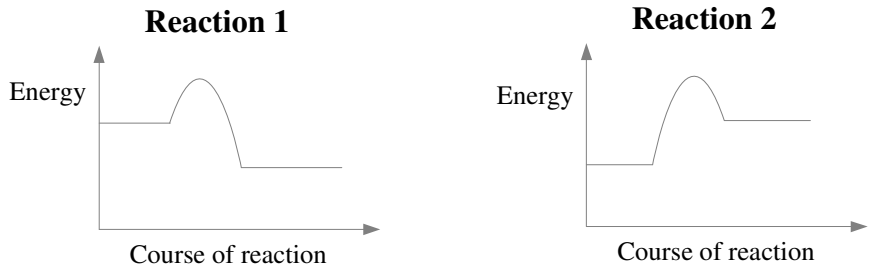
Year 12 Chemistry Formative Test NAME_____

Using and Controlling Reactions 2

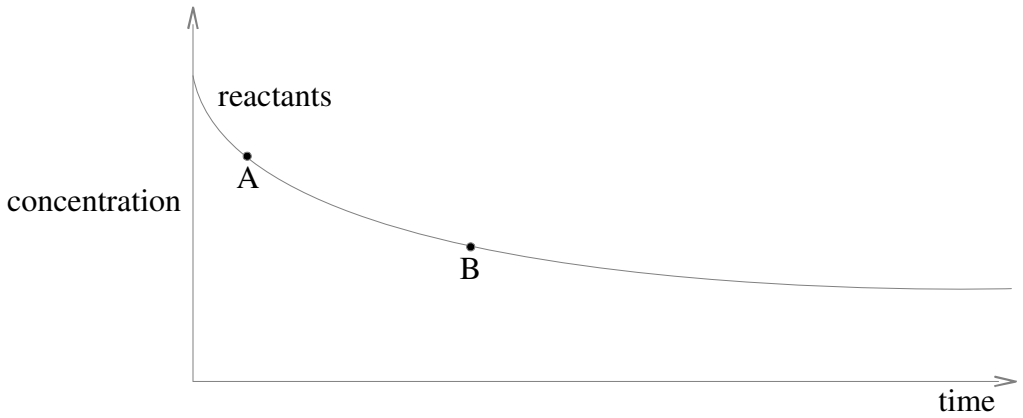
Subtopics: Rate of Reaction, Equilibrium, Chemical Industry, Metal Production

1. The energy profile diagrams for two reactions are shown below.



State which reaction is exothermic. /1

2. The graph below shows the concentration of reactants over time for some reaction.



(a) Two points in time are marked as A and B.
(i) Compare the rate of reaction at A with the rate of reaction at B. /1
(ii) State how the graph shows this. /1
(iii) Explain why the reduction in concentration causes this. /2

(b) State and explain the effect of the presence of a catalyst on the rate of reaction. /2

(c) State two reasons why increasing temperature will increase rate of reaction. /2

3. Lithium carbonate is an important industrial chemical.

(a) Predict whether lithium is more likely to occur in nature as Li metal or in lithium carbonate. /1

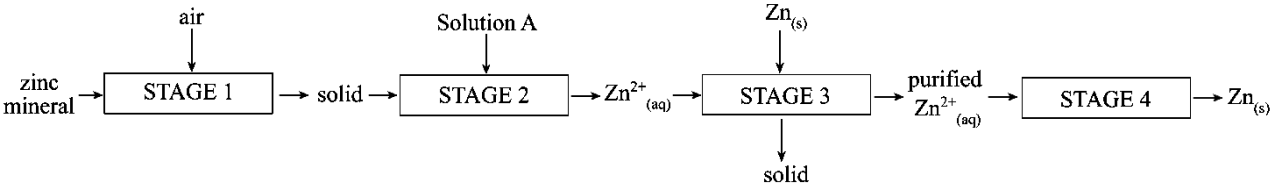
(b) Describe, using at least one half equation, how lithium can be produced from lithium carbonate. /3

(c) Identify the stages in the production of a metal from its ore. /4

(d) Explain why aluminium metal must be produced from a non-aqueous electrolyte. /2

(e) Predict whether the method of reduction of tin metal from the compound SnO_2 is more likely to be by smelting or by electrolysis of a melt. /1

4. The conversion of zinc mineral into zinc metal is summarised in the flow chart below:



(a) Describe the concentration process that takes place before this conversion. /3

(b) Write an equation for the reaction in Stage 1. /2

(c) State the reaction condition that is used in Stage 1. /1

(d) Identify the reactant shown as Solution A. /1

(e) Describe the process that purifies Zn^{2+} in Stage 3. /2

(f) Stage 4 is the electrolysis of zinc solution. Explain why reduction using electrolysis of the solution is preferable to electrolysis of a melt. /2

(g) Write a half-equation for the electrode reaction in which zinc is produced. /2

5. Consider the reaction $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

(a) State one condition necessary for a system to achieve equilibrium. /1

(b) Write a K_c expression for this reaction. /1

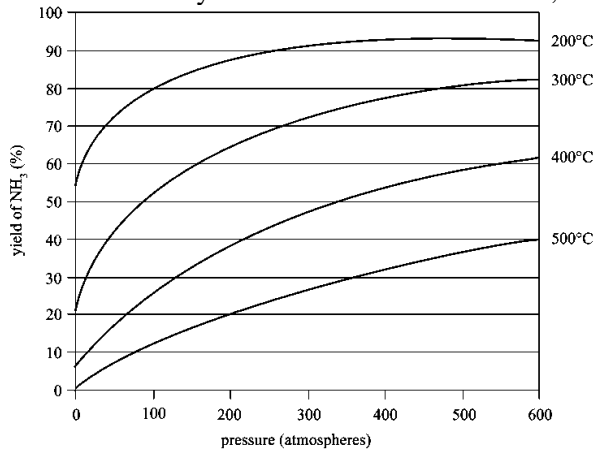
(c) In one experiment conducted at 400°C, the concentrations of three gases in a system were determined. The results are shown in the table below:

Gas	Concentration (mol L^{-1})
N_2	0.3
H_2	0.4
NH_3	0.4

The value of K_c for this reaction at 400°C is 0.50.
Using your K_c expression, explain why the system above is not at equilibrium. /3

(d) At equilibrium at 400°C, the concentration of NH_3 is 0.231 mol L^{-1} and the concentration of H_2 is 0.654 mol L^{-1}. Calculate $[N_2]$. /2

(e) The yield of ammonia produced is affected by different reaction conditions, as shown in the graph below:



Deduce, with reference to the graph, whether the reaction that is producing ammonia is exothermic or endothermic. /2

(f) Explain, in terms of Le Châtelier's principle, why increasing the pressure produces a higher yield of ammonia. /3

TOTAL /45