A Brief Note about "R" and MC Problems: Use $R = \frac{8}{100}$ when doing multiple choice calculation approximations!

1. A sample of nitrogen gas has a volume of 1.80 L at 25°C and 1.00 atm. How many moles of N_2 are present?

   a. 0.014 mol N_2
   b. 0.072 mol N_2
   c. 0.72 mol N_2
   d. 3.6 mol N_2

$n = \frac{PV}{RT} = \frac{(1.00)(1.80)}{(8/100)(298)} \approx \frac{1.80}{(8/100)(300)} = \frac{1.8}{8\times 3} = \frac{0.6}{8} = \frac{6}{8}\times 0.1$

$= 0.075$

2. At constant volume, decreasing the temperature of a gas (in Kelvin) by half would result in:

   a. the pressure decreasing by half
   b. no change in the pressure
   c. the pressure doubling
   d. a ½ increase in pressure

3. A gas sample with a mass of 10 grams occupies 6.0 liters and exerts a pressure of 2.0 atm at a temperature of 26°C. Which of the following expressions is equal to the molecular mass of the gas?

   a. $\frac{(10)(0.08206)(299)}{(2.0)(6.0)}$ g/mol
   b. $\frac{(10)(0.08206)(26)}{(2.0)(6.0)}$ g/mol
   c. $\frac{(299)(2.0)(6.0)}{(10)(0.08206)}$ g/mol
   d. $\frac{(2.0)(6.0)}{(10)(0.08206)(26)}$ g/mol

$MM = \frac{DRT}{P} = \frac{mRT}{PV}$

$= \frac{(10)(0.08206)(299)}{(2.0)(6.0)}$

4. If 2.0 moles of gas in a sealed glass flask is heated from 25°C to 50°C, which of the following conditions are true?

	Kinetic energy	Pressure	Number of moles	Distance between particles
a.	increases	increases	stays the same	stays the same
b.	stays the same	increases	stays the same	increases
c.	increases	stays the same	stays the same	increases
d.	increases	increases	increases	stays the same

5. A sample of oxygen gas (47.1 g) occupies _____ L at 22°C and 4.5 atm.

   a. 0.079
   b. 0.12
   c. 13
   d. 7.9

$\frac{47.1\text{ g } O_2}{32\text{ g/mol}} \approx 1.5\text{ mol } O_2$

$V = \frac{nRT}{P} = \frac{(1.5)(8/100)(295)}{4.5} = \frac{1\,(8/100)(300)}{3}$

$= 8$

6. A sample of oxygen gas at 50°C is heated, reaching a final temperature of 100°C. Which statement best describes the behavior of the gas molecules?

$50°C \rightarrow 100°C$

$\Rightarrow 323\text{ K} \rightarrow 373\text{ K}$

   a. Their velocity increases by a factor of two.
   b. Their velocity increases by a factor of four.
   c. Their kinetic energy increases by a factor of two.
   d. Their kinetic energy increases by a factor of less than two.

Questions 7–9 below refer to the information in table below.

Sample	O_2	He	SO_2	CH_4
Molar Mass	32 g/mol	4 g/mol	64 g/mol	16 g/mol
Volume	2 L	4 L	3 L	2 L
Temperature	400 K	400 K	400 K	400 K
Pressure	1 atm	1 atm	0.5 atm	0.5 atm

7. Which gaseous sample has the largest number of moles?

$n = \frac{PV}{RT}$

$\Rightarrow n \propto PV$

a. O_2 (b.) He c. SO_2 d. CH_4

8. Which gaseous sample has the largest mass?

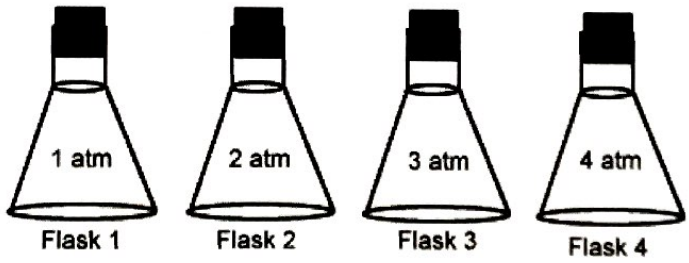
mass $\propto PV(MM)$

a. O_2 b. He (c.) SO_2 d. CH_4

9. Which gaseous sample has the smallest density?

$d = \frac{MM \cdot P}{RT} \propto MM \cdot P$ (RT: constant)

a. O_2 (b.) He c. SO_2 d. CH_4



10. Each of these flasks is the same size and at the same temperature. Which one contains the most molecules?

a. Flask 1 b. Flask 2 c. Flask 3 (d.) Flask 4

11. An ideal gas is contained in a 5.0 L chamber at a temperature of 37°C. If the gas exerts a pressure of 2.0 atm on the walls of the chamber, which of the following expressions is equal to the number of moles of the gas?

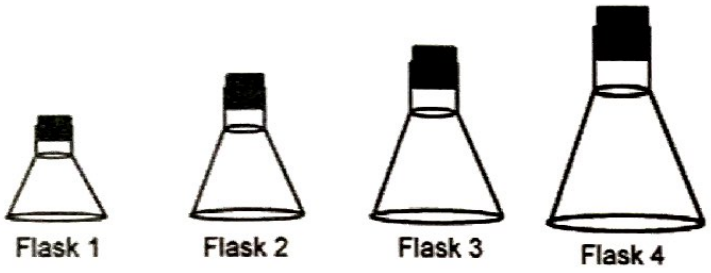
a. $\frac{(2.0)(5.0)}{(0.08206)(37)}$ mol

b. $\frac{(2.0)(0.08206)}{(5.0)(37)}$ mol

c. $\frac{(2.0)(310)}{(0.08206)(5.0)}$ mol

(d.) $\frac{(2.0)(5.0)}{(0.08206)(310)}$ mol

$n = \frac{PV}{RT}$



12. Each of the flasks above contains the same number of molecules. In which container is the pressure the lowest?

a. Flask 1 b. Flask 2 c. Flask 3 (d.) Flask 4

13. The density of an unknown gas is 2.00 grams per liter at 3.00 atmospheres pressure and 127°C. What is the molecular mass of this gas?

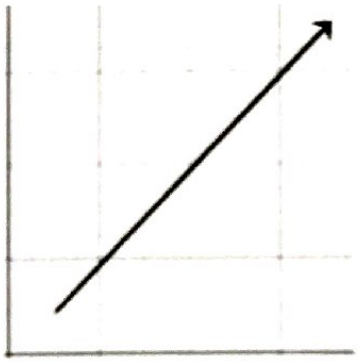
$MM = \frac{dRT}{P} = \frac{(2)R(400)}{3}$

a. $\frac{254}{3}R$ (c.) $\frac{800}{3}R$

b. 188 R d. 800 R

14. According to the kinetic molecular theory, gases are compressible because:

a. their particles are in constant, random motion
b. collisions between particles are elastic
c. attractive forces between particles are insignificant
(d.) the volume of their particles is very small compared to the total volume of the container



15. The unlabeled graph shown above is a correct representation of the relationship between each pair of variables below <u>except</u>:

a. temperature and pressure c. temperature and volume
(b.) pressure and volume d. number of moles and volume