

# THE MOLE & CONCENTRATION

**Q1.** The ethanoic acid in 25.0 cm<sup>3</sup> of diluted vinegar reacted completely with 15.0 cm<sup>3</sup> of sodium hydroxide solution of concentration 0.10 moles per cubic decimetre.

The equation which represents this reaction is:



Calculate the concentration of ethanoic acid in moles per cubic decimetre.

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(2 marks)

**Q2.** When a known mass of a hydrocarbon was completely burned in oxygen, 17.6 g of carbon dioxide and 7.2 g of water were the only products.

Relative formula masses ( $M_r$ ):  $\text{CO}_2 = 44$ ;  $\text{H}_2\text{O} = 18$ .

Use this information to calculate the number of moles of carbon dioxide and of water produced in this reaction. Use your answers to calculate the empirical formula of this hydrocarbon.

You must show your working to gain full marks.

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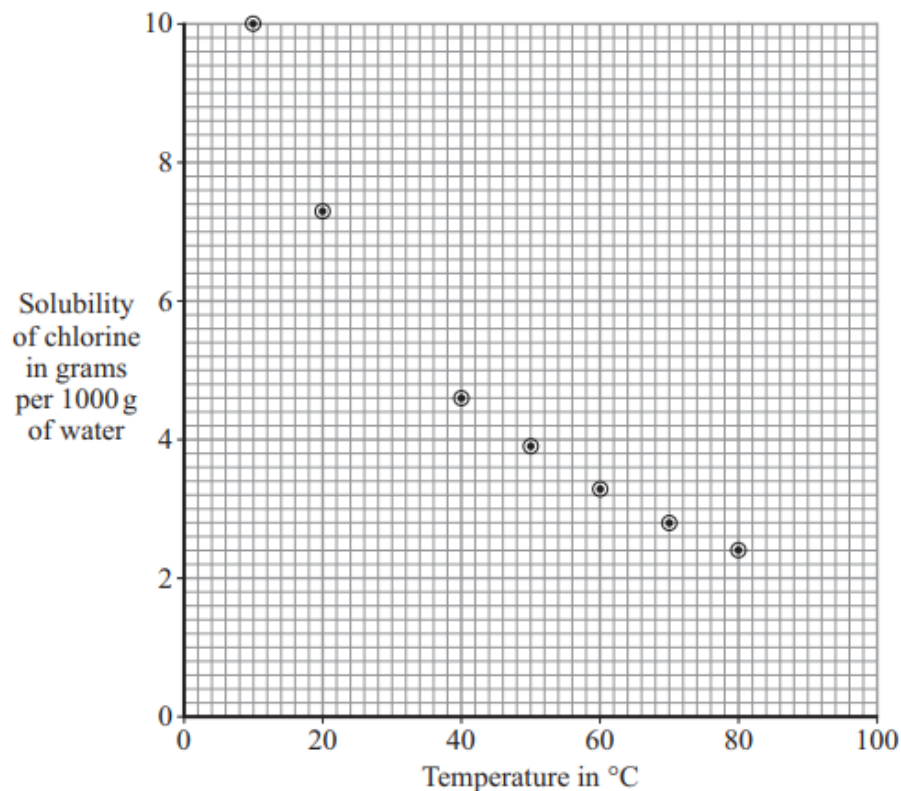
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(3 marks)

**Q3.** The points on the graph show the mass of chlorine that dissolves in 1000 g of water at different temperatures.



Use the graph to answer the following questions.

**(a)** Draw a smooth curve through all the points.

(1 mark)

**(b)** What is the mass of chlorine that dissolves in 1000 g of water at 30 °C?

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(1 mark)

**(c)** Calculate the mass of chlorine that bubbles out of 1000 g of water when the temperature increases from 10 °C to 80 °C.

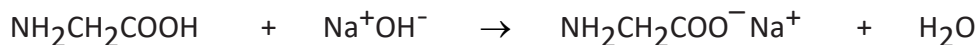
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(2 marks)

**Q4.** In a titration, 25.00 cm<sup>3</sup> of a solution of aminoethanoic acid reacted with 18.40 cm<sup>3</sup> of sodium hydroxide solution of concentration 0.15 moles per cubic decimetre.

The equation which represents the reaction is:



Calculate the concentration of aminoethanoic acid in moles per cubic decimeter.

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(2 marks)

**Q5.** When 0.4 g of a hydrocarbon gas was completely burned in oxygen, 1.1 g of carbon dioxide and 0.9 g of water were the only products.

Relative formula masses: CO<sub>2</sub> = 44; H<sub>2</sub>O = 18.

Use this information to calculate the number of moles of carbon dioxide and of water produced in this reaction. Use your answers to calculate the empirical formula of this hydrocarbon.

You must show all your working to gain full marks.

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(4 marks)

**Q6.** Spanish coin eight has a mass of 27.06 g and is 90% silver.

**(i)** Calculate the number of moles of silver in a piece of eight.

Relative atomic mass: Ag = 108.

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(2 marks)

**(ii)** Suggest why the actual mass of a piece of eight may be less than this.

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(1 mark)

**Q7.** Some acid in 25.0 cm<sup>3</sup> of champagne reacted completely with 13.5 cm<sup>3</sup> of sodium hydroxide of concentration 0.10 moles per cubic decimetre.

Calculate the concentration in moles per cubic decimetre of acid in the champagne.

Assume that 1 mole of sodium hydroxide reacts completely with 1 mole of acid.

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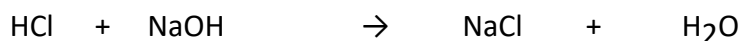
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(2 marks)

**Q8.** A student does a titration to find the concentration of a solution of hydrochloric acid. The student titrates 25.00 cm<sup>3</sup> of hydrochloric acid with sodium hydroxide solution of concentration 0.200 moles per dm<sup>3</sup>. The equation for the reaction is:



The student added 28.60 cm<sup>3</sup> of sodium hydroxide solution to neutralise the hydrochloric acid. Calculate the concentration of the hydrochloric acid.

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(3 marks)

Total marks (23)