Name:________________

SCH 4U – Quantitative Equilibrium Test

1. The following gas phase equilibrium was carried out in an 800 mL flask at a constant temperature:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Injection of NH_3 into an empty flask produces an initial concentration of 0.500 mol/L. After equilibrium has been reached (some time has passed), the concentration of NH_3 has dropped to a final value of 0.200 mol/L. Use this information to determine the K_{eq} value for this equilibrium reaction at the given temperature.

initial [ ]			
initial amount			
final amount			
final [ ]			

2. Using the information form the last question, construct a graph for ammonia equilibrium. Assume that equilibrium is reached at t = 8 minutes. Now at t = 15 minutes add the effect of an increase in temperature. Show a complete Le Chatelier's Principle calculation to get the direction correct. Show a shift in the graph that corresponds to this direction. The size of the shift cannot be calculated (use anything that you like). Note however, that the stoichiometry in this reaction will affect the relative size of the individual shifts for N_2, H_2 and NH_3. Show a return to equilibrium by t = 20 minutes. I would recommend a concentration axis scale division of 0.05 per division.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

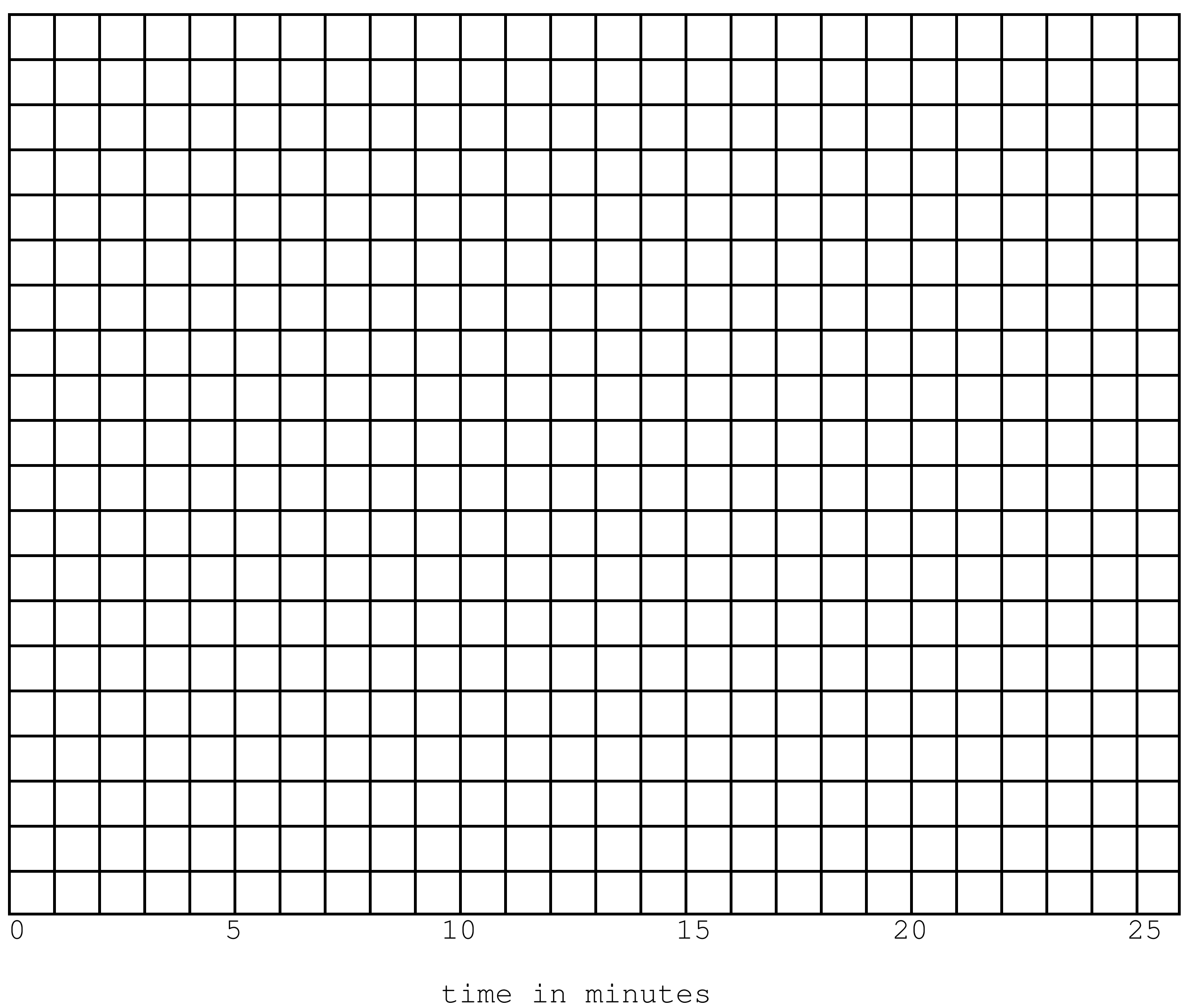
Stress:

Response:

How:

Direction:

Effect:



3. For the gas phase equilibrium:

$$2A \rightleftharpoons B + C$$

An initial concentration of A of 0.200 mol/L in a 5.00 L flask is allowed to equilibriate. If the equilibrium constant for this reaction is K_{eq} = 4.00, what will the final concentrations of all three gases become at the final equilibrium state? Is it possible that you need a variable here??

initial [ ]			
initial amount			
final amount			
final [ ]			

4. For the gas phase equilibrium:

$$2A + B \rightleftharpoons 3C$$

equilibrium concentrations are found to be:

[A] = 0.200 mol/L
[B] = 0.400 mol/L
[C] = 0.900 mol/L

Now to this equilibrium, a substantial amount of C in injected, such that the [A] rises to 0.800 mol/L once equilibrium has been reestablished. If the volume of the flask is fixed at 25.0 L, determine the amount of C that was injected. Believe it or not, you have enough information to solve this problem. The stated concentrations above are at equilibrium, the injection of C then creates initial conditions, which then lead to final concentrations such that [A] rises to 0.800 mol/L

initial [ ]			
initial amount			
final amount			
final [ ]			