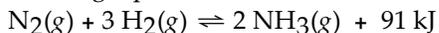


# Worksheet: Chemical Reaction Rates & Equilibrium

## MULTIPLE CHOICE.

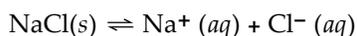
- 1) Equilibrium is reached in a chemical reaction when 1) \_\_\_\_\_  
A) The rates of the opposing reactions become equal  
B) The reactants are completely consumed  
C) The forward and reverse reactions stop  
D) The concentrations of all reactants and products become equal
- 2) In which direction will the point of equilibrium shift when the concentration of iron(III) ion decreases in the following equilibrium? 2) \_\_\_\_\_  
$$\text{Fe}^{3+}(\text{aq}) + \text{SCN}^{-}(\text{aq}) \rightleftharpoons \text{Fe}(\text{SCN})^{2+}(\text{aq})$$
  
A) Shift to the right                      B) No shift                      C) Shift to the left
- 3) In which direction will the point of equilibrium shift when the pressure is increased in the following equilibrium? 3) \_\_\_\_\_  
$$\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g})$$
  
A) Shift to the right                      B) No shift                      C) Shift to the left
- 4) In which direction will the point of equilibrium shift when when a catalyst is added to the following equilibrium system? 4) \_\_\_\_\_  
$$2 \text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{NO}_2(\text{g}) + 113 \text{kJ}$$
  
A) No shift                      B) Shift to the right                      C) Shift to the left
- 5) In the following equilibrium, 5) \_\_\_\_\_  
$$\text{NaCl}(\text{s}) \rightleftharpoons \text{Na}^{+}(\text{aq}) + \text{Cl}^{-}(\text{aq})$$
  
When chloride ion is added, the concentration of sodium ion will  
A) decrease                      B) increase                      C) not change
- 6) Ammonia, an essential chemical for modern civilization, is produced from the forward reaction of the following equilibrium 6) \_\_\_\_\_  
$$\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g}) + 92.5 \text{kJ}$$
  
From the equilibrium, which of the following would favor the production of ammonia?  
A) Reducing the concentration of ammonia  
B) Increasing the pressure  
C) Increasing the concentration of nitrogen gas  
D) All of the above
- 7) Which one of the following factors would affect the rate of the chemical reaction? 7) \_\_\_\_\_  
A) Temperature                      B) Concentration of reactants  
C) Catalyst                      D) All of the above

8) Which of the following ways would the point of equilibrium shift toward to right (product) in the following equilibrium? 8) \_\_\_\_\_



- A) Reduce the concentrations of  $\text{NH}_3(\text{g})$
- B) Increase the temperature of the reaction.
- C) Use better catalyst
- D) Increase the pressure of the system.
- E) Lower the temperature of the reaction.
- F) Reduce the pressure of the system.
- G) Increase the concentrations of  $\text{N}_2(\text{g})$  and/or  $\text{H}_2(\text{g})$  or both

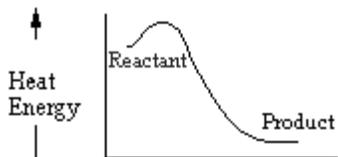
9) Critical thinking: The solubilities of most ionic compounds increase as the temperature increases, such as table salt: 9) \_\_\_\_\_



which of the following must be true?

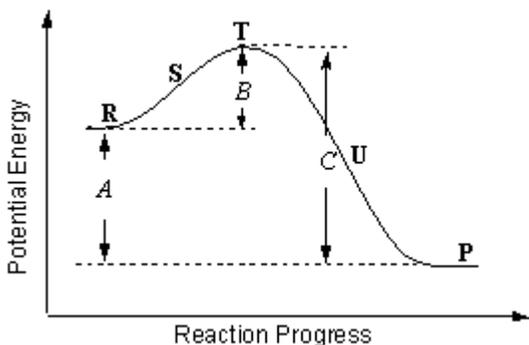
- A) The crystallization process is exothermic.
- B) The dissolving process is exothermic.
- C) The crystallization process is endothermic.
- D) The dissolving process is endothermic.

10) The reaction energy profile as shown below indicates the reaction is \_\_\_\_\_. 10) \_\_\_\_\_



- A) exothermic.
- B) isothermic.
- C) endothermic.
- D) quasithermic.

11) The question below refer to the following diagram: 11) \_\_\_\_\_

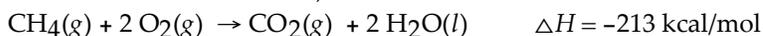


The activation energy of the forward reaction ( $\text{R} \rightarrow \text{P}$ ) is

- A) A
- B) B
- C) C
- D) B+C

**PROBLEMS. Show work with proper Significant Figures and Units to receive credit.**

12) For the combustion of methane,



- a. How many kilocalories of energy are released from 5.0 mol of methane?
- b. How many moles of methane are needed to give 100. kcal heat?

Answer Key

Testname: WKST\_IC\_CHEMEQUIL

- 1) A
- 2) C
- 3) A
- 4) A
- 5) A
- 6) D
- 7) D
- 8) A, D, E, G
- 9) A, D
- 10) A
- 11) B
- 12) a.  $1.07 \times 10^3$  kcal  
b. 0.469 mol