Worksheet 6.4

Calculations involving gases and solutions

1 a What is the concentration of a solution when 60 g of sodium hydroxide is dissolved in water to make 1 dm³ of sodium hydroxide solution?

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b What is the concentration of the sodium hydroxide solution if 20 g of NaOH is added to water to make 500 cm³ of solution?

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c Calculate the volume of hydrogen evolved at r.t.p. when excess hydrochloric acid is added to 4 g of zinc.

$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$

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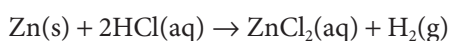
2 A student carried out a titration using 25.0 cm³ sodium hydroxide solution of unknown concentration, which was placed in a conical flask. The sodium hydroxide was exactly neutralised by 20.0 cm³ of 0.50 mol/dm³ hydrochloric acid added from a burette. What was the concentration of the sodium hydroxide solution?

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3 In a titration, 15.0 cm³ of hydrochloric acid reacted exactly with 10.0 cm³ of sodium hydroxide solution. The concentration of the acid was 0.10 mol/dm³.

a Write an equation for this reaction.

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b Calculate the number of moles of hydrochloric acid in the acid solution added to the sodium hydroxide solution.

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c Write down the number of moles of sodium hydroxide in the alkali solution.

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d Calculate the concentration of the sodium hydroxide solution.

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4 A student dissolved 2.5 g of a water softener (washing soda or sodium carbonate) in water in a conical flask. By titration it was found that exactly 17.5 cm^3 of hydrochloric acid with a concentration of 1.0 mol/dm^3 reacted with the water softener.

a Suggest an indicator that could have been used in the titration.

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b Write a balanced equation for the reaction between hydrochloric acid and sodium carbonate.

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c Calculate the number of moles of hydrochloric acid that reacted with the sodium carbonate in the flask.

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d How many moles of sodium carbonate did this react with?

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e What mass of sodium carbonate (Na_2CO_3) was this? (A_r: Na = 23, C = 12, O = 16, H = 1)

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f What mass of the water softener in the conical flask was water of crystallisation?

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g How many moles of water was this?

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h The formula of sodium carbonate can be written as $Na_2CO_3.xH_2O$.

Use your answers to parts **d** and **g** to calculate a value for x.

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