

Project Advance Chemistry 106 Study Questions
on Material in *General Chemistry*, Brown, LeMay, and Bursten

Chapter 4. Aqueous Reactions and Solution Stoichiometry

Fall Semester 1996

1. The temperature of a 0.847 M solution of NaBr was increased from 25°C to 40°C. What effect did this temperature change have on the molarity of NaBr in this solution?
 - (a) the molarity decreased
 - (b) the molarity increased
 - (c) the molarity did not change
2. What is the molarity of NaCl in a solution made by mixing 25.0 mL of 0.100 M NaCl with 50.0 mL of 0.100 M NaCl?
 - (a) 0.0333 M
 - (b) 0.100 M
 - (c) 0.0500 M
 - (d) 0.0250 M
 - (e) none of the above.
3. What is the concentration in M of an aqueous ethanol solution if 400 mL thereof diluted to 4.00 L affords a concentration of 0.0400 M?
 - (a) 4.00
 - (b) 0.400
 - (c) 2.00
 - (d) 1.60
 - (e) 0.200
4. What is the molarity of CH₃OH in a solution prepared by dissolving 11.7 g of CH₃OH in 230 mL of solution?
 - (a) 1.59×10^{-3} M
 - (b) 0.0841 M
 - (c) 1.59 M
 - (d) 11.9 M
 - (e) none of the above.
5. How many grams of H₃PO₄ are in 175 mL of a 3.5 M solution of H₃PO₄?
 - (a) 0.61
 - (b) 4.9
 - (c) 20
 - (d) 60
 - (e) none of the above.

6. How many moles of Br^- are present in 0.500 L of 0.300 M AlBr_3 ?
- (a) 0.167
 - (b) 0.450
 - (c) 0.0500
 - (d) 0.500
 - (e) 0.150
7. What are the respective molar concentrations of Na^+ and SO_4^{2-} afforded by dissolving 0.500 mol Na_2SO_4 in water to afford 1.33 L of solution?
- (a) 0.752 and 0.376
 - (b) 0.665 and 1.33
 - (c) 1.33 and 0.665
 - (d) 0.376 and 0.752
 - (e) 0.665 and 0.665
8. Which one of the following is a weak acid?
- (a) HCl
 - (b) HI
 - (c) HNO_3
 - (d) HF
 - (e) HClO_4
9. The hydroxide of which of the following is a weak base?
- (a) strontium
 - (b) barium
 - (c) calcium
 - (d) magnesium
 - (e) rubidium
10. The color of litmus is changed from ___ to ___ by base.
- (a) yellow, green
 - (b) red, blue
 - (c) blue, red
 - (d) colorless, pink
 - (e) none of the above.

11. $\text{Ca}(\text{OH})_2$ is a
- (a) strong base
 - (b) weak acid
 - (c) strong acid
 - (d) weak base
 - (e) acidic salt
12. HClO_4 is a
- (a) weak base
 - (b) strong acid
 - (c) weak acid
 - (d) strong base
 - (e) basic salt
13. What are the spectator ions in the reaction between KOH and HNO_3 ?
- (a) H^+ and NO_3^-
 - (b) H^+ and OH^-
 - (c) K^+ and H^+
 - (d) K^+ and NO_3^-
 - (e) H_2O only
14. Aqueous sodium chloride will react with which one of the following in a metathesis reaction?
- (a) barium nitrate
 - (b) calcium nitrate
 - (c) lead nitrate
 - (d) potassium bromide
 - (e) no reaction will occur.
15. Which one of the following forms an insoluble bromide, iodide, and sulfate but a soluble chloride?
- (a) Hg^{2+}
 - (b) Ag^+
 - (c) Pb^{2+}
 - (d) Hg_2^{2+}
 - (e) None of the above. All have insoluble chlorides.

16. The formation of which one of the compounds below will act as the driving force for metathesis reactions?
- (a) NaNO_3
 - (b) $\text{HC}_2\text{H}_3\text{O}_2$
 - (c) KOH
 - (d) MgCl_2
 - (e) none of the above since all are soluble in water.
17. Solubility rules predict precipitate formation for mixing 0.1 M aqueous solutions of
- (a) NaI and KBr
 - (b) KOH and $\text{Ba}(\text{NO}_3)_2$
 - (c) NiBr_2 and AgNO_3
 - (d) K_2SO_4 and CrCl_3
 - (e) Li_2CO_3 and CsI
18. One method for removal of metal ions from a solution is to convert the metal to its elemental form so it can be filtered out as a solid. Which metal can be used to remove aluminum ions from solution?
- (a) zinc
 - (b) cobalt
 - (c) lead
 - (d) copper
 - (e) none of these
19. Which one of the following will produce hydrogen gas?
- (a) $\text{Hg} + \text{HCl}$
 - (b) $\text{Co} + \text{HCl}$
 - (c) $\text{Ag} + \text{HCl}$
 - (d) $\text{Cu} + \text{HNO}_3$
 - (e) none of the above.
20. Based on the activity series, which reaction below will not occur?
- (a) $2\text{Ag}(\text{s}) + 2\text{HNO}_3(\text{aq}) \longrightarrow 2\text{AgNO}_3(\text{aq}) + \text{H}_2(\text{g})$
 - (b) $\text{Zn}(\text{s}) + 2\text{HI}(\text{aq}) \longrightarrow \text{ZnI}_2(\text{aq}) + \text{H}_2(\text{g})$
 - (c) $\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \longrightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$
 - (d) $2\text{Ni}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{Ni}_2\text{SO}_4(\text{aq}) + \text{H}_2(\text{g})$
 - (e) $2\text{Al}(\text{s}) + 6\text{HBr}(\text{aq}) \longrightarrow 2\text{AlBr}_3(\text{aq}) + 3\text{H}_2(\text{g})$

21. The balanced net ionic equation for the dissolution of zinc metal in aqueous hydrobromic acid is
- (a) $\text{Zn(s)} + 2\text{HBr(aq)} \longrightarrow \text{ZnBr}_2\text{(aq)} + 2\text{H}^+\text{(aq)}$
 - (b) $\text{Zn(s)} + 2\text{H}^+\text{(aq)} \longrightarrow \text{Zn}^{2+}\text{(aq)} + \text{H}_2\text{(g)}$
 - (c) $2\text{Zn(s)} + \text{H}^+\text{(aq)} \longrightarrow 2\text{Zn}^{2+}\text{(aq)} + \text{H}_2\text{(g)}$
 - (d) $\text{Zn(s)} + 2\text{HBr(aq)} \longrightarrow \text{ZnBr}_2\text{(s)} + 2\text{H}^+\text{(aq)}$
 - (e) $\text{Zn(s)} + 2\text{Br}^-\text{(aq)} \longrightarrow \text{ZnBr}_2\text{(aq)}$
22. Zinc is more active than cobalt and iron but less active than aluminum. Cobalt is more active than nickel but less active than iron. Which of the following correctly lists the elements in order of increasing activity?
- (a) $\text{Ni} < \text{Fe} < \text{Co} < \text{Zn} < \text{Al}$
 - (b) $\text{Co} < \text{Ni} < \text{Fe} < \text{Zn} < \text{Al}$
 - (c) $\text{Ni} < \text{Co} < \text{Fe} < \text{Zn} < \text{Al}$
 - (d) $\text{Fe} < \text{Ni} < \text{Co} < \text{Al} < \text{Zn}$
23. Calculate the percent of oxalic acid, $\text{H}_2\text{C}_2\text{O}_4$, in a solid given that a 0.7984 g sample of that solid required 37.98 mL of 0.2283 M NaOH for titration.
- (a) 48.89%
 - (b) 97.78%
 - (c) 1.086%
 - (d) 28.59%
 - (e) none of the above.
24. A 17.5 mL sample of acetic acid ($\text{CH}_3\text{CO}_2\text{H}$) required 29.6 mL of 0.250 M NaOH to neutralize it. What was the molarity of the acetic acid solution?
- (a) 6.8
 - (b) 0.15
 - (c) 130
 - (d) 0.42
 - (e) none of the above.
25. Determine the number of liters of 0.250 M HNO_3 required to neutralize a solution prepared by dissolving 17.5 g of NaOH in 350 mL of solution.
- (a) 1.75
 - (b) 0.070
 - (c) 50.0
 - (d) 0.44
 - (e) none of the above.