Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Acids And Bases

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Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Q1.

Buffer solutions are important in biological systems and in industry to maintain almost constant pH values.

(a) In the human body, one important buffer system in blood involves the hydrogencarbonate ion, HCO_3^-, and carbonic acid, H_2CO_3, which is formed when carbon dioxide dissolves in water.

(i) Use the following equation to explain how this buffer maintains a constant pH of 7.41 even if a small amount of acid enters the bloodstream.

$$H_2CO_3(aq) \rightleftharpoons H^+(aq) + HCO_3^-(aq)$$

_____

_____

_____

(ii) In a sample of blood with a pH of 7.41, the concentration of $HCO_3^-(aq)$ ions is 2.50×10^{-2} mol dm^{-3} and the concentration of $H_2CO_3(aq)$ is 1.25×10^{-3} mol dm^{-3}. Calculate a value for the acid dissociation constant, K_a, for carbonic acid at this temperature.

_____

_____

_____

_____

(5)

(b) In industry, the pH of a solution used to dye cloth must be controlled or else the colour varies.

A solution of dye in a beaker is buffered by the presence of ethanoic acid and sodium ethanoate. In the solution, the concentration of ethanoic acid is 0.15 mol dm^{-3} and the concentration of sodium ethanoate is 0.10 mol dm^{-3}. The value of K_a for ethanoic acid is 1.74×10^{-5} mol dm^{-3} at 298 K.

(i) A 10.0 cm^3 portion of 1.00 mol dm^{-3} hydrochloric acid is added to 1000 cm^3 of this buffered solution.

Calculate the number of moles of hydrochloric acid added.

_____

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(ii) Calculate the number of moles of ethanoic acid and the number of moles of sodium ethanoate in the solution after addition of the hydrochloric acid.

Mol of ethanoic acid after addition _____

_____

Mol of sodium ethanoate after addition _____

_____

(iii) Hence calculate the pH of this new solution. Give your answer to 2 decimal places.

_____

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_____

(6)

(Total 11 marks)

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Q2.

(a) A sample of hydrochloric acid has a pH of 2.34
Write an expression for pH and calculate the concentration of this acid.

pH _____

Concentration _____

_____

(2)

(b) A 0.150 mol dm^{-3} solution of a weak acid, HX, also has a pH of 2.34

(i) Write an expression for the acid dissociation constant, K_a, for the acid HX.

_____

_____

(ii) Calculate the value of K_a for this acid and state its units.

Calculation _____

_____

_____

Units _____

(iii) Calculate the value of pK_a for the acid HX. Give your answer to two decimal places.

_____

(5)

(c) A 30.0 cm^3 sample of a 0.480 mol dm^{-3} solution of potassium hydroxide was partially neutralised by the addition of 18.0 cm^3 of a 0.350 mol dm^{-3} solution of sulphuric acid.

(i) Calculate the initial number of moles of potassium hydroxide.

_____

_____

(ii) Calculate the number of moles of sulphuric acid added.

_____

_____

(iii) Calculate the number of moles of potassium hydroxide remaining in excess in the solution formed.

_____

_____

(iv) Calculate the concentration of hydroxide ions in the solution formed.

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(v) Hence calculate the pH of the solution formed. Give your answer to two decimal places.

_____

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_____

(6)

(Total 13 marks)

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