

- 1 (a) it is an alkane **or** hydrocarbon [1]  
 it is saturated **or** only C—C single bonds [1]  
 accept: no double bonds
- (b) molecular formula  $C_6H_{12}$  [1]  
 empirical formula  $CH_2$  [1]
- (c) correct structural formula of cyclobutane [1]
- (d)  $C_6H_{12}$  [1]  
**accept:** a correct structural formula
- (ii) same molecular formula **not:** chemical formula [1]  
 different structural formulae / structures [1]
- (e) add bromine (water) or (l) [1]  
**cond:** (remains) brown **or** orange **or** red or yellow [1]  
**cond:** changes from brown, etc. to colourless or decolourises [1]  
**not:** clear
- OR**  
 potassium manganate(VII) [1]  
**note:** oxidation state not essential but if given must be correct or [0]  
**accept:** potassium permanganate
- cond:** remains pink / purple [1]  
**cond:** changes from pink to colourless (**acidic**) [1]  
**not:** clear
- cond:** change from pink to green / brown (**alkaline**)

[Total: 11]

- 2 (a) (i) cars, ships, bridges, construction, white goods, screws, nails, roofing, fencing, etc. [1]  
 (ii) e.g. stainless steel [1]  
 cooking utensils, surgical equipment, sinks or main use [1]
- (b) blow in oxygen **NOT** air [1]  
 carbon dioxide and sulfur dioxide (escape as gases) [1]  
**COND** on reaction with air / oxygen  
 add calcium oxide / quicklime [1]  
**ALLOW** calcium carbonate, limestone  
 phosphorus oxide **or** silicon oxide (are acidic)  
 reacts (with calcium oxide /  $CaCO_3$ ) [1]  
 to form slag / calcium silicate [1]

- 3 (a) (i) roast or heat or burn in air / roast or heat or burn in oxygen [1]  
 need both of the above
- (ii)  $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$  /  $2\text{ZnO} + \text{C} \rightarrow 2\text{Zn} + \text{CO}_2$  /  $\text{ZnO} + \text{CO} \rightarrow \text{Zn} + \text{CO}_2$  [1]
- (b)  $\text{ZnO} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2\text{O}$  [1]
- (ii) zinc reduces / gives electrons / displaces (copper / cobalt / nickel ions) [1]  
 forming copper / cobalt / nickel (metal which is precipitated) [1]
- (c)  $\text{Zn}^{2+} + 2\text{e} \rightarrow \text{Zn}$  [1]
- (ii)  $\text{OH}^- \rightarrow \text{H}_2\text{O} + \text{O}_2 + \dots\text{e}^-$  (1) only [2]  
 $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
- (iii) sulfuric acid / hydrogen sulfate [1]  
**ACCEPT:** sulfuric acid
- (d) Any two of:  
 appearance  
 more resistant to corrosion  
 harder (accept stronger)  
 easier to cast [2]
- (ii) zinc more reactive (than iron or steel) [1]  
 zinc loses electrons [1]  
 electrons move (from zinc) to iron [1]  
 zinc reacts (with air and water) / zinc corrodes / is oxidised / forms positive ions / anodic  
**or**  
 iron and steel don't react (with air and water) / not oxidised / do not form ions / do not lose electrons [1]

**[Total: 15]**

4 (a) calcium carbonate  $\rightarrow$  calcium oxide + carbon dioxide [1]  
**accept:** correct symbol equation



(b) (i) CuO and NO<sub>2</sub> and O<sub>2</sub>; [1]  
**accept:** names or correct formulae

(ii)  $2\text{NaNO}_3 \rightarrow 2\text{NaNO}_2 + \text{O}_2$  [2]  
**accept:**  $\text{NaNO}_3 \rightarrow \text{NaNO}_2 + 1/2 \text{O}_2$   
**not balanced = [1]**

(c) Na / Ca; [1]

(d) Cu; Ag; [2]  
**accept:** ions Cu<sup>2+</sup> and Ag<sup>+</sup>

[Total: 8]

- 5 (a) (i) device which changes chemical energy; [1]  
 into electrical energy; [1]  
**OR**  
 produces a voltage / potential difference / electricity; [1]  
 due to difference in reactivity of two metals; [1]  
**OR**  
 produces a voltage / potential difference / electricity; [1]  
 by redox reactions; [1]
- (ii) negative / electrode B / right electrode; [1]  
**accept:** anode because it is the electrode which supplies electrons to  
 external circuit  
 loses ions / iron ions /  $\text{Fe}^{2+}$  or  $\text{Fe}^{3+}$ ; [1]  
 electrons move from this electrode; [1]
- (iii) change of mass of electrode / mass of rust formed; [1]  
 time / mention of stop watch / regular intervals; [1]
- (iv) to make it a better conductor; [1]
- (b) moles of Fe =  $51.85/56 = 0.926$  (0.93); [1]  
 moles of O =  $22.22/16 = 1.389$  (1.39); [1]  
 moles of  $\text{H}_2\text{O}$  =  $16.67/18 = 0.926$  (0.93); [1]
- if given as 0.9 1.4 0.9  
**three** of the above correct = [2]  
**two** of the above correct = [1]
- simplest whole number mole ratio Fe : O :  $\text{H}_2\text{O}$  is 2: 3: 2 /  $\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ; [1]  
**allow:** ecf for a formula based on an incorrect whole number ratio

[Total: 12]

- 6 (a) flexible / easily form different shapes / easily moulded / bends (without cracking); [1]  
non-biodegradable / unreactive / don't corrode / prevent corrosion / prevent oxidation (of the  
conducting metal) / water resistant / waterproof; [1]
- (b) improve appearance / decorative / makes appearance shiny; [1]  
prevent corrosion / rusting / protect steel / chromium will not corrode / chromium is not  
oxidised / chromium protected by an oxide layer; [1]
- (c) low density / light / protected by oxide layer / no need to paint / resists corrosion / (high)  
strength / strong;; **any two** [2]  
**note:** high strength to weight ratio = 2
- (d) high mpt / withstands high temperature / good conductor (of heat) / heats up quickly /  
malleable / ductile / resists corrosion / good appearance / unreactive (or example of lack of  
reactivity e.g. does not react with food or water or acid or air);; **any two** [1]
- (e) (lattice) positive ions / cations / metal ions and sea of electrons / delocalised or free or mobile  
or moving electrons; [1]  
attraction between positive ions and electrons; [1]