4 Worksheet: Acids and bases

QUESTION 1

Write balanced equations for the following reactions and indicate the type of reaction (Ionisation, Dissociation, Neutralisation or Redox):

	Reaction	Type of reaction
Ex	sodium hydroxide and nitric acid $NaOH + HNO_3 \longrightarrow NaNO_3 + H_2O$	Neutralisation
1.1	Potassium hydroxide and water	
1.2	Zinc and hydrochloric acid	
1.3	Lithium hydroxide and sulphuric acid	
1.4	Sulphuric acid and water	
1.5	ammonia and nitric acid	
1.6	sodium hydroxide and acetic acid	

QUESTION 2

2.1 Write a balanced equation for the reaction between nitric acid and water and indicate the conjugated acid-base pairs.

2.2 Write down the conjugated bases for the following acids:

   a. NH_4^+

   b. HSO_4^-

   c. H_2O

2.3 Write down the conjugated acids of the following bases:

   a. $H_2PO_4^-$

   b. HSO_4^-

   c. H_2O

2.4 25 cm^3 water is added tot 75 cm^3 of a 0,13 mol·dm^{-3} sulphuric acid solution. Calculate the concentration of the diluted solution.

2.5 Calculate the mass of NaOH that must be dissolved in 240 cm^3 of water to give a 0,04 mol.dm^{-3} solution.

2.6 A solution is made with 0,0015 mol.dm^{-3} H_2SO_4. Calculate what volume of water must be added to 10 cm^3 of a 0,0015 mol.dm^{-3} H_2SO_4 solution to dilute it to 0,0005 mol.dm^{-3}.

2.7 Hypothetical acid HA is a **weak acid**. HA is added to water.

   a. Write an equation for the reaction of HA with water.

   b. How does the number of hydronium-ions in the solution compare with the number of HA molecules?

   c. How does the number of hydronium-ions compare with the number of A$^-$-ions?

2.8 Solutions of the acids with the same concentrations are prepared.

Acid	Formula	K_a
Boric acid	H_3BO_4	$5,4 \times 10^{-10}$
Carbonic acid	H_2CO_3	$4,6 \times 10^{-7}$.

   a. Which of these acids is stronger? Explain.

   b. Which of these solutions is a better electrolyte? Explain.

   c. Which of these solutions contains more hydroxide ions?

   d. Which acid solution will have the lowest pH?

2.9 A 0,02 mol·dm^{-3} solution of a monoprotic, hypothetical acid HR has a [H_3O^+] of 3×10^{-5} mol.dm^{-3}.

   a. Explain the term monoprotic.

   b. Is HR a strong acid? Explain.

(The rest of the questions focus on study material covered in Video 3 and 4)

QUESTION 3

3.1 Calculate the pH of a 0,0015 mol·dm^{-3} H_2SO_4 solution.

3.2 Calculate the pH of a 0,004 mol·dm^{-3} lithium hydroxide solution.

3.3 Calculate the pH of a 2 dm^3 HNO_3 solution that contains 1,89 g HNO_3.

3.4 If a glass of beer has a pH of 4,3, calculate the concentration of OH^- ions of the beer.

3.5 A sodium hydroxide solution is prepared by dissolving 0,28 g sodium hydroxide pellets in water to a volume of 500 cm^3. Calculate the pH of the solution.

3.6 An unknown amount of NaOH is dissolved in 250 cm^3 water and the solution has a pH of 12,2.
   a. Calculate the concentration of the hydronium ions in the solution.
   b. Calculate the mass of NaOH that is dissolved in the water.

QUESTION 4

4.1 Sodium acetate is dissolved in water.
   a. What is the correct term for the reaction of a salt with water?
   b. Is the solution acidic, basic or neutral?
   c. Use equations to explain the previous answer.

4.2 A standard carbonic acid solution has a concentration of 0,02 mol.dm^{-3}. The solution is used to determine the concentration of a NaOH solution with a titration experiment. The acid is placed in the buret.

   a. Name the piece of glassware that is used to measure a fixed volume of base solution.
   b. Write a balanced equation for the reaction that is used in the titration.
   c. Name a suitable indicator for the experiment. Explain.
   d. What is the colour of the indicator in the base?
   e. What liquid can be used to rinse the buret. Explain.
   f. How does tyhe pH change as acid is added to the base in the conical flask.
   g. If 25 cm^3 of a 0,1 mol.dm^{-3} carbonic acid is used to neutralise 20 cm^3 NaOH, determine the NaOH concentration.