

SELF-TEST QUESTIONS

1. Write ^{ionization}(dissociation) equations for the following when they are dissolved in water.
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| a. HF | d. NH_4Cl |
| b. SrBr_2 | e. NaNO_3 |
| c. MgBr_2 | f. $\text{Al}_2(\text{SO}_4)_3$ |
2. Which of the following pairs of substances are miscible and which are not? Give a reason.
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| a. $\text{CH}_3\text{CH}_2\text{OH}$ and H_2O | c. C_6H_6 and H_2O |
| b. C_6H_6 and C_6H_{12} | d. LiBr and H_2O |
3. Classify the following as strong, weak or nonelectrolyte.
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| a. $\text{CH}_3\text{CH}_2\text{OH}$ | d. NH_3 |
| b. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ (sugar) | e. C_6H_{12} |
| c. HCl | |
4. Calculate the molarity of the following solutions.
- 49.73 g H_2SO_4 in enough water to make 500 mL of solution.
 - 4.739 g RuCl_3 in enough water to make 1.00 L of solution.
 - 5.035 g FeCl_3 in enough water to make 250 mL of solution.
 - 27.74 g $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ in enough water to make 750 mL of solution.
 - 218.7 g HCl in enough water to make 500 mL of solution.
5. Calculate the concentrations of each of the ions in the following solutions.
- 0.25 M Na_3PO_4
 - 0.15 M $\text{Al}_2(\text{SO}_4)_3$
 - 0.87 M Na_2CO_3
6. Describe how you would prepare the following solutions.
- 100 mL of 1 M NaCl
 - 250 mL of 1.0 M Na_2SO_4
 - 1.50 L of 0.50 M $\text{K}_2\text{Cr}_2\text{O}_7$.
7. Describe how you would prepare the following solutions:
- 500 mL of 1.0 M H_2SO_4 from 17.8 M H_2SO_4 .
 - 1.5 L of 0.25 M KMnO_4 from 1.0 M stock solution.
 - 1.0 L of 0.15 M KBrO_3 from solid KBrO_3 .
 - 100 mL of 0.010 M AgNO_3 from 0.50 M stock solution.
 - 1 L of 0.5 M AgNO_3 from solid AgNO_3 .
8. A standard solution of KHP ($\text{C}_8\text{H}_5\text{O}_4\text{K}$) was made by dissolving 3.697 g of KHP in enough water to make 100.0 mL of solution. Calculate the concentration.

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9. How many moles of KHP are contained in 30.00 mL of the solution in problem 8?
10. How many milliliters of 0.136 M NaOH are required to react with the H_2SO_4 in 10 mL of a 0.202 M solution? The reaction of the two is
- $$2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$$
11. What is the concentration of the following in ppm?
- 1.0×10^{-2} g Cu^{2+} in 2 L of solution
 - concentration of Pb^{2+} in 2.1×10^{-5} M $\text{Pb}(\text{NO}_3)_2$
12. Complete and balance the following reactions:
- $\text{NaCl}(\text{aq}) + \text{HgNO}_3(\text{aq}) \rightarrow$
 - $\text{Ca}(\text{OH})_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow$
 - $\text{Na}_2\text{S}(\text{aq}) + \text{FeCl}_3(\text{aq}) \rightarrow$
13. How would you separate the following by selective precipitation?
 Ba^{2+} , Pb^{2+} , Fe^{2+} .
14. Write molecular, complete ionic and net ionic equations for the following reactions.
- aqueous sodium sulfide reacts with aqueous copper(II) nitrate.
 - aqueous hydrogen fluoride reacts with aqueous potassium hydroxide to give water and aqueous potassium fluoride.
15. What mass of $\text{Mg}(\text{OH})_2$ is produced when 100 mL of 0.42 M $\text{Mg}(\text{NO}_3)_2$ is added to excess NaOH solution?
16. Calculate the mass of CaSO_4 produced when 10 mL of 6.0 M H_2SO_4 is added to 100 mL of 0.52 M $\text{Ca}(\text{NO}_3)_2$.
17. Calculate the mass of Al_2S_3 produced when 100 mL of 0.50 M AlCl_3 is added to 100 mL of 0.50 M Na_2S .
18. An AgCl precipitate weighing 0.2967 g was obtained when excess AgNO_3 solution was added to a solution containing 0.4561 g of a soluble salt mixture. What is the percentage of chloride in the salt?
19. What is the percentage of iron in an ore sample if a 0.9973 g sample dissolved in acid produces 0.8314 g of $\text{Fe}(\text{OH})_3$ precipitate when treated with excess KOH?
20. A sample containing only sodium chloride and potassium chloride is dissolved and treated with excess AgNO_3 . A 0.9341 g sample of the salt mixture gave 2.0321 g of AgCl . Calculate the percentage of chloride in the sample.
21. What volume of 0.1379 M HCl is required to neutralize 10.0 mL of 0.2789 M NaOH solution?
22. How many mL of 1.50 M NaOH is required to neutralize 275 mL of 0.5 M H_2SO_4 ?

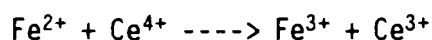
23. What is the molarity of a solution of HCl if it requires 29.31 mL of a 0.0923 M NaOH solution to reach a phenolphthalein endpoint for the titration of a 10.0 mL aliquot of the HCl solution?
24. A titration is done using 0.1302 M NaOH to determine the molecular weight of an acid. The acid contains one acidic hydrogen per molecule. If 1.863 g of the acid require 70.11 mL of the NaOH solution what is the molecular weight of the acid?
25. Determine the oxidation number for Mn in each of the following:
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| a. KMnO_4 | d. K_2MnCl_4 |
| b. LiMnO_2 | e. Mn_2O_7 |
| c. MnO_2 | |

26. Determine the oxidation number for each atom in the following compounds or ions:
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| a. H_3O^+ | d. H_2CO |
| b. P_4O_{10} | e. NH_4ClO_4 |
| c. S_8 | |

27. Balance the following oxidation reduction reactions. Which species in each is the oxidizing agent? Which is the reducing agent?
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| a. $\text{P} + \text{Cl}_2 \rightarrow \text{PCl}_5$ |
| b. $\text{Sn}^{2+} + \text{Cu}^{2+} \rightarrow \text{Sn}^{4+} + \text{Cu}^+$ |
| c. $\text{Cu} + \text{H}^+ + \text{NO}_3^- \rightarrow \text{Cu}^{2+} + \text{NO}_2 + \text{H}_2\text{O}$ |
| d. $\text{Br}_2 + \text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{Br}^- + \text{SO}_4^{2-}$ |
| e. $\text{H}_2\text{SO}_4 + \text{HBr} \rightarrow \text{SO}_2 + \text{Br}_2 + \text{H}_2\text{O}$ |

28. Balance the following in basic solution:
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| a. $\text{P}_4 \rightarrow \text{PH}_3 + \text{HPO}_3^{2-}$ |
| b. $\text{Cl}_2 + \text{OH}^- \rightarrow \text{Cl}^- + \text{ClO}_3^-$ |
| c. $\text{Zn} + \text{NO}_3^- \rightarrow \text{Zn}^{2+} + \text{NH}_3$ |

29. Iron(II) can be determined by redox titration with a cerium (IV) solution. The oxidation reduction reaction is



What is the concentration of Fe^{2+} if it requires 21.35 mL of 0.3136 M Ce^{4+} to titrate a 10.00 mL aliquot to the endpoint?