

Mark Scheme

Combined Science GCSE

Extracting Metals and Equilibria Test

(Levels 4-9)

	Answer	Marks
1. (a) i.	The Haber process.	(1)
1. (a) ii.	It denotes a reversible reaction.	(1)
1. (a) iii.	Nitrogen, hydrogen and ammonia (full marks only if all 3 are given).	(2)
1. (b)	The forward and backward reaction happen at the same time/ rate of reaction is the same forwards and backwards. (1) There is no observable change in overall concentration/ volume/reactant/product. (1)	(2)
1. (c) i.	Lower temperature favours forward reaction, (1) so the reaction is exothermic/yield increases. (1)	(2)
1. (c) ii.	Using a catalyst (iron).	(1)
1. (c) iii.	Higher pressure favours forward reaction, (1) meaning a decrease in number of molecules/an increase in the yield. (1)	(2)

(Total for Question 1 = 11 marks)

	Answer	Marks
2. (a)	Ore	(1)
2. (b) i.	iron oxide + carbon → iron + carbon dioxide (accept carbon monoxide)	(1)
2. (b) ii.	Pass the gas through lime water. (1) If carbon dioxide is present, it will turn cloudy/milky. (1)	(2)
2. (b) iii.	$2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$ (3) Award 1 mark for correct symbol equation, with a further 2 for correct balancing.	(3)
2. (c)	Lead oxide loses oxygen (1) and carbon gains oxygen. (1)	(2)
2. (d) i.	The loss of oxygen.	(1)
2. (d) ii.	Aluminium is very reactive/more reactive than carbon, (1) so it needs more energy to extract/needs electricity. (1)	(2)
2. (d) iii.	Having little or no ability to react.	(1)
2. (d) iv.	Anode: oxidation/loss of electrons (1) Cathode: reduction/gaining of electrons (1)	(2)

2. (e)	Some points from: Gold: • least reactive; • should be lowest down on series. Iron: • carbon is more reactive than iron; • carbon reduces iron oxide; • carbon does not reduce aluminium oxide; • not found uncombined; • more reactive than gold, so should be in the middle. Aluminium: • electricity is needed to extract aluminium; • very reactive/most reactive of the three; • more reactive than carbon; • should be in the top space. 1-2 marks – all metals in the correct places with no explanation or one metal in the correct place with an explanation. 3-4 marks – all metals in the correct places and explanation for only one given. 5-6 marks – all metals in the correct places and explanation given for each. Full marks awarded based on extra detail.	(6)
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(Total for Question 2 = 21 marks)

	Answer	Marks
3. (a)	Tin is more expensive. (1) There is less tin in the earth. (1) Accept reverse arguments.	(2)
3. (b)	Phytoextraction/phytomining.	(1)

(Total for Question 3 = 3 marks)

	Answer	Marks
4. (a)	To increase crop growth.	(1)
4. (b)	Urea has the highest percentage of nitrogen, (1) which promotes the growth of plants. (1)	(2)
4. (c)	Any two from: • Fertilisers may be washed into rivers, causing algae to grow bigger. • Decomposing algae removes oxygen from the river, meaning animals can no longer survive in these areas. • Chemicals from fertilisers can be ingested by fish, causing disease or death.	(2)

(Total for Question 4 = 5 marks)