

Name _____

Secret word _____

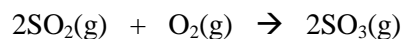
1. What is the pH of 0.0010 M KOH?
2. Complete and balance the following equation:
 $\text{NaHCO}_3 + \text{HCl} \rightarrow$
3. Sodium nitrite, NaNO_2 , reacts with aqueous HF in a Brønsted acid-base reaction as follows:
$$\text{NaNO}_2(\text{aq}) + \text{HF}(\text{aq}) \rightarrow \text{HNO}_2(\text{aq}) + \text{NaF}(\text{aq})$$

Circle the stronger base.
4. Which solution will generate more osmotic pressure versus water: ____ 0.10 M sodium sulfate (Na_2SO_4) or ____ 0.10 M sodium nitrate (NaNO_3) or ____ neither? Check one.
5. What is the conjugate base of hydrogen sulfate ion, HSO_4^- ?
6. A sealed vessel of steam, $\text{H}_2\text{O}(\text{g})$, at 120 deg C and 1.50 atm pressure is heated to 270 deg C at constant volume. What is the final pressure of the steam?

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7. What is the pH of a nitrite buffer which is 0.200 M in sodium nitrite and 0.150 M in nitrous acid? The pK_a of nitrous acid (HNO_2) is 3.37.
8. When a solid melts, heat is absorbed and the entropy increases. True____ or False____ (check one).
9. What is the molar concentration of hydroxide ion in a 0.025 M solution of calcium hydroxide, $\text{Ca}(\text{OH})_2$?
10. The total pressure of a gas mixture of 60% helium (He) and 40% nitrogen (N_2) is 720 mm Hg. What is the partial pressure of helium?
11. Which of the following behave as strong electrolytes in water? Circle all that apply (Score = number correct minus number incorrect):
 H_2SO_4 ; NH_4Cl ; KNO_3 ; CH_3OH ; HNO_3 ; Nitrous acid (HNO_2).

12. Consider the following reaction:



How many liters of oxygen are required to consume 2.4 liters of sulfur dioxide at STP?

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13. How many grams of oxygen (O_2) are contained in a 25.0 L sample at 5.20 atm and 27 deg C?
14. Hydrogen cyanide (HCN) is a weak acid. Write the chemical equation for its dissociation in aqueous solution.
15. (10 pts). What is the molar concentration of NaCl in a solution made up by mixing 100 mL of 0.20 M NaOH and 100 mL of 0.25 M HCl? (Hint: First write the balanced chemical equation).
16. The heat of vaporization of water is much higher (more exothermic) than that for most other liquids of comparable molecular weight. This is because of the energy required to break:
- a. ____ Ionic bonds
 - b. ____ Hydrogen bonds
 - c. ____ Covalent bonds
 - d. ____ Molecular bonds

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Useful information:

Henderson-Hasselbalch equation:

$$\text{pH} = \text{pK}_a + \log \frac{[\text{A}^-]}{[\text{HA}]} \quad \text{or} \quad \text{pH} = \text{pK}_a - \log \frac{[\text{HA}]}{[\text{A}^-]}$$

Abbreviated table of acids in order of decreasing acid strength:

ACID	CONJUGATE BASE
HCl	Cl ⁻
H ₃ O ⁺	H ₂ O
H ₃ PO ₄	H ₂ PO ₄ ⁻
HNO ₂	NO ₂ ⁻
HF	F ⁻
CH ₃ COOH (HOAc)	OAc ⁻
H ₂ CO ₃	
NH ₄ ⁺	
HCN	
H ₂ O	OH ⁻
NH ₃	NH ₂ ⁻

$$K_w = 10^{-14}; \quad \text{pH} + \text{pOH} = 14$$

$$K_a K_b = K_w; \quad \text{pK}_a + \text{pK}_b = 14$$

Ideal gas law, $PV = nRT$

$$R = 0.0821 \text{ L-atm per mol-K or } 62.4 \text{ L-mmHg per mol-K}$$

$$K = \text{deg C} + 273$$

$$760 \text{ mmHg} = 760 \text{ torr} = 1.000 \text{ atm} = 14.7 \text{ psi}$$