1 **(a)**

electron	**or** e	1/1840 **or** 1/2000 **or** 0 1/1837 **or** negligible	-1
proton	**or** p^+ **or** H^+	1	+1
neutron		1	0 **or** neutral

each correct row (1) [3]

(b) equal numbers of protons and electrons of positive and negative charges **or** charges cancel/balance
or net charge = 0 [1]

(ii) lose electron(s) [1]
more protons than electrons [1]
NOT more + than –

(iii) different numbers of neutrons [1]
same number of protons **or** same number of electrons [1]
for just giving- they are isotopes [1] **ONLY**

(iv) an element is known for each proton number [1]
accept any sensible idea, for example no gaps between z = 1 and z = 103

[Total: 10]

2 **(a) (i)** BaO [1]

(ii) B_2O_3 [1]

(b) (i) S^2 [1]

(ii) Ga^{3+} [1]

(c) NCl_3 [1]
COND 8e (1bp and 3nbp) around each chlorine [1]
8e (3bp and 1nbp) around nitrogen [1]

(d) (i) ignore a correct chemical property in **(i)**
vanadium harder
vanadium higher melting point **or** boiling point
vanadium higher density
ANY TWO [2]
OR corresponding statements for potassium
NB has to be comparison

(ii) ignore a correct physical property in **(ii)**
potassium more reactive or example of different reactivities-
potassium reacts with cold water, vanadium does not.
potassium one oxidation state, vanadium more than one
vanadium coloured compounds, potassium white **or** colourless
vanadium and its compounds catalysts, not potassium
ANY TWO [2]
NB has to be comment about both elements

(e) (i) fluorine gas [1]
astatine solid [1]

(ii) both have valency of one
both can react with other elements to form halides
both are oxidants
or any correct Chemistry – they both form acidic hydrides
both have diatomic molecules
both accept one electron **or** form ion X
both have seven valency electrons
both react with non-metals to form covalent compounds
both react with metals to form ionic compounds
both form acidic oxides
NOT have a valency of 7
ANY TWO [2]

[Total: 15]

3 **(a** $^{23}_{11}Na$ [1]

$^{40}_{18}Ar$ [1]

$^{31}_{15}P^{3}$ [1] for charge and [1] for symbol etc. [2]

$^{27}_{13}Al^{3+}$ [1] for charge and [1] for symbol etc. [2]
ACCEPT +3 and –3
NOTE Only the above are to be awarded the mark

(b) particle B **or** $^{23}_{11}Na$ **or** sodium [1]
COND they have the same proton number **or** the same number of protons
or the same atomic number [1]
NOT the same number of electrons
Accept same number of electrons and protons

[Total: 8]

4 **(a)(i)** 38p 38e 50n **[1]**
38p 38e 52n **[1]**
30p 28e 35n **[1]**

(ii) Same number of protons and different number of neutrons **[1]**

(iii) 8+ 2 **[1]**

(b)(i) heat zinc blende in air to form oxide **[1]**
reduce oxide with carbon **[1]**

(ii) galvanising
sacrificial protection
alloys
batteries
roofing
Any **ONE** **[1]**

(c)(i) hydrochloric acid **[1]**

(ii) $Sr^{2+} + 2e = Sr$ **[1]**
$2Cl - 2e = Cl_2$ **[1]**
or $2Cl = Cl_2 + 2e$

(iii) hydrogen **[1]** and strontium hydroxide **[1]**

(d)(i) zinc + water = zinc oxide + hydrogen **[1]**
heat **[1]** steam **[1]**

(ii) $Sr + 2H_2O = Sr(OH)_2 + H_2$ **[2]**
Not balanced **[1]**
cold water **[1]**

TOTAL = 19

5 **(a)** neon has full outer shell / energy level / valency shell / octet / 8 (electrons) in outer shell / neon does not need to lose or gain electrons; [1]
fluorine atoms have 7 electrons / needs 1 to fill / has incomplete shell / forms bonds with other fluorine atoms / fluorine (atoms) form covalent bonds / shares electrons; [1]

(b) atomic number / proton number / number of protons (in one atom); [1]

(c) weak intermolecular (or between molecules) forces / Van der Waals forces between molecules / low amount of energy required to break bonds between molecules; [1]
strong bonds don't break / covalent bonds don't break / (unnamed) bonds within molecules / between atoms don't break; [1]

(d) 1 non-bonding pair on each nitrogen atom; [1]
6 electrons between nitrogen atoms; [1]

6 **(a) (i)** rate of reaction; [1]
influenced by light / only happens in light; [1]
or:
turns light into chemical energy = [2]
accept: light is catalyst = [1]

(ii) reduction of silver halides; [1]
they are reduced to silver / $2AgCl \rightarrow 2Ag + Cl_2$; [1
appropriate importance given; [1]
or:
photosynthesis;
correct comment about chemistry carbon dioxide to carbohydrates / carbon dioxide to oxygen;
anything sensible e.g. its role in the food chain or decrease greenhouse effect or oxygen for respiration;
or:
chlorination;
making chloroalkanes;
appropriate importance given;

(b) (i) pressure would move position of equilibrium to right / increase yield of $COCl_2$; [1
increase pressure favours side with less (gas) molecules / smaller volume; [1]

(ii) increase temperature favours endothermic reaction; [1]
so less products / reduce yield; [1]

(iii) keeps rate high / increase rate at lower temperatures; [1]

(c) each chlorine 1 bp and 3 nbps;
4 e between carbon atom and oxygen atom; [1]
2 nbps on oxygen atom; [1]

[Total: 13]