

- 1 (a) (i) decrease down group; [1]
 (ii) caesium / francium; [1]
 (iii) $2\text{Rb} + 2\text{H}_2\text{O} \rightarrow 2\text{RbOH} + \text{H}_2$ [2]
 not balanced = [1]

- (b) (i) Li^+ [1]
 (ii) N^3 [1]
 (iii) regular arrangement of ions / particles / positive and negative ions alternate; [1]
not: atoms
 (iv) 3:1; [1]
 ratio to balance charges / reason in terms of valency; [1]

[Total: 9]

- 2 (a) $2 + 8 + 11 + 2$ [1]

- (b) hard; [2]
 strong / high tensile strength;
 high mp / bp / high fixed points;
 high density;

three properties = [2]

two properties = [1]

not: properties of all metals e.g. good conductor, lustre etc. or form coloured compounds

- (c) catalyst would not affect yield / change position of equilibrium / affects both sides equally; [1]
 (higher) temperature would reduce yield / increase in temperature would favour back reaction; [1]

- (d) (i) V^{3+} is oxidant; [1]
 (ii) V^{3+} to V^{4+} ; [1]
 increase in oxidation number / electron loss; [1]

[Total: 8]

- 3 (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]
- 4 (a) Ca / calcium; [1]
- (b) Kr / krypton; [1]
- (c) Ge / germanium; [1]
- (d) Ni / nickel **or** Cr / chromium; [1]
- (e) Br / bromine / Br₂; [1]
- (f) Se / selenium; [1]
- (g) Cu / copper; [1]
- (h) Br / bromine / Br₂; [1]

[Total: 8]

- 5 (a) (i) zinc mixed with an element(s) or metal(s) or non-metal; [1]
- (ii) galvanising / baths / coating steel (i.e. description of galvanising) / roofing / sacrificial protection / protection from rusting / electroplating / zinc plating / batteries; [1]
- (iii) (lattice) positive ions / cations / metal ions / sea of electrons / delocalised or free or mobile or moving electrons; [1]
 attraction between positive ions and electrons; [1]
 the layers (of ions) or particles can slide or slip or shift past each other; [1]
- (iv) different atom / ion / particle of different size; [1]
 prevents (layers / atoms / ions / particles / molecules) moving / slipping / sliding / shifting; [1]
- (b) (i) heat with carbon or coke or carbon monoxide; [1]
- (ii) $\text{ZnO} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O}$ [2]
 [1] for correct reactants [1] for correct products
- (iii) zinc (**not**: ions) more reactive than silver and lead; [1]
 zinc displaces both metals / silver **and** lead produced / ions become atoms / zinc reduces silver ions and lead ions; [1]
 (silver and lead) can be removed by filtering / centrifugation / decanting; [1]
- an ionic equation; i.e.
 $\text{Zn} + 2 \text{Ag}^+ \rightarrow \text{Zn}^{2+} + 2\text{Ag}$ or $\text{Zn} + \text{Pb}^{2+} \rightarrow \text{Zn}^{2+} + \text{Pb}$ [1]
allow: any two correct half equations
- (iv) cathode labelled carbon / zinc / platinum; [1]
 zinc deposited at cathode; [1]
 oxygen formed (at anode); [1]
 (electrolyte becomes) sulfuric acid / remaining solution contains H^+ and SO_4^{2-} ; [1]

[Total: 18]

- 6 (a) (i) photosynthesis or a photochemical reaction [1]
not an example, question requires a process
not devices which convert light into electricity
- (ii) cell [1]
accept battery
not generator
- (b) (i) correct formula [1]
cond following marks conditional on correct formula
 If covalent mark 1 only
 correct charges [1]
 6x and 2o around anion [1]
 do **NOT** penalise for incorrect coding
ignore electrons around potassium
- (ii) correct formula [1]
 If ionic mark 1 only
cond
 2 bp and 2 nbp around selenium [1]
 1 bp and 3 nbp around both chlorine atoms [1]
- (iii) the ionic compound [2]
 higher melting point / boiling point / less volatile
 conducts when molten or aqueous, covalent compound does not
 is soluble in water, covalent is not / ionic insoluble in organic solvents, covalent soluble
 in organic solvents
 harder
 any **two** [2]
note there has to be comparison between the ionic compound and the covalent
 compound
not density
- (c) base [1]
not alkali
 accepts a proton [2]
 accepts hydrogen ion / H^+ **only** [1]
 proton and H^+ [2]

- 7 (i) Rb / Sr [1]
 (ii) I [1]
 (iii) Fe [1]
 (iv) P [1]
 (v) Si [1]