Titrations 1 Answers

Question 1

25.0 cm³ of sodium hydroxide solution reacted with 18.5 cm³ of 0.120 mol/dm³ hydrochloric acid.
$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

a) Calculate the concentration of the sodium hydroxide solution in mol/dm³. Give your answer to 3 significant figures.

Answer:

1. **Calculate the moles of HCl:** Moles = (volume in cm³ / 1000) x concentration Moles of HCl = (18.5 / 1000) dm³ x 0.120 mol/dm³ = 0.00222 mol
2. **From the balanced equation, the mole ratio of NaOH to HCl is 1:1.** Therefore, moles of NaOH = 0.00222 mol
3. **Calculate the concentration of NaOH:** Concentration = moles / (volume in cm³ / 1000) Concentration of NaOH = 0.00222 mol / (25.0 / 1000) dm³ = **0.0888 mol/dm³**

Question 2

15.8 cm³ of potassium hydroxide solution reacted with 20.0 cm³ of 0.085 mol/dm³ nitric acid.
$KOH(aq) + HNO_3(aq) \rightarrow KNO_3(aq) + H_2O(l)$

a) Calculate the concentration of the potassium hydroxide solution in mol/dm³. Give your answer to 3 significant figures.

Answer:

1. **Moles of HNO₃:** (20.0 / 1000) dm³ x 0.085 mol/dm³ = 0.00170 mol
2. **Mole ratio KOH:HNO₃ is 1:1.** Moles of KOH = 0.00170 mol
3. **Concentration of KOH:** 0.00170 mol / (15.8 / 1000) dm³ = **0.108 mol/dm³**

Question 3

21.2 cm³ of sodium hydroxide solution reacted with 25.0 cm³ of 0.105 mol/dm³ hydrochloric acid.
$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

Answer:

1. **Moles of HCl:** (25.0 / 1000) dm³ x 0.105 mol/dm³ = 0.002625 mol
2. **Moles of NaOH:** 0.002625 mol
3. **Concentration of NaOH:** 0.002625 mol / (21.2 / 1000) dm³ = **0.124 mol/dm³**

Question 4

17.0 cm³ of potassium hydroxide solution reacted with 15.0 cm³ of 0.135 mol/dm³ nitric acid.
$KOH(aq) + HNO_3(aq) \rightarrow KNO_3(aq) + H_2O(l)$

Answer:

1. **Moles of HNO₃:** (15.0 / 1000) dm³ x 0.135 mol/dm³ = 0.002025 mol
2. **Moles of KOH:** 0.002025 mol
3. **Concentration of KOH:** 0.002025 mol / (17.0 / 1000) dm³ = **0.119 mol/dm³**

Question 5

23.5 cm³ of sodium hydroxide solution reacted with 20.0 cm³ of 0.095 mol/dm³ hydrochloric acid.
NaOH(aq) + HCl(aq) --> NaCl(aq) + H₂O(l)

Answer:

1. **Moles of HCl:** (20.0 / 1000) dm³ x 0.095 mol/dm³ = 0.00190 mol
2. **Moles of NaOH:** 0.00190 mol
3. **Concentration of NaOH:** 0.00190 mol / (23.5 / 1000) dm³ = **0.0809 mol/dm³**

Question 6

19.8 cm³ of potassium hydroxide solution reacted with 25.0 cm³ of 0.115 mol/dm³ nitric acid.
KOH(aq) + HNO₃(aq) --> KNO₃(aq) + H₂O(l)

Answer:

1. **Moles of HNO₃:** (25.0 / 1000) dm³ x 0.115 mol/dm³ = 0.002875 mol
2. **Moles of KOH:** 0.002875 mol
3. **Concentration of KOH:** 0.002875 mol / (19.8 / 1000) dm³ = **0.145 mol/dm³**

Question 7

16.2 cm³ of sodium hydroxide solution reacted with 18.0 cm³ of 0.075 mol/dm³ hydrochloric acid.
NaOH(aq) + HCl(aq) --> NaCl(aq) + H₂O(l)

Answer:

1. **Moles of HCl:** (18.0 / 1000) dm³ x 0.075 mol/dm³ = 0.00135 mol
2. **Moles of NaOH:** 0.00135 mol
3. **Concentration of NaOH:** 0.00135 mol / (16.2 / 1000) dm³ = **0.0833 mol/dm³**

Question 8

22.8 cm³ of potassium hydroxide solution reacted with 20.0 cm³ of 0.100 mol/dm³ nitric acid.
KOH(aq) + HNO₃(aq) --> KNO₃(aq) + H₂O(l)

Answer:

1. **Moles of HNO₃:** (20.0 / 1000) dm³ x 0.100 mol/dm³ = 0.00200 mol
2. **Moles of KOH:** 0.00200 mol
3. **Concentration of KOH:** 0.00200 mol / (22.8 / 1000) dm³ = **0.0877 mol/dm³**

Question 9

18.5 cm³ of sodium hydroxide solution reacted with 15.0 cm³ of 0.125 mol/dm³ hydrochloric acid.

NaOH(aq) + HCl(aq) --> NaCl(aq) + $H_2O(l)$
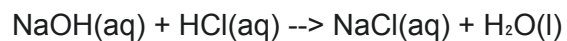
Answer:

1. **Moles of HCl:** (15.0 / 1000) dm³ x 0.125 mol/dm³ = 0.001875 mol
2. **Moles of NaOH:** 0.001875 mol
3. **Concentration of NaOH:** 0.001875 mol / (18.5 / 1000) dm³ = **0.101 mol/dm³**

Question 10

24.2 cm³ of potassium hydroxide solution reacted with 25.0 cm³ of 0.090 mol/dm³ nitric acid.
KOH(aq) + HNO_3(aq) --> KNO_3(aq) + $H_2O(l)$
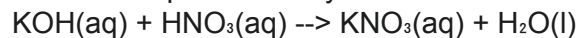
Answer:

1. **Moles of HNO_3:** (25.0 / 1000) dm³ x 0.090 mol/dm³ = 0.00225 mol
2. **Moles of KOH:** 0.00225 mol
3. **Concentration of KOH:** 0.00225 mol / (24.2 / 1000) dm³ = **0.0930 mol/dm³**