1 **(a** 23p 23e 28n [1]
23p 20e 28n [1]
23p 23e 27n [1]

(b) (contains) iron [1]
cond with other element(s) / compounds / suitable named element [1]
if iron is absent = 0

(ii) mild steel [1]
cars / fridges / white goods / construction etc. [1]
credit any sensible suggestion e.g. roofing, nails, screws, radiators
or
stainless steel [1]
cutlery / chemical plant / jewellery / (kitchen) utensils / named kitchen utensil / in cars / surgical equipment / car exhausts etc. [1]
not vanadium steel (this is in the question)

(c) V_2O_3 [1]
VO_2 [1]

(ii) add sodium hydroxide(aq) or other named alkali [1]
not ammonia
cond vanadium(IV) oxide dissolves / reacts [1]
filter (to remove vanadium(III) oxide) [1]

[Total: 12]

2 **(a) (i)** silver, tin (cobalt and magnesium not possible to decide) [2]
for silver less reactive then tin = 1

(ii) magnesium and cobalt <u>salt / compound / ions</u>
or
cobalt and magnesium <u>salt / compound / ions</u> [1]

(iii) $Sn + 2Ag^+ \rightarrow Sn^{2+} + 2Ag$ [2]
all species correct = 1 balancing = 1
Sn to Sn^{2+} oxidation (can be written separately or as a correct half-equation) [1]

(b) no reaction [1]
$Mg(OH)_2 \rightarrow MgO + H_2O$ accept multiples [1]

(c) (i) it forms <u>positive</u> ions / loses or gives electrons [1]
electrons move / flow from this electrode / enter the circuit / electrons flow from negative to positive (so it is negative) [1]

(ii) bigger voltage of Zn/Cu cell than Sn/Cu cell
or
zinc is negative relative to tin (in the third cell) [1]

(iii) magnesium / more reactive metal (must be named) instead of zinc
not anything above calcium in the reactivity series
or
silver / less reactive metal (must be named) instead of copper
or
use (more) concentrated acid [1]

(iv) polarities correct that is Zn - and Sn + [1]
0.6 V [1]

[Total: 14]

3 **(i)** Cu and Pd [2]

(ii) Ba and La [2]

(iii) +2 **or** 2+ **or** Ba^{2+} [1]

(iv) Ba **or** La [1]

(v) it is a transition metal **or** a d block element [1]

[Total: 7]

4 **(a) (i)** heat **or** roast **or** burn <u>in air</u> [1]
need both points for mark

(ii) $ZnO + C \rightarrow Zn + CO$ [2]
or $2ZnO + C \rightarrow 2Zn + CO_2$
unbalanced **ONLY** [1]

(b) zinc is more reactive [1]
it loses electrons and forms ions in preference to iron [1]
zinc corrodes not iron [1]
NOT zinc rusts

OR zinc loses electrons and forms ions [1]
the electrons move on to the iron [1]
the iron cannot be oxidised **or** it cannot rust **or** it cannot lose electrons [1]
CREDIT correct Chemistry that includes the above ideas

(c) (i) zinc atoms change into ions, (the zinc dissolves) [1]
copper(II) ions change into atoms, (becomes plated with copper) [1]

(ii) ions [1]
electrons [1]

[Total: 10]

5 **(a)** <u>impure copper</u> [1]
(pure) copper [1]
ACCEPT any (soluble) copper salt **or** Cu^{2+} [1]
if both name and formulae given, both have to be correct

(b) $Cu - 2e \rightarrow Cu^{2+}$ **or** $Cu \rightarrow Cu^{2+} + 2e$ [2]
for having $Cu \rightarrow Cu^{2+}$ [1] **ONLY**

(c) (i) <u>good conductor</u> [1]
malleable **or** ductile [1]

<u>good conductor of heat</u>
high melting point (and high boiling point)
unreactive **or** resists corrosion
appearance
any **TWO** [2]
do not accept malleable **or** ductile if either is given for wiring

(ii) alloys **or** named alloy **or** pipes **or** ornaments **or** jewellery **or** integrated circuit boards **or** electroplating **or** roofs, etc. [1]

[Total: 10]

6 **(a) (i)** water **or** moisture **ACCEPT** salty water [1]
air **or** oxygen [1]

(ii) galvanising **or** coat with zinc
tin plate
chromium plate
nickel plate
cobalt plate
copper plate
cover with aluminium
anodic protection **or** sacrificial protection
cathodic protection
cover with plastic
alloying (ignore any named metal)
any **TWO** [2]
NOT just plate **or** electroplate need electroplate with suitable metal
NOT oil
ACCEPT both galvanising and sacrificial protection

(b) hydrogen **or** carbon **or** carbon monoxide **or** methane
or more reactive metal **NOT** Group I [1]

(ii) any correct equation [2]
only error not balanced [1]

(c) 196 [1]

(ii) 112/196 × 100 [1]
= 57(.1)% **ACCEPT** 57 to nearest whole number [1]
mark **e.c.f.** to **(c)(i)** provided percentage not greater than 100%
ONLY ACCEPT 112/answer **(c)(i)** × 100
otherwise [0]

(d) forms carbon dioxide/carbon monoxide (which escapes) [1]

(ii) forms silicon(IV) oxide **or** silicon oxide **or** silica [1]
OR CaO reacts with SiO_2
to form slag **or** calcium silicate [1]
ignore an incorrect formula if a correct name "slag" given
NOT Si + O_2 + CaO form slag, this gains mark for slag only

[Total: 13]