

## Chapter test

# Chapter 4 Volumetric analysis

Name: \_\_\_\_\_

Class: \_\_\_\_\_

**Time permitted: 50 minutes**

|          | Section         | Number of questions | Marks available | Marks achieved |
|----------|-----------------|---------------------|-----------------|----------------|
| <b>A</b> | Multiple choice | 15                  | 15              |                |
| <b>B</b> | Short answer    | 5                   | 15              |                |
|          | <b>Total</b>    | <b>20</b>           | <b>30</b>       |                |

**Grade:** \_\_\_\_\_

**Scale:**

|           |       |          |       |          |       |          |       |          |       |          |      |           |     |
|-----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|------|-----------|-----|
| <b>A+</b> | 29–30 | <b>A</b> | 26–28 | <b>B</b> | 23–25 | <b>C</b> | 19–22 | <b>D</b> | 15–18 | <b>E</b> | 9–14 | <b>UG</b> | 0–8 |
|-----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|------|-----------|-----|

**Comments:**

## Section A Multiple choice (15 marks)

Section A consists of 15 questions, each worth one mark. Each question has only one correct answer. Circle the correct answer. Attempt all questions. Marks will not be deducted for incorrect answers. You are advised to spend no more than 15 minutes on this section.

- 1 A 50 mL  $0.2 \text{ mol L}^{-1}$  solution of NaOH is diluted to 500 mL with water. What is the final concentration of the NaOH?  
**A**  $0.01 \text{ mol L}^{-1}$   
**B**  $0.02 \text{ mol L}^{-1}$   
**C**  $0.1 \text{ mol L}^{-1}$   
**D**  $0.2 \text{ mol L}^{-1}$
- 2 A sample of oxalic acid is pipetted into a small conical flask and titrated with NaOH solution from a burette. Which of the following lists the correct rinsing procedure?  
**A** Rinse the pipette and flask with oxalic acid solution and the burette with NaOH.  
**B** Rinse pipette and flask with oxalic solution and the burette with distilled water.  
**C** Rinse the pipette and flask with distilled water and the burette with NaOH.  
**D** Rinse the pipette with oxalic acid, the flask with distilled water and the burette with NaOH.
- 3 What is a standard solution?  
**A** A solution whose concentration is to be determined  
**B** A solution made from a standard compound  
**C** A solution of an unknown substance  
**D** A solution whose concentration is accurately known
- 4 A primary standard is:  
**A** a solution whose concentration is accurately known.  
**B** a solid suitable for making a standard solution.  
**C** a compound with a large molecular mass.  
**D** a simple substance.
- 5 An indicator:  
**A** determines an equivalence point.  
**B** approximates an endpoint.  
**C** changes colour at the endpoint.  
**D** changes colour at various pH values.
- 6 Which of the following is not a unit of concentration?  
**A**  $\text{mol L}^{-1}$   
**B**  $\text{g mol}^{-1}$   
**C**  $\text{g L}^{-1}$   
**D** ppm

- 7 When titrating:
- A rinse all glassware with distilled water.
  - B rinse only the burette with distilled water.
  - C rinse the pipette and titre flasks with distilled water.
  - D rinse the pipette with solution being used in it.
- 8 What volume should be used in calculations from these results?
- |                             |       |       |       |       |
|-----------------------------|-------|-------|-------|-------|
| <b>Initial reading (mL)</b> | 0.45  | 16.00 | 31.40 | 1.40  |
| <b>Final reading (mL)</b>   | 16.00 | 31.40 | 46.75 | 16.80 |
- A 15.43
  - B 15.38
  - C 15.40
  - D 15.39
- 9 Acid–base titrations are always used for determining concentrations with:
- A strong acids/strong bases and weak acid/weak base solutions.
  - B strong acid/weak base and weak acid/strong base solutions.
  - C strong acids/weak base solutions only.
  - D strong acid/strong base solutions only.
- 10 Equivalence point and endpoint:
- A are determined by stoichiometry and indicators respectively.
  - B are the same thing.
  - C change depending on indicator used.
  - D are never the same.
- 11 A good primary standard:
- A must be a solution.
  - B must have a low molecular mass.
  - C must be obtainable as a pure solid substance.
  - D must be insoluble.
- 12 A weak base:
- A only partially dissociates to release  $\text{OH}^-$  ions.
  - B only accepts a few protons.
  - C only partially dissociates to produce a low percentage of  $\text{OH}^-$  ions.
  - D is not very soluble in water.
- 13 Parallax error:
- A never occurs if reading volume at eye level.
  - B occurs at all times unless you wear glasses.
  - C occurs when reading volumes at an angle.
  - D only occurs with solutions that have a meniscus.



- 14** To make up a standard solution:
- A** make the solution up to the mark in a measuring cylinder.
  - B** make the solution up to the mark in a burette.
  - C** make the solution up to the mark in a volumetric flask.
  - D** make the solution up to the mark in a beaker.
- 15** A successful titration will have three concordant results, which means:
- A** the concentration of the solution varies within  $0.1 \text{ mol L}^{-1}$ .
  - B** the volume of the titres agree to  $0.1 \text{ mL}$  of each other.
  - C** the average of the titres agree within  $0.01 \text{ mL}$  each time it is calculated.
  - D** the indicator changes colour at the same volume each time.

### Section B Short answer (15 marks)

Section B consists of five questions. Write your answers in the spaces provided. You are advised to spend 20 minutes on this section.

- 1 a** Explain the difference between endpoint and equivalence point in titrations.
- b** Name a suitable indicator for a strong acid strong base titration.

(2 + 1 = 3 marks)

- 2** Name three requirements for a primary standard.

(3 marks)

- 3 a** You need  $64 \text{ mL}$  of  $0.5 \text{ mol L}^{-1} \text{ NaOH}$  to neutralise  $123 \text{ mL}$  of an  $\text{HCl}$  solution. Calculate the concentration of the acid.
- b** It takes  $55 \text{ mL}$  of  $0.1 \text{ mol L}^{-1} \text{ KOH}$  to neutralise  $245 \text{ mL HNO}_3$ . Determine the nitric acid concentration.
- c** A  $222 \text{ mL}$  solution of  $\text{H}_2\text{SO}_4$  is neutralised by  $77 \text{ mL}$  of  $0.2 \text{ mol L}^{-1}$  of  $\text{NaOH}$ . What is the concentration of the sulfuric acid?

(1 + 1 + 1 = 3 marks)

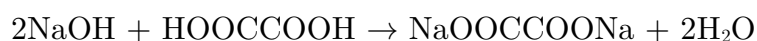
- 4 a Explain why phenolphthalein can be used as an indicator for both a weak acid and a strong acid being titrated against a strong base, while methyl red could be used for the strong acid/strong base but not for the weak acid/strong base?

- b Which indicator would you use for the titration of KOH with CH<sub>3</sub>COOH? Explain.

(2 + 1 = 3 marks)

- 5 A titration was done to standardise a solution of approximately 0.1 mol L<sup>-1</sup> NaOH, using oxalic acid. 0.18 g of oxalic acid was completely dissolved in 20 mL of distilled water and titrated with the base. Using the results below, determine the concentration of the base.

Molar mass of oxalic acid, HOOC<sub>2</sub>COOH, is 126 g mol<sup>-1</sup>



|                             |       |       |       |       |
|-----------------------------|-------|-------|-------|-------|
| <b>Initial reading (mL)</b> | 0.00  | 0.10  | 0.10  | 0.10  |
| <b>Final reading (mL)</b>   | 22.00 | 20.10 | 20.20 | 20.00 |

(3 marks)