Using & Controlling Reactions *Formative Test 2* *SOLUTIONS*

1. Reaction 1

2. (a) (i) The rate of reaction is faster at A than at B.

(ii) The slope of the graph is steeper at A than at B.

(iii) As the concentration of reactants decreases there is less chance of reactant particles colliding, which means there will be less productive collisions per unit of time, hence a slower rate of reaction.

(b) The rate of reaction increases. The catalyst provides an alternate reaction pathway with lower activation energy, meaning there will be more collisions of sufficient energy to be productive per unit of time.

(c) Increasing temperature increases the movement of particles, which increases the number of collisions per unit of time. Increasing temperature also increases the energy available which will increase the chance that each collision will be productive.

3. (a) lithium carbonate

(b) Electrolysis of molten lithium carbonate will cause lithium metal to be produced at the cathode.

$Li^+ + e^- \rightarrow Li$

(c) Concentration of ore, conversion to a form suitable for reduction, reduction, purification

(e) Aluminium is very reactive; water would be preferentially reduced.

(f) Smelting

4. (a) The mixture of zinc mineral and gangue is crushed to a powder. This is then mixed with a frothing agent and water soluble collector. Air is blown through the mixture; bubbles of concentrated zinc mineral form on the surface.

(b) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

(c) heat (high temperature)

(d) H_2SO_4 (sulfuric acid)

(e) Powered zinc metal is added; single-displacement occurs reducing ions of metals less reactive than zinc, allowing them to be filtered out.

(f) Electrolysis of a melt requires high temperature conditions, therefore higher energy cost

(g) $Zn^{2+} + 2e^- \rightarrow Zn$

5. (a) closed system

-or- fixed temperature

(b) $\dfrac{[NH_3]^2}{[N_2][H_2]^3}$

(c) $\dfrac{0.4^2}{0.3\times0.4^3} = 8.3$

K_C is not 8.3 therefore the system is not at equilibrium

(d) $0.5 = \dfrac{[NH_3]^2}{[N_2][H_2]^3}$

$$\therefore [N_2] = \frac{[NH_3]^2}{0.5\times[H_2]^3} = \frac{0.231^2}{0.5\times0.654^3} = 0.382 \text{ mol L}^{-1}$$

(e) The graph shows higher yield at lower temperature, therefore the equilibrium position is further to the right at lower temperature, therefore the reaction is exothermic (heat is released to counteract the change of lowering temperature)

(f) According to LCP, increasing the pressure will cause a reaction to occur to counteract the change by decreasing the moles of gas present. In this case there are less moles of gas on the right side (products) therefore the equilibrium position is pushed to the right (forward reaction favoured) and hence higher yield produced.