Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Q1.

In this question, give all values of pH to 2 decimal places.

(a) (i) Write an expression for the term pH.

_____

(1)

(ii) Calculate the concentration, in mol dm^{-3}, of an aqueous solution of sulfuric acid that has a pH of 0.25

_____

_____

_____

_____

(2)

(b) A student carried out a titration by adding an aqueous solution of sodium hydroxide from a burette to an aqueous solution of ethanoic acid. The end-point was reached when 22.60 cm^3 of the sodium hydroxide solution had been added to 25.00 cm^3 of 0.410 mol dm^{-3} ethanoic acid.

(i) Write an equation for the reaction between sodium hydroxide and ethanoic acid.

_____

(1)

(ii) Calculate the concentration, in mol dm^{-3}, of the sodium hydroxide solution used.

_____

_____

_____

_____

(2)

(iii) A list of indicators is shown below.

Indicator	pH range
thymol blue	1.2–2.8

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bromophenol blue	3.0–4.6
litmus	5.0–8.0
cresol purple	7.6–9.2

Select from the list the most suitable indicator for the end-point of this titration.

_____

(1)

(iv) Suggest why the concentration of sodium hydroxide in a solution slowly decreases when left open to air.

_____

_____

(1)

(c) At 298 K, the value of the acid dissociation constant, K_a, for ethanoic acid in aqueous solution is 1.74×10^{-5} mol dm^{-3}

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

_____

_____

(1)

(ii) Calculate the pH of 0.410 mol dm^{-3} ethanoic acid at this temperature.

_____

_____

_____

_____

(3)

(iii) Calculate the pH of the buffer solution formed when 10.00 cm^3 of 0.100 mol dm^{-3} potassium hydroxide are added to 25.00 cm^3 of 0.410 mol dm^{-3} ethanoic acid.

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(6)

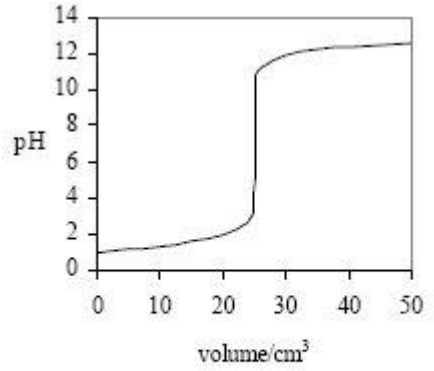
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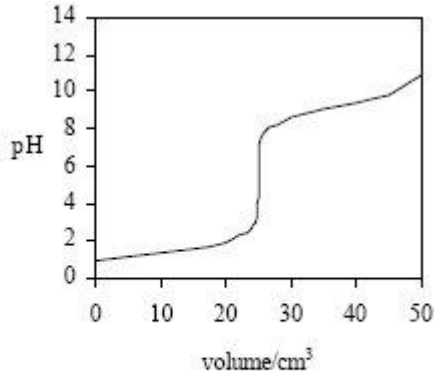
Q2.

Indicators and pH curves can be used to determine the end point in a titration.

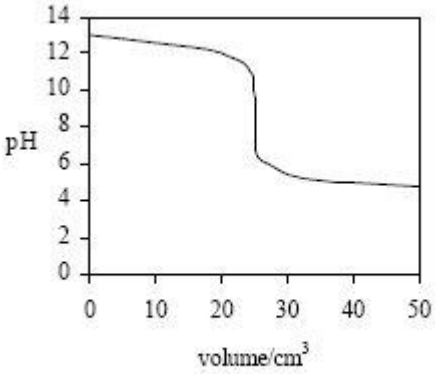
(a) The pH curves labelled **J, K, L** and **M** for combinations of different acids and bases are shown below. All solutions have a concentration of 0.1 mol dm^{-3}.



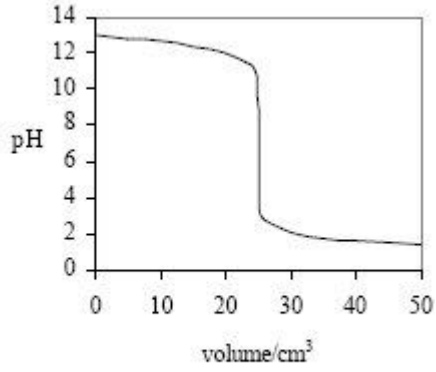
J



K



L



M

(i) Select from **J**, **K**, **L** and **M** the curve produced by the addition of

ammonia to 25 cm^3 of hydrochloric acid _____

ethanoic acid to 25 cm^3 of sodium hydroxide _____

sodium hydroxide to 25 cm^3 of hydrochloric acid _____

(ii) A table of acid–base indicators and the pH ranges over which they change colour is shown below.

Indicator	pH range
Thymol blue	1.2 – 2.8
Bromophenol blue	3.0 – 4.6
Methyl red	4.2 – 6.3
Cresolphthalein	8.2 – 9.8
Thymolphthalein	9.3 – 10.5

Select from the list above an indicator which could be used in the titration which produces curve **J** but not in the titration which produces curve **K**.

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_____

(4)

(b) The acid dissociation constant, K_a, for the weak acid, ethanoic acid, has a value of 1.74×10^{-5} mol dm^{-3} at 25 °C.

$$K_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]}$$

(i) Write an expression for the term pH.

_____

(ii) Calculate the pH of a 0.15 mol dm^{-3} solution of ethanoic acid. Give your answer to 2 decimal places.

_____

_____

_____

_____

(4)

(Total 8 marks)

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