

- 1 (a) (i) Any bond that is broken C-H **or** O=O [1]
 Bond that is formed C=O **or** O-H [1]
 Do not insist on double bonds [1]
- (ii) More energy is released forming bonds [1]
 than is used breaking bonds [1]
 For just - more energy released than used [1]
 For - energy is released forming bonds and it is used
 breaking bonds [1]
- (b) (i) U [1]
 235 [1]
- (ii) treatment of cancer, autoradiographs, tracer, sterilising food, [1]
 surgical equipment, measuring thickness, checking welds [1]
- (c) (i) reductant zinc [1]
 oxidant hydrogen (ions) [1]
- (ii) magnesium instead of zinc **or** increase concentration of acid [1]
or copper instead of iron [1]
- (iii) sacrificial protection **or** stop iron/steel rusting [1]
or galvanising [1]
- (d) pink **or** purple [1]
 to colourless **or** decolourised [1]
NOT red **NOT** clear
- (ii) $2I - 2e = I_2$ [2]
 unbalanced **ONLY** [1]

[TOTAL = 15]

2 (a)

	copper	iron	sulphur
composition by mass/g	(4.80)		4.8 [1]
number of moles of atoms	0.075		0.15 [1]
simplest mole ratio of atoms	1		2 [1]

The empirical formula is CuFeS_2

[3]

[1]

(b) impure copper/blister copper/boulder copper etc

[1]

(pure) copper

[1]

copper sulphate **or** nitrate **or** chloride **or** contains Cu^{2+} aq

[1]

(ii) $\text{Cu}^{2+} + 2\text{e}^- = \text{Cu}$

[1]

(iii) Zinc

[1]

(c) Copper has delocalised electrons

[1]

In sulphur the electrons are localised **or** cannot move in the piece of sulphur

[1]

In copper there are layers of copper atoms/ions

Which can slip

[1]

In sulphur there are no layers

[1]

[TOTAL = 13]

- 3 (a) (i) Correct equation with a more reactive metal [1]
- (ii) Electron loss [1]
- (iii) Because they can accept electrons or take electrons away from..... [1]
- (iv) Silver or silver(I) [1]
- (b) increase [1]
- (ii) zinc
COND and a correct reason - such as it loses electrons more easily **or**
it is more reactive [1]
Need both zinc and reason for the mark.
- (iii) from the more reactive to the less reactive **NOT** just from zinc to lead [1]

TOTAL = 7

- 4 (a) (i) wiring **NOT** good conductor
 pipes
 utensils
 roofs
 electroplating
 lightning conductor
 bi-metallic strips
NOT coinage metal or any other use than involves an alloy
TWO from above [2]
- (ii) regular array [1]
 different sizes [1]
 delocalised **or** mobile **or** free electrons [1]
- (b) (i) copper deposited **or** mass increases [1]
 (ii) copper goes into solution **or** mass decreases [1]
 (iii) $\text{Cu}^{2+} + 2\text{e} \rightleftharpoons \text{Cu}$ [1]
 (iv) oxygen [1]
 sulphuric acid accept hydrogen sulphate [1]
- (c) (ii) cells produce electricity **or** exothermic **or** change
 chemical energy into electrical energy [1]
 electrolysis uses it **or** endothermic **or** change
 electrical energy into chemical energy [1]
- (d) (i) $\text{CuO} + \text{C} \rightleftharpoons \text{Cu} + \text{CO}$
or $2\text{CuO} + \text{C} \rightleftharpoons 2\text{Cu} + \text{CO}_2$
or any other correct reductant – hydrogen or metal [1]
 (ii) Copper(II) hydroxide = copper oxide + water [1]
 accept symbols
 (iii) $2\text{Cu}(\text{NO}_3)_2 \rightleftharpoons 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$ [2]
 unbalanced ONLY [1]
NOT word equation

TOTAL = 16