Using and Controlling Reactions Summative Test SOLUTIONS

1.

(a) Releases

(b) $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

(c) $\Delta H = 2870 \text{ kJ mol}^{-1}$

$M_{C_4H_{10}} = 58.12 \text{ g mol}^{-1}$

kJ per gram $\therefore \dfrac{2870}{58.12} = 49.4 \text{ kJ g}^{-1}$

(d) $E = mc_p\Delta T$

$= 1000 \times 4.18 \times 75$

$= 3.135 \times 10^5 \text{ J}$

$\times 2$ since 50% is lost = 6.27×10^5 J = 6.27×10^2 kJ

$\dfrac{6.27 \times 10^2}{49.4} = 12.7 \text{ g}$

(e) Any of these (with any one adverse effect)

soot (carbon) - can create visual pollution, restrict light to leaves, damage the respiratory system, etc.

CO - can deprive the body of oxygen leading to adverse health effects

Unburnt hydrocarbons - react with other molecules in the atmosphere and produce secondary pollutants

CO_2 contributes to enhanced greenhouse effect

(f) Advantage: Easily obtained/used for energy

Disadvantage: Less availability for use in chemical industry

2. (a) $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$

(b) Anode

(c) ←

(d) →

(e) Does not need replacing

(f) Fuel must be continuously supplied

3.

(a) Electrolytic

(b) $Fe + 2OH^-$ (or “iron and hydroxide” etc)

4. (a) The forward and back reactions are occurring at the same rate.

(b) (i) III. Increasing temperature increases rate of reaction, hence equilibrium is achieved more quickly. Since the reaction is exothermic, the equilibrium shifts to oppose the change, hence the reaction occurs to decrease temperature, that is, to the left. Thus there is more A present at equilibrium.

(ii) II. Increasing pressure increases rate of reaction, hence equilibrium is achieved more quickly. The equilibrium will shift to oppose the change (decrease the moles of gas) so the reaction occurs to the right. Thus there is less A present at equilibrium.

(c) The rate of reaction will increase, since the catalyst provides an alternate reaction pathway with lower activation energy, meaning there will be more successful collisions per time.

5.

(a) $\frac{[SO_{3\,(g)}]^2}{[O_{2(g)}][SO_{2\,(g)}]^2}$

(b)

	SO_2	O_2	SO_3
Initial moles	1	1	1
Change	-0.8	-0.4	+0.8
Final	0.2	0.6	1.8

$C = n/V = 0.6/2 = 0.3 \text{ mol L}^{-1}$

(c) It will decrease

(d) High pressure conditions. The reaction will counteract the change by moving the equilibrium position to the side with less moles of gas, in this case to the right meaning more products (higher yield).

6. (a) Silver; it is less reactive and therefore less likely to lose electrons (become oxidised) to form compounds

(b) Concentration, Conversion to a form suitable for reduction, Reduction, Refining

(c) Zinc is less reactive than aluminium. Carbon is not a strong enough reducing agent for aluminium.

(d) Electrolysis of molten KCl

$K^+ + e^- \rightarrow K$

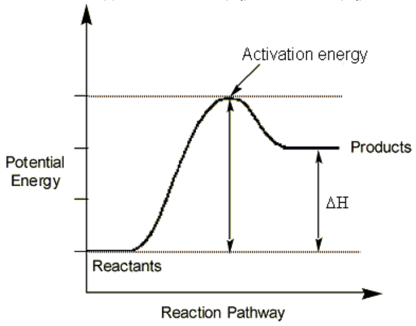
7. (a) ZnS
(b) O_2 / oxygen
(c) H_2SO_4 / sulfuric acid
(d) (i) $Zn^{2+} + 2e^- \rightarrow Zn$
(ii) Cathode
(iii) Zinc metal will contain less-active metals
(e) Melting an ionic substance requires very high temperatures which are expensive to produce.

8.

(a) Endothermic

(b) $NH_4NO_{3(s)} \rightarrow NH_4^+{}_{(aq)} + NO_3^-{}_{(aq)}$ $\Delta H = +26.0 \text{ kJ mol}^{-1}$

(c)



(d) (i), (ii) *see data spreadsheet*

(iii) *relate to hypothesis (support or not), discuss proportionality (straight line with zero intercept)*

(iv) The solution could be stirred during the reaction to ensure even distribution of heat and therefore accurate measurement.