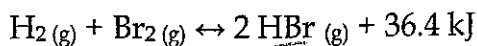


### 5.5 La Chatelier's Principle Assignment

1. For the following system at equilibrium:



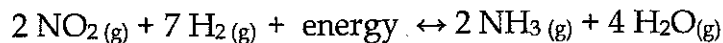
a. Predict the shift in equilibrium when more  $\text{HBr}(\text{g})$  is added to the system.

$\uparrow P =$  shifts left to make more reactant

b. How will a temperature increase shift equilibrium?

$\uparrow \text{temp} =$  shifts left to use up extra heat

2. For the reaction below, predict the direction the equilibrium will shift given the following changes. Temperature and volume are held constant.



a. addition of ammonia  $\rightarrow$  shifts left

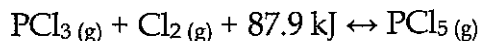
b. removal of nitrogen dioxide  $\rightarrow$  shifts left

c. decrease the temperature  $\rightarrow$  shifts to left

d. removal of water vapour  $\rightarrow$  shifts to right

e. addition of hydrogen  $\rightarrow$  shifts to right

3. At a particular temperature, the following reaction has an equilibrium constant,  $K_{\text{eq}}$  of 0.18



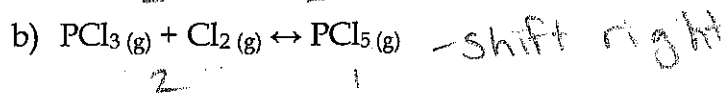
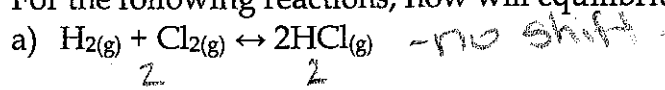
a) If more  $\text{PCl}_3$  is added to the system. Will the value of  $K_{\text{eq}}$  increase, decrease, or remain the same? *remain the same*

b) How would the equilibrium shift if a catalyst is introduced? *No change*

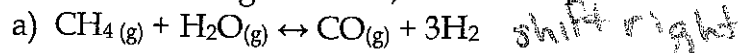
c) Explain how you can shift the equilibrium to the products by separately altering the concentration of one of the substances, the temperature, or the pressure.

$\uparrow \text{temp}$ ; remove  $\text{PCl}_5$ ; add  $\text{Cl}_2$  or  $\text{PCl}_5$ ;  $\uparrow \text{Pressure}$

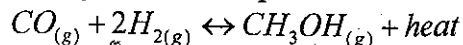
4. For the following reactions, how will equilibrium shift for an increase in pressure?



5. For the following reactions, how will equilibrium shift if the pressure is decreased?



6. Methyl alcohol is produced according to the equation:



Predict the effect on the equilibrium species distribution if there was an increase in:

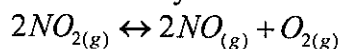
a) Temperature

*shift left*

b) Pressure

*shift right*

7. List three ways that the following equilibrium reaction could be forced to shift to the right:



1

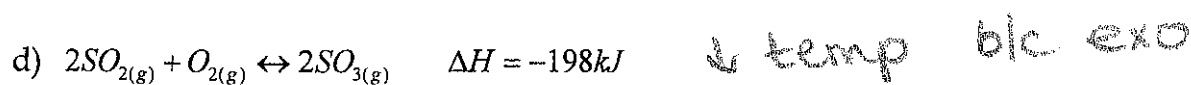
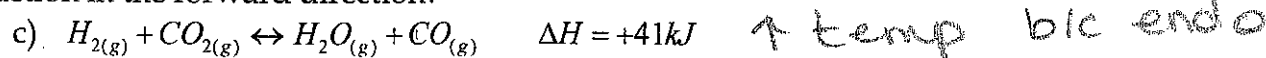
3

• *↓ Pressure*

• *↓ products*

• *↑ reactants*

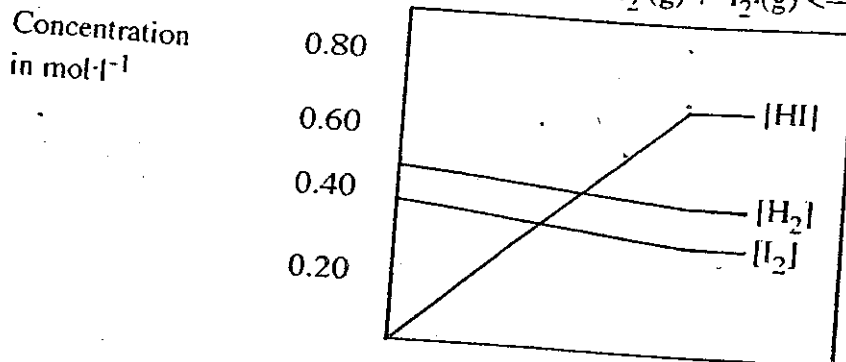
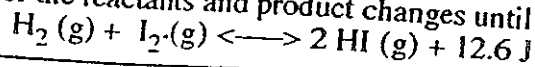
9. In each of the following equilibria, would you increase or decrease the temperature to force the reaction in the forward direction?



# Unit 5: Chemical Equilibrium

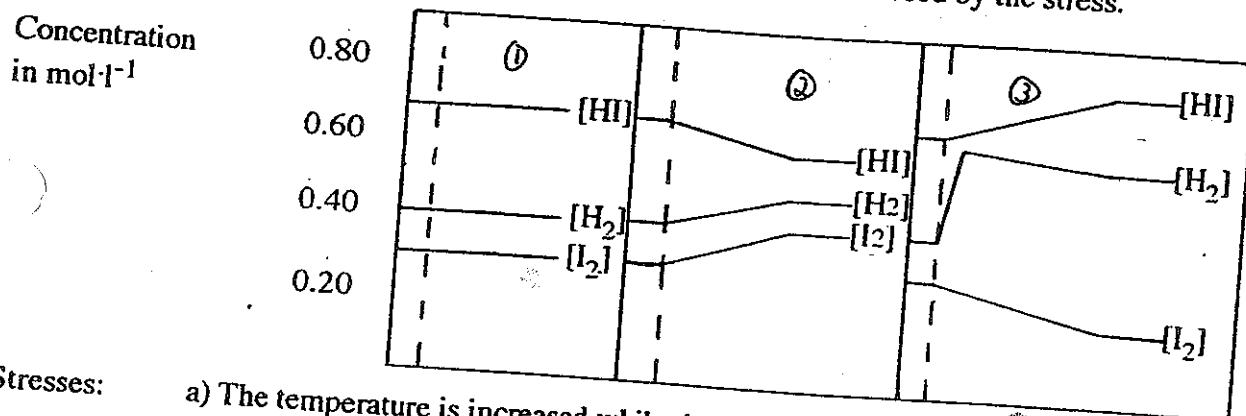
Chem 30

The following graph show how the concentration of the reactants and product changes until equilibrium is established for the reactions:



exo

The following graphs begin with the system at equilibrium and then have a stress applied. Select whether graph 1, 2 or 3 best represents the change that would be caused by the stress.



Stresses:

- The temperature is increased while the pressure is constant. ②
- The temperature and pressure are increased. ②
- Some hydrogen gas is added. ③
- The pressure is increased while the temperature is constant. ①
- A catalyst is added. ①

