INSTRUCTIONS: Use a soft, #2 pencil. Your marks must be dark to be counted correctly.

Bubble in Form B on your Scantron Form

Write your perm number, and bubble in your perm number. Correct perm = 2 points!

There are 6 questions. Each question is worth 3 points, you will not lose more than 3 points for incorrect answers. You may work out the problems and write your answers on this quiz. Turn in the Scantron form only. Keep the quiz so you can check your work and your answers later. The answers to the quiz will be posted on the web.

\[ R = 0.08206 \text{ L atm mol}^{-1} \text{K}^{-1} \quad 1 \text{ atm} = 760 \text{ torr} \]
\[
(KE)_{av} = \frac{1}{2}mu^2 = \frac{3}{2}RT \quad u_{av} = \bar{u} = \sqrt{\frac{8RT}{\pi M}} \\
\frac{PV}{nT} = \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2} \\
P_1 = X_1P_{tot} \\
Z = 4 \left( \frac{N}{V} \right)^2 \sqrt{\frac{RT}{M}}
\]

1. Uranium hexafluoride is a solid at room temperature, but boils at 45°C. Determine the density of uranium hexafluoride at 80°C and 730 torr. The molar mass of UF₆ is 352 g/mol.
   a) 0.085 g/L
   b) 12.9 g/L
   c) 0.019 g/L
   d) 11.7 g/L
   e) 51.5 g/L
   \[
   \frac{n}{V} = \frac{P}{RT} = \frac{0.96 \text{ atm}}{(0.08206 \text{ L atm mol}^{-1} \text{K}^{-1})(353 \text{ K})} \\
   \frac{n}{V} = 0.035 \text{ mol} \text{ L}^{-1} (3.52 \frac{9}{\text{ mol}}) = 11.7 \text{ g/L}
   \]

2. Consider three identical flasks filled with different gases.
   Flask A contains CO (g) at 760 torr and 0°C.
   Flask B contains H₂ (g) at 100 torr and 0°C.
   Flask C contains N₂ (g) at 250 torr and 0°C.

   In which flask do the molecules have the greatest average speed?
   a) Flask A
   b) Flask B
   c) Flask C
   d) All are the same

3. A 275.0 mL sample of O₂ is collected over water at 60.0°C. The total pressure is 755 torr. What is the volume of the O₂ at STP? (The vapor pressure of water at 60°C is 149 torr).
   a) 244 mL
   b) 180 mL
   c) 224 mL
   d) 333 mL
   e) none of these
   \[
   P_{tot} = P_{H_2O} + P_{O_2} \\
P_{O_2} = 755 - 149 \text{ torr} = 606 \text{ torr} \\
V_2 = V_1 \frac{P_1}{P_2} \frac{T_2}{T_1} \\
V_2 = 275.0 \text{ mL} \left( \frac{606 \text{ torr}}{760 \text{ torr}} \right) \left( \frac{273}{333} \text{ K} \right) \\
V_2 = 180 \text{ mL}
   \]
4. Consider the following reaction: \[ A + 2B \rightarrow 3C + D \]

If 3.0 mol of A is mixed with 5.0 mol of B and the reaction produces 6.0 mol of C? What is the percent yield of this reaction?

a) 80 %

\[
3.0 \text{ mol } A \times \frac{3 \text{ mol } C}{1 \text{ mol } A} = 9 \text{ mol } C
\]

b) 71 %

c) 75 %

\[
5.0 \text{ mol } B \times \frac{3 \text{ mol } C}{2 \text{ mol } B} = 7.5 \text{ mol } C
\]

d) 90 %

\[
\frac{6.0}{7.5} \times 100 = 80 \%
\]

e) 67 %

5. When aqueous solutions of Na₂SO₄ and Pb(NO₃)₂ are mixed, PbSO₄ precipitates. 125 mL of 0.50 M Pb(NO₃)₂ is mixed with 200 mL of 0.25 M Na₂SO₄. Calculate the final concentration of Pb²⁺ in solution after the reaction goes to completion.

a) 0.19 M

\[ \text{Pb}^{2+} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4 (s) \]

\[
(0.125 \text{ mol } L^{-1})(0.125 \text{ L}) = 0.0625 \text{ mol } \text{Pb}^{2+}
\]

b) 0.078 M

\[
(0.25 \text{ mol } L^{-1})(0.200 \text{ L}) = 0.050 \text{ mol } \text{SO}_4^{2-}
\]

c) 0.10 M

\[
0.0625 - 0.050 = 0.0125 \text{ mol } \text{Pb}^{2+}
\]

d) 0.039 M

\[
\frac{0.0125 \text{ mol}}{0.325 \text{ L}} = 0.038 \text{ M}
\]

e) 0.31 M

6. From the information given in problem 5, calculate the final concentration of NO₃⁻ in solution after the reaction goes to completion.

a) 0.31 M

\[ \text{Pb(NO}_3\text{)}_2 \rightarrow \text{Pb}^{2+} + 2 \text{NO}_3^- \]

b) 0.25 M

c) 0.19 M

d) 1.0 M

e) 0.38 M

\[
[\text{NO}_3^-] = 2 \times (0.5 \text{ M}) \times \frac{125 \text{ mL}}{325 \text{ mL}} = 0.38 \text{ M}
\]