



Oxford Cambridge and RSA

A Level Chemistry B (Salters)
H433/02 Scientific literacy in chemistry

Question Set 9

1 The pH of human blood needs to be held within strict limits for good health. The pH is controlled using buffer systems. One buffer system is based on the equilibrium in **equation 4.1**.



(a) (i) Give the **systematic** name for HCO_3^- . [1]

(ii) HCO_3^- can act as either an acid or a base.

Give the **formula** of the conjugate **base** of HCO_3^- . [1]

(b) (i) Draw a '*dot-and-cross*' diagram for CO_2 and use it to name the shape of the molecule. '*Dot-and-cross*' diagram:

Shape of molecule [2]

(ii) A CO_2 molecule has no dipole.

A student says that this is because bonds between carbon and oxygen atoms are not polar.

Discuss the student's statement. [2]

(c) Another student says that CO_2 will form only instantaneous dipole-induced dipole bonds with water molecules.

Explain why this is incorrect. [2]

(d) (i) For the equilibrium in **equation 4.1**:

$$K_a = \frac{[\text{HCO}_3^-][\text{H}^+]}{[\text{CO}_2(\text{aq})]} = 7.9 \times 10^{-7} \text{ mol dm}^{-3}$$

A saturated solution of CO_2 at 298 K has a concentration of $3.3 \times 10^{-2} \text{ mol dm}^{-3}$.

Calculate the pH of this solution.

pH = [2]

(ii) Calculate the concentration of a solution of HCl that has the same pH as the solution in (i).

concentration = mol dm⁻³ [1]

(e) (i) The pH of healthy human blood is 7.4.

Calculate the ratio of $\frac{[\text{HCO}_3^-]}{[\text{CO}_2]}$ in healthy human blood.

$$\frac{[\text{HCO}_3^-]}{[\text{CO}_2]} = \dots\dots\dots [2]$$

(ii) A patient's blood has a pH below 7.4. A student says that HCO^- needs to be added to the patient's blood.

Say, with reasons, whether the student is correct. [2]

(f) Some students mix 20 cm^3 of $5.0 \times 10^{-3} \text{ mol dm}^{-3} \text{ HCl}$ with 20 cm^3 of $1.0 \times 10^{-2} \text{ mol dm}^{-3} \text{ NaOH}$.

Calculate the pH of the resulting solution.

pH = [3]

Total Marks for Question Set 9: 18

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