

Mark Scheme - 11

1.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	1	hydrogen	H ₂	H	
(b)	2	iron (1) speeds up the reaction / increases the rate of the reaction (1)			
(c)	2	recycled / returned into reactor (1) basic qualification required e.g. reduces cost of process / less waste of raw materials (1)	fed back in re-used	more efficient / reacted again / more yield / saves time	
(d)	2	lower yield with higher temperature (1) higher yield with a higher pressure (1)	vice versa		
(e)	3	N ₂ + H ₂ (1) NH ₃ (1) (1), 3, 2 (1) formulae must be correct to award balancing mark			

2.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)		2	number of nitrogen atoms 2 number of hydrogen atoms 6 both needed for (1) equal / same number (of these atoms) on right hand side (1)			
	(ii)		1	gas / gaseous			
(b)	(i)	I	1	cooling			
		II	1	recycling			
	(ii)		2	iron (1) speeds up reaction (1)			

3.

Mark	Guidance
	<p>Indicative content: Explanation of choice of temperature and pressure conditions and rationale of presence of catalyst e.g.</p> <p>reversible reaction, left to right reaction required to produce ammonia</p> <p>(left to right reaction is exothermic and) higher yield is favoured by lower temperature however lower temperature results in lower rate so compromise made – moderately high temperature increases rate at the expense of yield rate further increased by using iron catalyst</p> <p>higher yield is favoured by higher pressure however increasing pressure increases plant costs and is potentially more hazardous – moderate pressure chosen provides moderate yield</p> <p>lower yield acceptable because unreacted nitrogen/hydrogen can be easily separated and returned to reaction vessel</p> <p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

4.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	1	1000 atmospheres 100 °C both needed for (1)			
	(ii)	2	low rate/ slow reaction (1) (iron) catalyst (1)	decreased rate		incorrectly named catalyst e.g. V ₂ O ₅
	(iii)	1	cost of container/more expensive to build/thicker container walls/ cost of getting to high pressure		'cost'	
(b)	(i)	1	exothermic			
	(ii)	1	4 \longrightarrow 4			
	(iii)	2	$\text{CuCO}_3 + 2\text{HNO}_3 \longrightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$ formulae correct (1) balancing (1) formulae must be correct for balancing mark to be awarded			

5.

Mark	Answer
6	<p data-bbox="285 337 520 370">Indicative content</p> <p data-bbox="285 391 1816 451">Benefits e.g. increase crop yield, more food, healthier plants, improves quality of soil, cheaper food and releases land for other purposes.</p> <p data-bbox="285 456 1816 581">Problems e.g. increased soil acidity (which needs neutralising using lime), pollutes water supplies/ nitrates in drinking water (possible health problems), overgrowth of plants in canals (which requires unblocking) and 'eutrophication' or full description – (algae over growth, bloom formation, sunlight blocked, plants die, bacteria removes oxygen during decomposition, water de-oxygenated and water becomes lifeless)</p> <p data-bbox="285 602 415 634">5-6 marks</p> <p data-bbox="285 639 1816 732">The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p data-bbox="285 753 415 786">3-4 marks</p> <p data-bbox="285 790 1816 883">The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p data-bbox="285 904 415 937">1-2 marks</p> <p data-bbox="285 941 1816 1034">The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p data-bbox="285 1055 394 1088">0 marks</p> <p data-bbox="285 1092 1304 1125">The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

6.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	2	$436 + 242$ (1) $= 678$ (1) – correct answer only (cao) (2)			
	(ii)	2	2×431 (1) $= 862$ (1) – cao (2)			
(b)		1	exothermic since energy given out (as bonds made) > energy needed (to break the bonds) energy given by reaction is negative / -184 credit ‘endothermic’ with correct reason if calculation error followed through (ft)			

7.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)	(i)	2	sulfur dioxide (1) sulfur trioxide (1)	SO ₂ SO ₃		
	(ii)	1	2			
	(iii)	1	far too / very exothermic or acid forms mist / white fumes form or acid is difficult to collect		dangerous / explosive / reactive	
(b)	(i)	2	5 + 5 + 30 + 30 + 15 (1) 15 (1) follow through error (ft) correct answer only (cao) (2)			
	(ii)	1	ammonia	NH ₃		
	(iii)	3	overgrowth of algae (1) good description of eutrophication – up to (3) gets into water supplies (1) must be some linking of points in explanation for full marks to be awarded	gets into water supplies and can lead to blue baby syndrome (2)	kills fish pollution	

8.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	carbon dioxide → turns limewater milky (1) ammonia → turns damp red litmus blue (1) oxygen → relights a glowing splint (1)			
(b)	3	yellow flame (1) green flame (1) brown precipitate (1)			

9.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a)	3	$M_r(\text{Cu}_2\text{S}) = 64 + 64 + 32 = 160$ (1) 1 mol of Cu_2S produces 2 mol of Cu or 160 tonnes of Cu_2S produces 128 tonnes of Cu (1) 20.5 tonnes of Cu_2S produces $\frac{128}{160} \times 20.5$ $= 16.4$ tonnes of Cu (1) error carried forward possible correct answer only (3)			
(b)	2	4.1 tonnes of 'missing product' (1) $\frac{4.1}{16.4} \times 100 = 25\%$ (1) error carried forward from (a) correct answer only (2)			