REVIEW 8

1. Fill in the blanks

a) Gases consist of large numbers of particles that are in continuous, random________________

b) The combined volume of all the particles of a gas is negligible compared to the total volume of the particles'_________________

c) Attractive (or repulsive) forces between ideal gas molecules are _________________

d) Ideal gas behavior is far more likely at high ______________and low __________________

e) The middle of the kinetic energy distribution curve is the ________kinetic energy of molecules.

Answers

1a)motion; b)container c)negligible; d)temperatures, pressures; e)average

2. What is the partial pressure of oxygen in the air at STP? Air is 21% oxygen.

$P_o = (n_o/n_T)(P_T)$
= (21/100)101.3
=21 kPa;

3. What allows us to conclude that the volume ratio of two different gases is equal to their mole ratio?

The reason that volume % is also mole %for ideal gases?

Avogadro's Law

4. Prove that the density of an ideal gas equals $P\mathfrak{M}/RT$, where $\mathfrak{M}$ = molar mass

First rearrange PV = nRT:

$$\frac{1}{V} = \frac{P}{nRT}$$

Now multiply both sides by mass, m

$$\frac{m}{V} = \frac{mP}{nRT}$$

Density = D = $\frac{m}{V}$ and $\frac{m}{V}$ = $\mathfrak{M}$

$$\mathfrak{D} = \mathfrak{M}\,\frac{P}{RT}$$

5.

One reaction involved in the conversion of iron ore to the metal is

$FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g)$

Calculate the standard enthalpy change for this reaction from these reactions of iron oxides with CO:

(1) $3\,Fe_2O_3(s) + CO(g) \rightarrow 2\,Fe_3O_4(s) + CO_2(g)$ $\Delta H° = -47.0$ kJ

(2) $Fe_2O_3(s) + 3\,CO(g) \rightarrow 2\,Fe(s) + 3\,CO_2(g)$ $\Delta H° = -25.0$ kJ

(3) $Fe_3O_4(s) + CO(g) \rightarrow 3\,FeO(s) + CO_2(g)$ $\Delta H° = 19.0$ kJ

$2\,Fe_3O_4 + CO_2 \rightarrow 3\,Fe_2O_3 + CO$ $\Delta H° = -47.0$ kJ (-1)

$3\,Fe_2O_3 + 9\,CO \rightarrow 6\,Fe + 9\,CO_2$ $\Delta H = -25.0(3) = -75.0$ kJ

$6\,FeO + 2\,CO_2 \rightarrow 2\,Fe_3O_4 + 2\,CO$ $\Delta H = -19.0\,(2) = -38.0$

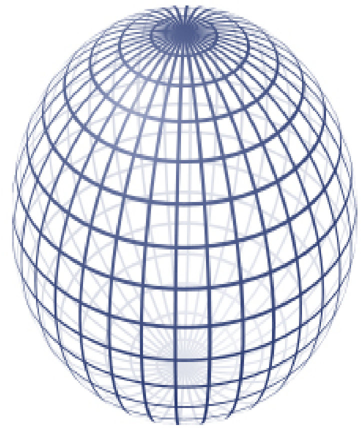
Sum: $6\,FeO + 6\,CO \rightarrow 6\,Fe + 6CO_2$ $\Delta H = -66$ kJ

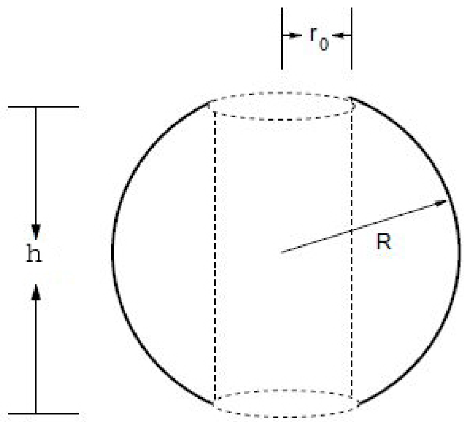
Divide through by 6 moles:

$\Delta H = -11$kJ/mole

6. Two spherical apples are peeled. It takes 12.0 s for apple A to accumulate 1.0 g of brownish phenolic compounds.

From an identical apple B, we cut out a cylindrical hole that passes through the apple's center, and we throw out the cylinder.





How long will it take apple B to form 1.0 g of brownish phenolic compounds if R = 2r?

$\frac{A_2}{A_1} = \frac{new\ total area}{original} = \frac{4\pi R^2 - \pi r^2(2) + 2\pi r H}{4\pi R^2}$ but H = 2R and R = 2r,(notice H = 4r)so substituting:

$$\frac{A_2}{A_1} = \frac{new\ total area}{original} = \frac{4\pi(2r)^2 - \pi r^2(2) + 2\pi r(4r)}{4\pi(2r)^2}$$

$$\frac{A_2}{A_1} = \frac{new\ total area}{original} = \frac{16\pi r^2 - 2\pi r^2 + 8\pi r^2}{16\pi r^2} = \frac{22}{16} = rateB/rateA$$

So rate B = 22/16 rate A

$Rate_A(time_A) = Rate_B(time_B)$

$Rate_A(12s) = 22/16\ rate\ A(time_B)$

$time_B = 12s(16)/22 = 8.7\ s$

7. The bond energy of X-X is 30.0kJ/mole and that of Y-Y is 40.0 kJ/mole.

If $35\ kJ + X_2 + Y_2 \rightarrow 2\ XY$

what is the bond energy of XY on a per mole basis?

$\Delta H_{BB} - \Delta H_{BF} = \Delta H$

$\Delta H_{BB} - \Delta H_{BF} = 35$

X- -X + Y- -Y – 2(X—Y) = 35

30.0 + 40.0 – 2XY = 35

2XY = 70 - 35

XY = 18 kJ/mole (was 17.5 but rounded to 2SF)