Revision 2

- Equilibrium and rate of reaction.

a) - $N_2O_4(g) \rightleftarrows 2NO_2(g)$ $K_c = 3.6 \times 10^{-3}M$

b) - $N_2(g) + 2O_2(g) \rightleftarrows 2NO_2(g)$ $K_c = 3.1 \times 10^{-9}M^{-}$

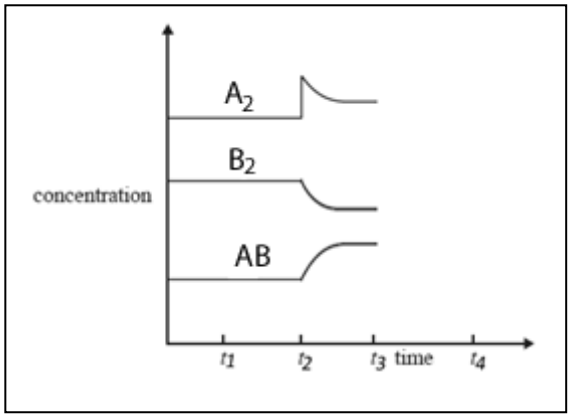
1) Use the information above to obtain the magnitude of the Kc for the reaction shown below.
$N_2O_4(g) \rightleftarrows N_2(g) + 2O_2(g)$

2) At a given temperature 3.00 mol of A_2 gas and 4.00 mol of B_2 gas were mixed in a 4.00 litre sealed vessel and allowed to react according to the equation below
$A_2(g) + B_2(g) \rightleftarrows 2AB(g)$
After a while equilibrium was reached, at which point the gas mixture in the sealed container was analysed and found to contain 2.00 mol of AB gas.
   a) What is the theoretical yield of AB?
   b) Percentage yield is given by the formula below

$$\frac{\textit{actual yield}}{\textit{theoretical yield}} \; X \; 100$$

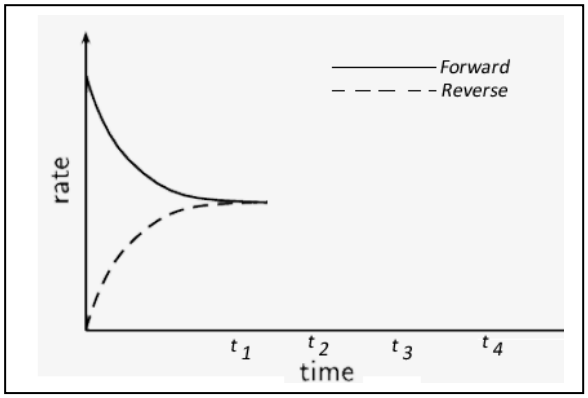
   Calculate the percentage yield for this system.

   c) Calculate the equilibrium constant for the system.



3) The same system as in Q2 above was subjected to some changes. A graph of the change in concentrations of each species is shown on the right.
   a) What change was made to the system at t_2? Explain how the system responded.

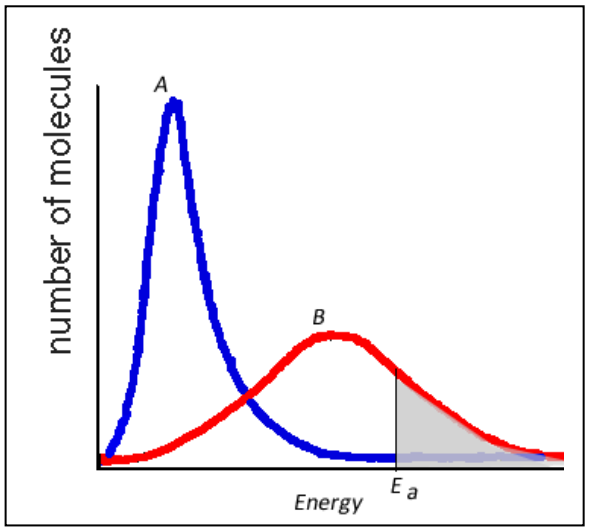
   b) At t_3 the volume of the vessel was doubled. Draw, on the graph above, how the concentration of each species changes over time before equilibrium is reached once more just before t_4.
   c) At t_4 a catalyst was added. Draw, on the graph above, how the system responded.
   d) Indicate, on the graph shown on the right, how the rates of the forward and reverse reactions change as the changes at t_2,t_3 and t_4 take place.



4) The following reaction takes place at a given temperature.

$2HCl(aq) + BaO(s) \rightarrow BaCl_2(aq) + H_2O(l)$

The graph on the right shows the kinetic energy of molecules at two different temperatures A and B. E_a represents the activation energy for the reaction.



a) Write a balanced ionic equation for the above reaction.

b) Which graph represents the hottest temperature?

c) Which statements below are true?

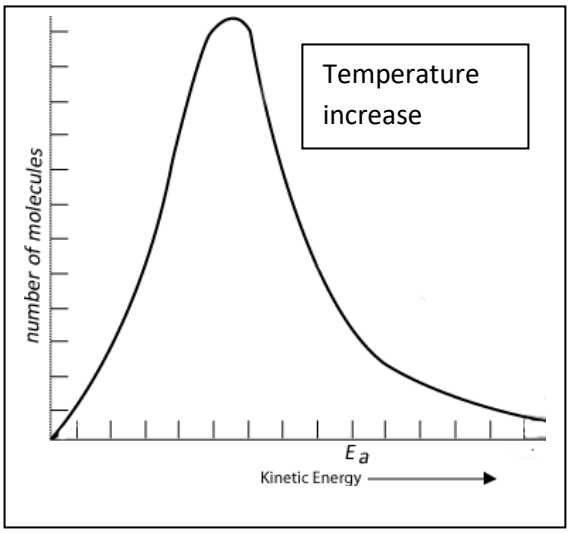
i. The kinetic energy of all particles increases at higher temperature.

ii. The average kinetic energy of the particles decreases at lower temperatures.

iii. All particles have a lower kinetic energy at lower temperatures.

d) At which temperature A or B will the fastest rate of reaction take place? Explain.

e) What does the shaded area represent?



f) Two students were arguing as to how the rate of a reaction can be increased. Darren suggested that a catalyst will definitely speed up the reaction. Jason also suggested that increasing temperature will also increase the rate of the reaction. On the graphs shown on the right, draw how a catalyst or an increase in temperature changes the distribution of energy amongst the particles and hence causes an increase in the rate of a reaction.
Explain how each increases the rate of the reaction.