Question Number	Answer	Acceptable answers	Mark
1(a)	B potassium and caesium, copper and iron		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	A description linking (regular arrangement of) positive ions /cations (1) (surrounded by) {delocalised/sea of} electrons (1)	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks overall metal ions reject "negative and positive particles" / positive atoms / protons ignore descriptions of atoms in rows/ layers of particles etc cloud of electrons ignore free	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	An explanation linking M1 electrons (1) M2 move/flow (1) M2 dep on M1	 pass through / travel For M2: ignore free/delocalised (electrons) ignore electricity flows ignore (electrons) vibrate ignore carry/pass the current/charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	A description including any two from floats (1) moves (around) (1) effervescence / fizzing / bubbles (1) melts/changes to a ball shape (1) becomes smaller /disappears (1)	moves (around) on the surface (2) white smoke formed ignore gas/hydrogen given off dissolves / explodes Ignore: burns/catches fire/ignites/flame/sparks ignore addition of indicators	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$ LHS (1) RHS (1) balancing of correct formulae(1)	NaHO ignore brackets around OH Use of lower case h, upper case A, lower case o, or use of superscripts or large numbers inside the formulae loses 1 mark only ignore state symbols	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)	An explanation including two of • does not corrode/tarnish **(1)** • unreactive (1) M2 • shiny/lustrous (1) M3 • malleable/easily shaped **(1)** • scarce/expensive/maintains its value (1) M5	 Ignore does not rust does not react with oxygen and/or water Ignore least reactive/less reactive/not very reactive/reacts very slowly attractive Ignore soft/strong valuable	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	C 24 carat		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking three of • (gold) atoms all same size **(1)** • {layers/sheets} (of atoms) {slide/slip/move} M2 (over one another easily) **(1)** • (alloy) added metals atoms are different size **(1)** • disrupt{layers/structure/arrangement} of gold atoms (1) M4 • prevent {layers/atoms} {slide/slip/move} (1) M5	Marks can be gained from suitable diagrams No mention of layers/sheets in answer maximum 2 marks Accept particles/ions for atoms reject molecules (once only) {lock/hold} layers/atoms together	**(3)**

Question Number		Indicative Content	Mark
QWC	***2(d)**	An explanation including some of the following points **reactivity series** • aluminium more reactive than iron/aluminium higher than iron in reactivity series • aluminium forms stronger bonds with oxygen than iron does • aluminium oxide more stable (to decomposition) than iron oxide • aluminium more reactive than carbon/aluminium higher than carbon in reactivity series **cost** • electrolysis/electricity (more) expensive (than heating with carbon) • heating with carbon is (relatively) cheap method **Iron** • carbon more reactive than iron/iron less reactive than carbon • iron oxide reduced • by heating with carbon • no need to use (expensive) electrolysis • **Aluminium** • aluminium oxide difficult to reduce • aluminium oxide cannot be reduced by (heating with) carbon • (cheaper) reduction with carbon does not work • need more powerful method of reduction • therefore must use electrolysis	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. aluminium is very reactive e.g. aluminium extracted by electrolysis e.g. iron extracted using carbon e.g. costs more to extract aluminium • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	

2	**3 - 4**	• a simple description containing two statements referring to one method of extraction and a cost e.g. iron is extracted by heating iron oxide with carbon and this is cheaper OR the relative reactivity of one metal and a method of extraction e.g. aluminium is extracted by electrolysis. Aluminium is more reactive than iron (has made a comparison in reactivity) OR the relative reactivity of one metal and reference to cost e.g. aluminium is a more reactive metal and so is expensive to extract • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description containing at least three statements referring to relative reactivity of both metals, a method of extraction of at least one metal, and a cost reference e.g. aluminium is more reactive than iron so is extracted by electrolysis which is expensive • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
3(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	a description including the following • heat/reduced {with} (1) • (with) carbon/coke/carbon monoxide(1)	**Ignore** references to blast furnace **Reject** references to electrolysis	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 (c)	A description including **three** of the following, with a maximum of **two** from either group of three • reduction is the loss of oxygen (1) • copper(oxide) loses oxygen (1) • (hence) copper (oxide) is reduced (1) OR • oxidation is the gain of oxygen (1) • hydrogen gains oxygen (1) • (hence) hydrogen is oxidised (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
3(d)	an explanation linking **one** of the following pairs • when bent / deformed (1) • shape memory alloys return to their original shape (1) OR • shape memory alloys return to their original shape (1) • (but) other alloys stay deformed (1)	must refer to metal's shape being changed i.e. ignore "broke", "sat on etc."	**(2)**

Question Number	Answer	Acceptable answers	Mark
3 (e)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	Any **one** from • steel {corrodes/rusts} • prevents {corrosion/rusting} • (copper) does not {corrode/rust} • (copper) oxidises slower • kills bacteria (1)	copper is less reactive than {iron/steel} does not oxidise/does not react with {oxygen/water} prevents germs spreading cheaper than (using) pure copper **Ignore** to make it less reactive and references to appearance and erosion	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	zinc	Zn	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	An explanation linking **three** of the following: • in pure metal {**layers/sheets**} (of particles){slide/slip/move} (over one another easily) (1) • second (metal) particles larger (1) • disrupt {layers/structure} (1) • prevent {layers/particles} slipping (1)	**Accept** ions or atoms for particles but **reject** molecules different sized particles {lock/hold} layers together Ignore glue	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	An explanation linking **two** of the following • (aluminium) more reactive (1) • forms more stable compounds (1) • more difficult {to remove oxygen /split (compound)} (1) • electrolysis is more powerful method of reduction (1)	too reactive/{above carbon/higher up} in reactivity series forms compounds with stronger bonds carbon {cannot remove oxygen/displace aluminium}	**(2)**

Question number	Answer	Mark
5(a)(i)	C	(1)

Question number	Answer	Mark
5(a)(ii)	C	(1)

Question number	Answer	Mark
5(b)	reactants are being used up (1)	(1)

Question number	Answer	Mark
5(c)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • aluminium and copper have different size atoms (1) • and so this prevents the layers of metal atoms from sliding over one another (1)	(2)

Question number	Answer	Additional guidance	Mark
5(d)	proportion gold = 9 ÷ 24 (= 0.375) (1) mass = 0.375 × 12 = 4.5 (g) (1)	Award full marks for correct numerical answer without working.	(2)