IB Topic 8 Acids and Bases Review

1. Explain why rain is naturally acidic.
2. Give the formulas of two acids that arise from human activities and that are present in acid rain.
3. Describe the pre and post combustion methods for reducing sulfur oxide emissions.
4. Fill in the table:

|  |  |  |  |
| --- | --- | --- | --- |
| Oxide | Source(s) | Synthesis Equation | Formation of acid from oxide |
| SO2 |  |  |  |
| SO3 |  |  |  |
| NO |  |  |  |
| NO2 |  |  |  |

1. 20.0cm3 of KOH is exactly neutralized by 26.80cm3 of 0.100 mol dm-3 sulfuric acid. What is the concentration of KOH?

Complete the following reactions and balance:

1. H2SO4 + Mg 🡪
2. H2SO4 + MgCO3 🡪
3. H2SO4 + KOH 🡪
4. 0.060g of H2SO4 is dissolved in 350 cm3 of water
   1. What is the concentration of H2SO4 ?
   2. What is the concentration of H+ ions in the solution?
   3. What is the concentration of sulfate ions in the solution?
5. Define the terms *concentrated* and *dilute*. Give an example of each.

**2.** Define the terms *strong acid* and *weak acid*. Using hydrochloric and ethanoic acid as examples, write equations to show the dissociation of each acid in aqueous solution. Outline **three** different methods to distinguish between equimolar solutions of these acids in the laboratory. State how the results would differ for each acid.

**3.** (i) Calcium carbonate is added to separate solutions of hydrochloric acid and ethanoic acid of the same concentration. State **one** similarity and **one** difference in the observations you could make.

(ii) Write an equation for the reaction between hydrochloric acid and calcium carbonate.

(iii) Determine the volume of 1.50 mol dm–3 hydrochloric acid that would react with exactly 1.25 g of calcium carbonate.

(iv) Calculate the volume of carbon dioxide, measured at 273 K and 1.01×105 Pa, which would be produced when 1.25 g of calcium carbonate reacts completely with the hydrochloric acid.

**4.** Which **one** of the following species is amphiprotic in an aqueous solution?

A. CH3COOH

B. NO3–

C. H2PO4–

D. OH–

**10.** Which substance can be dissolved in water to give a 0.1 mol dm–3 solution with a high pH and a high electrical conductivity?

A. HCl

B. NaCl

C. NH3

D. NaOH

**16.** The equation for the reaction between nitric acid and sulfuric acid is shown below.

H2SO4 + HNO3 🡪 H2NO3+ + HSO4–

Which species are acting as acids in this reaction according to the Brønsted-Lowry theory?

**17.** Lime was added to a sample of soil and the pH changed from 4 to 6. What was the corresponding change in the hydrogen ion concentration?

**19.** The pH values of solutions of three organic acids of the same concentration were measured.

acid X pH = 5

acid Y pH = 2

acid Z pH = 3

(i) Identify which solution is the least acidic.

**(1)**

(ii) Deduce how the [H+] values compare in solutions of acids Y and Z.

**(2)**

(iii) Arrange the solutions of the three acids in decreasing order of electrical conductivity, starting with the greatest conductivity, giving a reason for your choice.

**20.** The equilibrium reached when ethanoic acid is added to water can be represented by the following equation:

CH3COOH(l) + H2O(l) CH3COO–(aq)+H3O+(aq)

Define the terms Brønsted-Lowry acid and Lewis base, and identify two examples of each of these species in the equation.

**23.** Vinegar has a pH of approximately 3 and some detergents have a pH of approximately 8. State and explain which of these has the higher concentration of H+ and by what factor.

**25.** Which species is a conjugate pair according to the Brønsted-Lowry theory?

A. CH3COOH and CH3CHO

B. NH3 and BF3

C. H2NO3+ and NO3–

D. H2SO4 and HSO4–

**31.** Solutions of hydrochloric acid (HCl(aq)) and ethanoic acid (CH3COOH(aq)) of the same concentration reacted completely with 5.0 g of calcium carbonate in separate containers. Which statement is correct?

A. CH3COOH(aq) reacted slower because it has a lower pH than HCl(aq).

B. A smaller volume of CO2(g) was produced with CH3COOH(aq) than with HCl(aq).

C. A greater volume of CO2(g) was produced with CH3COOH(aq) than with HCl(aq).

D. The same volume of CO2(g) was produced with both CH3COOH(aq) and HCl(aq)

**37.** The pH of a solution changes from pH = 1 to pH = 3. What happens to the [H+] during this pH change?