

QUESTIONSHEET 1

(a)	proteins /amino acids	1
(b)	nitrate will be used up eventually / will run out	1
(c)	(i) $23 + 14 + (3 \times 16) = 85$	1
	(ii) $14 / 85 \times 100 = 16.5$ (16.47) if incorrect, one mark is given for the correct fraction (ii) is marked consequentially on part (i)	2
(d)	(i) air	1
	(ii) water / natural gas / methane	1
(e)	(i) iron acts as a catalyst	1
	(ii) this increases surface area and increases the rate of reaction	1 1
(f)	sulphuric acid	1
(g)	increase in plant/algal growth	1
	plants/algae die and rot	1
	the rotting process uses up oxygen in the water	1
	lack of oxygen results in death of fish and other wildlife	1

TOTAL 15

QUESTIONSHEET 2

- (a) provides raw materials to make useful products 1
provides jobs for people 1
adds valuable income to the local community 1
- (b) THREE from :
-removes a mineral that cannot be replaced
-damages habitats of plants and/or animals
-spoilheaps produced that are unsightly
-named form of pollution from mining eg.noise/more lorries/dust 3
- (c) (i) (s) = solid 1
(g) = gas 1
- (ii) CaCO_3 : 100 1
CaO : 56 1
CO₂ : 44 1
- (d) (i) 100 tonnes limestone → 56 tonnes calcium oxide
300 tonnes → 168 tonnes
3,000 tonnes → 1680 tonnes 2
marked consequentially on the masses given in (c)
- (ii) some limestone remains unreacted/does not get hot enough 1
- (e) glass making / cement making / building material / neutralising agent for soils 1

TOTAL 15

QUESTIONSHEET 3

- (a) anode correctly labelled – electrode on left 1
- (b) Test – use damp litmus paper 1
Result - turns white / bleached 1
- (c) kill bacteria in drinking water or swimming pools /
manufacture of PVC or bleach or disinfectants 1
- (d) $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ 1
- (e) hydrogen 1
- (f) (i) solution is alkaline 1
(ii) sodium hydroxide 1
- (g) FIVE from :
- run cell with known concentration of salt solution
- measure volume of gas collected after specified time/ time how long to collect a specified volume of gas
- repeat experiment with weaker/stronger concentration of salt solution
- use same volume of solution
- use same electrodes
- use same current 5
- (h) increase current of cell 1
use different electrodes 1

TOTAL 15

QUESTIONSHEET 4

- (a) Al^{3+} 1
 O^{2-} 1
- (b) lowers melting point of the aluminium oxide 1
- (c) ions need to be free to move towards the electrodes 1
ions are able to move as a liquid / ions unable to move as a solid 1
- (d) (i) $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ 1
- (ii) oxide ions are attracted to the anode 1
oxide ions lose electrons 1
to form oxygen gas 1
- (e) method of extraction from the ores is related to a metal's position in the reactivity series 1
metals at the top of the series need more energy than those lower down 1
- (f) (i) United Kingdom 1
- (ii) TWO from:
- large amount of electricity not available
- money for construction of plant not available
- lack of suitable trained workforce 2

TOTAL 14

QUESTIONSHEET 5

- (a) $C + O_2 \rightarrow CO_2$ 1
- (b) sulphur dioxide reacts with oxygen in the air and dissolves in water 1
forming sulphuric acid or 'acid rain' 1
making the soil too acidic and damages the roots of the trees/
rain water is very acidic and attacks or damages leaves 1
- (c) (i) neutralisation 1
- (ii) CaO : 56 1
SO₂ : 64 1
- (iii) $32 / 64 \times 56 = 28$ tonnes 2
if incorrect, 1 mark is given for the fraction
mark consequentially on answers to (ii)
- (iv) TWO from :
-do not want sulphur dioxide to escape so best to have excess calcium oxide
-would be difficult to ensure thorough mixing of reactants
-impurities may be present in calcium oxide / may be impure 2
- (d) (i) reaction is reversible/products break up to reform reactants 1
- (ii) sulphur trioxide 1
- (iii) sulphuric acid 1

TOTAL 14

QUESTIONSHEET 6

- (a) + 189 kJ 1
- (b) (i) the minimum amount of energy needed to start a reaction 1
- (ii) line drawn from the reactants to the top of the curve 1
- (iii) speeds up the reaction / makes the reaction go faster 1
- (c) (i) 70 % 1
- (ii) $70 / 100 \times 300 = 210$ tonnes 2
if incorrect one mark is awarded for the correct fraction
mark consequentially on the answer to (c) (i)
- (iii) low rate of reaction / slow reaction 1
low temperature makes the catalyst less effective
- (d) (i) $\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S}_2\text{O}_7$ 2
one mark for correct reactants, one mark for correct products
- (ii) the reaction is too violent / too exothermic 1
- (e) (i) transition metal / transition element 1
- (ii) vanadium catalyst is not used up in the reaction 1

TOTAL 13

QUESTIONSHEET 7

- (a) amount or percentage of copper present is very small 1
- (b) reacts in air to form sulphuric acid 1
this is the cause of 'acid rain' 1
poisonous / causes pollution scores one mark
- (c) sulphur dioxide reacted with air or oxygen 1
to form sulphur trioxide 1
sulphur trioxide absorbed into concentrated sulphuric acid 1
- (d) (i) copper from the anode/impure electrode forms copper ions or dissolves 1
copper ions turn to copper on cathode/deposited on cathode/pure copper 1
impurities are left behind/fall to the bottom of the cell 1
- (ii) $2e^-$ 1
- (iii) 'reduction' is electron gain 1
copper ions gain two electrons 1
- (iv) 'anode slime' contains precious metals/named metals 1
eg. silver, gold
- (e) high melting points 1
form coloured compounds 1

TOTAL 15**QUESTIONSHEET 8**

- (a) (i) 1.03% 1
(ii) oxygen 1
- (b) (i) fractional distillation 1
(ii) argon 1
(iii) oxygen 1
- (c) carbon dioxide & water vapour 2
- (d) (i) in electric bulbs, for risky welding jobs, etc. 1
(ii) fast freezing food, for packing food, making ammonia, etc. 1
- (e) convert iron to steel (1) by burning impurities (1) 2

TOTAL 11

(a)	air	1
(b)	(i) NO	1
	(ii) O ₂	1
	(iii) NO ₂	1
(c)	platinum	1
(d)	gases are cooled using water	1
(e)	reacted with water and oxygen	1 1
(f)	(i) ammonia solution / ammonium hydroxide	1
	(ii) neutralisation	1
	(iii) nitrogen is converted into plant protein crop yield is therefore increased	1 1
	(iv) 10% nitrogen 5% potassium no phosphorus is present	1 1 1

TOTAL 15

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QUESTIONSHEET 10

(a)	iron	1
(b)	3H_2 2NH_3	1 1
(c)	a reaction in which the products reform the reactants	1
(d)	(i) increases as the pressure increases decreases as the temperature increases	1 1
	(ii) temperature 300°C pressure 225 atmospheres	1
	(iii) line drawn between 300°C and 500°C lines and is closer to 300°C line	1
(e)	Two from: - more expensive plant or pipelines as they need to be thicker/stronger - greater risk of explosion / greater danger to workforce - higher power costs for compressor	2
(f)	lower rate of reaction / reaction takes a long time	1
(g)	cool down the mixture of gases ammonia will be the first to turn into a liquid	1 1
(h)	recycled	1

TOTAL 14

QUESTIONSHEET 11

- (a) haematite/magnetite 1
- (b) (i) carbon reacts with oxygen to form carbon dioxide 1
this reacts with more carbon 1
- (ii) oxygen is removed 1
- (c) (i) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ 2
- (ii) limestone removes acid/sandy impurities 1
- (d) molten iron 1
slag 1
- (e) need for shift work / unsociable hours 1
- (f) THREE from :
-near to supply of coal/coke or near to coalfield
-near to a port for import of ore
-good communication links eg. good road or rail links
-availability of skilled workforce 3
- (g) steel 1
girders for construction / motor car bodies / shipbuilding 1

TOTAL 15

QUESTIONSHEET 12

- (a) TWO from :
- large amount of impurities present in ore/
only one tonne of metal formed from every 4 tonnes of ore
- large amounts of energy required in the extraction process/ uses large amounts of electricity
- special equipment required to cope with the high temperatures involved 2
- (b) THREE from :
- high demand reduces the Earth's resources
- more fuel burnt that adds to atmospheric pollution/greenhouse effect/increase in carbon dioxide levels
- bauxite ore will run out/is a non-renewable resource
- problems involved in more recycling to meet the increased demand
- more waste produced from purification of bauxite
- more land used to build HEP plants to meet electricity demand 3
- (c) (i) anode connected to +; cathode to – 1
electrolyte – the solution 1
aluminium metal – the bottom layer 1
- (ii) oxygen formed at the anode 1
reacts with the carbon forming carbon dioxide gas 1
- (d) (i) $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ 1
- (ii) molar mass of oxygen = 32 g 1
each O_2 releases 4 electrons to form $\frac{4}{3}$ aluminium 1
 $\frac{4}{3} \times 27 \times 10 = 360$ tonnes 1

TOTAL 14

QUESTIONSHEET 13

(i)	oxygen	1
(ii)	vanadium(V) oxide	1
(iii)	water	1
(iv)	(s) O ₂ (g)	2
(v)	toxic nature of the gas/forms acid rain	1
(vi)	hydrogen, sulphur and oxygen	1
(vii)	dangerous reaction/ a sulphuric acid mist is formed	1
(viii)	paints/fertilisers/car batteries/detergents/plastics/cleaning metals/ many more	1
TOTAL		9

QUESTIONSHEET 14

(a)	(i)	N ₂ (l) 3 2 (l)	2
	(ii)	iron behaves as a catalyst in speeding up the reaction	1
	(iii)	heat speeds up the reaction	1
(b)	(i)	as the pressure increases % of ammonia also increases	1
		as the temperature increases % of ammonia decreases	1
	(ii)	construction cost or plant too dangerous	1
(c)		sulphuric acid	1
TOTAL		8	

QUESTIONSHEET 15

(a)	(i)	(I) coke	1
		(II) limestone	1
	(ii)	slag	1
(b)	(i)	carbon monoxide	1
	(ii)	2×56 + 3×16	1
		=160	1
	(iii)	1 mole of Fe ₂ O ₃ gives 2 moles of Fe	1
		320 tonnes gives 224 tonnes of iron	1
TOTAL		8	

QUESTIONSHEET 16

- | | | | |
|-----|-------|---|---|
| (a) | (i) | cost of electricity | 1 |
| | (ii) | breaking down a substance by electricity | 1 |
| | (iii) | reduce energy/lower the melting point of the aluminium oxide | 1 |
| | (iv) | ions must be mobile | 1 |
| | (v) | oxide O ²⁻ | 1 |
| (b) | (i) | near power station (1) electrolysis needs electricity (1) OR
good transport system (1) import of bauxite/export of aluminium (1) | 2 |
| | (ii) | making our resources last longer/cheaper metals/ lower energy costs | 1 |
| (c) | (i) | conducts heat | 1 |
| | (ii) | conducts electricity | 1 |
| | (iii) | does not corrode | 1 |

TOTAL 11**QUESTIONSHEET 17**

- | | | | |
|-----|-------|--|--------|
| (a) | (i) | One each for:
sodium ----- electrolysis
zinc -----reduction with coke
copper -----heat sulphide with oxygen | 3 |
| | (ii) | most reactive metals need electrolysis
least reactive by heating | 1
1 |
| | (iii) | carbon | 1 |
| (b) | (i) | displacement/ oxidation – reduction/ reduction | 1 |
| | (ii) | sodium more reactive than titanium | 1 |

TOTAL 8

QUESTIONSHEET 18

- | | | | |
|-----|-------|--|---|
| (a) | (i) | C | 1 |
| | (ii) | E | 1 |
| | (iii) | D | 1 |
| | (iv) | B | 1 |
| (b) | (i) | heating up incoming air | 1 |
| | (ii) | Two from:
nitrogen, carbon dioxide, carbon monoxide | 2 |
| (c) | | carbon | 1 |

TOTAL 8**QUESTIONSHEET 19**

- | | | | |
|-----|------|--|---|
| (a) | | nitrogen is very unreactive | 1 |
| (b) | | products turn back into reactants | 1 |
| (c) | | a catalyst/ iron catalyst | 1 |
| (d) | | returned to reaction/recycled/used again | 1 |
| (e) | | strong smell | 1 |
| | | alkaline/ red litmus paper turns blue | 1 |
| (f) | (i) | ammonium nitrate | 1 |
| | (ii) | contain a lot of nitrogen | 1 |
| | | improves crop yield | 1 |

TOTAL 10

QUESTIONSHEET 20

- | | | | |
|-----|------|--|--------|
| (a) | (i) | sodium chloride | 1 |
| | (ii) | Two from:
on roads in winter, seasoning, preserving food, glazing earthenware, curing bacon | 2 |
| (b) | (i) | strong alkali | 1 |
| | (ii) | Two from:
soap, paper, dyes, rayon | 2 |
| (c) | (i) | gas
bleach | 1
1 |
| | (ii) | Two from:
treating water, swimming pools, making plastics, dyes, hydrochloric acid, solvents,
refrigerants, bleaches | 2 |

TOTAL 10

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