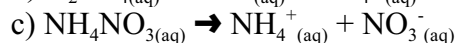
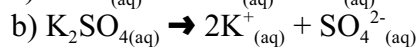


Summary: P811, # 1-14, 16-27

1)



2)

a) $C = 0.174 \text{ mol} / 0.250 \text{ L} = 0.696 \text{ mol/L}$

b) $n(\text{NaOH}) = 60.0 \text{ g} / 40.00 \text{ g/mol} = 1.50 \text{ mol}$

$C = 1.50 \text{ mol} / 0.7500 \text{ L} = 2.00 \text{ mol/L}$

c) $n(\text{glucose}) = 15.0 \text{ g} / 180.16 \text{ g/mol} = 0.0833 \text{ mol}$

$C = 0.0833 \text{ mol} / 0.1250 \text{ L} = 0.666 \text{ mol/L}$

3) $V = 0.09 \text{ mol} / 0.36 \text{ mol/L} = 0.3 \text{ L}$

4) $n(\text{Na}_2\text{CO}_3) = 0.12 \text{ mol/L} \times 0.500 \text{ L} = 0.060 \text{ mol}$

$m(\text{Na}_2\text{CO}_3) = 0.060 \text{ mol} \times 105.99 \text{ g/mol} = 6.4 \text{ g}$

5)

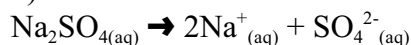
$m(\text{NaCl}) = 31.6 \text{ g/100mL} \times 375 \text{ mL/100mL} = 119 \text{ g}$

6)

$n(\text{KHCO}_3) = 13.8 \text{ g} / 100.12 \text{ g/mol} = 0.138 \text{ mol}$

$C = 0.138 \text{ mol} / 0.354 \text{ L} = 0.390 \text{ mol/L}$

7)



$n(\text{Na}_2\text{SO}_4) = 0.320 \text{ mol}$

a) $C(\text{Na}_2\text{SO}_{4(\text{aq})}) = 0.320 \text{ mol} / 0.500 \text{ L} = 0.640 \text{ mol/L}$

b) $C(\text{Na}_{(\text{aq})}^+) = 0.320 \text{ mol} \times 2 / 0.500 \text{ L} = 1.28 \text{ mol/L}$

c) $C(\text{SO}_{4(\text{aq})}^{2-}) = 0.320 \text{ mol} / 0.500 \text{ L} = 0.640 \text{ mol/L}$

8)

$n(\text{NaOH}) = 0.200 \text{ mol/L} \times 0.0249 \text{ L} = 0.00498 \text{ mol}$

9)

$M(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = 249.68 \text{ g/mol}$

$n = 0.125 \text{ mol/L} \times 0.1500 \text{ L} = 0.0188 \text{ mol}$

$m = 0.0188 \text{ mol} \times 249.68 \text{ g/mol} = 4.69 \text{ g}$

10)

When diluting solutions, $C_1V_1 = C_2V_2$

$$C = 11.6 \text{ mol/L} \times 0.0150 \text{ L} / 0.5000 \text{ L} = 0.348 \text{ mol/L}$$

11)

$$V = 2.00 \text{ L} \times 0.215 \text{ mol/L} / 17.8 \text{ mol/L} = 0.0242 \text{ L}$$

12)

$$\text{a) } m = 1.00 \times 10^3 \text{ g}$$

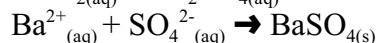
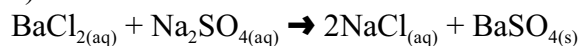
$$\text{b) } n = 1.00 \times 10^3 \text{ g} / 18.02 \text{ g/mol} = 55.5 \text{ mol}$$

$$\text{c) } C = 55.5 \text{ mol} / 1.00 \text{ L} = 55.5 \text{ mol/L}$$

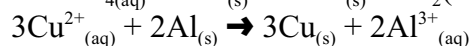
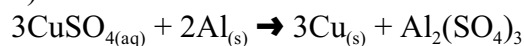
d) The concentration of water will change only when its density changes, which occurs when its temperature changes.

13)

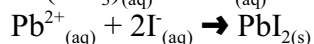
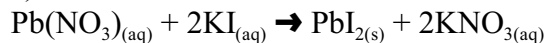
a)



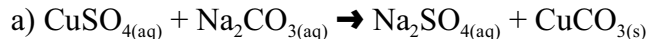
b)



c)



14)



b) Product chosen is $\text{CuCO}_{3(\text{s})}$

$$n(\text{CuCO}_3) \text{ from } \text{CuSO}_4 = 0.0275 \text{ L} \times 1.12 \text{ mol/L} \times 1/1 = 0.00308 \text{ mol}$$

$$n(\text{CuCO}_3) \text{ from } \text{Na}_2\text{CO}_3 = 0.0450 \text{ L} \times 0.088 \text{ mol/L} \times 1/1 = 0.0040 \text{ mol}$$

Therefore, CuSO_4 is limiting reactant

$$\text{c) } m(\text{CuCO}_3) = 0.00308 \text{ mol} \times 123.56 \text{ g/mol} = 0.381 \text{ g}$$

16)

a) Dissociation is when two substances separate from each other. Ionization is when a substance loses or gains an electron and becomes an ion in the process.

b) A strong acid completely dissociates in solution. A weak acid only partially dissociates in solution.

c) A strong base completely dissociates in solution. A weak base only partially dissociates in solution.

17)

a) $\text{pH} = -\log(1 \times 10^{-2}) = 2.0$

b) $\text{pH} = -\log(4.5 \times 10^{-11}) = 10.35$

c) $\text{pH} = -\log(5.5 \times 10^{-3}) = 2.26$

d) $\text{pH} = -\log(7.2 \times 10^{-10}) = 9.14$

18)

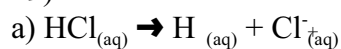
a) $[\text{H}^+] = 10^{-5.00} = 1.0 \times 10^{-5} \text{ mol/L}$

b) $[\text{H}^+] = 10^{-2.1} = 8 \times 10^{-3} \text{ mol/L}$

c) $[\text{H}^+] = 10^{-9.88} = 1.3 \times 10^{-10} \text{ mol/L}$

d) $[\text{H}^+] = 10^{-7.00} = 1.0 \times 10^{-7} \text{ mol/L}$

19)



b) $[\text{H}^+] = 10^{-1.1} = 8 \times 10^{-2} \text{ mol/L}$

c) $[\text{HCl}_{(\text{aq})}] = 8 \times 10^{-2} \text{ mol/L}$

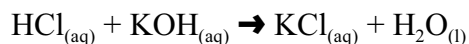
20)

a) According to the Arrhenius definition, an acid is a source of $\text{H}_{(\text{aq})}^+$, while bases are a source of $\text{OH}_{(\text{aq})}^-$ b) According to the Bronstead-Lowry definition, acids are $\text{H}_{(\text{aq})}^+$ (or proton) donors, while bases are proton acceptors

21)

a) Acid: H_3O^+ , conjugate base is H_2O Base: NH_3 , conjugate acid is NH_4^+ b) Base: OH^- , conjugate acid is H_2O Acid: HSO_3^- , conjugate base is SO_3^{2-} c) Base: HPO_4^{2-} , conjugate acid is H_2PO_4^- Acid: HSO_4^- , conjugate base is SO_4^{2-} d) Base: HS^- , conjugate acid is H_2S Acid: HCO_3^- , conjugate base is CO_3^{2-}

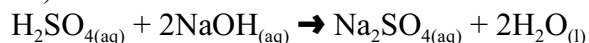
22)



$$n(\text{KOH}) = n(\text{HCl}) = 0.0250 \text{ L} \times 0.125 \text{ mol/L} = 0.00313 \text{ mol}$$

$$C(\text{KOH}) = 0.00313 \text{ mol} / 0.0214 \text{ L} = 0.146 \text{ mol/L}$$

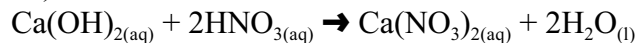
23)



$$n(\text{H}_2\text{SO}_4) = 0.0168 \text{ L} \times 0.250 \text{ mol/L} \times \frac{1}{2} = 0.00210 \text{ mol}$$

$$C(\text{H}_2\text{SO}_4) = 0.00210 \text{ mol} / 0.0200 \text{ L} = 0.105 \text{ mol/L}$$

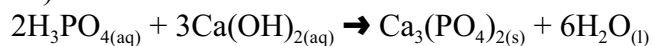
24)



$$n(\text{Ca(OH)}_2) = 0.0155 \text{ L} \times 0.100 \text{ mol/L} \times \frac{1}{2} = 0.000775 \text{ mol}$$

$$C(\text{Ca(OH)}_2) = 0.000775 \text{ mol} / 0.0100 \text{ L} = 0.0775 \text{ mol/L}$$

25)



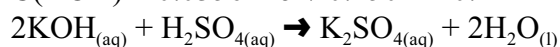
$$n(\text{H}_3\text{PO}_4) = 0.0200 \text{ L} \times 0.050 \text{ mol/L} \times \frac{2}{3} = 0.00067 \text{ mol}$$

$$C(\text{H}_3\text{PO}_4) = 0.00067 \text{ mol} / 0.0178 \text{ L} = 0.038 \text{ mol/L}$$

26)

$$n(\text{KOH}) = 2.00 \text{ g} / 56.11 \text{ g/mol} = 0.0356 \text{ mol}$$

$$C(\text{KOH}) = 0.0356 \text{ mol} / 0.250 \text{ L} = 0.142 \text{ mol/L}$$



$$n(\text{KOH neutralized}) = 0.0200 \text{ L} \times 0.115 \text{ mol/L} \times \frac{2}{1} = 0.00460 \text{ mol}$$

$$V(\text{KOH}) = 0.00460 \text{ mol} / 0.142 \text{ mol/L} = 0.0324 \text{ L}$$

27)

$$M((\text{COOH})_2 \cdot 2\text{H}_2\text{O}) = 126.07 \text{ g/mol}$$

$$n(\text{oxalic acid}) = 0.118 \text{ g} / 126.07 \text{ g/mol} = 0.000935 \text{ mol}$$

$$n(\text{NaOH}) = 0.000935 \text{ mol} \times \frac{2}{1} = 0.00187 \text{ mol}$$

$$C(\text{NaOH}) = 0.00187 \text{ mol} / 0.0104 \text{ L} = 0.179 \text{ mol/L}$$