**Chemistry 20 – Lesson 25**

**Theories of Acids and Bases**

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1. Compare and contrast a *weak* acid and a *dilute* acid.

/2 **A *weak* acid refers to an acid that does not ionize 100% when it reacts with water, while a *dilute* acid refers to a solution with a relatively small amount of dissolved solute. The terms weak and dilute refer to different chemical properties.**

2. Compare and contrast a *strong* acid and a *concentrated* acid.

/2 **A *strong* acid refers to an acid that ionizes 100% when it reacts with water, while a *concentrated* acid refers to a solution with a relatively large amount of dissolved solute. The terms strong and concentrated refer to different chemical properties.**

3.

/2 each

a. sodium carbonate

**Na2CO3 (s) → 2 Na+(aq) + CO32−(aq)**

**neutral ionic, strong electrolyte**

b. propanoic acid

**C2H5COOH (aq) + H2O (l) → C2H5COO−(aq) + H3O+(aq)**

**acidic, weak electrolyte**

c. Rb2S

**Rb2S (s) → 2 Rb+(aq) + S2−(aq)**

**neutral ionic, strong electrolyte**

d. Al(OH)3

**Al(OH)3 (s) → Al3+(aq) + 3 OH−(aq)**

**basic, strong electrolyte**

e. KHSO4

**KHSO4 (s) → K+(aq) + HSO4−(aq)**

**neutral ionic, strong electrolyte**

f. CO2

**CO2(g) + H2O (l) → H2CO3 (aq)**

**H2CO3 (aq) + H2O (l) → HCO3−(aq) + H3O+(aq)**

**acidic, weak electrolyte**

g. H2Cr2O7

**H2Cr2O7 (aq) + H2O (l) → HCr2O7−(aq) + H3O+(aq)**

**acidic, weak electrolyte**

h. NaNO3

**NaNO3 (s) → Na+(aq) + NO3−(aq)**

**neutral ionic, strong electrolyte**

i. C2H5OH

**C2H5OH (l) → C2H5OH (aq)**

**neutral molecular, non-electrolyte**

j. NH3

**NH3 (aq) + H2O (l) → NH4+(aq) + OH−(aq)**

**basic, weak electrolyte**

k. H2SO3

**H2SO3 (aq) + H2O (l) → HSO3−(aq) + H3O+(aq)**

**acidic, weak electrolyte**

l. FrOH

**FrOH (s) → Fr+(aq) + OH−(aq)**

**basic, strong electrolyte**

m. HI

**HI (aq) + H2O (l) → I−(aq) + H3O+(aq)**

**acidic, strong electrolyte**

n. Fe(H2PO4)3

**Fe(H2PO4)3 (s) → Fe3+(aq) + 3 H2PO4−(aq)**

**neutral ionic, strong electrolyte**

o. HCOOH

**HCOOH (aq) + H2O (l) → HCOO−(aq) + H3O+(aq)**

**acidic, weak electrolyte**

p. H3BO3

**H3BO3 (aq) + H2O (l) → H2BO3−(aq) + H3O+(aq)**

**acidic, weak electrolyte**

q. C12H22O11

**C12H22O11 (s) → C12H22O11 (aq)**

**neutral molecular, non-electrolyte**

4.

1/ each

a. A neutral solution has equal concentrations of H+ (aq) and OH– (aq). **(B)**

b. An acid contains H3O+(aq) in solution. **(MA)**

c. A base dissociates to produce free OH– (aq) in solution. **(A)**

d. NH3 (aq) produces a basic solution. **(MA)**

e. The theory(ies) cannot predict whether H2PO4– (aq) will act as an acid or as a base. **(B)**

f. Neutralization occurs when H+(aq) + OH–(aq) → H2O (l) **(A)**

g. The theory(ies) involve(s) the creation of a hydronium ion. **(MA)**

h. Basic solutions are formed when substances react with water to produce hydroxide ions. **(MA)**

i. Water has no reactive role to play in the formation of acidic and basic solutions. **(A)**

j. The theory(ies) can only predict the basic behaviour of substances containing the hydroxide ion. **(A)**

k. This theory can explain the acid or base behaviours of more substances than the other theory. **(MA)**

l. The theory(ies) need(s) revision to improve the ability to predict new results. **(A)**

5. For the following reactions, write the non-ionic, total ionic and net ionic reaction equations.

a. Excess hydrochloric acid in gastric fluid may be neutralized by a magnesium hydroxide suspension.

/3 **2 HCl(aq) + Mg(OH)2 (s) → MgCl2 (aq) + 2 H2O (l) (non–ionic)**

**2 H3O+(aq) + 2 Cl–(aq) + Mg(OH)2 (s) → 4 H2O (l) + Mg2+(aq) + 2 Cl–(aq) (total ionic)**

**2 H3O+(aq) + Mg(OH)2 (s) → 4 H2O (l) + Mg2+(aq) (net ionic)**

b. Chloric acid is neutralized by a potassium hydroxide solution.

/3 **HClO3 (aq) + KOH (aq) → KClO3 (aq) + H2O (l) (non–ionic)**

**HClO3 (aq) + K+(aq) + OH–(aq) → K+(aq) + ClO3− (aq) + H2O (l) (total ionic)**

**HClO3 (aq) + OH–(aq) → ClO3− (aq) + H2O (l) (net ionic)**

c. Iron pipes are strongly attacked and corroded by hydrochloric acid.

/3 **6 HCl(aq) + 2 Fe (s) → 2 FeCl3 (aq) + 3 H2 (g) (non–ionic)**

**6 H3O+(aq) + 6 Cl–(aq) + 2 Fe (s) → 2 Fe3+(aq) + 6 Cl–(aq) + 3 H2 (g) + 6 H2O (l) (total ionic)**

**6 H3O+(aq) + 2 Fe (s) → 2 Fe3+(aq) + 3 H2 (g) + 6 H2O (l) (net ionic)**

d. Hydrocyanic acid can be used to neutralize a barium hydroxide solution.

/3 **2 HCN (aq) + Ba(OH)2 (aq) → Ba(CN)2 (aq) + 2 H2O (l) (non–ionic)**

**2 HCN (aq) + Ba2+(aq) + 2 OH–(aq) → Ba2+(aq) + 2 CN− (aq) + 2 H2O (l) (total ionic)**

**HCN (aq) + OH–(aq) → CN− (aq) + H2O (l) (net ionic)**