* Change #3 to Liters Even 3(ii)

AP Chemistry
Reaction Practice
Day 4

Name _____
Date _____ **Period** _____

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

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1. A strip of zinc is added to a solution of 6.0-molar hydrobromic acid.

(i) $Zn + 2H^+ \rightarrow Zn^{2+} + H_2$

(ii) What test would you perform to help identify the gaseous product and what would the test results be?

Use a Flaming wooden splint and "pop" the H_2 gas.

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2. Solid magnesium carbonate is strongly heated.

(i) $MgCO_3 \rightarrow MgO + CO_2$

(ii) What test would you perform to help identify the gaseous product and what would the test results be?

Use a flaming splint and the CO_2 will extinguish the flame

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3. Nitrogen gas reacts with hydrogen gas

(i) $N_2 + 3H_2 \rightarrow 2NH_3$

Excess 2 mol 2.00

(ii) If you react 2 moles of hydrogen gas with excess nitrogen, then how many moles of product are formed at STP?

$$2\text{ mol } H_2 \left| \frac{2\text{ mol } NH_3}{3\text{ mol } H_2} \right| = 1.33\text{ mol } NH_3$$

L ??

29.8 L NH_3

Gases

(1)

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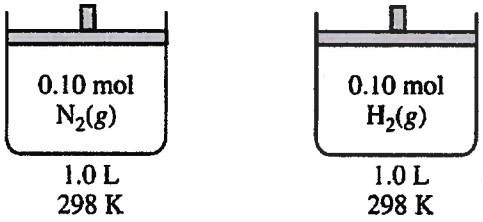
Question 6



Consider two containers of volume 1.0 L at 298 K, as shown above. One container holds 0.10 mol $N_2(g)$ and the other holds 0.10 mol $H_2(g)$. The average kinetic energy of the $N_2(g)$ molecules is 6.2×10^{-21} J. Assume that the $N_2(g)$ and the $H_2(g)$ exhibit ideal behavior.

(a) Is the pressure in the container holding the $H_2(g)$ less than, greater than, or equal to the pressure in the container holding the $N_2(g)$? Justify your answer.

The pressure in the container holding the $H_2(g)$ is equal to the pressure in the container holding the $N_2(g)$ because there is an equal number of moles of both gases at the same temperature and volume ($P = nK$, *where the constant* $K = \frac{RT}{V}$).	One point is earned for the correct choice. One point is earned for the correct explanation.

(b) What is the average kinetic energy of the $H_2(g)$ molecules?

The average kinetic energy of the $H_2(g)$ molecules is 6.2×10^{-21} J because both gases are at the same temperature.	One point is earned for the correct energy.

(c) The molecules of which gas, N_2 or H_2 , have the greater average speed? Justify your answer.

$H_2(g)$ molecules will have the greater average speed. Both gases have the same average kinetic energy, but $H_2(g)$ has the smaller molar mass. Therefore, the $H_2(g)$ molecules will have a greater average speed because, at a given temperature , the average (root-mean-square) speed of gas molecules is inversely proportional to the square root of the molar mass of the gas: $u_{rms} = \left(\sqrt{3RT}\right)\frac{1}{\sqrt{M}}$	One point is earned for the correct answer with an explanation.

Gases

(2)

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Question 6 (continued)

(d) What change could be made that would decrease the average kinetic energy of the molecules in the container?

The average kinetic energy of a gas particle depends on the temperature of the gas sample. To decrease the average kinetic energy of the gas particles in a gas sample, the temperature of the $N_2(g)$ would have to be lowered.	One point is earned for the correct answer with an explanation.

(e) If the volume of the container holding the $H_2(g)$ was decreased to 0.50 L at 298 K, what would be the change in each of the following variables? In each case, justify your answer.

(i) The pressure within the container

The pressure would be doubled. PV is a constant when the temperature and number of moles of gas are held constant. Therefore, if the volume is halved the pressure is doubled. $P_1V_1 = P_2V_2$ If $V_2 = \frac{1}{2}V_1$, then $P_1V_1 = P_2\left(\frac{1}{2}V_1\right) \Rightarrow P_1 = P_2\left(\frac{1}{2}\right) \Rightarrow$ $P_2 = 2P_1$	One point is earned for the correct answer. One point is earned for the correct explanation.

(ii) The average speed of the $H_2(g)$ molecules

The average speed is unchanged when the volume of the gas sample is halved. Average speed depends on changes in temperature, not changes in volume.	One point is earned for the correct answer with an explanation.