Assignment: Chemical Reactions in Aqueous Solution

Instructions

As you work these problems, consider and explain:

- A. What type of question is it?
- B. How do you know what type of question it is?
- C. What information are you looking for?
- D. What information do they give?
- E. How will you go about solving this?
- F. Show how to solve the problem.
- G. Be able to answer for a different reaction, number, set of conditions, etc.

Questions

- 1. Consider two organic molecules, ethanol and benzene. One dissolves in water and the other does not. Why?
 - a. They have different molar masses.
 - b. One is ionic, the other is not.
 - c. One is an electrolyte, the other is not.
 - d. Ethanol contains a polar O-H bond, and benzene does not.
 - e. Two of these are correct.
- 2. Which of the following is a strong acid?
 - a. HF
 - b. кон
 - c. HClO₄
 - d. HClO
 - e. HBrO
- 3. Which of the following is not a strong base?
 - a. $Ca(OH)_2$

- b. кон
- c. NH₃
- d. LiOH
- e. Sr(OH)₂
- 4. 1.00 mL of a 2.90 × 10⁻⁴M solution of oleic acid is diluted with 9.00 mL of petroleum ether, forming solution A. Then 2.00 mL of solution A is diluted with 8.00 mL of petroleum ether, forming solution B. What is the concentration of solution B?
 - a. 2.90×10^{-6} M
 - b. 8.06×10^{-6} M
 - c. 5.80×10^{-5} M
 - d. 6.44×10^{-5} M
 - e. 5.80×10^{-6} M
- 5. How many grams of NaCl are contained in 350. mL of a 0.196 M solution of sodium chloride?
 - a. 11.5 g
 - b. 4.01 g
 - c. 8.02 g
 - d. 68.6 g
 - e. none of these
- 6. What volume of 18 M sulfuric acid must be used to prepare 2.00 L of 0.140 M H_2SO_4
 - a. 16 mL
 - b. 0.28 mL
 - c. $1.3 \times 103 \text{ mL}$
 - d. 2.8 mL
 - e. 5.0 mL
- 7. What are the following reactions examples of?

$$Pb^{2+} + 2I \rightarrow PbI_2$$

$$2\mathsf{Ce}^{\scriptscriptstyle 4+} + 2\mathsf{I}^{\scriptscriptstyle -} \rightarrow \mathsf{I}_2 + 2\mathsf{Ce}^{\scriptscriptstyle 3+}$$

$$HOAc + NH_3 \rightarrow NH_4^+ + OAc^-$$

a.	acid-base reactions
b.	unbalanced reactions
C.	precipitation, acid-base, and redox reactions, respectively
d.	redox, acid-base, and precipitation reactions, respectively
e.	precipitation, redox, and acid-base reactions, respectively
8. You h	ave exposed electrodes of a light bulb in a solution of H ₂ SO ₄ such that
the li	ght bulb is on. You add a dilute solution and the bulb grows dim. Which of
the fo	ollowing could be in the solution?
a.	Ba(OH) ₂
b.	NaNO ₃
c.	K_2SO_4
d.	Cu(NO ₃) ₂
e.	none of these
9. Aque	ous solutions of potassium sulfate and ammonium nitrate are mixed
toget	ner. Which statement is correct?
a.	Both KNO ₃ and NH ₄ SO ₄ precipitate from solution.
b.	A gas is released.
C.	NH ₄ SO ₄ will precipitate from solution.
d.	KNO ₃ will precipitate from solution.
e.	No reaction will occur.
10. How many of the following salts are expected to be insoluble in water?	
	sodium sulfide
	barium nitrate
	ammonium sulfate
	potassium phosphate
a.	none
b.	1
C.	2
d.	3
e.	4
11. Which	n of the following ions is most likely to form an insoluble sulfate?

C.	Ca ²⁺
d.	S ²⁻
e.	Cl-
Use the follo	wing to answer questions 12–13: Aqueous solutions of barium chloride
and silver nit	trate are mixed to form solid silver chloride and aqueous barium nitrate.
12. The ba	alanced molecular equation contains which one of the following terms?
a.	AgCl (s)
b.	2AgCl (s)
С.	2Ba(NO ₃)2 (aq)
d.	BaNO ₃ (aq)
e.	3AgCl (aq)
13. The net ionic equation contains which of the following terms?	
a.	Ag ⁺ (aq)
b.	Ba ²⁺ (aq)
C.	NO ₃ ⁻ (aq)
d.	H ⁺ (aq)
e.	AgCl (aq)
14. The net ionic equation for the reaction of calcium bromide and sodium	
phosphate contains which of the following species?	
a.	2Br ⁻ (aq)
b.	PO_4^{3-} (aq)
С.	$2Ca_3(PO_4)_2(s)$
d.	6NaBr (aq)
e.	3Ca ²⁺ (aq)
15. The no	et ionic equation for the reaction of aluminum sulfate and sodium
hydro	xide contains which of the following species?
a.	3Al ³⁺ (aq)
b.	OH ⁻ (aq)
C.	30H ⁻ (aq)
	2Al ³⁺ (aq)
e.	2Al(OH) ³ (s)

a. K⁺

b. Li⁺

- 16. You mix 265.0 mL of 1.20 M lead(II) nitrate with 300.0 mL of 1.55 M potassium iodide. The lead(II) iodide is insoluble. Which of the following is false?
 - a. The final concentration of Pb2+ ions is 0.151 M.
 - b. You form 107 g of lead(II) iodide.
 - c. The final concentration of K+ is 0.823 M.
 - d. The final concentration of NO_3^- is 0.823 M.
 - e. All are true.
- 17. When solutions of formic acid and sodium hydroxide react, which of the following are NOT present in the net ionic equation?
 - I. hydrogen ion
 - II. formate ion
 - III. sodium ion
 - IV. hydroxide ion
 - a. I and II
 - b. I, II, and III
 - c. I and IV
 - d. I and III
 - e. II and III
- 18. When solutions of acetic acid and copper(II) react, which of the following are spectator ions?
 - a. hydrogen ion
 - b. acetate ion
 - c. copper(II) ion
 - d. hydroxide ion
 - e. none of these
- 19. A 0.307-g sample of an unknown triprotic acid is titrated to the third equivalence point using 35.2 mL of 0.106 M NaOH. Calculate the molar mass of the acid.
 - a. 247 g/mol
 - b. 171 g/mol
 - c. 165 g/mol
 - d. 151 g/mol
 - e. 82.7 g/mol

- 20. 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. C and D
- 21. With what volume of 5.00 M HF will 5.41 g of calcium hydroxide react completely, according to the following reaction?
 - $2 HF + Ca(OH)_2 \rightarrow CaF_2 + 2H_2O$
 - a. 14.6 mL
 - b. 146 mL
 - c. 730 mL
 - d. 29.2 mL
 - e. 34.2 mL
- 22. A student weighs out 0.557 g of KHP (molar mass = 204.22 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.
 - a. 0.00273 M
 - b. 0.100 M
 - c. 0.0151 M
 - d. 0.0742 M
 - e. none of these
- 23. In which of the following does nitrogen have an oxidation state of +4?
 - a. HNO₃
 - b. NO₂
 - c. N_2O
 - d. NH₄Cl
 - e. NaNO₂
- 24. What is the oxidation state of chlorine in ClO-?

a.	0
b.	+1
C.	-1
d.	+3
e.	- 7
25. In the	reaction 2Ca(s) + O2(g) \rightarrow 2CaO(s), which species is oxidized?
a.	O_2
b.	O^{2-}
C.	Ca
d.	Ca ²⁺
e.	none of these
26. In the	reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, N_2 is
a.	oxidized
b.	reduced
C.	the electron donor
d.	the reducing agent
e.	two of these
27. Which	of the following are oxidation-reduction reactions?
	I. $PCl_3 + Cl_2 \rightarrow PCl_5$
	II. $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$
	III. $CO_2 + 2LiOH \rightarrow Li_2CO_3 + H_2O$
	IV. $FeCl_2 + 2NaOH \rightarrow Fe(OH)_2 + 2NaCl$
	III
	IV
	I and II
	I, II, and III
	I, II, III, and IV
	reaction $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$, which, if any, element is oxidized?
	zinc
	hydrogen
	sulfur
	oxygen
e.	none of these

29. Balance the following oxidation-reduction reaction using the oxidation number method: $Fe_{3+} + I^- \rightarrow Fe_{2+} + I_2$

In the balanced equation, the coefficient of $Fe^{2+} + I_2$

- a. 1
- b. 2
- c. 3
- d. 4
- e. none of these
- 30. Given the reaction $2MnO_{4-} + 5H_2O_2 + 6H^+$ $2Mn^{2+} + 8H_2O + 5O_2$ determine the number of electrons involved in this reaction.
 - a. 10
 - b. 8
 - c. 6
 - d. 4
 - e. 2