Section A: Multiple Choice: (1 mark each)
Write your answers on the multiple choice grid on page 2

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2   (B) 6   (C) 8   (D) 9

A ◯   B ⬤   C ◯   D ◯

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ⬤   B ⊗   C ◯   D ◯

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.

correct

A ⊗   B ⊗   C ◯   D ◯

1. Which substance would not be classified as an acid according to Lavoisier*?*

(A) CH_3COOH
(B) HCl
(C) H_2SO_4
(D) H_2CO_3

2. Which equation shows the ionisation of sulfuric acid in water*?*

(A) $H_2SO_4 \text{ (l)} + H_2O \text{ (l)} \rightarrow 2H_2O \text{ (l)} + SO_3 \text{ (aq)}$

(B) $H_2SO_4 \text{ (l)} + H_2O \text{ (l)} \rightarrow H_3O^+ \text{ (aq)} + OH^- \text{ (aq)} + SO_3 \text{ (aq)}$

(C) $H_2SO_4 \text{ (l)} + H_2O \text{ (l)} \rightarrow H_2SO_3 \text{ (aq)} + H_2O_2 \text{ (aq)}$

(D) $H_2SO_4 \text{ (l)} + H_2O \text{ (l)} \rightarrow H_3O^+ \text{ (aq)} + HSO_4^- \text{ (aq)}$

3. The table shows data about four different acid solutions …

Solution	Data
A	pH 3.50
B	$[H^+] = 2.0 \times 10^{-4} \text{ mol L}^{-1}$
C	$0.00025 \text{ mol L}^{-1} \text{ CH}_3\text{COOH}$
D	$0.00025 \text{ mol L}^{-1} \text{ HCl}$

Which solution will have the lowest pH*?*

(A)   A
(B)   B
(C)   C
(D)   D

4. Rosa Canina wanted to see if a certain potting mix is suitable for cultivating a special type of grass seed requiring a soil pH of 4.5. Given the following indicator properties:

Indicator	Transition pH
Methyl orange (MO)	3.1 – 4.4
Bromothymol blue (BTB)	6.0 – 7.6
Phenolphthalein (Ph)	8.0 – 9.6

Which indicator or combination of indicators will she need to ascertain the pH most accurately.

(A) BTB and MO
(B) BTB and Ph
(C) BTB only
(D) MO only

5. Which of the following is the best description for a 0.01 mol L^{-1} solution of citric acid?

(A) A dilute strong acid solution
(B) A dilute weak acid solution
(C) A concentrated strong acid solution
(D) A concentrated dilute acid solution

6. Which of the following is an acidic oxide?

(A) CoO
(B) CaO
(C) MgO
(D) NO_2

Section A

Multiple Choice Answer Grid

1. A O   B O   C O   D O

2. A O   B O   C O   D O

3. A O   B O   C O   D O

4. A O   B O   C O   D O

5. A O   B O   C O   D O

6. A O   B O   C O   D O

Section B: Questions requiring short answers

Question 7 (**3 marks**)

Concentrated sulfuric acid is shipped around Australia in large steel tanks by road and rail transport. Accidents have occurred where the acid tanks have ruptured and the concentrated acid has spilled out into the surrounding environment.

Assess the use of neutralisation reactions as a safety measure to minimise damage in such accidents. **(3 marks)**
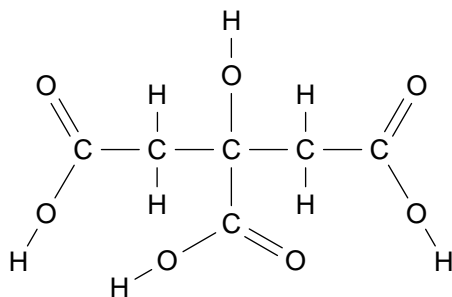
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Question 8 (**1 mark**)

Compare the relative strengths of 0.10 mol L^{-1} solutions of acetic, citric and hydrochloric acids.

(1 mark)

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Question 9

Calculate the mass of citric acid crystals required to prepare 500 mL of 0.10 mol L^{-1} solution.
   (1 mark)

Citric acid

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Question 10

Identify the need for collaboration between chemists as they collect and analyse data.   **(2 marks)**

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Question 11

Ken Chemiski attempts to prepare propyl butanoate by setting up the apparatus diagrammed.
► *For clarity, supporting clamps are not shown on the diagram.*

He mixes 25mL of the alkanoic acid and 25mL of the alkanol in the flask and adds a few boiling chips. The reaction mixture is heated using a hot plate set on low heat.

(a)   Identify two errors Ken has made in his procedure/equipment.   **(2 marks)**

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water inlet

water outlet

(b)   Using structural formulae write the balanced equation for the esterification reaction.   **(1 mark)**

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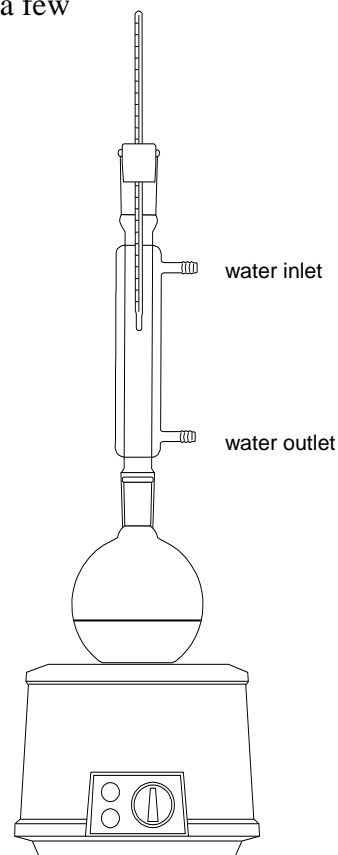
Question 12 **(3 marks)**

The mass of a sealed 300mL soft drink was found to be 400.02g. The soft drink was then decarbonated by shaking, opening gently to release the gas and recapping, the series of processes being done several times. When no visible sign of gas was being evolved, the capped soft drink weighed 397.08g.

What volume of carbon dioxide gas was released at 25°C and 100 kPa? Show your working (**3 marks**)

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Question 13 (3 marks)

Describe an experiment which will allow you to decide which of two acids, HX and HZ is the stronger. Justify your answer. (**3 marks**)

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Question 14 (2 marks)

Describe the way in which a medical radioisotope is used and explain its use in terms of its chemical property.

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Question 15   (3 marks)

(a) Write a net ionic equation to explain the acidity of a solution of carbon dioxide in
    water.   (**1 mark**)

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(b) What will happen to the pH of carbonated water if the temperature of the solution is increased?
    Explain your answer   (**1 mark**)

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(c) What happens to the pH of the carbonated water if the pressure of the gas above the solution is
     reduced? Explain your answer.   (**1 mark**)

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A END of TEST