**Friday Worksheet** **Name: ……..**

**Chemical equilibrium worksheet 5**

1) Consider the following equilibrium

$Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons FeSCN^{2+}(aq)$ $\Delta H$ = *positive*

Explain what has happened at t2 in each of the three concentration vs time graphs A, B and C shown on the right.

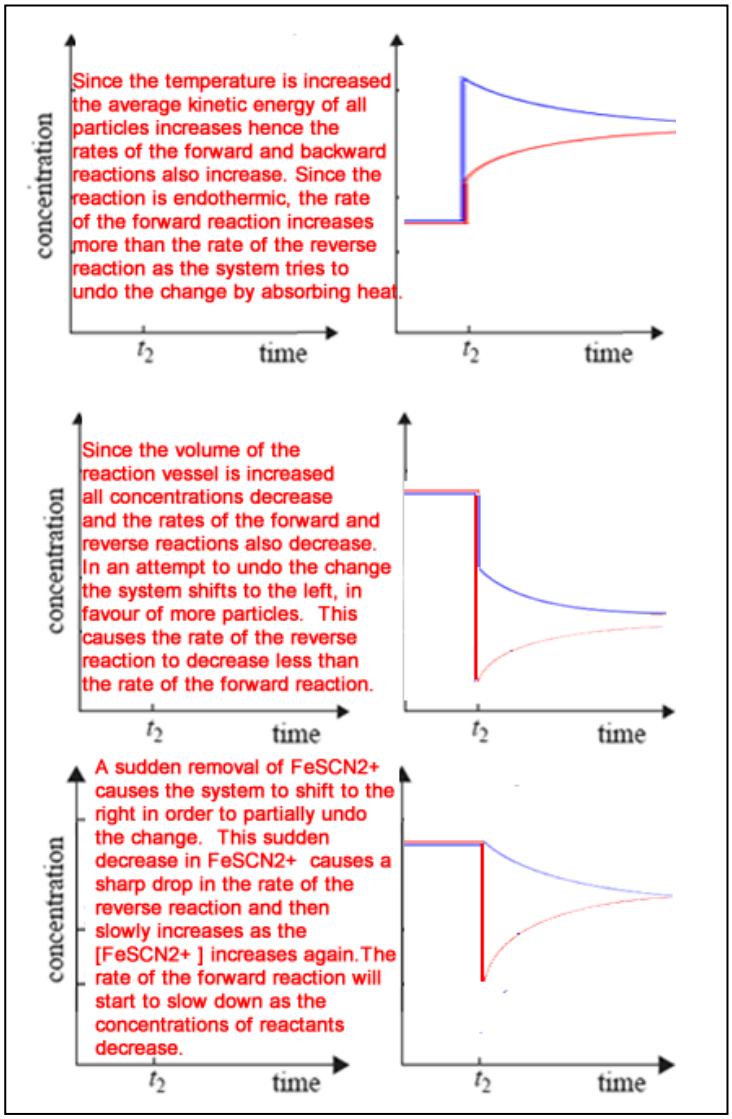
Complete the rate vs time graph for each.

Indicate in red the rate of the reverse reaction and in blue the rate of the forward direction.

A) Temperature increase

B) Volume increase

C) Removal of $FeSCN^{2+}$




2) Consider the following equilibrium systems

a) $a(g) + b(g) \rightleftharpoons c(g)$

b) $a(g) + b(g) \rightleftharpoons 2c(g)$

c) $2a(g) + b(g) \rightleftharpoons 2c(g)$

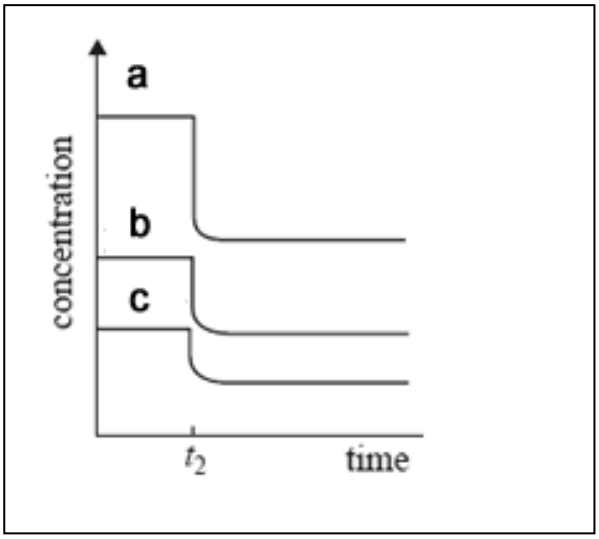
i. What happened at t2?

ii. Which equilibrium system is depicted in the diagram on the right?

b)

Explain

Equation b) has equal number of particles on both sides of the equation and hence will not shift in response to a volume change.




iii. How has the equilibrium constant changed at t2?

The equilibrium constant remains unchanged.

3) *Consider the two equations below. They show ethane burning in atmospheric oxygen.*

i. $2C_2H_6(g) + 7O_2(g) \text{ ---> } 4CO_2(g) + 6H_2O(l)$ $\Delta H = -3120$ kJ/mol

ii. $2C_2H_6(g) + 7O_2(g) \text{ ---> } 4CO_2(g) + 6H_2O(g)$ $\Delta H = -?$kJ/mol

a) Will the magnitude of the ΔH of equation ii) be greater, equal or less than 3120kJ/mol ? Explain.

Less than 3120 kJ/mol. More energy is needed to keep $H_2O$ as a gas than as a liquid and hence less energy will be given out by the reaction.

b) Why do the equations above never reach equilibrium but rather go to completion?

Products are allowed to escape.

c) A pure 0.300 gram sample of ethane is placed in an open reaction vessel with 16.40 grams of pure oxygen gas. The reaction proceeds as shown below.

$2C_2H_6(g) + 7O_2(g) \text{ ---> } 4CO_2(g) + 6H_2O(l)$ $\Delta H = -3120$ kJ/mol

The energy from this reaction is used to heat 200.0 grams of water at 25°C. Assuming no energy loss, calculate the final temperature of the water.

Step 1 Find the limiting reactant.

- ⇨ Mol of $C_2H_6$ = 0.300 / 30.0 = 0.0100
- ⇨ Mol of $O_2$ = 16.40 / 32.0 = 0.513
- ⇨ According to the equation ethane reacts with oxygen gas in the ratio 2:7.
  Hence 0.0100 mol of ethane needs 0.035 mol of oxygen gas. Clearly we have too much oxygen gas.

Step 2 Using the limiting reactant find the amount of energy released in kJ.

- ⇨ According to the equation for every 2 mol of ethane that reacts 3120 kJ
- ⇨ 3120/2 = x/0.0100
- ⇨ 15.6 kJ

Step 3 Calculate the temperature change of the water.

- ⇨ Energy(J) = 4.18 X mass X ΔT
- ⇨ 15,600 / (4.18 X 200.0) = ΔT
- ⇨ 18.7°C

Step 4 Find the final temperature.

- ⇨ 18.7 + 25.0 = 43. 7°C