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Multiple Choice Practice

1. Chlorine gas and fluorine gas will combine to form one gaseous product. 1.0 liter of Cl_2 reacts with 3.0 liters of F_2 to produce 2.0 liters of product. Assuming constant temperature and pressure conditions, what is the formula of the product?

   a. Cl_2F_2 b. ClF_2 c. Cl_2F (d.) ClF_3

$$1\ Cl_{2(g)} + 3\ F_{2(g)} \rightarrow 2\ Cl_x F_y$$

2. Some students are invited to a barbeque. The food is cooked with propane burning in excess oxygen to produce heat, as shown in this equation.

$$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g) + \text{heat}$$

   If 22 grams of propane are consumed, what volume of gaseous products is produced at 1.0 atm and 37°C? (The molar mass of propane is 44 g/mol). not STP

   a. 130 L (b.) 89 L c. 74 L d. 11 L

$$22\text{ g } C_3H_8 \times \frac{1\text{ mol } C_3H_8}{44\text{ g } C_3H_8} \times \frac{7\text{ mol products}}{1\text{ mol } C_3H_8} = 3.5\text{ mol products}$$

$$V = \frac{nRT}{P} = \frac{(3.5)(8/100)(310)}{1} = 3.5 \times 8 \times 3.1 \approx 11 \times 8 = 88$$

$$N_2(g) + 2\ O_2(g) \rightarrow N_2O_4(g)$$

3. The reaction above takes place in a closed, rigid vessel. The initial pressure of $N_2(g)$ is 1.0 atm, and that of $O_2(g)$ is 1.5 atm. No N_2O_4 is initially present. The experiment is carried out at a constant temperature. What is the total pressure in the container when the partial pressure of N_2O_4 reaches 0.75 atm?

   a. 0.25 atm b. 0.75 atm (c.) 1.0 atm d. 2.0 atm

N_2	+ $2O_2$	→ N_2O_4
1	1.5	∅
−.75	−1.5	+0.75
0.25	∅	0.75

$P_{tot} = 0.25 + 0.75$

4. A sample of 18.0 g of aluminum metal is added to excess hydrochloric acid. The volume of hydrogen gas produced at 0.0°C and 1.0 atm pressure is approximately: $2Al + 6HCl \rightarrow 3H_2 + 2AlCl_3$

   a. 67 L b. 45 L (c.) 22 L d. 11 L

$$\frac{18\text{ g Al}}{27\text{ g/mol}} = \frac{2}{3}\text{ mol Al} \times \frac{3\ H_2}{2\ Al} \times \frac{22.4\text{ L}}{1\text{ mol}} = 22.4\text{ L}$$

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$2SO_2 + O_2 \rightarrow 2SO_3$

4 6 Ø

-4 -2 +4

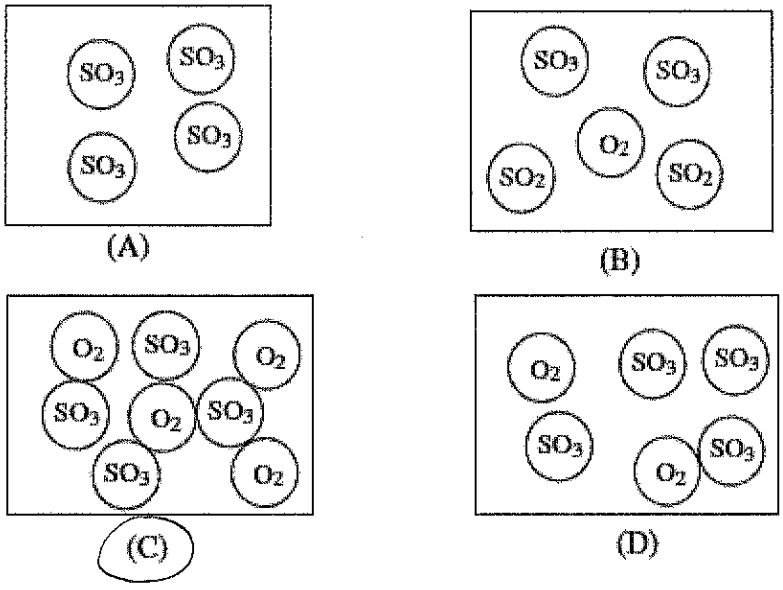
Ø 4 4

Use the following information to answer questions 5–8.

$$2\ SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$$

4.0 mol of gaseous SO_2 and 6.0 mol of O_2 are allowed to react in a sealed container.

5. Which particulate drawing below best represents the contents of the flask after the reaction goes to completion?



10 mol → 8 mol

6. If the temperature remains constant, what percentage of the original pressure will the final pressure in the container be equal to?

a. 67% (b.) 80% c. 100% d. 133%

7. At a given point in the reaction, all three gases are present at the same temperature. Which gas molecules will have the highest velocity and why?

(a.) The O_2 molecules, because they have the least mass.

b. The O_2 molecules, because they are the smallest.

c. The SO_3 molecules, because they are products in the reaction.

d. Molecules of all three gases will have the same speed because they are at the same temperature.

8. Under which of the following conditions would the gases in the container most deviate from ideal conditions, and why?

a. Low pressure, because the gas molecules would be spread far apart.

b. High pressure, because the gas molecules will be colliding frequently.

(c.) Low temperature, because the attractive forces between the gas molecules would be more significant.

d. High temperature, because the gas molecules are moving too fast to interact with each other.

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9. Consider the decomposition of ammonium nitrite, in which 6 atm of ammonium nitrite is added to an evacuated flask with a catalyst and then heated.

$$NH_4NO_2(g) \rightarrow N_2(g) + 2\,H_2O(g)$$

At equilibrium, the total pressure is 14 atm. Calculate the partial pressure of the water vapor at equilibrium.

a. 2.0 atm b. 4.0 atm c. 6.0 atm (d.) 8.0 atm

$NH_4NO_2 \rightarrow N_2 + 2H_2O$

6 | $-x$ | $+x$ | $+2x$

$(6-x)$ | x | $2x$

$6 - x + x + 2x = 14$

$6 + 2x = 14$

$2x = 8 \quad x = 4$

10. Nitrogen gas reacts with chlorine gas in a rigid, sealed container at constant temperature. Initially, P_{N_2} = 6.0 atm and P_{Cl_2} = 3.6 atm. When the reaction is done, all of the chlorine gas has reacted, and the partial pressure of the remaining krypton is 4.8 atm. What is formula of the compound produced?

a. N_2Cl_3 b. NCl_2 c. N_2Cl (d.) NCl_3

$N_2 + Cl_2 \rightarrow N_xCl_y$

6.0 | 3.6

-1.2 | -3.6

4.8 | 0

$\Rightarrow 1.2\,N_2 : 3.6\,Cl_2$

$1\,N_2 : 3\,Cl_2$

$2\,H_2(g) + O_2(g) \rightarrow 2\,H_2O(g)$

11. When 1.0 mole of H_2 is combined with 1.0 mol of O_2 in a sealed flask, the reaction above occurs to completion at a constant temperature. After the reaction, the pressure in the container will have:

a. increased by 25% (c.) decreased by 25%

b. increased by 50% d. decreased by 50%

$2H_2 + O_2 \rightarrow 2H_2O$

1 | 1 | 0

-1 | $-1/2$ | $+1$

0 | 0.5 | 1

$2 \rightarrow 1.5$

Use the following information to answer questions 12–14.

The following reaction is found at equilibrium at 25°C: $2\,SO_3(g) \rightleftharpoons O_2(g) + 2\,SO_2(g)$ $\Delta H = -198$ kJ/mol

12. Which of the following would cause the reverse reaction to speed up?

a. Adding more SO_3 (c.) Raising the pressure

b. Lowering the temperature d. Removing some SO_2

13. Which of the following would cause a reduction in the value for the equilibrium constant?

a. Increasing the amount of SO_3 c. Reducing the amount of O_2

(b.) Raising the temperature d. Lowering the temperature

14. If initially only SO_3 was added to the reaction vessel, what is true about the following values as the system approached equilibrium?

a. $\Delta G > 0$ and $Q > K$ b. $\Delta G < 0$ and $Q > K$ c. $\Delta G > 0$ and $Q < K$ (d.) $\Delta G < 0$ and $Q < K$