



# VCE Chemistry Practice Paper 1

Units 3 & 4 — Practice Examination

**Section A: 20 multiple-choice (20 marks) · Section B: short-answer and extended-response (100 marks) · 120 marks in all**

## How to use this booklet

- Reading time – 15 minutes. Writing time – 2 hours 30 minutes. A scientific calculator and the data sheet at the back of the paper are permitted.
- Section A has 20 multiple-choice questions (1 mark each). Section B has 31 questions (100 marks); show working wherever more than one mark is available.
- A data sheet (atomic masses, constants,  $K_a$ ,  $K_{sp}$ ,  $E^\circ$  values) is provided at the back of the question paper.
- Worked solutions follow the paper: every question has step-by-step working, a key takeaway and (for multiple choice) a note on why each wrong option is wrong.

## SECTION A — MULTIPLE-CHOICE QUESTIONS

20 marks · Answer all questions

Choose the response that is correct or that best answers the question. A correct answer scores 1; an incorrect answer scores 0. Marks will not be deducted for incorrect answers.

**1. A current of 3.9 A flows for 10 minutes through a solution containing copper ions, depositing copper metal at the cathode. (Faraday constant =  $96\,485\text{ C mol}^{-1}$ .) Calculate the mass of copper deposited.**

- A 0.385 g
- B 0.193 g
- C 1.54 g
- D 0.771 g

**2. Before a titration a burette should be rinsed with:**

- A the solution it will contain
- B the solution in the conical flask
- C a detergent solution
- D distilled water only

**3. The  $^1\text{H}$  NMR spectrum of 2-methylpropanoic acid ( $\text{C}_4\text{H}_8\text{O}_2$ ) is recorded. Ignore any splitting caused by hydrogen atoms on oxygen. How many signals appear in the spectrum?**

- A 3
- B 2
- C 4
- D 5

**4. A spirit burner containing methanol is used to heat 160 g of water in a calorimeter. 1.60 g of methanol is burned and the temperature of the water rises by  $16.0\text{ }^\circ\text{C}$ . The molar enthalpy of combustion of methanol is  $726.0\text{ kJ mol}^{-1}$ . (Specific heat capacity of water  $4.18\text{ J g}^{-1}\text{ }^\circ\text{C}^{-1}$ ;  $M(\text{methanol}) = 32.04\text{ g mol}^{-1}$ .) Calculate the energy absorbed by the water, in kJ.**

- A 0.107 kJ
- B 10.7 kJ
- C 10700 kJ
- D 2.56 kJ

5. Consider the reaction  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ . A 40 g sample of  $\text{CH}_4$  reacts completely with an excess of  $\text{O}_2$ . What mass of  $\text{CO}_2$  is produced?

- A 110 g
- B 54.9 g
- C 40.0 g
- D 220 g

6. A compound has the condensed structural formula  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{Br})\text{CHO}$ . Which functional group is present in this compound?

- A a haloalkane
- B an aldehyde
- C a ketone
- D a carboxylic acid

7. Bromine water is added to samples of hexane and hex-1-ene. Which observation is correct?

- A The bromine water is decolourised by both
- B The bromine water is decolourised by hex-1-ene but not by hexane
- C Neither sample changes the colour of bromine water
- D The bromine water is decolourised by hexane but not by hex-1-ene

8. But-2-ene ( $\text{CH}_3\text{CH}=\text{CHCH}_3$ ) reacts with hydrogen bromide. Name the organic product of the reaction.

- A but-2-ene
- B 2,3-dibromobutane
- C 2-bromobutane
- D butane

9. A sample of  $\text{MgO}$  has a mass of 150 g. (Use the atomic masses from the data sheet: H 1.008, C 12.01, N 14.01, O 16.00, Na 22.99, Mg 24.31, Al 26.98, S 32.07, Cl 35.45, K 39.10, Ca 40.08, Mn 54.94, Fe 55.85, Cu 63.55, Ag 107.9, Ba 137.3;  $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$ .) How many moles of  $\text{MgO}$  are in the sample?

- A 7.44 mol
- B 6050 mol
- C 0.269 mol
- D 3.72 mol

## WORKED SOLUTIONS

Answers & worked solutions

### Multiple-choice answer key

|    |   |    |   |    |   |    |   |    |   |    |   |
|----|---|----|---|----|---|----|---|----|---|----|---|
| 1  | D | 2  | A | 3  | A | 4  | B | 5  | A | 6  | B |
| 7  | B | 8  | C | 9  | D | 10 | D | 11 | A | 12 | B |
| 13 | A | 14 | C | 15 | D | 16 | C | 17 | C | 18 | B |
| 19 | D | 20 | C |    |   |    |   |    |   |    |   |

### SECTION A — MULTIPLE-CHOICE QUESTIONS

1. A current of 3.9 A flows for 10 minutes through a solution containing copper ions, depositing copper metal at the cathode. (Faraday constant =  $96\,485\text{ C mol}^{-1}$ .) Calculate the mass of copper deposited. [Electrochemistry]

**Correct answer: D — 0.771 g**

- Charge  $Q = It = 3.9 \times 600 = 2340$  C.
- Moles of electrons =  $Q \div F = 2340 \div 96\,485 = 0.0243$  mol.
- $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ , so  $n(\text{Cu}) = 0.0243 \div 2 = 0.0121$  mol.
- Mass =  $n \times M = 0.0121 \times 63.55 = 0.771$  g
- Why the other options are wrong:
  - A (0.385 g): halved the answer
  - B (0.193 g): divided by the charge twice
  - C (1.54 g): ignored the charge on the ion (1 mol of  $\text{e}^-$  per mole of metal)

LOS: Electrochemistry

#### KEY TAKEAWAY

Electrolysis:  $Q = It$ ;  $n(\text{e}^-) = Q/F$ ; use the half-equation to link moles of electrons to moles of product; then  $m = nM$ .

2. Before a titration a burette should be rinsed with: [Volumetric analysis]

**Correct answer: A — the solution it will contain**

- Rinsing with the solution removes traces of water that would dilute it.
- The conical flask and volumetric flask are rinsed with distilled water, because extra water there does not change the number of moles.
- Why the other options are wrong:
  - B (the solution in the conical flask): this contaminates the burette
  - C (a detergent solution): detergent would contaminate the solution
  - D (distilled water only): this would dilute the solution in the burette

LOS: Volumetric analysis