



General Certificate of Secondary Education

Science: Double Award 3462/2H *Specification B*

Mark Scheme

2006 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 (Co-ordinated) Higher Tier 3462/2H

3462/2H Q1

question	answers	extra information	mark
(a)	accurate plotting of points ($\pm\frac{1}{2}$ square)	2 marks for all points 1 mark for 3 or 4 points accept if points cannot be seen and lines go through points	2
	sensible attempt at a smooth curve	may not be perfect but do not accept joining the dots ignore any extension before first point do not accept multiple lines that cover more than one large square	1
(b)(i)	75 seconds	accept answers correctly read from their graphs ($\pm \frac{1}{2}$ square) accept 73 to 77 without reference to graph	1
(ii)	rate doubles (owtte)	accept time halves accept speed doubles do not accept just gets faster etc. do not accept the rate of reaction takes half the time	1
(iii)	more particles (owtte)	n.b. they / them = particles accept molecules	1
	<u>more</u> collisions	max 1 mark for any reference to particles moving faster / gaining energy ignore reference to 'react'	1
total			7

3462/2H Q2

question	answers	extra information	mark
(a)(i)	broken down (owtte)	accept big molecules to small molecules or production of smaller molecules do not accept separated do not accept cracking / breaking down to elements do not accept mention of oxygen ignore decompose / decomposed	1
	by heat / high temperature	(owtte)	1
(ii)	carbon dioxide	accept CO ₂ do not accept CO ² , Co ₂ (apply halfway rule for O and ₂)	1
(iii)	to mix the reactants (owtte)	accept to increase rate of reaction accept idea of movement accept 'so that the reactants are heated evenly' (owtte) accept to ensure complete reaction	1
(b)(i)	coke	accept carbon / C do not accept coal / charcoal	1
	iron	accept Fe / pig iron / cast iron do not accept FE ignore references to solid / molten etc.	1
(ii)	oxygen removed (owtte)	accept gains electrons accept decrease in oxidation number / state do not accept oxide removed	1

Continued

3462/2H Q3

question	answers	extra information	mark
(a)	<p>Science marks</p> <p>any three from:</p> <ul style="list-style-type: none"> • inert / unreactive • not broken down / decomposed / non-biodegradable • by micro-organisms • causes litter • problems of waste disposal e.g. landfill • difficult to recycle • incineration / burning causes problems such as (air) pollution <p>QoWC</p> <p>1 mark which is awarded for the use of one of the following scientific words:</p> <ul style="list-style-type: none"> • (non-) biodegradable • micro-organism / bacteria • inert / unreactive • decomposed • toxic / poisonous 	<p>accept flooding (in India) by blocked drains</p> <p>accept does not rot / decay / disintegrate</p> <p>ignore erode and corrode</p> <p>must be linked to not broken-down</p> <p>can be implied</p> <p>must be linked to incineration</p> <p>annotate Q✓ or Q✗</p> <p>word must be used in correct context</p> <p>must be linked to air pollution</p>	<p>3</p> <p>1</p>
(b)	<p>any two from:</p> <ul style="list-style-type: none"> • plastic tar is harder (than ordinary tar) • plastic tar has better resistance to water penetration (than ordinary tar) • plastic tar lasts longer (than ordinary tar) • using plastic waste to make plastic tar means less has to be disposed of in other ways i.e. buried / burned • plastic is recycled 	<p>ignore cost / strength</p> <p>ignore saving tar or bitumen</p> <p>accept more waterproof</p> <p>accept it causes less pollution</p> <p>accept makes use of a waste product</p>	2
total			6

3462/2H Q4

question	answers	extra information	mark
(a)	152	$56 + 32 + (4 \times 16)$ for 1 mark	2
(b)	36.8%	accept 37% / 36.84% etc accept error carried forward from (a) accept 36% for 1 mark or $56 / 152 \times 100$ ($56 / (a) \times 100$) for 1 mark	2
(c)	7.3 to 7.4	accept error carried forward from (b) e.g. $36 \rightarrow 7.2$ $20 \times 36.84 / 100$ ($20 \times (b) / 100$) for 1 mark	2
total			6

3462/2H Q5

question	answers	extra information	mark
(a)	any three sensible properties e.g. transition elements are metals TM high melting points / boiling points TM hard / strong TM conduct electricity TM conduct heat TM sonorous TM ductile TM malleable TM high density TM are catalysts TM form positive ions	they = transition elements ignore references to colours ignore other chemical properties / reactivity if point is not made for TM accept converse for halogens accept halogens are diatomic / molecular / covalent ignore halogens form covalent <u>compounds</u> / bonds ignore electrons ignore solid	3
(b)(i)	hydrogen forms a 1+ ion	accept form a positive ion accept one electron in outer shell	1
(ii)	any one from: <ul style="list-style-type: none"> • can form 1– ion • forms diatomic molecule (owtte) or small molecule or molecular • (very) low boiling point/ melting point / gas • only needs one electron to fill outer shell • non metal • any other general property of non-metals 	accept form a negative ion ignore has covalent bonds	1
total			5

3462/2H Q6

question	answers	extra information	mark
	action by water running over the surface (owtte) on a beach / mud flats / river / under water etc	currents / waves / tides ignore action of wind any place where water may run over the sediment accept seabed do not accept rock	1 1
total			2

3462/2H Q7

question	answers	extra information	mark
(a)(i)	2	accept multiples i.e. 2, 4, 2, 2 any other numbers / symbols lose the mark	1
(ii)	warm / heat acid / mixture	do not accept heat MgO	1
	add MgO or mix together acid and MgO		1
	until no more will react	accept dissolve	1
	filter (off excess MgO)		1
	QoWC mark: awarded for getting any two steps in the correct not necessarily consecutive order	annotate Q✓ or Q✗	1
(b)(i)	magnesium / ions / it / they are <u>positive</u> / Mg ²⁺	accept magnesium ions / it / they gain electrons	1
	so are attracted / go / move to the negative electrode / cathode	from the negative electrode	1
(ii)	kill / destroy bacteria / microbes / germs etc.	accept disinfect / sterilise ignore purify / clean / get rid of bacteria n.b. kills bacteria and removes impurities = 0 marks	1
total			9

3462/2H Q8

question	answers	extra information	mark																																																		
(a)(i)	catalyst / speed reaction (owtte)	accept lower activation energy	1																																																		
(ii)	any two from: <ul style="list-style-type: none"> break down <u>large</u> molecules / hydrocarbons / alkanes / chains change <u>large</u> molecules into small molecules / hydrocarbons / alkanes / chains (into) more useful products or smaller molecules are more useful or greater demand for products / smaller molecules to give alkenes / petrol 	accept named short alkenes do not accept petroleum	2																																																		
(b)	X marked in the inverted test tube in the portion where gas has collected		1																																																		
(c)(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr><td></td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td></td></tr> <tr><td></td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td></td></tr> <tr><td>H—</td><td>C—</td><td>C—</td><td>C—</td><td>C—</td><td>C—</td><td>C—</td><td>C—</td><td>C</td><td>—H</td></tr> <tr><td></td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td></td></tr> <tr><td></td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td><td></td></tr> </tbody> </table>		H	H	H	H	H	H	H	H												H—	C—	C—	C—	C—	C—	C—	C—	C	—H												H	H	H	H	H	H	H	H		do not accept condensed structures	1
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(ii)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr><td>H</td><td>H</td></tr> <tr><td> </td><td> </td></tr> <tr><td>C =</td><td>C</td></tr> <tr><td> </td><td> </td></tr> <tr><td>H</td><td>H</td></tr> </tbody> </table>	H	H			C =	C			H	H	ignore bond angles accept CH ₂ = CH ₂ H ₂ C = CH ₂	1																																								
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total			6																																																		

3462/2H Q9

question	answers	extra information	mark
(a)	enzyme / biological catalyst	accept catalyst accept protein	1
(b)	it / enzyme / lactase is trapped / held / fixed (owtte)	accept cannot move	1
	in the resin / gel / (alginate) bead	accept inert solid do not accept column	1
(c)	avoids losing the lactase / enzyme or helps to stabilise the enzyme / lactase or helps to allow the enzyme to withstand higher temperatures / wider range of pH	accept doesn't have to be separated at end accept don't have to keep adding lactase not left in the milk on its own accept stops decomposition accept it lasts longer or it can be used over and over again	1
(d)	does not have to be stopped after each batch or no breaks in production etc. or faster process / saves time / saves money or less labour intensive	ignore same enzyme used for a long time ignore faster reaction or more products or saves energy ignore comments about purity	1
total			5

3462/2H Q10

question	answers	extra information	mark
(a)	20000	accept 20 m ³ (must specify unit) (100 / 0.9) × 180 gets 1 mark	2
(b)(i)	full <u>outer</u> / <u>last</u> shell (of electrons) or 8 (electrons) in <u>outer</u> / <u>last</u> shell	accept energy level / ring / orbit for shell do not accept orbital	1
	no need to gain / lose / share electrons	accept no need to form bonds (owtte) accept don't form ions	1
(ii)	prevent oxidation / reaction with oxygen etc. (owtte)	accept reacts with air to form oxides do not accept air only ignore reference to burning	1
total			5

3462/2H Q11

question	answers	extra information	mark
(a)	2, 8, 8,1		1
(b)	they both have one electron in the <u>outer</u> shell / same number of electrons in <u>outer</u> shell	accept ring / orbit for shell do not accept orbital for shell	1
(c)	outer shell electron further from nucleus or more shells less attraction to nucleus or more shielding outer electron more easily lost	it = potassium outer electron must be mentioned once for all 3 marks or converse argument for sodium less reactive provided sodium is specified assume it etc. means potassium not potassium reacts more easily	1 1 1
(d)	sodium water	do not accept symbols or formulae accept sodium hydrogen (phosphate)	1 1
total			7

3462/2H Q12

question	answers	extra information	mark
(a)	64 g	$2 \times (2 \times 16)$ for 1 mark	2
(b)(i)	(-) 730	ignore sign bonds broken 2736 kJ for 1 mark bonds formed 3466 kJ for 1 mark accept ecf	3
(ii)	the energy given out in forming new bonds is more / greater / bigger than the energy needed to break existing bonds (owtte)	energy needed to form new bonds is more than energy needed to break bonds = 0 marks	1
(c)	incomplete combustion / not enough / less oxygen (owtte)	do not accept air for oxygen do not accept no oxygen	1
total			7

3462/2H Q13

question	answers	extra information	mark
(a)	any two from: <ul style="list-style-type: none"> the gases / they are cooled or temperature goes down the ammonia turns into a liquid the nitrogen and hydrogen / others / remain as gases (owtte) 	accept ammonia is liquified / condensed accept the others don't (liquefy)	2
(b)	catalyst / make reaction faster / lower activation energy		1
(c)(i)	the reaction / it is <u>exothermic</u> / <u>gives out heat</u> (owtte)	accept ΔH is negative accept the reverse reaction is endothermic	1
(ii)	reaction too slow at low temperatures or catalyst does not work at low temperatures or compromise between yield and rate (owtte) or does not provide sufficient energy to overcome the activation energy		1
total			5

3462/2H Q14

questions	answers	extra information	mark
(a)(i)	$P_4 + 6 Cl_2 \rightarrow 4 PCl_3$	correct formulae (1 mark) correctly balanced (1 mark) (or multiples) $P + 1.5 Cl_2 \rightarrow PCl_3$ or $4P + 6Cl_2 \rightarrow 4PCl_3$ for 1 mark	2
(ii)	three bonding pairs and one lone pair on the P 6 unbonded electrons and a bonding pair around the three Cl	circles not necessarily required	1 1
(iii)	liquid		1
(iv)	intermolecular bond or intermolecular forces or forces between molecules or Van de Waals forces weak (owtte)	dependant on first marking point bonds / attractive forces between atoms are weak = 0 ionic / covalent bonds are weak = 0 intramolecular bonds / forces are weak = 0	1 1
(b)	$\begin{array}{cc} Zn & P \\ 1.95 / 65 & 0.62 / 31 \\ = 0.03 & = 0.02 \\ 3 & 2 \\ & Zn_3P_2 \end{array}$	1 mark for mass / Ar 1 mark for proportions 1 mark for correct whole number ratio 1 mark for correct formula accept P_2Zn_3 second or third step can be inferred if empirical formula is correct if ratio upside down max is 2 marks	4
total			11