Neap

Trial Examination 2023

HSC Year 12 Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used
- A formulae sheet, data sheet and Periodic Table are provided at the back of this paper

Total Marks: 100

Section I – 20 marks (pages 2–10)

- Attempt Questions 1– 20
- Allow about 35 minutes for this section

Section II – 80 marks (pages 11–34)

- Attempt Questions 21– 33
- Allow about 2 hours and 25 minutes for this section

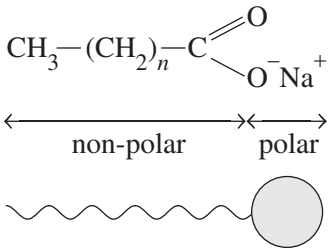
Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2023 HSC Year 12 Chemistry examination.

SECTION I

20 marks
Attempt Questions 1–20
Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1–20.

1 Consider the diagram.



The diagram represents the structure of a

A. detergent molecule.
B. soap molecule.
C. hydrocarbon.
D. polymer.

2 Which of the following statements about activation energy, E_a, and equilibrium is correct?

A. Lowering the E_a will cause a reaction to reach equilibrium faster.
B. Lowering the E_a will shift the position of equilibrium to increase product yield.
C. E_a affects only exothermic equilibrium reactions.
D. E_a does not apply to equilibrium reactions.

3 Which row of the table correctly describes dynamic equilibrium and static equilibrium?

	Dynamic equilibrium	*Static equilibrium*
A.	It is reversible in nature.	It is reversible in nature.
B.	No further chemical reaction occurs in the system.	The reactants and the products are still participating in chemical reactions.
C.	The forward and backward reaction rates are zero.	The forward and backward reaction rates are zero.
D.	It occurs in only closed systems.	It occurs in both open and closed systems.

4 Phosphoric acid (H_3PO_4) is a tribasic acid.

An aqueous solution of H_3PO_4 is used to neutralise a sample of powdered potassium hydroxide (KOH).

Which of the following equations represents this reaction?

A. $H_3PO_4(aq) + 3KOH(s) \rightarrow K_3PO_4(aq) + 3H_2O(l)$

B. $H_3PO_4(s) + 3KOH(s) \rightarrow K_3PO_4(aq) + 3H_2O(l)$

C. $3H_3PO_4(s) + KOH(s) \rightarrow K_3PO_4(aq) + H_2O(l)$

D. $H_3PO_4(aq) + 3KOH(s) \rightarrow K_3PO_4(s) + 3H_2O(l)$

5 Which of the following could be used as a buffer?

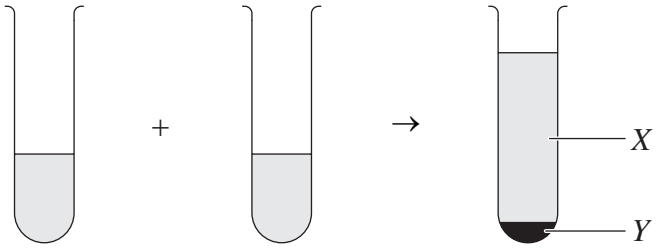
A. distilled water

B. a solution containing only sodium chloride

C. a solution containing a strong acid and a strong base

D. a solution containing a weak acid and its salt

6 The diagram shows two solutions being mixed.



lead(II) nitrate ($Pb(NO_3)_2(aq)$) potassium iodide ($KI(aq)$)

Which row of the table identifies *X* and *Y*?

	X	*Y*
A.	$PbI_2(aq)$	$KNO_3(s)$
B.	$KNO_3(aq)$	$PbI_2(s)$
C.	$PbI_2(s)$	$KNO_3(aq)$
D.	$KNO_3(s)$	$PbI_2(aq)$

7 The enthalpy change, ΔH, of a reaction is –30 kJ, and the entropy change, ΔS, is –90 J K^{-1}.

At what temperature will this reaction change from spontaneous to non-spontaneous?

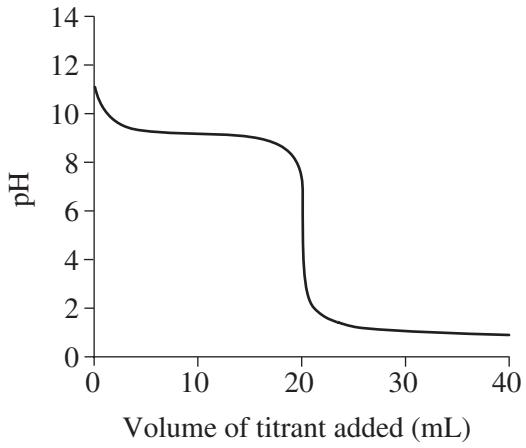
A. 30°C

B. 333°C

C. 333 K

D. 670 K

8 Consider the titration curve.



Based on the curve, what can be concluded about the titration?

A. A strong acid was added to a strong base.

B. A strong acid was added to a weak base.

C. A strong base was added to a strong acid.

D. A weak acid was added to a weak base.

9 If the pH of a solution is 3.5, what is the solution's hydroxide ion concentration, $[OH^-]$?

A. $1 \times 10^{-10.5}$ mol L^{-1}

B. $1 \times 10^{-3.5}$ mol L^{-1}

C. $1 \times 10^{3.5}$ mol L^{-1}

D. $1 \times 10^{10.5}$ mol L^{-1}

10 Which of the following best describes a Brønsted–Lowry base?

A. When dissolved in water, it increases the concentration of hydrogen ions, $[H^+]$.

B. When dissolved in water, it increases the concentration of hydroxide ions, $[OH^-]$.

C. It donates protons to another species.

D. It accepts protons from another species.

11 Which of the following reactions is most likely to occur?

A. $C_2H_6(g) + H_2O(l) \rightarrow C_2H_5OH(l) + H_2(g)$

B. $C_6H_{14}(g) + H_2(g) \rightarrow C_6H_{16}(g)$

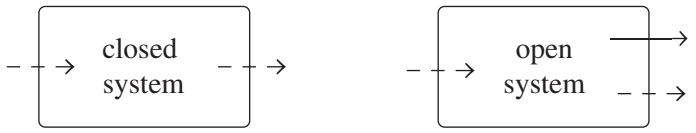
C. $C_6H_{12}(g) + HCl(aq) \rightarrow C_6H_{13}Cl(g)$

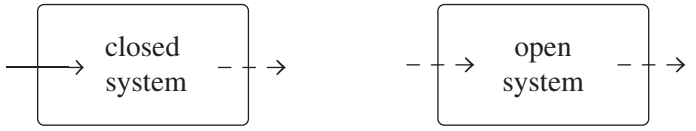
D. $C_8H_{18}(l) + Cl_2(g) \rightarrow C_6H_{14}Cl_2(l)$

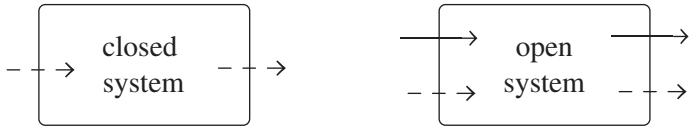
12 A student drew a diagram that illustrated the flow of matter and energy in closed and open systems. They used the following key.

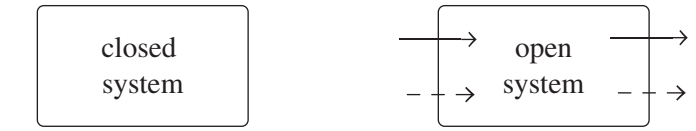
KEY
⟶ exchange of matter with the surroundings
- - → exchange of energy with the surroundings

Which of the following could be the student's diagram?

A 

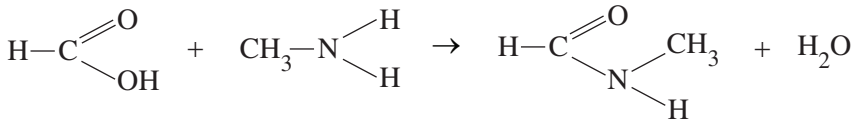
B. 

C. 

D. 

13 The diagram shows molecules *P* and *Q* reacting to form molecule *R* and water.

P *Q* *R*

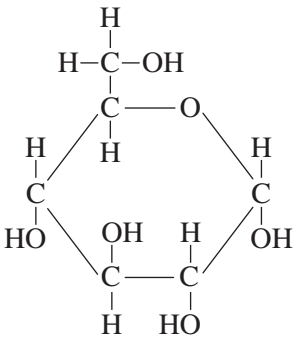


Which row of the table identifies the molecule types?

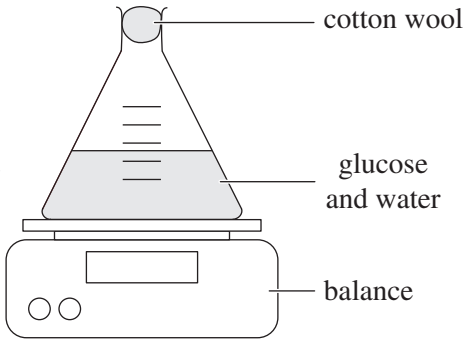
	P	*Q*	*R*
A.	carboxylic acid	amine	amide
B.	carboxylic acid	amide	amine
C.	alcohol	amine	ester
D.	aldehyde	amide	ketone

Use the following information to answer Questions 14 and 15.

Consider the structural formula of glucose ($C_6H_{12}O_6$).

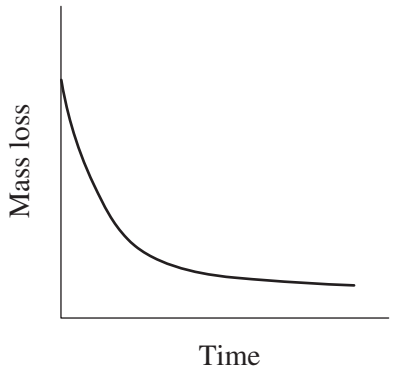


A student conducted an experiment using the apparatus shown below to investigate the fermentation of $C_6H_{12}O_6$. The fermentation of $C_6H_{12}O_6$ produces ethanol (C_2H_5OH) and carbon dioxide (CO_2). The student dissolved 5.0 g of $C_6H_{12}O_6$ in 50 mL of water in a conical flask, then added 1.0 g of yeast. They used cotton wool to plug the neck of the flask. The initial total mass of the flask and its contents was recorded. The flask and its contents were weighed at regular intervals until fermentation had ceased, and the results were recorded.

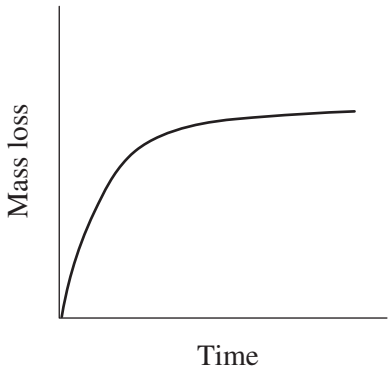


14 The student plotted a graph showing the progress of the reaction.
Which graph could be the student's graph?

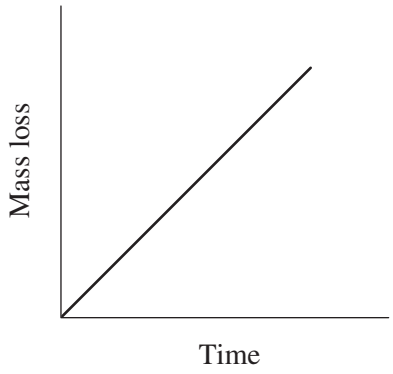
A.



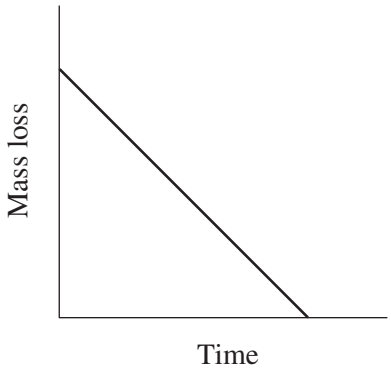
B.



C.



D.



15 Which of the following statements is correct?

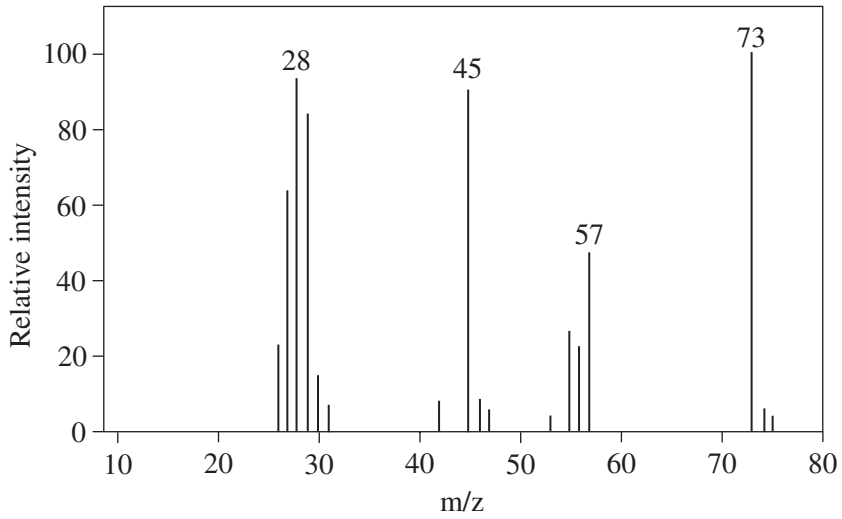
A. The initial concentration of the glucose was 1 m/v%.

B. The yeast was used up in the reaction.

C. The stoichiometry of the reaction shows that 2 mol of CO_2 was produced for every 1 mol of $C_6H_{12}O_6$ initially present.

D. C_2H_5OH is only used in beverages.

16 A simplified mass spectrum of butanoic acid is shown.



The peak with the mass-to-charge ratio, m/z, of 73

A. has the greatest mass-to-charge ratio.

B. represents the species $CH_2CH_2COOH^-$.

C. represents the species CH_2CH_2COOH.

D. represents the species $CH_2CH_2COOH^+$.

17 Five steps that are commonly followed in a gravimetric analysis are listed in an incorrect order.

I Calculate the amount of the isolated constituent using its mass.

II Separate the desired constituent.

III Prepare a solution containing a known mass of the substance being investigated.

IV Obtain a pure sample of the substance being investigated.

V Determine the mass of the isolated constituent.

Which is the correct order of the steps?

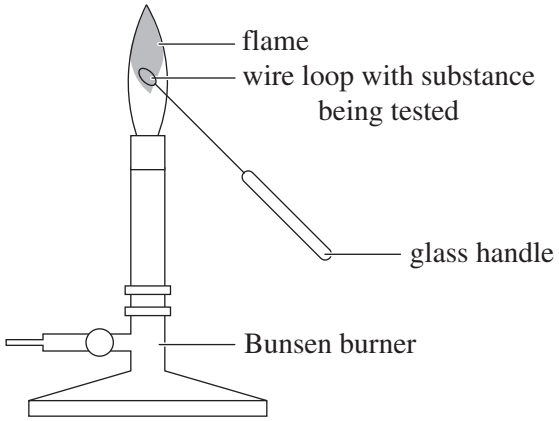
A. III, II, I, V, IV

B. III, IV, II, V, I

C. IV, III, V, II, I

D. IV, III, II, V, I

18 The diagram shows a test being carried out.



This type of test is used to identify

A. cations.

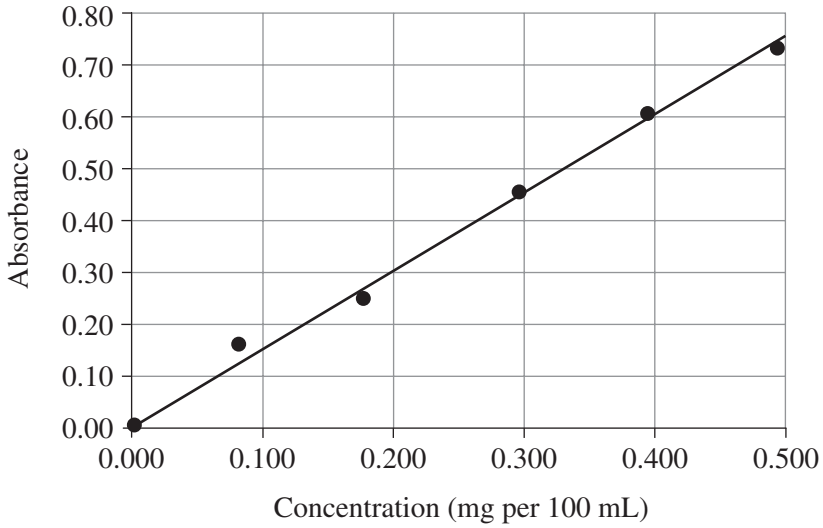
B. anions.

C. organic compounds.

D. mineral acids.

19 A mining company tested a sample of ore to determine the lead concentration. A 10 g sample of the ore was treated with a mixture of nitric and hydrochloric acids to dissolve all the lead in the sample. The resulting solution was diluted to 1.0 L, and the concentration of lead was determined using atomic absorption spectroscopy.

The absorbances of a series of lead standard solutions were then measured and the results plotted to produce the calibration curve shown.



Using the curve, the company was able to determine that the absorbance of the 1.00 L sample solution was 0.53.

What is the percentage by mass of lead in the original ore sample?

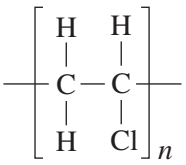
A. 0.0035%

B. 0.0053%

C. 0.035%

D. 0.35%

20 A researcher was examining a sample of the polymer polyvinyl chloride (PVC) to determine its chain length. The sample was found to have a molar mass of 623 800 g mol^{-1}. A section of the chain is shown.



What is the value of n?

A. 789.8

B. 2494

C. 9982

D. 155 950

HSC Year 12 Chemistry

Section II Answer Booklet

80 marks
Attempt Questions 21–33
Allow about 2 hours and 25 minutes for this section

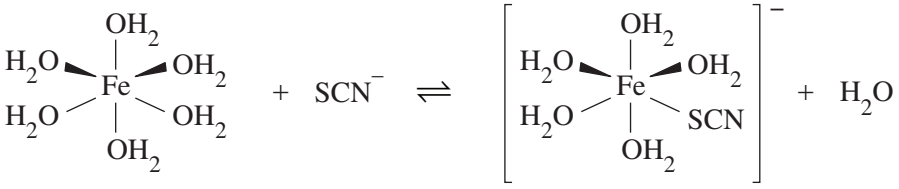
Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Show all relevant working in questions involving calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 21 (4 marks)

The equilibrium reaction between hydrated Fe^{3+} ions and SCN^- ions is shown.



(a) At equilibrium, how do the rates of the forward and backward reactions compare? **1**

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(b) Write the equilibrium expression for this reaction. **1**

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(c) The reaction's equilibrium constant, K_{eq}, under a particular set of conditions was found to be 2.7×10^2. **2**

Explain what this indicates about the equilibrium position.

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Question 22 (7 marks)

Ammonia gas (NH_3) reacts with carbon monoxide gas (CO) to produce the highly toxic gas hydrogen cyanide (HCN), as well as carbon dioxide (CO_2) and hydrogen (H_2). This is an endothermic equilibrium reaction. A student attempted to write the chemical equation for the reaction; their equation is shown.

$$NH_3 + CO \rightleftharpoons HCN + CO_2 + H_2$$

(a) Write the complete balanced chemical equation. **1**

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(b) In the table, state the effect of each of the changes on the system's equilibrium position. **4**

Change	*Effect*
adding a catalyst	
increasing the pressure	
increasing the temperature	
adding a quantity of an inert gas	

(c) HCN dissolves in water (H_2O) to form conjugate acid/base pairs. **2**

Label the conjugate acid/base pairs in the equation below. Use appropriate scientific notation.

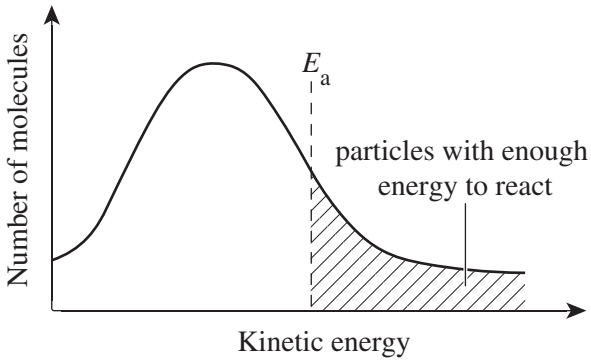
$$HCN(aq) \quad + \quad H_2O(l) \quad \rightleftharpoons \quad CN^-(aq) \quad + \quad H_3O^+(aq)$$

Question 23 (5 marks)

A student was studying chemical equilibrium reactions. As part of their studies, they wrote a report to analyse the relationship between collision theory and the rate of reactions. An extract from their report is shown. **5**

Collision theory

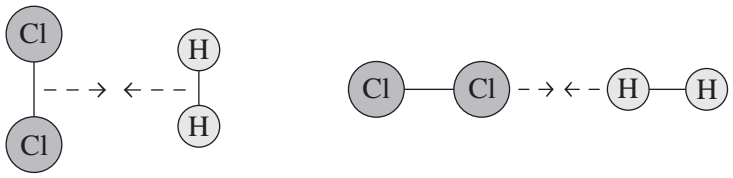
There are several factors involved in collision theory. Reactant molecules must collide successfully for a chemical reaction to occur. Only collisions with sufficient kinetic energy are successful. The maximum kinetic energy required for a reaction to occur is called the activation energy, E_a.



Only particles with kinetic energy to the left of the dashed line have the required amount of kinetic energy.

Also, how molecules line up affects how successful a collision will be. This example shows the stages of the reaction between chlorine and hydrogen: $Cl_2(g) + H_2(g) \rightarrow 2HCl(g)$.

Successful collision likely *Successful collision unlikely*



A collision will only result in a reaction if the molecules are lined up in the right way. The more successful collisions there are in a system, the faster the reactants and products will reach equilibrium.

Evaluate how well the student analysed the relationship between collision theory and reaction rate in terms of how it relates to chemical equilibrium reactions.

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Question 24 (6 marks)

An aqueous solution containing silver nitrate ($AgNO_3$) was mixed with an aqueous solution of sodium chloride (NaCl). A precipitate, *X*, was formed and found to have a solubility product constant, K_{sp}, of 1.77×10^{-10}.

(a) Write the name and molecular formula of *X*. **1**

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(b) What information about a substance does its K_{sp} provide? **1**

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(c) Determine the equilibrium expression for *X* and calculate the solubility, in grams per litre, of *X*. **4**

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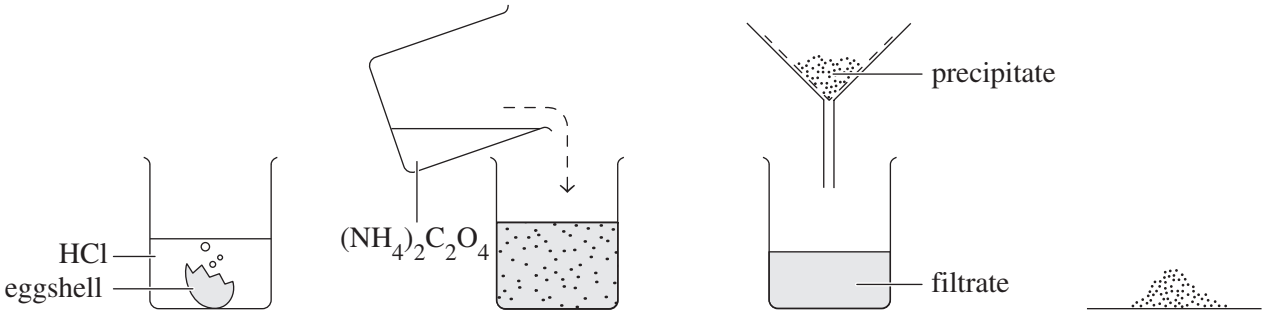
Question 25 (6 marks)

A commercial producer of chicken eggs conducted a quality control check of their eggs to ensure that they were suitable for transport. They tested the strength of the eggshells by measuring the calcium carbonate ($CaCO_3$) content of the shells. The percentage by mass of $CaCO_3$ in the shells was determined using a multi-stage process. Part of the laboratory technician's report for the test is shown.

> A sample of clean, dry eggshell with a mass of 0.391 g was completely reacted with a minimum volume of dilute hydrochloric acid (HCl). A solution of ammonium oxalate ($(NH_4)_2C_2O_4$) was then added in excess to form crystals of calcium oxalate monohydrate ($CaC_2O_4.H_2O$). The resulting suspension was filtered and the insoluble residue was dried to a constant mass. A mass of 0.497 g of $CaC_2O_4.H_2O$ was collected.

Some details of the process are illustrated in the diagram.



Step 1
The reaction occurs.

Step 2
A precipitate is formed.

Step 3
The precipitate is filtered.

Step 4
The precipitate is dried.

(a) How would the technician have known when all the $CaCo_3$ in the eggshell had reacted with the HCl? **1**

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Question 25 continues on page 18

Question 25 (continued)

(b) Determine the percentage by mass of $CaCO_3$ in the eggshell. Include all relevant chemical equations in your answer. **4**

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(c) Identify ONE assumption that was made in accepting that the mass of $CaC_2O_4.H_2O$ obtained was accurate. **1**

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End of Question 25

Question 26 (7 marks)

As part of the Chemistry course, you have carried out an investigation to demonstrate the use of pH to indicate the differences between the strengths of acids and bases. **7**

Explain how you carried out your investigation. In your answer, refer to how pH relates to acid and base strength, the conclusions reached and any safety precautions taken.

Question 27 (5 marks)

A Chemistry class was instructed to find the concentration of a sample of sodium hydroxide (NaOH) solution using 1.07 mol L^{-1} HCl. The class determined that an average titre of 23.45 mL of acid was required to neutralise a 20.00 mL aliquot of the base.

(a) Calculate the concentration of the NaOH solution. **3**

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(b) A group of students in the class did not rinse one of the pieces of glassware with the appropriate solution; they rinsed the 20.00 mL pipette with water rather than the base. **2**

Explain the effect that this had on the figure that the class obtained for the titre.

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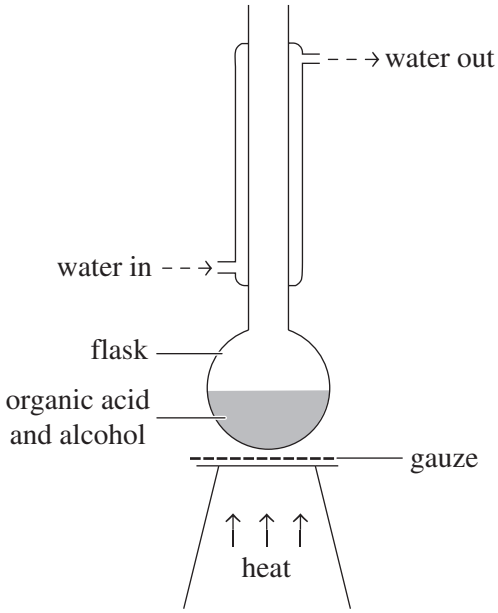
Question 28 (10 marks)

Alcohols can be used to make different compounds. The diagram shows the apparatus used to react an organic acid with an alcohol.



(a) Identify the technique illustrated in the diagram. **1**

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(b) Provide ONE reason why this technique was used for the reaction. **1**

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(c) What is the general name of the type of compound produced by this reaction? **1**

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Question 28 continues on page 22

Question 28 (continued)

The table shows the solubility of a series of alcohols.

Alcohol	*Solubility in water ($g\ L^{-1}$)*
butan-1-ol	73
hexan-1-ol	5.9
heptan-1-ol	1.7
octan-1-ol	0.3

(d) Plot the number of carbon atoms against solubility. **3**

(e) Estimate the solubility of pentan-1-ol in grams per litre. **1**

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Question 28 continues on page 23

Question 28 (continued)

(f) Explain the trend in the solubilities of these alcohols. **3**

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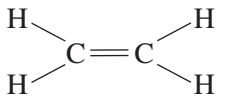
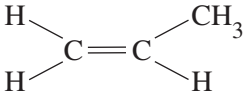
End of Question 28

Question 29 (4 marks)

The table shows the reactants of two reactions involving unsaturated hydrocarbons. **4**

Complete the table with the structural formulae and names of the products.

Reactants		*Structural formula of product*	*Name of product*
	→		
	→		

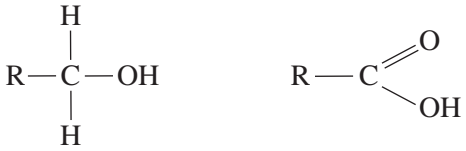
Question 30 (7 marks)

Discuss the implications of the extraction and use of hydrocarbons obtained from Earth. **7**

Question 31 (6 marks)

The general structural formulae of two types of organic compounds, *A* and *B*, are shown. **6**

Compound A *Compound B*



Using examples, explain how qualitative tests could be used to differentiate these compound types.

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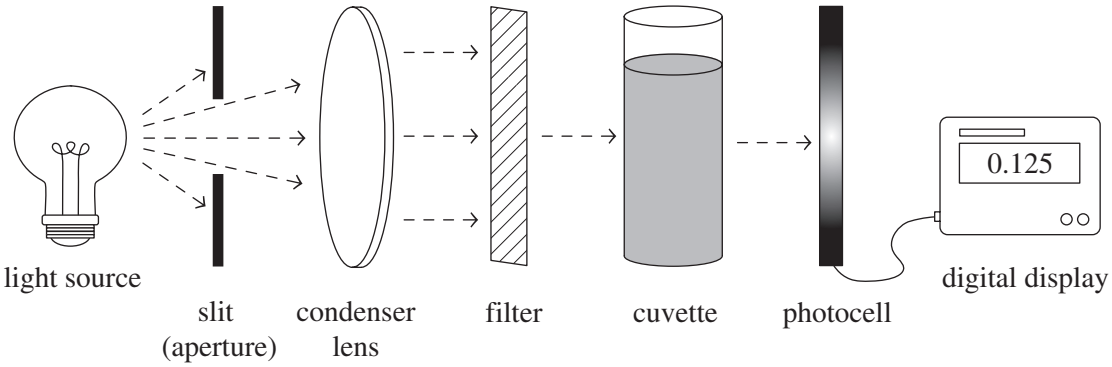
Question 32 (6 marks)

The diagram shows the major components of a colourimeter. **6**



Explain the purpose of and principle behind colourimetry and, with reference to the diagram, explain how a colourimeter works.

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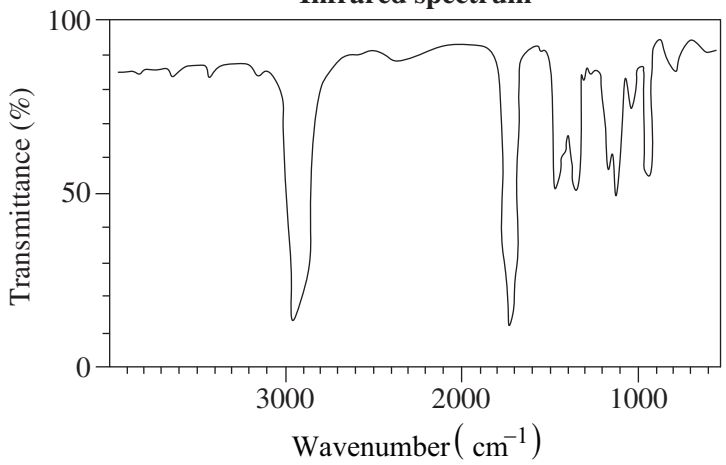
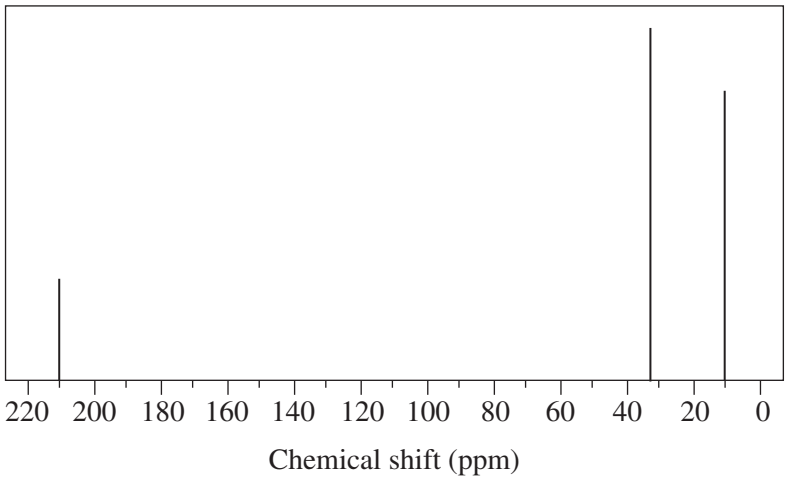
Question 33 (7 marks)

A laboratory technician came across a bottle containing an unknown organic compound. There was an incomplete label on the bottle that only indicated the empirical formula of the bottle's contents: $C_5H_{10}O$. The technician carried out several tests on the bottle's contents. The results of the tests are shown. The molar mass of the compound is 86.13 g mol^{-1}.

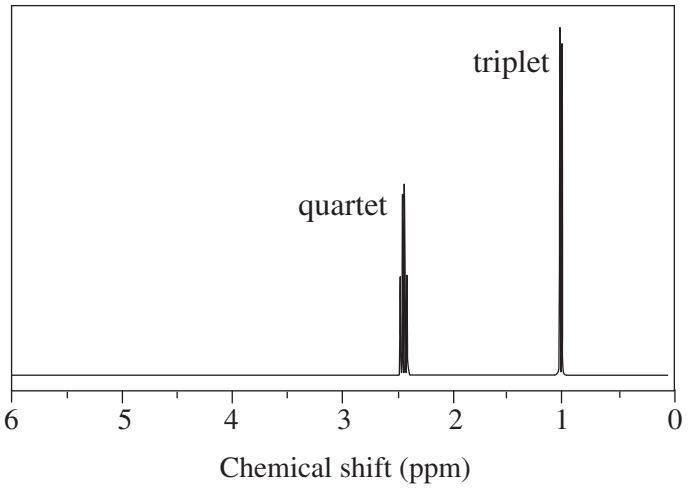
Infrared spectrum



Carbon-13 NMR spectrum



Proton NMR



Question 33 continued on page 29

Question 33 (continued)

(a) Determine the molecular formula of the compound. Justify your answer. **2**

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(b) Draw and name the compound. Justify your answer with reference to the information provided. **5**
Structure:

Question 33 continues on page 30

Question 33 (continued)

Name:.....

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End of paper

Section II extra writing space

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Section II extra writing space

If you use this space, clearly indicate which question you are answering.

FORMULAE SHEET

$$n = \frac{m}{MM} \qquad c = \frac{n}{V} \qquad PV = nRT$$

$$q = mc\Delta T \qquad \Delta G^\circ = \Delta H^\circ - T\Delta S^\circ \qquad \text{pH} = -\log_{10}\left[\text{H}^+\right]$$

$$pK_a = -\log_{10}\left[K_a\right] \qquad A = \varepsilon lc = \log_{10}\frac{I_o}{I}$$

Avogadro constant, N_A		6.022×10^{23} mol^{-1}
Volume of 1 mole ideal gas:	at 100 kPa and	
	at 0°C (273.15 K)	22.71 L
	at 25°C (298.15 K)	24.79 L
Gas constant		8.314 J mol^{-1} K^{-1}
Ionisation constant for water at 25°C (298.15 K), K_w		1.0×10^{-14}
Specific heat capacity of water		4.18×10^3 J kg^{-1} K^{-1}

DATA SHEET

Solubility constants at 25°C

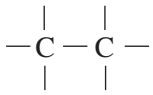
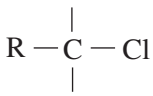
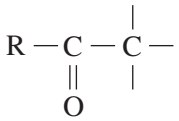
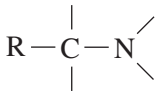
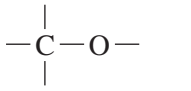
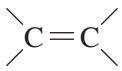
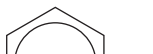
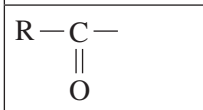
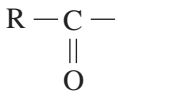
Compound	K_{sp}
Barium carbonate	2.58×10^{-9}
Barium hydroxide	2.55×10^{-4}
Barium phosphate	1.3×10^{-29}
Barium sulfate	1.08×10^{-10}
Calcium carbonate	3.36×10^{-9}
Calcium hydroxide	5.02×10^{-6}
Calcium phosphate	2.07×10^{-29}
Calcium sulfate	4.93×10^{-5}
Copper(II) carbonate	1.4×10^{-10}
Copper(II) hydroxide	2.2×10^{-20}
Copper(II) phosphate	1.40×10^{-37}
Iron(II) carbonate	3.13×10^{-11}
Iron(II) hydroxide	4.87×10^{-17}
Iron(III) hydroxide	2.79×10^{-39}
Iron(III) phosphate	9.91×10^{-16}

Compound	K_{sp}
Lead(II) bromide	6.60×10^{-6}
Lead(II) chloride	1.70×10^{-5}
Lead(II) iodide	9.8×10^{-9}
Lead(II) carbonate	7.40×10^{-14}
Lead(II) hydroxide	1.43×10^{-15}
Lead(II) phosphate	8.0×10^{-43}
Lead(II) sulfate	2.53×10^{-8}
Magnesium carbonate	6.82×10^{-6}
Magnesium hydroxide	5.61×10^{-12}
Magnesium phosphate	1.04×10^{-24}
Silver bromide	5.35×10^{-13}
Silver chloride	1.77×10^{-10}
Silver carbonate	8.46×10^{-12}
Silver hydroxide	2.0×10^{-8}
Silver iodide	8.52×10^{-17}
Silver phosphate	8.89×10^{-17}
Silver sulfate	1.20×10^{-5}

Infrared absorption data

Bond	Wavenumber/cm^{-1}
N—H (amines)	3300–3500
O—H (alcohols)	3230–3550 (broad)
C—H	2850–3300
O—H (acids)	2500–3000 (very broad)
C≡N	2220–2260
C═O	1680–1750
C═C	1620–1680
C—O	1000–1300
C—C	750–1100

^{13}C NMR chemical shift data

Type of carbon	δ/ppm
	5–40
	10–70
	20–50
	25–60
 alcohols, ethers or esters	50–90
	90–150
	110–125
	110–160
 esters or acids	160–185
 aldehydes or ketones	190–220

UV absorption

(This is not a definitive list and is approximate.)

Chromophore	λ_{max} (nm)
C—H	112
C—C	135
C═C	162

Chromophore	λ_{max} (nm)
C≡C	173 178 196 222
C—Cl	173
C—Br	208

Some standard potentials

$K^+ + e^-$	$\rightleftharpoons$	$K(s)$	–2.94 V
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	$Ba(s)$	–2.91 V
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	$Ca(s)$	–2.87 V
$Na^+ + e^-$	$\rightleftharpoons$	$Na(s)$	–2.71 V
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	$Mg(s)$	–2.36 V
$Al^{3+} + 3e^-$	$\rightleftharpoons$	$Al(s)$	–1.68 V
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	$Mn(s)$	–1.18 V
$H_2O + e^-$	$\rightleftharpoons$	$\frac{1}{2} H_2(g) + OH^-$	–0.83 V
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	$Zn(s)$	–0.76 V
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	$Fe(s)$	–0.44 V
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	$Ni(s)$	–0.24 V
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	$Sn(s)$	–0.14 V
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	$Pb(s)$	–0.13 V
$H^+ + e^-$	$\rightleftharpoons$	$\frac{1}{2} H_2(g)$	0.00 V
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(aq) + 2H_2O$	0.16 V
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	$Cu(s)$	0.34 V
$\frac{1}{2} O_2(g) + H_2O + 2e^-$	$\rightleftharpoons$	$2OH^-$	0.40 V
$Cu^+ + e^-$	$\rightleftharpoons$	$Cu(s)$	0.52 V
$\frac{1}{2} I_2(s) + e^-$	$\rightleftharpoons$	I^-	0.54 V
$\frac{1}{2} I_2(aq) + e^-$	$\rightleftharpoons$	I^-	0.62 V
$Fe^{3+} + e$	$\rightleftharpoons$	Fe^{2+}	0.77 V
$Ag^+ + e^-$	$\rightleftharpoons$	$Ag(s)$	0.80 V
$\frac{1}{2} Br_2(l) + e^-$	$\rightleftharpoons$	Br^-	1.08 V
$\frac{1}{2} Br_2(aq) + e^-$	$\rightleftharpoons$	Br^-	1.10 V
$\frac{1}{2} O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O	1.23 V
$\frac{1}{2} Cl_2(g) + e^-$	$\rightleftharpoons$	Cl^-	1.36 V
$\frac{1}{2} Cr_2O_7^{2-} + 7H^+ + 3e^-$	$\rightleftharpoons$	$Cr^{3+} + \frac{7}{2} H_2O$	1.36 V
$\frac{1}{2} Cl_2(aq) + e^-$	$\rightleftharpoons$	Cl^-	1.40 V
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	1.51 V
$\frac{1}{2} F_2(g) + e^-$	$\rightleftharpoons$	F^-	2.89 V

Aylward and Findlay, *SI Chemical Data (5th Edition)* is the principal source of data for the standard potentials. Some data may have been modified for examination purposes.

PERIODIC TABLE OF THE ELEMENTS

KEY

atomic number
symbol
standard atomic weight
name

79 Au 197.0 gold

1 H 1.008 hydrogen																	**2 He** 4.003 helium
3 Li 6.941 lithium	**4 Be** 9.012 beryllium											**5 B** 10.81 boron	**6 C** 12.01 carbon	**7 N** 14.01 nitrogen	**8 O** 16.00 oxygen	**9 F** 19.00 fluorine	**10 Ne** 20.18 neon
11 Na 22.99 sodium	**12 Mg** 24.31 magnesium											**13 Al** 26.98 aluminium	**14 Si** 28.09 silicon	**15 P** 30.97 phosphorus	**16 S** 32.07 sulfur	**17 Cl** 35.45 chlorine	**18 Ar** 39.95 argon
19 K 39.10 potassium	**20 Ca** 40.08 calcium	**21 Sc** 44.96 scandium	**22 Ti** 47.87 titanium	**23 V** 50.94 vanadium	**24 Cr** 52.00 chromium	**25 Mn** 54.94 manganese	**26 Fe** 55.85 iron	**27 Co** 58.93 cobalt	**28 Ni** 58.69 nickel	**29 Cu** 63.55 copper	**30 Zn** 65.38 zinc	**31 Ga** 69.72 gallium	**32 Ge** 72.64 germanium	**33 As** 74.92 arsenic	**34 Se** 78.96 selenium	**35 Br** 79.90 bromine	**36 Kr** 83.80 krypton
37 Rb 85.47 rubidium	**38 Sr** 87.61 strontium	**39 Y** 88.91 yttrium	**40 Zr** 91.22 zirconium	**41 Nb** 92.91 niobium	**42 Mo** 95.96 molybdenum	**43 Tc** technetium	**44 Ru** 101.1 ruthenium	**45 Rh** 102.9 rhodium	**46 Pd** 106.4 palladium	**47 Ag** 107.9 silver	**48 Cd** 112.4 cadmium	**49 In** 114.8 indium	**50 Sn** 118.7 tin	**51 Sb** 121.8 antimony	**52 Te** 127.6 tellurium	**53 I** 126.9 iodine	**54 Xe** 131.3 xenon
55 Cs 132.9 caesium	**56 Ba** 137.3 barium	**57–71** lanthanoids	**72 Hf** 178.5 hafnium	**73 Ta** 180.9 tantalum	**74 W** 183.9 tungsten	**75 Re** 186.2 rhenium	**76 Os** 190.2 osmium	**77 Ir** 192.2 iridium	**78 Pt** 195.1 platinum	**79 Au** 197.0 gold	**80 Hg** 200.6 mercury	**81 Tl** 204.4 thallium	**82 Pb** 207.2 lead	**83 Bi** 209.0 bismuth	**84 Po** polonium	**85 At** astatine	**86 Rn** radon
87 Fr francium	**88 Ra** radium	**89–103** actinoids	**104 Rf** rutherfordium	**105 Db** dubnium	**106 Sg** seaborgium	**107 Bh** bohrium	**108 Hs** hassium	**109 Mt** meitnerium	**110 Ds** darmstadtium	**111 Rg** roentgenium	**112 Cn** copernicium	**113 Nh** nihonium	**114 Fl** flerovium	**115 Mc** moscovium	**116 Lv** livermorium	**117 Ts** tennessine	**118 Og** oganesson

Lanthanoids

57 La 138.9 lanthanum	**58 Ce** 140.1 cerium	**59 Pr** 140.9 praseodymium	**60 Nd** 144.2 neodymium	**61 Pm** promethium	**62 Sm** 150.4 samarium	**63 Eu** 152.0 europium	**64 Gd** 157.3 gadolinium	**65 Tb** 158.9 terbium	**66 Dy** 162.5 dysprosium	**67 Ho** 164.9 holmium	**68 Er** 167.3 erbium	**69 Tm** 168.9 thulium	**70 Yb** 173.1 ytterbium	**71 Lu** 175.0 lutetium

Actinoids

89 Ac actinium	**90 Th** 232.0 thorium	**91 Pa** 231.0 protactinium	**92 U** 238.0 uranium	**93 Np** neptunium	**94 Pu** plutonium	**95 Am** americium	**96 Cm** curium	**97 Bk** berkelium	**98 Cf** californium	**99 Es** einsteinium	**100 Fm** fermium	**101 Md** mendelevium	**102 No** nobelium	**103 Lr** lawrencium

Standard atomic weights are abridged to four significant figures.
Elements with no reported values in the table have no stable nuclides.
Information on elements with atomic numbers 113 and above is sourced from the International Union of Pure and Applied Chemistry Periodic Table of the Elements (November 2016 version).
The International Union of Pure and Applied Chemistry Periodic Table of the Elements (February 2010 version) is the principal source of all other data. Some data may have been modified.

Trial Examination 2023

Neap HSC Year 12 Chemistry

DIRECTIONS:

Write your name in the space provided.
Write your student number in the boxes provided below. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.
Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark only **one** oval per question.

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 this by writing the word *correct* and draw an arrow as follows.

correct ↓

A ⊗ B ⊗ C ○ D ○

STUDENT NAME: _____

STUDENT NUMBER:

1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0

SECTION I
MULTIPLE-CHOICE ANSWER SHEET

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

STUDENTS SHOULD NOW CONTINUE WITH SECTION II