

Name:

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Multiple Choice*Identify the letter of the choice that best completes the statement or answers the question. (20 marks)*

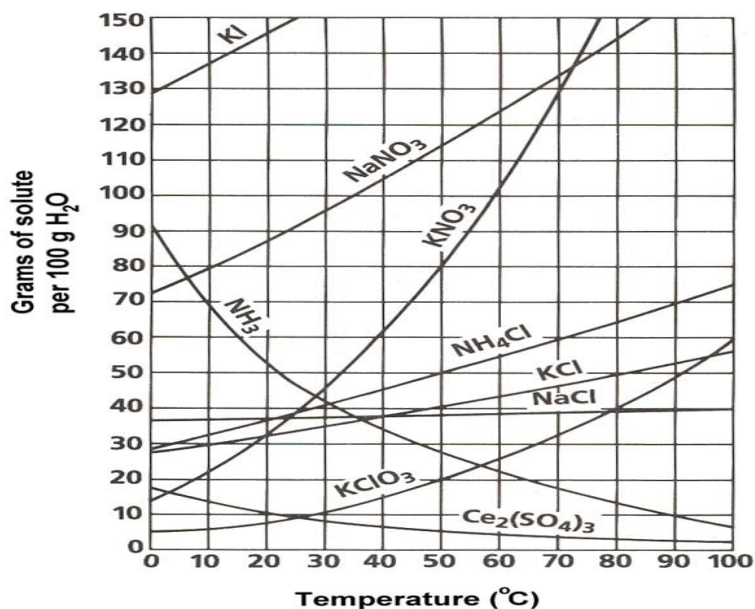
1. What term is associated with the part of a solution that is present in the smallest amount?
 - a. ionic compound
 - b. covalent compound
 - c. solute
 - d. solvent
2. A solution is saturated at 25°C. It is then slowly cooled to 20°C with no change to the appearance of the liquid. What term would be associated with this solution?
 - a. saturated
 - b. unsaturated
 - c. supersaturated
 - d. oversaturated
3. Ice that contains a small amount of dissolved air is an example of what type of solution?
 - a. a liquid dissolved in a liquid
 - b. a gas dissolved in a liquid
 - c. a solid dissolved in a gas
 - d. a gas dissolved in a solid
4. A saturated solution is made by dissolving 36.8 g of a solid in 200 mL of water. A second solution is made by dissolving 19.1 g of the same solid in 100 mL of water. How would this solution be classified?
 - a. unsaturated
 - b. saturated
 - c. supersaturated
 - d. hypersaturated
5. Which of the following tests can be used to distinguish between an ionic solution and most molecular solutions?
 - a. pH measurement
 - b. solubility test
 - c. test for saturation
 - d. conductivity test
6. Which type(s) of molecule(s) are polar solvents more likely to be able to dissolve?
 - a. ionic molecules
 - b. polar molecules
 - c. polar and ionic molecules
 - d. ionic, polar and non-polar molecules
7. Which forces affect solubility?
 - a. intramolecular forces
 - b. intermolecular forces
 - c. hydrogen bonding
 - d. intramolecular and intermolecular forces
8. Which of the following is the least soluble in water?
 - a. lead(II) nitrate
 - b. magnesium sulfide
 - c. lithium phosphate
 - d. silver acetate
9. What is the ionic equation for the reaction of nitric acid with sodium hydroxide?
 - a. $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
 - b. $\text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{NaNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 - c. $\text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{Na}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 - d. $\text{H}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{no reaction}$
10. What can be added to a solution containing $\text{Pb}^{+2}(\text{aq})$ ions to precipitate the ions from the solution?
 - a. lithium chloride
 - b. potassium hydroxide
 - c. sodium acetate
 - d. Two of the above are correct

11. Which solution will contain the higher concentration of iodide ions?
0.25 mol/L calcium iodide or 0.45 mol/L potassium iodide
- potassium iodide
 - calcium iodide
 - They contain the same concentration of iodide ions.
 - This must be determined experimentally.
12. Which of the following expressions best describes the term *net ionic equation*?
- an equation where all reactants and products are ions
 - an equation listing all ions that are not spectator ions
 - an equation where soluble substances are written in dissociated form
 - an equation where only products are written in dissociated form
13. When 325 mL of a lead(II) nitrate solution of unknown concentration had an excess of sodium chloride added, 6.34 g of solid was filtered out of the solution. What was the molar concentration of the lead(II) nitrate solution?
- 0.035 mol/L
 - 0.70 mol/L
 - 0.070 mol/L
 - 0.080 mol/L
14. What property allows a compound to be classified as an Arrhenius acid?
- the production of water in a chemical reaction
 - the release of hydroxide ions in a water solution
 - the release of release hydrogen ions in a water solution
 - the neutralization of a base
15. Which of the following is the best description of an acid-base indicator?
- a substance that indicates the pH of a solution
 - a substance that changes colour beyond a threshold pH level
 - a substance that is colourless in one solution but has a colour in the other
 - a substance that has one colour in one solution but a different colour in the other
16. What is *true* of the pH of a solution that is an Arrhenius acid?
- the solution will have a pH that is less than 5
 - the solution will have a pH that is less than 7
 - the solution will have a pH that is more than 5
 - the solution will have a pH that is more than 7
17. Which of the following best describes a weak base?
- a base that is not very strong
 - a dilute strong base
 - a base with a very low concentration
 - a base that dissociates very slightly in a water solution
18. Which of the following best describes the term *end point*?
- the point at which the amount of titrant is slightly less than the amount of reactant in the sample
 - the point at which the amount of titrant is slightly larger than the amount of reactant in the sample
 - the point at which the amount of titrant is enough to react with all of the reactant in the sample
 - the point at which the indicator in a titration changes colour
19. What is the resulting pH of a solution that forms when 15.00 mL of a 0.150 mol/L hydrochloric acid solution combined with 10.00 mL of a 0.150 mol/L sodium hydroxide solution?
- greater than 7
 - less than 7
 - equal to 7
 - the pH must be determined experimentally
20. 18.35 g of magnesium hydroxide are added to 0.75 L of 2.25 mol/L hydrochloric acid. What is best description of the pH of the resulting solution?
- the pH is just over 7
 - the pH is well over 7
 - the pH is well over 7
 - the pH is 7

Short Answer and Calculations: Answer the questions you can do the best on **FIRST!** Only work on the **Foolscap** will be marked. For each question, show **ALL** your work if you want part marks.

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21. Answer the following questions based on the solubility curve below. (5)



- Which compound is the most soluble at 10°C?
- Which compounds show a *decrease* in solubility from 0°C to 100°C?
- If KClO₃ is cooled from 90°C to 60°C how much precipitate, in grams, is expected?
- A saturated solution of NH₄Cl is formed from one hundred grams of water. If the saturated solution is cooled from 80°C to 40°C, how many grams of precipitate are formed?
- How much of 30 g of Ce₂(SO₄)₃ will dissolve and how much will remain undissolved at the bottom of the test tube in 100 g of water at 10°C?

22. A solution has a concentration of copper(II) sulfate that is 0.25 mol/L. What mass of sulfate ions would be present in 225 mL of the solution? (5)

23. Cooper's pen metal is a solution made up of 50% m/m of copper, 25% m/m of gold, and 25% m/m of silver.
- Which is the solvent in this solution? (1)
 - In a sample of 450 g of Cooper's pen metal, what is the mass of each component in the solution? (5)

24. 77.5 g of lead(II) nitrate is dissolved in enough water to make a final volume of 375 mL. What is the molar concentration of the solution? (5)

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25. A chemical reaction occurs when the following aqueous solutions are mixed: potassium dichromate and iron(II)sulfate. Write the balanced chemical equation. Then write the total ionic equation. Then write the net ionic equation. Then identify the spectator ions.

Balanced chemical equation: (2 marks)

Total ionic equation: (1 mark)

Net ionic equation: (1 mark)

Spectator ions: (1 mark)

26. A titration is performed on a 25.0 mL sample of calcium hydroxide with a 0.15 mol/L solution of nitric acid. Using the results below, calculate the concentration of the calcium hydroxide. (10 marks)

TABLE 1. Titration of Ca(OH)_2 with 0.15M HNO_3

Volume of Ca(OH)_2 (mL)	V_{initial} of HNO_3 (mL)	V_{final} of HNO_3 (mL)	V_{total} of HNO_3 (mL)
25.0 mL	0.3 mL	12.6 mL	
25.0 mL	12.6 mL	25.0 mL	
25.0 mL	25.0 mL	37.3 mL	

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27. 34.50 mL of a 2.54 mol/L calcium nitrate solution is added to 47.53 mL of a 1.95 mol/L sodium sulfate solution. Find the mass of calcium sulfate that is expected to precipitate in this process. (10)
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28. Determine the concentration of hydroxide ions in stomach acid, with a pH of 2.0 (5 marks)
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