Moles questions – Solutions 1
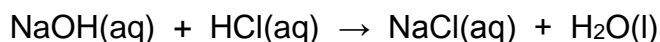
The molar volume of a gas at room temperature and pressure is 24 dm³ or 24 000 cm³

1   A student carries out a titration experiment. They measured out 25.0 cm³ of hydrochloric acid into a conical flask and put 0.100 mol/dm³ sodium hydroxide in the burette. 23.40 cm³ of sodium hydroxide was required for neutralisation.

$$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$$

Calculate the concentration of the hydrochloric acid.   [3]

2   A teacher adds excess solid sodium carbonate to 50.0 cm³ of 0.200 mol/dm³ nitric acid.

$$Na_2CO_3(s) + 2HNO_3(aq) \rightarrow 2NaNO_3(aq) + CO_2(g) + H_2O(l)$$

Calculate the volume of CO_2 produced.   [3]

3   A students adds excess magnesium to 25.0 cm³ of hydrochloric acid.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$
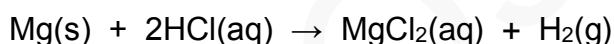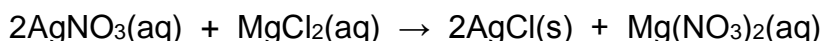
45 cm³ of hydrogen gas was produced (measured at room temperature and pressure). Calculate the concentration of the hydrochloric acid.   [3]
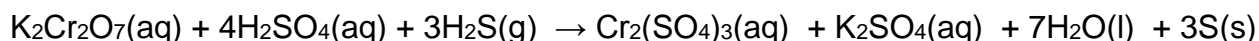
4   A student added excess silver nitrate solution to 40.0 cm³ of 0.200 mol/dm³ magnesium chloride solution. Calculate the mass of silver chloride produced.   [3]

$$2AgNO_3(aq) + MgCl_2(aq) \rightarrow 2AgCl(s) + Mg(NO_3)_2(aq)$$

5   Following reaction can be used as a test for hydrogen sulphide.

$K_2Cr_2O_7(aq) + 4H_2SO_4(aq) + 3H_2S(g) \rightarrow Cr_2(SO_4)_3(aq) + K_2SO_4(aq) + 7H_2O(l) + 3S(s)$

A student put 0.0200 mol/dm^3 potassium dichromate(VI) ($K_2Cr_2O_7$) in a beaker and added excess sulfuric acid to acidify it. She then bubbled excess hydrogen sulphide through the acidified potassium dichromate(VI) solution. 0.192 g of sulfur was produced. Calculate the volume of potassium dichromate(VI) solution that was used.   [3]

6   The test for Fe^{3+} ions is to add sodium hydroxide solution to a solution and look for the production of an orange-brown precipitate of iron(III) hydroxide.

$FeCl_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3NaCl(aq)$
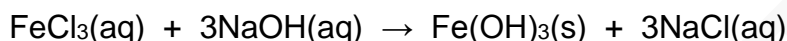
A student added excess iron(III) chloride solution to 2.00 cm^3 of 0.100 mol/dm^3 sodium hydroxide solution. Calculate the mass of iron(III) hydroxide produced.   [3]

7   Fe^{2+} ions are oxidised by an acidified solution of potassium manganate(VII):

$10FeSO_4(aq) + 8H_2SO_4(aq) + 2KMnO_4(aq) \rightarrow 2MnSO_4(aq) + 5Fe_2(SO_4)_3(aq) + 8H_2O(l) + K_2SO_4(aq)$

A student put 25.0 cm^3 of 0.0200 mol/dm^3 $KMnO_4$(aq) in a beaker and added excess sulfuric acid. They then added iron(II) sulfate from a burette until the purple colour of the $KMnO_4$ disappeared completely. 28.30 cm^3 of iron(II) sulafte solution was required for exact reaction. Calculate the concentration of the iron(II) sulfate solution.   [3]