Question	Answer	Marks	Guidance
1 a	slippery (1)	1	**allow** weak bonds or forces **between layers** (1) **allow layers** can slide over each other (1)
b	has delocalised electrons / free electrons / electrons can move (1)	1	**ignore** spare electrons **not** ions can move
	Total	**2**	

Question	Answer	Marks	Guidance
2 a	slippery / layers can slide over one another (1) (black / grey so) can be seen on the paper (1)	2	**allow** weak forces (of attraction) or weak bonds between layers (1) **allow** leaves mark on the paper / comes off onto the paper (1)
b i	has free electrons / mobile electrons / electrons that can move / delocalised electrons (1)	1	**not** has free ions **ignore** has spare electrons
ii	idea of a giant structure / has **many** covalent bonds (1) idea that strong bonds need to be broken / bonds need lots of energy to break (1)	2	**not** ionic bonds / (strong) intermolecular forces / bonds between carbon molecules – 0 marks for the question **allow** bonds are difficult to break (1) **allow many** strong covalent bonds are broken for 2 marks
	Total	**5**	

Question			answer	Marks	Guidance
3	(a)		allotropes (1)	1	**allow** allotropy (1) **allow** giant structures or giant molecules (1)
	(b)		graphene only contains strong (carbon to carbon) covalent bonds (1) graphite contains weak forces or bonds between the layers (of carbon atoms) (1)	2	**allow** graphene only allows strong bonds between atoms (1) **not** strong ionic bonds / strong intermolecular forces **allow** van der Waals' forces between layers or (weak) intermolecular forces (1) **not** weak covalent bonds between layers **ignore** graphite has layers held loosely together
	(c)		**any two from:** (diamond) has a high melting point (1) (diamond) is very hard (1)	2	 **ignore** other properties from the table **allow** (diamond) is a good thermal conductor (1)
			Total	**5**	

Question			Answer	Marks	Guidance
4			**[Level 3]** All three metals are comprehensively evaluated **AND** metal A is chosen and justified. Quality of written communication does not impede communication of science at this level. **(5–6 marks)** **[Level 2]** An attempt is made to evaluate the strengths and weaknesses of at least two metals **AND** metal A or C is chosen with an attempt at a justification. Quality of written communication partly impedes communication of science at this level. **(3–4 marks)** **[Level 1]** An attempt is made to evaluate both the strengths or weaknesses of one metal. Quality of written communication impedes communication of science at this level. **(1–2 marks)** **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** • metal **A** has the lowest density and a high strength but is expensive • metal **B** has a high density, reasonable strength but is cheap • metal **C** has a high density but is cheap and is the strongest • metal **A** is the best choice • because it has the lowest density and good strength • metal **A** is expensive but not many aircraft will be made. • metal **B** has a low melting point as a disadvantage **Use the L1, L2, L3 annotations in scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
5			**[Level 3]** Candidates describe reinforced concrete as a mixture of materials **and** uses the table of information to explain why reinforced concrete is a better construction material than concrete. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Candidates describe reinforced concrete as a mixture of materials **and** uses the table of information to give one advantage of reinforced concrete over concrete. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** Candidates describe reinforced concrete as a mixture of materials **or** uses the table of information to give one advantage of reinforced concrete over concrete. Quality of written communication impedes communication of the science at this level (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A.** **Indicative scientific points at level 3 can include:** • buildings made of reinforced concrete will be able to flex more without collapsing • reinforced concrete is more flexible because of the flexibility of steel • both materials are very hard • steel is stronger than concrete so reinforced can hold a bigger load without breaking **Indicative scientific points at levels 1 and 2 can include** • reinforced concrete steel is more flexible • reinforced concrete is stronger • reinforced concrete is a composite material because it is a mixture of steel and concrete • a composite material is a mixture
			Total	**6**	

Question			answer	Marks	Guidance
6			aluminium is a good conductor of electricity / aluminium has a low density (1) aluminium is not strong enough on its own so has to be supported by iron (1)	2	for 2 marks mention must be made of the use of **iron** **allow** aluminium is lightweight **but ignore** light **allow** iron is used because it is strong**er** than aluminium **allow** using iron brings the cost down / iron is less expensive than aluminium **ignore** reference to conductivity of iron
			Total	**2**	

Question			answer	Marks	Guidance
7	(a)		granite (1) because it is the hardest (1)	2	**allow** granite because its hardness is 7 (1)
	(b)		steel (1) because it is the strongest (1)	2	**allow** steel (1) because it is (very) strong (1) **allow** steel (1) because its relative strength is 400 (1)
	(c)		list one advantage and one disadvantage for any of the materials (1) link property with the use once (1) second link of property with use (1)	3	(advantage) granite is hard (disadvantage) wood is soft scores 1 e.g. granite or marble is hard and scratch resistant scores 1 and with a second property e.g. wood is soft and not scratch resistant scores 3 but granite is hard and scratch resistant but wood is soft scores 2
			Total	**7**	

Question			Answer	Marks	Guidance
8	(a)		has many strong bonds between atoms / has many covalent bonds between atoms (1) takes lots of energy to break bonds present (1) – this mark is dependent on the correct bond being broken	2	many bonds / it has covalent bonds is **not** sufficient **allow** each carbon atom is covalently bonded or strongly bonded to 4 other (carbon) atoms **not** has many ionic bonds **not** references to intermolecular bonding **allow** has a giant structure for one mark if no other marking point has been awarded
	(b)		does not contain free electrons / all electrons are in bonds (1)	1	**allow** does not have delocalised / spare electrons
			Total	**3**	

Question			Answer	Marks	Guidance
9	(a)	(i)	(copper carbonate is) broken down (using heat) (1)	1	**allow** two or more substances are produced from one substance (by heating) (1) **allow** break up of (copper carbonate) (with heat) (1) **ignore** breaks up bonds **not** heat particles broken down **ignore** decay / dissolve
		(ii)	$2CuO + C \rightarrow 2Cu + CO_2$ formulae correct (1) balancing (1)	2	**allow** any correct multiple, including fractions **allow** = / ⇌ instead of → **not** and / & **not** '+ heat' in equation balancing mark is dependent on the correct formula **but** **allow** 1 mark for a balanced equation with minor errors of case, subscripts, superscripts, etc 2CuO + C → 2CU + CO2
	(b)	(i)	at the anode electrons are lost which is oxidation (1) at the cathode electrons are gained which is reduction (1)	2	**allow** 1 mark if oxidation is described as electron loss and reduction as electron gain without identification of the electrodes or with incorrect identification of the electrodes
		(ii)	the anode loses mass because copper ions go into solution (1) the cathode gains mass because the copper ions gain electrons and become copper (1)	2	if ion is missed out in both marking points then **allow** one mark **allow** copper ions move from the anode to the cathode for 1 mark if no other mark awarded

Question			Answer	Marks	Guidance
	(c)		**advantages any one from:** saves resources (because the ore does not have to be extracted) (1) uses less energy (1) idea of less environmental damage (due to quarrying) (1) **problems any one from:** copper has to be collected (1) copper has to be sorted from other metals (1)	2	must be **one** advantage and **one** problem for 2 marks **allow** copper is in short supply (1) **ignore** saves landfill space **allow** loss of jobs mining or extracting copper ore (1)
	(d)		(aluminium because) low(est) density (1) and does not corrode (1) **or** (copper because) best conductor (1) and only corrodes slowly (1)	2	no mark for metal; marks are for explanation **ignore** (aluminium because) it is light **ignore** other factors from the table **allow** (copper because it is) a good conductor (1) **ignore** other factors from the table **allow** one mark for iron because it is strongest
			Total		