

DIRECTIONS: Carefully mark the appropriate answer to each question on the Scantron sheet and show your work in the space provided. Each question is worth 1 point (20 points total). Write your name and the color (blue, green, yellow, pink) of the exam on the Scantron sheet. Please hand in both the quiz and the Scantron sheet.
[Table of solubility rules on page 4 of the exam.]

1. You have separate solutions of HCl and H₂SO₄ with the same concentrations in terms of molarity. You wish to neutralize a solution of NaOH. Which acid solution would require more volume (in mL) to neutralize the base?

- a. the HCl solution
- b. the H₂SO₄ solution
- c. You need to know the acid concentrations to answer this question.
- d. You need to know the volume and concentration of the NaOH solution to answer this question.
- e. You need to know the acid concentrations and the volume and concentration of the NaOH solution to answer this question.

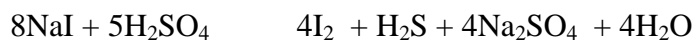
2. The balanced net ionic equation for the reaction of calcium bromide and sodium phosphate contains which of the following species?

- a. Ca²⁺ (aq) b. PO₄³⁻ (aq) c. 2Ca₃(PO₄)₃ (aq) d. 6NaBr (aq) e. 3Ca²⁺ (aq)

3. A 20.0-g sample of HF is dissolved in water to give 2.0 x 10² mL of solution. The concentration of the solution is:

- a. 0.10 M b. 1.0 M c. 5.0 M d. 3.0 M e. 10.0 M

4. In the following reaction, which "element" is oxidized?



- a. sodium b. iodine c. sulfur d. hydrogen e. oxygen

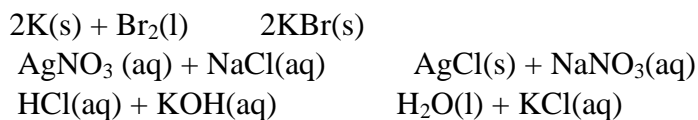
5. The oxidation state of iodine in IO₃⁻ is:

- a. -3 b. +3 c. 0 d. +5 e. -5

6. Which of the following is a strong acid?

- a. HF b. KOH c. H₂SO₄ d. HClO e. HBrO

7. The following reactions are examples of what types of reactions?



- precipitation (two) and acid-base reactions, respectively.
 - redox, precipitation, and acid-base, respectively.
 - precipitation reactions.
 - redox reactions.
 - none of these
8. You have exposed electrodes of a light bulb in a solution of H_2SO_4 such that the light bulb is on. You add a dilute salt solution and the bulb grows dim. Which of the following could be the salt in the solution? [Hint: it's a solubility problem]
- K_2SO_4
 - NaNO_3
 - $\text{Ca}(\text{NO}_3)_3$
 - KCl
 - KNO_3
9. A basketball is inflated to 15.0 psi (pounds per square inch). Express this pressure in kiloPascals. (760 mm Hg = 1 atm, 14.7 psi = 760 mm Hg, 1 atm = 101 kPa)
- 2.18 kPa
 - 1.29×10^{-3} kPa
 - 9.70×10^{-3} kPa
 - 776 kPa
 - 103 kPa
10. For the redox reaction $2\text{Fe}^{2+} + 3\text{Cl}_2 \rightarrow 2\text{Fe}^{3+} + 6\text{Cl}^-$ which of the following are the correct half-reactions?
- $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
 - $\text{Cl}^- \rightarrow \text{Cl}_2 + \text{e}^-$
 - $\text{Cl}_2 \rightarrow 2\text{Cl}^- + 2\text{e}^-$
 - $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$
 - $\text{Fe}^{2+} + \text{e}^- \rightarrow \text{Fe}^{3+}$
- I and V
 - II and V
 - III and IV
 - II and IV
 - I and IV
11. A student weighs out 0.568 g of KHP (molar mass = 204 g/mol) and titrates to the equivalence point with 36.78 mL of a stock NaOH solution. What is the concentration of the stock NaOH solution? KHP is an acid with one acidic proton.
- 3.15 M
 - 0.0757 M
 - 0.943 M
 - 0.100 M
 - 1.23 M

12. Aqueous solutions of sodium sulfide and copper(II) chloride are mixed together. Which statement is correct?
- No precipitate forms.
 - NaCl will precipitate from solution.
 - No reaction will occur.
 - CuS will precipitate from solution.
 - Both NaCl and CuS precipitate from solution.
13. The following reaction occurs in acidic media:
- $$\text{Fe}^{2+} + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Fe}^{3+} + \text{Cr}^{3+}$$
- What is the coefficient for water in the balanced reaction?
- 7
 - 5
 - 1
 - 3
 - 0 (water does not appear in the balanced equation)
14. Which of the following do you need to know to be able to calculate the molarity of a salt solution?
- the mass of salt added
 - the molar mass of the salt
 - the volume of water added
 - the total volume of the solution
- I, II, IV
 - II, III
 - I, III
 - You need all of the information.
 - I, II, III
15. A chemist needs 225 mL of 2.4 M HCl. What volume of 12 M HCl must be dissolved in water to form this solution?
- 6.8 mL
 - 21 mL
 - 3.4 mL
 - 45 mL
 - 7.2 mL
16. An unknown substance dissolves readily in water but not in benzene (a nonpolar solvent). Molecules of what type are present in the substance?
- nonpolar
 - either polar or nonpolar
 - neither polar nor nonpolar
 - polar
 - polar and nonpolar

17. How many grams of solute are contained in 141 mL of a 0.175 M silver nitrate (molar mass = 169.91 g) solution?
- a. 4.19 g b. 0.145 g c. 6.85 g d. 3.80 g e. none of these
18. The interaction between solute particles and water molecules, which tends to cause a salt to fall apart in water, is called
- a. dispersion. b. conductivity. c. polarization. d. coagulation. e. hydration.
19. A 230.-mL sample of a 0.275 M solution is left on a hot plate overnight; the following morning the solution is 1.10 M. What volume of solvent has evaporated from the 0.275 M solution?
- a. 173 mL b. 288 mL c. 63.3 mL d. 230. mL e. 58.0 mL
20. What volume of 0.25 M HNO_3 is necessary to react exactly with 7.4 g of $\text{Ca}(\text{OH})_2$?
- a. 4.0×10^2 , mL
b. 1.2×10^2 , mL
c. 2.5×10^2 , mL
d. 8.0×10^2 , mL
e. 2.0×10^2 , mL

Table 4.1 Solubility Rules

1. Most nitrate (NO_3^-) and acetate ($\text{C}_2\text{H}_3\text{O}_2^-$) salts are soluble.
2. Most salts containing the alkali metal ions (Li^+ , Na^+ , ...) and the ammonium ion (NH_4^+) are soluble.
3. Most chloride, bromide, and iodide salts are soluble. Notable exceptions are salts containing the ions Ag^+ , Pb^{2+} , and Hg_2^{2+} .
4. Most sulfate salts are soluble. Notable exceptions are BaSO_4 , PbSO_4 , HgSO_4 , and CaSO_4 .
5. Most hydroxide salts are only slightly soluble. The important soluble hydroxides are NaOH and KOH . The compounds $\text{Ba}(\text{OH})_2$, $\text{Sr}(\text{OH})_2$, and $\text{Ca}(\text{OH})_2$ are marginally soluble.
6. Most sulfide (S^{2-}), carbonate (CO_3^{2-}), chromate (CrO_4^{2-}), and phosphate (PO_4^{3-}) salts are only slightly soluble.

ANSWER KEY FOR TEST - Pink

1. a

2. e

3. c

4. b

5. d

6. c

7. b

8. c

9. e

10. e

11. b

12. d

13. a

14. a

15. d

16. d

17. a

18. e

19. a

20. d