

ACIDS AND BASES AHL (HL only)

Please ensure that you have also completed the Core (SL & HL) questions

1. (a) Methanoic acid, HCOOH (aq) , is a weak organic acid.

(i) Write the K_a expression for methanoic acid.

[1]

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(ii) Using section 21 of the data booklet, calculate the pH of a $0.0010 \text{ mol dm}^{-3}$ solution of methanoic acid.

[3]

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(iii) State one assumption that you made for your calculation in 1(a)(ii) above.

[1]

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(iv) Explain, with the aid of chemical equations, how an equimolar mixture of methanoic acid and sodium methanoate can act as a buffer solution, upon addition of small amounts of acid or base.

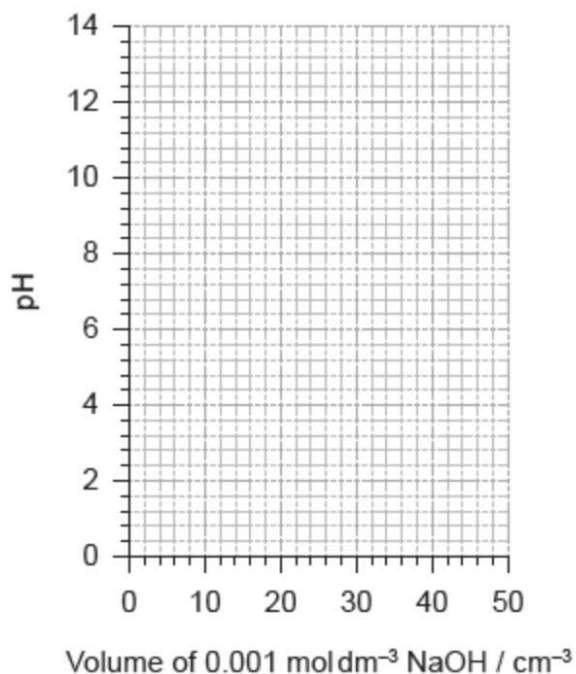
[4]

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(b) A titration is carried out: 50cm³ of NaOH (0.0010 mol dm⁻³) is gradually added to 25cm³ of 0.0010 mol dm⁻³ methanoic acid.

(i) Sketch the shape of the titration curve on the graph.

[3]



(ii) Identify and label the buffer region on the graph.

[1]

(iii) Explain how you could **use the graph** to determine the pK_a of methanoic acid.

[2]

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(iv) Identify an indicator that could be used for the titration in 1(b)(i) using section 22 of the data booklet.

[1]

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PTO

(vi) Calculate the K_b of the conjugate base of methanoic acid using sections 2 and 21 of the data booklet.

[2]

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(c) Identify whether the following solutions are acidic, basic or neutral. Explain your reasoning.

[3]

Sodium methanoate:.....

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Ammonium chloride:.....

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2. (a) Explain the Brønsted-Lowry acid-base **and** Lewis acid-base nature of water, H_2O .

[2]

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(b) Bromocresol green is a weak acid used as an indicator, and listed in section 22 of the data booklet. Using $HIn(aq)$ to represent the protonated species, explain how bromocresol green functions as an indicator.

[3]

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Total 26 marks (39 minutes)