1 **(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]

[3]

The empirical formula is $CuFeS_2$ [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) $Cu^{2+} + 2e^- = Cu$ [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]

2 **(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

3 **(a)** A correct equation either CO or CO_2 as product
If not balanced but otherwise correct [1] ONLY [2]

(b) **(i)** $C + O_2 \rightarrow CO_2$ NOT word equation [1]
(ii) (higher in furnace) no oxygen left [1]
carbon dioxide reacts with carbon (to give carbon monoxide) [1]

OR incomplete combustion of carbon [2]

OR either equation gains both marks
$CO_2 + C = 2CO$ or $2C + O_2 = 2CO$

OR carbon dioxide reacts [1]
with carbon [1]

(c) limestone + sand $\rightarrow$ slag [2]
OR calcium carbonate + silicon (IV) oxide $\rightarrow$ calcium silicate (+ carbon dioxide)

For knowing that impurity is sand [1] ONLY

Accept calcium oxide and silicon oxide
Accept lime

(d) **(i)** Cutlery **or** chemical plant **or** watches **or** utensils **or** surgical instruments **or** cars **or** sinks **or** aircraft **or** garden tools [1]
(ii) nickel **or** chromium **or** molybdenum **or** niobium **or** titanium [1]
(iii) blow air/oxygen through
carbon becomes carbon dioxide
carbon dioxide escapes as gas
silicon and phosphorus become oxides
calcium oxide or calcium carbonate
forms slag
Any FOUR NOT blast furnace [4]

(e) anode tin NOT impure time [1]
cathode iron or steel [1]
tin salt **or** tin ions as electrolyte [1]
NOT oxide or hydroxide or carbonate

TOTAL = 16

4 (a) (i) heat **or** roast [1]
in air [1]

(ii) Either correct equation [2]
$ZnO + C = Zn + CO$
$2ZnO + C = 2Zn + CO_2$
Not balanced **ONLY** [1]
NOT carbon monoxide as a reductant

(iii) bp of lead above 1400 ^{0}C it remains
bp of zinc below 1400 ^{0}C
boils away **or** forms vapour
Any TWO [2]

OR lead does not boil [1]
zinc boils [1]

(b) (i) making brass **or** any zinc containing alloy **or** galvanising [1]
or sacrificial protection **or** batteries **or** roofs

(ii) lattice **or** layers of (positive) ions
delocalised **or** free **or** mobile electrons
layers/atoms/particles can slip [3]

(iii) different size atom **NOT** shape [1]
prevents layers from moving [1]

(c) (i) one involving lead change 2 [1]
cond because electrons are gained [1]
or oxidation number less

(ii) correct equation [2]
$Zn + 2Ag^+ = 2Ag + Zn^{2+}$
not balanced **ONLY** [1]

TOTAL = 16

5 (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) $Cu^{2+} + 2e \Longrightarrow Cu$ [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) $CuO + C \Longrightarrow Cu + CO$
or $2CuO + C \Longrightarrow 2Cu + CO_2$
or any other correct reductant – hydrogen or metal [1]

(ii) Copper(II) hydroxide = copper oxide + water [1]
accept symbols

(iii) $2Cu(NO_3)_2 \Longrightarrow 2CuO + 4NO_2 + O_2$ [2]
unbalanced ONLY [1]
NOT word equation

TOT = 16)