

Answers to examination–style questions

Answers	Marks	Examiner's tips
1 (a) electron donor	1	Do not refer to electron pairs.
(b) CO $3\text{CO} + \text{Fe}_2\text{O}_3 \rightarrow 3\text{CO}_2 + 2\text{Fe}$ (or correct equations with carbon)	1 1	Another answer could be C with the appropriate equation.
(c) Na <i>or</i> Mg argon Na (<i>or</i> Mg) reacts with air or oxygen or water	1 1 1	You could also say that TiCl_4 reacts with moist air or that impurities of O or N in Ti cause the Ti to become brittle.
(d) (i) cryolite molten (ii) $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$	1 1 1	There will always be equations expected in this type of question so make sure you know them.
2 (a) (i) $\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$ <i>or</i> $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$ (ii) $3\text{CO} + \text{Fe}_2\text{O}_3 \rightarrow 3\text{CO}_2 + 2\text{Fe}$ (iii) CO is gaseous <i>or</i> C is solid CO has more collisions <i>or</i> C has very few collisions	1 1 1 1	This question expects you to think 'outside the box' about collisions and rates of reactions.
(b) titanium carbide is formed and it is stable	1	
(c) <i>any two from:</i> saves energy removes scrap from the environment uses fewer raw materials fewer greenhouse gases released less CO released less SO_2 released less mining has greater % of iron	2	These questions have a range of answers and generally require common sense answers to score.
3 (a) batch process involves stopping and starting energy lost when cools down after stopping <i>or</i> energy needed to heat up each time	1 1	
(b) $\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO}$ use of C <i>or</i> CO equation balanced	1 1	Again there are 2 marks for this equation – one for knowing the reagents and one for the balancing. Alternative answers are: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ <i>or</i> $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$

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(c) $\text{TiO}_2 + 2\text{C} + 2\text{Cl}_2 \rightarrow \text{TiCl}_4 + 2\text{CO}$ use of C and Cl_2 equation balanced <i>or</i> $\text{TiO}_2 + \text{C} + 2\text{Cl}_2 \rightarrow \text{TiCl}_4 + \text{CO}_2$	1 1	
$\text{TiCl}_4 + 4\text{Na} \rightarrow \text{Ti} + 4\text{NaCl}$ use of Na or Mg <i>or</i> $\text{TiCl}_4 + 2\text{Mg} \rightarrow \text{Ti} + 2\text{MgCl}_2$ equation balanced	1 1	Again there are 2 marks for each correct equation. These equations are where candidates fail to score – so learn them.
(d) Ti carbide will be formed which is brittle and not a useful material	1	
(e) expensive electricity needed in electrolysis	1	
4 energy comes from combustion of coke or C	1	You cannot say coal. This mark will also be allowed if you stated that the $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$ reaction is exothermic.
<u>air</u> blown in (not oxygen)	1	This is not oxygen blown in.
$\text{C} + \text{O}_2 \rightarrow \text{CO}_2$	1	
$\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$	1	
$\text{Fe}_2\text{O}_3(\text{l}) + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$	1	
the carbon dioxide released contributes to global warming <i>or</i> CO is toxic <i>or</i> slag is an eyesore	1	
limestone is used to remove silicon dioxide / impurities as slag	1	Allow if this is stated under the equation.
$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$	1	
$\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$	1	A combination of these two equations gains 2 marks.
5 consumes less energy, which is expensive	1	
separation of pure aluminium from scrap	1	
collection costs (transport / fuel to get the cans)	1	
6 hydrogen	1	
explosive	1	
$\text{WO}_3 + 3\text{H}_2 \rightarrow \text{W} + 3\text{H}_2\text{O}$	1	
tungsten carbide is made, which is brittle	1	
7 $2\text{CuO} + \text{C} \rightarrow 2\text{Cu} + \text{CO}_2$	1	
high temperatures needed	1	
less scrap iron dumps, etc.	1	

Nelson Thornes is responsible for the solution(s) given and they may not constitute the only possible solution(s).