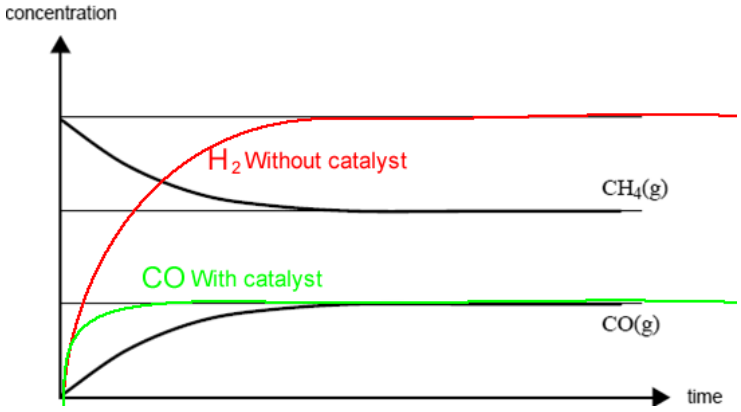
Friday Worksheet **Name: ……..**

Rates of reaction worksheet 2

1) Carbon monoxide and hydrogen can be produced from the reaction of methane with steam according to the equation below.

$$CH_4(g) + H_2O(g) <=> CO(g) + 3H_2(g); \Delta H = +206 \text{ kJ mol}^{-1}$$

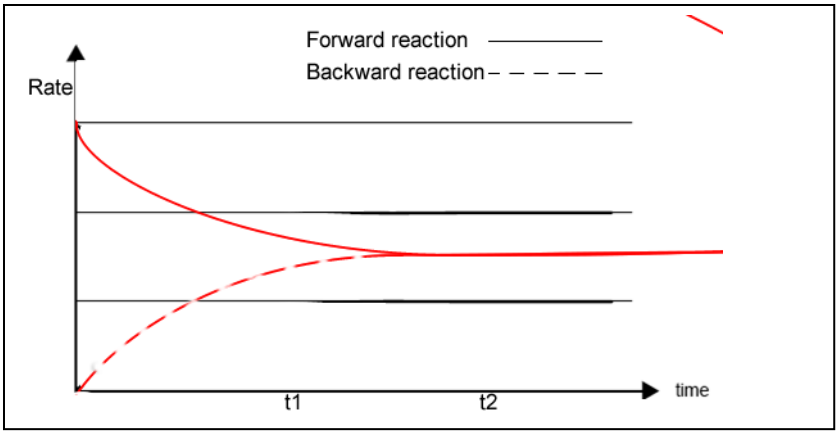
Some methane and steam are placed in a closed container and allowed to react at a fixed temperature. The following graph shows the change in concentration of methane and carbon monoxide as the reaction progresses.



a) On the graph above, draw a line to show the change in concentration of hydrogen gas as the reaction progresses. Label this line.

b) On the graph above, draw a line to show how the formation of carbon monoxide would differ over time in the presence of a catalyst. Label this line.

c) Draw the rate vs time graph for the forward and backward reactions on the set of axis below.



2) Explain why the following statements are True or False.

a) According to the Collision Theory all collision between reactant particles lead to a reaction.
False. Only the collisions with the right amount of a energy, activation energy, will react.

b) All particles at 40 ^{O}C have more kinetic energy than the same particles at 20 ^{o}C.
False. Not all particles have a greater energy, however, the average kinetic energy is higher at 40 ^{o}C than at 30 ^{o}C.

c) A catalyst increases the rate and the yield of chemical reactions.
False, a catalyst increases the rate at which a reaction reaches equilibrium but has no impact on the yield.

d) The rate of the forward reaction, at constant temperature, increases as the reaction proceeds.
False. As the reaction proceeds the concentration of reactants decreases and so does he rate of the forward reaction.

e) Endothermic reactions are slower than exothermic reactions.
False Some exothermic reactions are slower than some endothermic reactions. It depends on the activation energy of the forward reaction. The higher the activation energy the fewer particles that have that amount of energy, at a given temperature, and hence the slower the reaction.

f) An increase in temperature increases the activation energy needed for reactant particles to react.
False. The activation energy, is the energy needed to break chemical bonds and this does not change with temperature.

g) Increasing the activation energy increases the fraction of particles with the necessary activation energy with which to react.

False . As can be seen from the diagram on the right of the Maxwell-Boltzmann distribution of molecular energies in a gas, increasing activation energy reduces the number of particles the have the activation energy.