POD Unit 4 Test Review

1. What is the expression for Kc of the following reaction?
$H_2(g) + I_2(g) \leftrightarrow 2HI(g)$ $\frac{P}{R}$
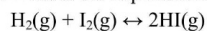
a. $Kc = \frac{[I_2][H_2]}{[HI]}$

b. $Kc = \frac{[2HI]}{[H_2][I_2]}$

c. $Kc = \frac{[HI]}{[H_2] + [I_2]}$

d. $Kc = \frac{[HI]^2}{[H_2][I_2]}$ *(circled)*

2. Under which of the following conditions does the equilibrium constant change for the reaction in Question 1?
a. Changing the size of the container
b. Introducing more I_2 into the container
c. Changing the temperature *(circled)*
d. Changing the concentration of HI
e. None of the above, it is always constant

3. For the reaction $3A \leftrightarrow 2B$, $Kc = 3.0$. Determine Kc for
$9A \leftrightarrow 6B$ $(3.0)^3$
a. 3.0
b. 6.0
c. 9.0
d. 27.0 *(circled)*

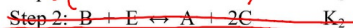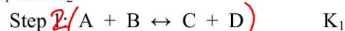4. Which of the following pure gases has the greatest density at 1.0 atm and 273K? STP
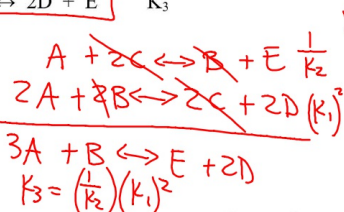a. He $d = \frac{m}{V} = \frac{PMM}{RT}$ *(circled)*
b. CO
c. N_2
d. CO_2
e. CF_4 *(circled)*

$PV = nRT$
$PV = \frac{m}{mm} RT$
$\frac{m}{V} = \frac{PMM}{RT}$

5. The following two-step process has equilibrium constants K_1 and K_2.

Step 2: ($A + B \leftrightarrow C + D$) $\quad K_1$
~~Step 2: $B + E \leftrightarrow A + 2C$~~ $\quad K_2$
Overall: $3A + B \leftrightarrow 2D + E$ $\quad K_3$

a. $K_3 = K_1 K_2$
b. $K_3 = (K_1)^2 + K_2$
c. $K_3 = (K_1)^2 K_2$
d. $K_3 = (K_1)^2 / K_2$ *(circled)*
e. $K_3 = K_2 / K_1$

$A + 2C \leftrightarrow B + E \quad \frac{1}{K_2}$
$2A + 2B \leftrightarrow 2C + 2D \quad (K_1)^2$
$3A + B \leftrightarrow E + 2D$
$K_3 = \left(\frac{1}{K_2}\right)(K_1)^2$

6. All of the following are properties of gases according to the kinetic theory EXCEPT
a. Gases consist of mostly empty space.
b. Attractive forces cause gas molecules to collide. *(circled)*
c. Gas pressure is caused by collisions of molecules with the container walls.
d. Collisions between gas molecules are elastic.
e. Gas molecules are in constant motion.

7. Attractive forces between gas molecules are most significant at
a. Low pressures and low temperatures
b. Low pressures and high temperatures
c. High pressures and high temperatures
d. High pressures and low temperatures *(circled)*

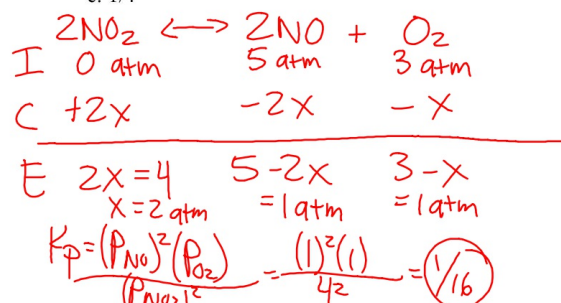8. Under which conditions does a real gas behave the most like an ideal gas?   **NO Attractions**
   a. 100 atm and 500K
   b. 100 atm and 10K
   c. 0.001 atm and 500K
   d. 0.001 and 10K
   e. 0.001 and 273K

$2NO_2(g) \leftrightarrow 2NO(g) + O_2(g)$

9. Initially, a sealed vessel contained only NO with a partial pressure of 5 atm and O_2 with a partial pressure of 3 atm. The reaction above was allowed to come to equilibrium at a temperature of 600.K. At equilibrium, the partial pressure due to NO_2 was found to be 4 atm. What is the value of the equilibrium constant Kp, for the reaction?

   a. 1/2   d. 2/3
   b. 1/3   e. 3/2
   c. 1/4

$$2NO_2 \longleftrightarrow 2NO + O_2$$

I   0 atm   5 atm   3 atm

C   +2x   −2x   −x

E   2x = 4   5 − 2x   3 − x
    x = 2 atm   = 1 atm   = 1 atm

$$Kp = \frac{(P_{NO})^2 (P_{O_2})}{(P_{NO_2})^2} = \frac{(1)^2(1)}{4^2} = \frac{1}{16}$$

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10. Ammonia is produced commercially by the Haber process in which nitrogen and hydrogen react by the reaction:

    $N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g) + heat$
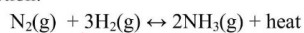
    Once the system is at equilibrium, which of the following changes will NOT result in a shift to the product side?

    Shift
    a. Removal of ammonia $= \downarrow P = \longrightarrow$
    b. Addition of nitrogen $= \uparrow R = \longrightarrow$
    c. Decreasing the size of the container $= \downarrow V = \frac{less}{moles} = \longrightarrow$
    d. Removal of hydrogen $= \downarrow R = \longleftarrow$
    e. Decreasing the temperature $= \downarrow P = \longrightarrow$

11. At a given temperature, molecules of different gases
    a. Have the same average kinetic energy
    b. Have the same average velocity
    c. Have the same diameter
    d. Have the same density
    e. Have identical masses

12. $A + B \leftrightarrow C$ is an all gaseous system where $Kc = 1.25$. Before equilibrium was established, Q was determined to be 0.501. Which of the following is true?

    $Q < Kc$

    a. The reaction will favor reactants until equilibrium is established.
    b. The reaction is at equilibrium.
    $\frac{P\uparrow}{R}$ **c.** The reaction will favor products until equilibrium is established.
    d. The reaction was temporarily at equilibrium.
    e. Equilibrium will never be established.