Chemistry 12

Solutions Manual Part A

Unit 4 Chemical Systems and Equilibrium

Answers to Unit 4 Preparation Questions

(Student textbook pages 414-7)

1. Accept all reasonable answers. *Sample answer*: Strong acids and strong bases are corrosive and dangerous to transport. Pouring strong acids and bases down the drain cause unsafe situations at water treatment plants and cause unnecessary wear and tear on pipes, valves, and other parts in the sewer system. Disposing of unneutralized acids and bases is both unsafe and costly.

2. a. Always add concentrated acid to water. Once the concentrated acid is measured, it should be added to the 45.00 mL of water, so that the exothermic reaction can dissipate the heat throughout the 45 mL of water.

b. Rinse any clothing thoroughly and use the eyewash station to rinse your eyes immediately and continuously for at least 15 minutes, get your lab partner to inform the teacher.

c. Using excessive amounts of chemicals is costly because the initial cost is higher than necessary for the extra chemicals, and the disposal is more costly because you have to safely dispose of excessive amounts of chemicals.

3. a. Because lead(II) chloride solid forms, follow all instructions given by the teacher in terms of its disposal. Some teachers might ask for the solution to be filtered and the filter paper disposed of in hazardous waste containers, while other teachers might ask for all solutions to be poured into a hazardous waste container.

b. When you wash solid materials down the drain you risk clogging the drain. It can be hazardous to unclog a drain that contains unknown or a variety of chemical solids in it.

4. a. A straw that another student has used is contaminated with germs. Illnesses and diseases can be spread among students that share straws.

b. Eyewear should always be worn in the laboratory. Also, when you blow too hard through the straw, spray from the mixture can get into your eyes.

5. a. 25.16 g of solid in enough water to make 225 mL of solution

b. 2.55 g of solid in enough water to make 75.0 mL of solution

c. 913.23 g of solid in enough water to make 1.75 L of solution

6. a. 46.7 mL of acid mixed with 153.3 mL of water

b. 0.25 mL of acid mixed with 12.25 mL of water

c. 18.3 mL of acid mixed with 1.08 L of water

7. a. $LiOH(aq) + HCl(aq) \rightarrow LiCl(aq) + H_2O(\ell)$

b. $2KCl(aq) + Pb(NO_3)_2(aq) \rightarrow PbCl_2(s) + 2KNO_3(aq)$

c. $Na_2S(aq) + 2AgNO_3(aq) \rightarrow Ag_2S(s) + 2NaNO_3(aq)$

8. b

9. e

10. a. $NO_3^-(aq)$ and Na^+

b. silver chromate, $Ag_2CrO_4(s)$

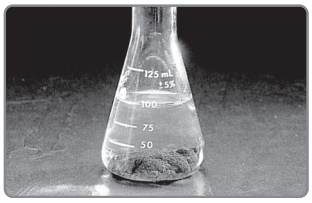
c. chromate, CrO_4^{2-}

d. $2Ag^+(aq) + CrO_4^{2-}(aq) \rightarrow Ag_2CrO_4(s)$

11. a. A solid formed.

b. $2Ag^+(aq) + 2NO_3^-(aq) + 2Na^+(aq) + CrO_4^-(aq) \rightarrow Ag_2CrO_4(s) + 2NO_3^-(aq) + 2Na^+(aq)$

$2Ag^+(aq) + CrO_4^-(aq) \rightarrow Ag_2CrO_4(s)$



12. a. $H^+(aq) + Br^-(aq) + K^+(aq) + OH^-(aq) \rightarrow K^+(aq) + Br^-(aq) + H_2O(\ell)$

b. $H^+(aq) + OH^-(aq) \rightarrow H_2O(\ell)$

c. neutralization reaction

13. $n = cV$

$$= \left(0.254 \frac{\text{mol}}{\cancel{\text{L}}}\right)(25.00\ \cancel{\text{mL}})\left(\frac{1\ \cancel{\text{L}}}{1000\ \cancel{\text{mL}}}\right)$$

$= 0.00635$ mol

14. $n = cV$

$$= \left(0.125 \frac{\text{mol}}{\cancel{\text{L}}}\right)(38.42\ \cancel{\text{mL}})\left(\frac{1\ \cancel{\text{L}}}{1000\ \cancel{\text{mL}}}\right)$$

$= 0.00480$ mol

15. $n = cV$

$$V = \frac{n}{c}$$

$$= \frac{0.425\ \cancel{\text{mol}}\ \text{L}}{0.125\ \frac{\cancel{\text{mol}}}{\text{L}}}$$

$$= 3.40\ \text{L}$$

16. $n = cV$

$$c = \frac{n}{V}$$

$$= \frac{0.385\ \text{mol}}{225\ \cancel{\text{mL}}} \times \frac{1000\ \cancel{\text{mL}}}{1\ \text{L}}$$

$$= 1.71\ \frac{\text{mol}}{\text{L}}$$

17. Moles of sulfate:

$$n = cV$$

$$= \left(0.200\ \frac{\text{mol}}{\cancel{\text{L}}}\right)(50.0\ \cancel{\text{mL}})\left(\frac{1\ \cancel{\text{L}}}{1000\ \cancel{\text{mL}}}\right)$$

$$= 0.0100\ \text{mol}$$

Moles of lead:

$$n = cV$$

$$= \left(0.100\ \frac{\text{mol}}{\cancel{\text{L}}}\right)(80.0\ \cancel{\text{mL}})\left(\frac{1\ \cancel{\text{L}}}{1000\ \cancel{\text{mL}}}\right)$$

$$= 0.00800\ \text{mol}$$

The limiting ion is lead so only 0.00800 moles of lead sulfate can form.

Molar mass of $PbSO_4(s)$:

$$M_{PbSO_4} = M_{Pb} + M_s + 4M_O$$

$$= 207.2\ \frac{\text{g}}{\text{mol}} + 32.07\ \frac{\text{g}}{\text{mol}} + \left(4 \times 16.00\ \frac{\text{g}}{\text{mol}}\right)$$

$$= 303.27\ \frac{\text{g}}{\text{mol}}$$

Mass of 0.00800 mol of lead sulfate:

$$n = \frac{m}{M}$$

$$m = nM$$

$$= (0.00800\ \cancel{\text{mol}})\left(303.27\ \frac{\text{g}}{\cancel{\text{mol}}}\right)$$

$$= 2.42616\ \text{g}$$

$$= 2.43\ \text{g}$$

18. a. lead (II) chromate

b. $2K^+(aq) + CrO_4^{2-}(aq) + Pb^{2+}(aq) + 2NO_3^-(aq) \rightarrow PbCrO_4(s) + 2K^+(aq) + 2NO_3^-(aq)$

c. 0.58 g

19. A concentrated acid has a large number of acid molecules in solution, while a dilute acid has a smaller number of acid molecules in solution.

20. A strong base completely dissociates in water, whereas a weak base does not dissociate completely.

21. A weak base can be concentrated, because concentration is based on the amount of material in solution, not the degree of ionization; therefore, the statement is true.

22. 0.182 mol/L

23. The first proton is lost from the sulfuric molecule due to the interactions of the polar water molecule. Once this proton is lost, HSO_4^- remains and due to the negative charge, the second proton (which is positively charged) is more difficult for water molecules to strip off the ion.

24. a. $x = -1.56$ or $x = 2.56$

b. $x = -1.46$ or $x = 5.46$

c. $x = -1.85$ or $x = 0.18$

25. a. $x = 0.50$

b. 4.20×10^{-4}

26. a. 2^6

b. a^{10}

c. x^4y^4

d. 3^4

27. a. 3

b. 4

c. 8

d. 12

e. −12

28. a. 2.87×10^2

b. 5.95×10^{-3}

c. 1.79×10^6

d. 4.12×10^{-7}

29. a. The function key *LOG* is used to take the logarithm of a number. The function key 10^x is used to take the antilogarithm or to find the number that you raise the base to in order to obtain a specific number.

b. *Sample answer*: $\log 0.001 = x$ and $10^{2.961} = x$;

c. The pH scale for acids and bases is based on logarithms.

Chapter 7 Chemical Equilibrium

Answers to Learning Check Questions

(Student textbook page 422)

1. A reversible reaction is a reaction that can proceed in both the forward and the reverse directions.