

- 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 C₆H₁₂ [1]
 empirical formula CH₂ [1]
- (c) correct structural formula of cyclobutane [1]
- (d) C₆H₁₂ [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 / CaCO₃) [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 NO₂ and O₂; [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 Cu²⁺ and Ag⁺

[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 / Fe^{2+} or 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 H_2O = $16.67/18 = 0.926$ (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 : H_2O 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]