

**REVIEW QUESTIONS**

**Test 1**

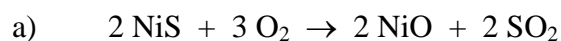
1. Consider the reaction shown below:



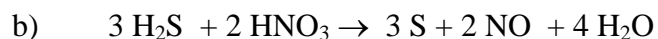
- a) How many mL of 0.55M HCl are needed to react with 3.7 g of CaCO<sub>3</sub>?
- b) After the reaction has gone to completion, what volume of CO<sub>2</sub> gas can be collected at 25.0°C and barometric pressure of 755 mmHg? (Vapor pressure of water at 25.0°C is 23.8 mmHg)
2. What is the concentration of chloride ions in a solution that contains 0.375 g of aluminum chloride in 15.0 mL of solution?
3. A mixture of 7.00 g of CO and 10.0 g of SO<sub>2</sub> is placed in a 250-mL flask at a particular temperature. If the total pressure of the mixture is 755 mmHg, what are the partial pressures of each gas in the mixture?

4. An ideal gas with a density of 3.00 g/L has a pressure of 675 mmHg at 25 °C. Determine the molar mass of this gas.

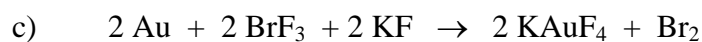
5. Identify the oxidizing and reducing agents in each of the following reactions:



oxidizing agent:\_\_\_\_\_ reducing agent:\_\_\_\_\_

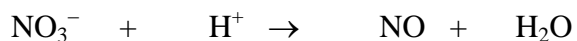


oxidizing agent:\_\_\_\_\_ reducing agent:\_\_\_\_\_



oxidizing agent:\_\_\_\_\_ reducing agent:\_\_\_\_\_

6. Balance the two half-reactions shown below and combine to find the overall equation for the reaction:



7. Tellurium, a group 6 element, forms the oxoanions  $\text{TeO}_4^{2-}$  and  $\text{TeO}_3^{2-}$ . What are the likely names for these anions? Which other group 6 oxoanions are these similar to?
  
8. How many mL of 2.0M  $\text{NaHCO}_3$  must be used to completely neutralize 55 mL of 3.0M  $\text{H}_2\text{SO}_4$  spilled from a battery?
  
9. To find the mass percent of limestone ( $\text{CaCO}_3$ ) in a soil sample, a geochemist titrates 1.586 g of the soil with 43.56 mL of 0.2516M  $\text{HCl}$ . What is the mass percent of  $\text{CaCO}_3$  in the soil?
  
10. An unknown gas effuses 1.73 times faster than  $\text{Kr}$ . What is the molar mass of this gas?
  
11. What is the temperature of  $\text{CO}_2$  gas if the root-mean-square velocity of the molecules is 750 m/s?

12. A solution is prepared by dissolving 10.8 g of ammonium sulfate in enough water to make 100.0 mL of stock solution. A 10.00 mL sample of this stock solution is added to 50.00 mL of water. Determine the concentration of ammonium and sulfate ions in the final solution.
13. Calculate the sodium ion concentration when 70.0 mL of 3.0 M sodium carbonate is added to 30.0 mL of 1.0 M sodium bicarbonate.
14. A 100.0-mL sample of 0.200 M aqueous KOH is mixed with 100.0 mL of 0.200 M of aqueous  $\text{Mg}(\text{NO}_3)_2$ .
- What is the mass of the precipitate produced after the reaction is complete?
  - Calculate the concentration of each ion remaining in solution after precipitation is complete.

15. Consider a 1.0-L sample of neon gas at STP. Will the average kinetic energy, average velocity, and frequency of collisions of gas molecules with the walls of the container increase, decrease or remain the same under each of the following conditions:
- The temperature is increased to  $100^{\circ}\text{C}$ .
  - The volume is decreased to 0.5 L
  - The temperature is decreased to  $-50^{\circ}\text{C}$ .
  - The number of moles of neon is doubled.
16. Calculate the average kinetic energy and root mean square velocity of  $\text{CH}_4(\text{g})$  molecules at 546 K.
17. A glass vessel contains 28 g of nitrogen gas. Assuming ideal behavior, which of the processes listed below would double the pressure exerted on the walls of the vessel? Give a brief explanation for your choices.
- Adding 28 g of oxygen gas.
  - Raising the temperature of the container from  $-73^{\circ}\text{C}$  to  $127^{\circ}\text{C}$ .
  - Adding enough mercury to fill one-half of the container.
  - Adding 32 g of oxygen gas.
  - Raising the temperature of the container from  $30^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ .
18. A 30.03-g sample compound containing C, H and O undergoes combustion analysis and yields 43.5 g of  $\text{CO}_2$  and 23.5 g of water. What is the empirical formula of the compound?

## ANSWERS

- 1a) 130 mL (2 sig figs)
- 1b) 0.94 L
- 2) 0.563 M
- 3)  $P_{\text{CO}} = 465 \text{ mmHg}$        $P_{\text{SO}_2} = 290 \text{ mmHg}$
- 4) 82.6 g/mol
- 5a) Oxidizing agent =  $\text{O}_2$       Reducing agent = NiS
- 5b) Oxidizing agent =  $\text{HNO}_3$       Reducing agent =  $\text{H}_2\text{S}$
- 5a) Oxidizing agent =  $\text{BrF}_3$       Reducing agent = Au
- 6)  $3 \text{P}_4 + 8 \text{H}_2\text{O} + 8 \text{H}^+ + 20 \text{NO}_3^- \rightarrow 12 \text{H}_2\text{PO}_4^- + 20 \text{NO}$
- 7) No answer provided
- 8) 170 mL (2 sig figs)
- 9) 34.58%
- 10) 28.0 g/mol
- 11) 992 K
- 12)  $[\text{NH}_4^+] = 0.272 \text{ M}$        $[\text{SO}_4^{2-}] = 0.136 \text{ M}$
- 13)  $[\text{Na}^+] = 4.5 \text{ M}$
- 14 a) 0.583 g  
b)  $[\text{Mg}^{2+}] = 0.050 \text{ M}$        $[\text{K}^+] = 0.100 \text{ M}$        $[\text{NO}_3^-] = 0.200 \text{ M}$
- 15) No answers provided.
- 16)  $\text{KE}_{\text{avg}} = 1.13 \times 10^{-20} \text{ J/molecule}$        $u_{\text{rms}} = 921 \text{ m/s}$
- 17) No answers provided.
- 18)  $\text{C}_3\text{H}_8\text{O}_3$