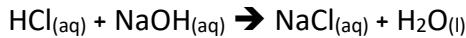


## Titration Calculations & Questions

1. Use the information to determine the concentration of the hydrochloric acid.
- A 25 cm<sup>3</sup> sample of hydrochloric acid is sucked into a pipette and transferred into a 250 cm<sup>3</sup> volumetric flask. The solution is made up to the mark.
  - 25 cm<sup>3</sup> of the diluted acid is transferred into a conical flask using a pipette.
  - A burette is used to neutralise the acid with 0.100 mol dm<sup>-3</sup> sodium hydroxide.

Hydrochloric acid reacts with sodium hydroxide according to the equation:



- a. The average titre of the sodium hydroxide solution was 30.00 cm<sup>3</sup>. Calculate the number of moles in the average titre.

\_\_\_\_\_ mol (1)

- b. Determine the number of moles in the diluted sample of hydrochloric acid, and hence the concentration of the diluted acid.

\_\_\_\_\_ mol dm<sup>-3</sup> (2)

- c. Calculate the concentration of the undiluted hydrochloric acid in mol dm<sup>-3</sup>.

\_\_\_\_\_ mol dm<sup>-3</sup> (1)

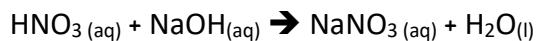
- d. Calculate the concentration of the hydrochloric acid in g dm<sup>-3</sup>.

\_\_\_\_\_ g dm<sup>-3</sup> (2)

2. Use the information to determine the concentration of the nitric acid.

- A 10 cm<sup>3</sup> sample of nitric acid is sucked into a pipette and transferred into a 100 cm<sup>3</sup> volumetric flask. The solution is made up to the mark.
- 25 cm<sup>3</sup> of the diluted acid is transferred into a conical flask using a pipette.
- A burette is used to neutralise the acid with 0.150 mol dm<sup>-3</sup> sodium hydroxide.

Nitric acid reacts with sodium hydroxide according to the equation:



- a. The average titre of the sodium hydroxide solution was 23.33 cm<sup>3</sup>. Calculate the number of moles in the average titre.

\_\_\_\_\_ mol (1)

- b. Determine the number of moles in the diluted sample of nitric acid, and hence the concentration of the diluted acid.

\_\_\_\_\_ mol dm<sup>-3</sup> (2)

- c. Calculate the concentration of the undiluted nitric acid in mol dm<sup>-3</sup>.

\_\_\_\_\_ mol dm<sup>-3</sup> (1)

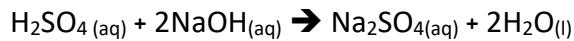
- d. Calculate the concentration of the nitric acid in g dm<sup>-3</sup>.

\_\_\_\_\_ g dm<sup>-3</sup> (2)

3. Use the information to determine the concentration of the sulfuric acid.

- A 25 cm<sup>3</sup> sample of sulfuric acid is sucked into a pipette and transferred into a 500 cm<sup>3</sup> volumetric flask. The solution is made up to the mark.
- 25 cm<sup>3</sup> of the diluted acid is transferred into a conical flask using a pipette.
- A burette is used to neutralise the acid with 0.100 mol dm<sup>-3</sup> sodium hydroxide.

Sulfuric acid reacts with sodium hydroxide according to the equation:



- a. The average titre of the sodium hydroxide solution was 25.00 cm<sup>3</sup>. Calculate the number of moles in the average titre.

\_\_\_\_\_ mol (1)

- b. Determine the number of moles in the diluted sample of sulfuric acid, and hence the concentration of the diluted acid.

\_\_\_\_\_ mol dm<sup>-3</sup> (2)

- c. Calculate the concentration of the undiluted sulfuric acid in mol dm<sup>-3</sup>.

\_\_\_\_\_ mol dm<sup>-3</sup> (1)

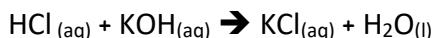
- d. Calculate the concentration of the sulfuric acid in g dm<sup>-3</sup>.

\_\_\_\_\_ g dm<sup>-3</sup> (2)

4. Use the information to determine the concentration of the hydrochloric acid.

- A 10 cm<sup>3</sup> sample of hydrochloric acid is sucked into a pipette and transferred into a 500 cm<sup>3</sup> volumetric flask. The solution is made up to the mark.
- 25 cm<sup>3</sup> of the diluted acid is transferred into a conical flask using a pipette.
- A burette is used to neutralise the acid with 0.050 mol dm<sup>-3</sup> potassium hydroxide.

Hydrochloric acid reacts with potassium hydroxide according to the equation:



- a. The average titre of the potassium hydroxide solution was 20.00 cm<sup>3</sup>. Calculate the number of moles in the average titre.

\_\_\_\_\_ mol (1)

- b. Determine the number of moles in the diluted sample of hydrochloric acid, and hence the concentration of the diluted acid.

\_\_\_\_\_ mol dm<sup>-3</sup> (2)

- c. Calculate the concentration of the undiluted hydrochloric acid in mol dm<sup>-3</sup>.

\_\_\_\_\_ mol dm<sup>-3</sup> (1)

- d. Calculate the concentration of the hydrochloric acid in g dm<sup>-3</sup>.

\_\_\_\_\_ g dm<sup>-3</sup> (2)

### Questions

1. Explain what the effect on the titre would be if:

- a. The pipette used to transfer the acid solution was filled to slightly above the mark.  
(2)

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- b. The pipette used to transfer the acid solution was filled to slightly below the mark.  
(2)

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- c. The volumetric flask was filled to slightly above the mark. (2)

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- d. The volumetric flask was filled to slightly below the mark. (2)

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2. Calculate the percentage uncertainty of:

- a. A  $100 \text{ cm}^3$  volumetric flask with an uncertainty of  $0.1 \text{ cm}^3$ . (1)

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- b. A  $250 \text{ cm}^3$  volumetric flask with an uncertainty of  $0.2 \text{ cm}^3$ . (1)

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- c. A  $500 \text{ cm}^3$  volumetric flask with an uncertainty of  $0.5 \text{ cm}^3$ . (1)

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3. A student suggests washing out the pipette with water before filling it with acid solution. Explain why this is not a good idea. (2)

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Total marks: 37