5

3462/2H Q7

question	answers	extra information	mark
(a)	all electrons correct (inner shell need not be shown)	three bond pairs and two electrons anywhere else can use dots, crosses or e's in any combination	1
(b)	covalent	accept phonetic spelling do not accept convalent	1
(c)	reversible or any indication that reaction can go in either way	accept can go either / both ways accept equilibrium accept can be reversed accept ammonia can be turned into nitrogen and hydrogen	1
(d)(i)	increase yield (owtte) or helps plants to grow	accept answers in terms of fast / <u>better</u> growth accept nitrogen needed for making amino acids / protein / enzymes accept replace / add nitrogen / nutrients in the soil ignore make ground more fertile or plants more healthy	1
(ii)	any one from: <ul style="list-style-type: none"> • jobs • money • exports • increased <u>yield</u> or more coffee 	accept increased business accept land used over again	1
(iii)	washed by rain / permeated / soaked down / passed through soil / rocks etc	accept leached or dissolved / soluble in water ignore absorbed / picks up nitrate	1
(iv)	harmful / risk to health or because it is drinking water or main supply of water or blue baby syndrome etc.	accept references to eutrophication / weed growth do not accept kills people / animals unqualified	1

cont...

3462/2H Q7 cont...

(v) E	use less	ignore do not use / stop using	1
	especially at end of growing season	do not use at end of growing season = 2 marks	1
	or use natural/slow release fertilisers (1) release nitrogen less quickly (1)	for alternative (nitrogen) fertiliser	
	or grow leguminous crops (1) nitrates not needed (1)	accept nitrogen obtained from air	
	or treat the water (1) to remove nitrates (1)	do not accept denitrifying bacteria	
		allow marks for mixing different routes	
total			9

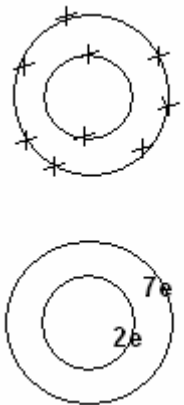
3462/2H Q8

question	answers	extra information	mark
(a)(i)	heat (the limestone)	accept decompose limestone accept heat with coke	1
	add water / slake	dependent on 1 st mark unless they say add water to the calcium oxide	1
(ii)	magnesium hydroxide + hydrochloric acid → magnesium chloride + water / H ₂ O	1 mark for each side of the equation (if a symbol equation is given then give 1 mark for correct formulae (all) and 1 mark for balancing)	1
			1
(b)	hydrogen ions (from acid) or protons / H ⁺		1
	react with hydroxide ions (from alkali) / OH ⁻		1
	to produce water	H ⁺ + OH ⁻ → H ₂ O gains all 3 marks ignore state symbols molecules of hydrogen <u>ions</u> and molecules of hydroxide <u>ions</u> produce water = 2 marks if they fail to get any of the above marks they can get 1 mark for neutralisation / product neutral	1
total			7

3462/2H Q9

question	answers	extra information	mark
(a)	$C_6H_{12}O_6$	any order accept $C_6H_7O(OH)_5$ accept 'the same'	1
(b)	sweeter / use in smaller quantities	accept uses more energy to be metabolised	1
(c)	enzyme	accept (biological) catalyst accept protein accept carbohydrase do not accept description alone	1
(d)	enzyme is trapped in / bonded to / attached / linked / combined / held / adsorbed	ignore 'reacted with' do not accept absorbed	1
	a gel / solid / (alginate) beads / surface / resin		1
(e)	to prevent being lost or to allow the same enzyme to be used for a long period of time	accept do not denature accept it is not washed away accept does not need to be replaced <u>as often</u> accept they can be reused do not accept recycled	1
total			6

3462/2H Q10

question	answers	extra information	mark
(a)(i)	all points plotted to $\pm \frac{1}{2}$ square		1
	sensible line of best fit extended	could be curve must not join dots, ie zig zag if they draw 2 lines then lose second mark, but can still gain marks in (a)(ii)	1
(ii)	as read from their graph $\pm \frac{1}{2}$ square		1
(iii)	iodine and astatine I/I ₂ At/At ₂	must give both	1
(b)(i)	 <p>or</p>	ignore symbol ignore nucleus / lack of nucleus accept dots / crosses etc / e / e ⁻ not 2.7 alone	1
(ii)	same number of electrons in outer shell or seven electrons in outer shell (owtte)	accept missing one electron in outer shell / energy level / orbit accept trying to gain one electron accept they all form 1 ⁻ ions do not accept orbital / rings	1
(c)(i)	8 electrons in outer shell or full outer shell / energy level		1
	does not need to lose / gain / share electrons or don't need to form bonds	accept don't bond ionically or covalently they do not react is not enough	1
(ii)	fluorine atom is smaller / fewer shells (owtte) or outer shell closer to nucleus	accept answers argued in terms of iodine	1
	more strongly attracted (to nucleus) or less shielding	accept holds electrons tighter (to the nucleus)	1
	gains electron(s) <u>more</u> easily	accept easier to gain electrons	1
total			11

3462/2H Q11

question	answers	extra information	mark
(a)	352 g gains 3 marks (moles $C_8H_{18} = 114 / 114 = 1$ mole) moles $CO_2 = 8$ (1) mass $CO_2 = 8 \times 44$ (1) = 352 g (1) or $114 \rightarrow 8$ (1) $\times 44$ (1) $114 \rightarrow 352$ g (1)	1 mark for each point (ecf allowed between parts) ecf allowed between parts	3
(b)	Quality of written communication any three from: <ul style="list-style-type: none"> • plants take in (CO_2) • converted to glucose / starch / carbohydrates • CO_2 locked up in fossil fuels • CO_2 reacts with / dissolves (sea)water • producing hydrogencarbonates • producing carbonates • marine animals use carbonates to make shells • forms sedimentary rocks 	for any two ideas sensibly stated accept photosynthesis uses (CO_2) ignore carbon compounds by itself accept coal / oil / <u>natural</u> gas / methane for fossil fuels accept ocean removes CO_2 accept carbonic acid accept named carbonates do not accept bones accept limestone / chalk accept marble do not accept sediments alone	1 3
(c)	any two from: <ul style="list-style-type: none"> • burning of fossil fuels or cars / industry / air travel / power stations • natural processes cannot absorb all the extra CO_2 • deforestation 	ignore increase in population ignore more use of electricity accept less photosynthesis ignore volcanic activity accept burn trees	2
total			9

3462/2H Q12

question	answers	extra information	mark
(a)(i)	yield increases	two marks are linked	1
	because more (gaseous) reactant molecules / particles than (gaseous) product molecules / particles	accept 7 → 4 moles or volumes ignore more reactants accept fewer particles on the right	1
(ii)	increased (rate) / faster / speeds up etc	two marks are linked	1
	more collisions or increased concentration or particles closer together	greater chance of more successful collisions	1
(b)	heat / high temperatures	do not accept burn it ignore cracking / catalyst	1
(c)	bromine (water)		1
	goes colourless or decolourised or loses colour / paler or orange bromine water goes yellow	do not accept discoloured / clear	1
	or potassium manganate (VII) / potassium permanganate (1) colourless / decolourised etc (1) or purple colour goes pink	accept potassium manganate	
(d)	polychloroeth <u>e</u> n <u>e</u> or poly(chloroeth <u>e</u> n <u>e</u>)	accept polyvinylchloride / PVC	1
total			8

3462/2H Q13

question	answers	extra information	mark														
(a)	Ag S																
	$\frac{10.8}{108}$ $\frac{1.6}{32}$	for evidence of mass / Ar	1														
	0.1 0.05	for proportions of each	1														
	2 1	for any whole number ratio can be assumed from correct formula	1														
	Ag ₂ S	correct formula allow SAg ₂ NB <table style="margin-left: auto; margin-right: auto;"> <tr> <td>Ag</td> <td>S</td> <td></td> </tr> <tr> <td>$\frac{108}{10.8}$</td> <td>$\frac{32}{1.6}$</td> <td>×</td> </tr> <tr> <td>10</td> <td>20</td> <td>×</td> </tr> <tr> <td>1</td> <td>2</td> <td>✓</td> </tr> <tr> <td>Ag</td> <td>S₂</td> <td>✓</td> </tr> </table> ratio mark can be given for correct formula if the first two steps are present	Ag	S		$\frac{108}{10.8}$	$\frac{32}{1.6}$	×	10	20	×	1	2	✓	Ag	S ₂	✓
Ag	S																
$\frac{108}{10.8}$	$\frac{32}{1.6}$	×															
10	20	×															
1	2	✓															
Ag	S ₂	✓															
(b)(i)	2 2	accept correct multiples eg 4 4 2	1														
	electrons are lost owtte	accept Br ⁻ - e ⁻ → ½ Br ₂ accept bromine ions lose electrons do not accept bromine loses electrons reference to oxygen loses the mark	1														
(ii)	+ e or e ⁻	accept correct multiples but not if they write Ag ₂ etc	1														
total			7														