2024
VCE
Chemistry
Trial Examination

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Write your **student number** in the boxes above. **Letter**

Chemistry

Question and Answer Book

VCE Trial Examination: 2024

- Reading time is **15 minutes**
- Writing time is **2 hours 30 minutes**

Materials supplied

- Question and Answer Book of 26 pages
- Data book
- Multiple-Choice Answer Sheet

Instructions

- Follow the instructions on your Multiple-Choice Answer sheet.
- At the end of the examination, place your answer sheet inside the front cover of this book.

Students are **not** permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents pages

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VCE CHEMISTRY 2024
Trial Written Examination

MULTIPLE-CHOICE ANSWER SHEET

Student Name _____

Student Number _____

Signature _____

If your name or number on this sheet is incorrect, notify the Supervisor.
Use a **PENCIL** for **ALL** entries. For each question, shade the box that indicates your answer.
All answers must be completed like **THIS** example.

A	■	**C**	**D**

Marks will **NOT** be deducted for incorrect answers.
NO MARK will be given if more than **ONE** answer is completed for any question.
If you make a mistake, **ERASE** the incorrect answer. **DO NOT** cross it out.

ONE ANSWER PER LINE **ONE ANSWER PER LINE**

1.	A	B	C	D	16.	A	B	C	D
2.	A	B	C	D	17.	A	B	C	D
3.	A	B	C	D	18.	A	B	C	D
4.	A	B	C	D	19.	A	B	C	D
5.	A	B	C	D	20.	A	B	C	D
6.	A	B	C	D	21.	A	B	C	D
7.	A	B	C	D	22.	A	B	C	D
8.	A	B	C	D	23.	A	B	C	D
9.	A	B	C	D	24.	A	B	C	D
10.	A	B	C	D	25.	A	B	C	D
11.	A	B	C	D	26.	A	B	C	D
12.	A	B	C	D	27.	A	B	C	D
13.	A	B	C	D	28.	A	B	C	D
14.	A	B	C	D	29.	A	B	C	D
15.	A	B	C	D	30.	A	B	C	D

SECTION A – Multiple-choice questions

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Question 1

Which of the following samples will release the greatest amount of energy after complete combustion?

A. 1.0 g of diesel
B. 1.2 g of biogas
C. 1.1 g of natural gas
D. 1.1 g of biodiesel

Question 2

The thermochemical equation for the complete combustion of butane gas is

A. $C_4H_{10}(g) + 6.5O_2(g) \rightarrow 4CO_2(g) + 5H_2O(g)$ ΔH = -2880 kJ
B. $C_4H_{10}(g) + 6.5O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$ ΔH = -2880 kJ
C. $C_4H_{10}(g) + 6.5O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$ ΔH = 2880 kJ
D. $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$ ΔH = -2880 kJ mol^{-1}

Question 3

The thermochemical equation for the complete combustion of propan-1-ol is

$C_3H_8O(l) + 4.5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$ ΔH = -2020 kJ

The volume of CO_2 gas produced at SLC, and the energy released, from the complete combustion of 10 mol of propan-1-ol will be

	CO_2 produced (L)	Energy released kJ
A.	248	2020
B.	248	20200
C.	744	20200
D.	744	60600

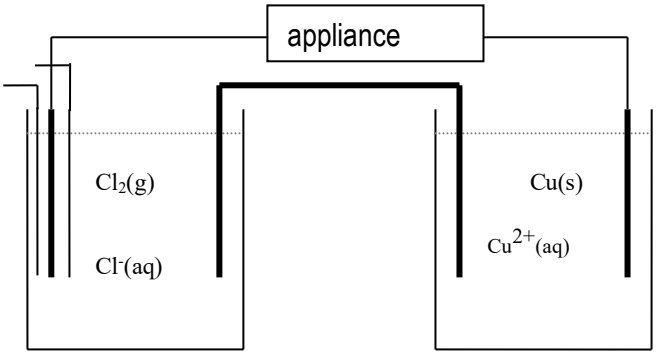
Question 4

A 2.00 g sample of olive oil is burnt under a steel can containing 1.20 kg of water.
The expected temperature change of the water, if the energy transfer is 100% efficient, is

A. 7.4 ^{0}C
B. 14.8 ^{0}C
C. 21.4 ^{0}C
D. 29.6 ^{0}C

Use the following information to answer Questions 5 and 6.

A galvanic cell is formed from the connection of a chlorine half-cell to a copper half-cell.
A sketch of the cell is shown below.



Question 5

The strongest oxidising agent in this cell is

A. Cl_2 gas.
B. Cl^- ions.
C. Cu metal.
D. Cu^{2+} ions.

Question 6

When this cell is operating,

A. electrons will flow from the chlorine electrode to the copper.
B. the mass of copper electrode will increase gradually.
C. electrons will flow through the salt-bridge from the chlorine half-cell to the copper.
D. cations will flow from the salt-bridge into the chlorine half-cell.

Question 7

Which of the following is a correct comparison of a galvanic cell and an electrolytic cell?

A. The anode is positive in both types of cells.
B. Reduction occurs at the cathode in both cells.
C. Oxidation occurs at the positive electrode in both cells.
D. Both cells convert chemical energy to electrical energy.

Question 8
X, Y and Z represent three elements found on the electrochemical series.

$$X_2(g) + 2e^- \rightarrow 2X^-(aq)$$
$$Y^{2+}(aq) + 2e^- \rightarrow Y(s)$$
$$Z^+(aq) + e^- \rightarrow Z(s)$$

$E^0(X_2) > E^0(Y^{2+}) > E^0(Z^+)$

Select the alternative that is a correct conclusion from these data.

A. The rate of the reaction between X_2 and Y is faster than the reaction between Y^{2+} and Z.
B. The weakest reducing agent on this list is X_2.
C. A power supply is required to produce a reaction between Y and ZNO_3.
D. A spontaneous reaction can occur between Z^+ ions and X^- ions.

Question 9
Petrol driven cars have a catalytic converter fitted to their exhausts to convert toxic gases like NO and CO to less harmful products. The catalyst should be 'cleaned' every two years to maintain its effectiveness. When the catalyst is cleaned,

A. the activation energy of the reactions involved is lowered.
B. the exhaust temperature can be lowered as the reaction is more efficient.
C. the enthalpy change of the reactions involved is lowered.
D. the available catalyst surface area is increased.

Question 10
Nitrosyl bromide can decompose to form nitrogen monoxide and bromine.
The equation for the reaction is

$$2NOBr(g) \rightleftharpoons 2NO(g) + Br_2(g)$$

Br_2 gas is brown in colour while the other gases are colourless. The volume of an equilibrium mixture of the above gases is halved. Compared to the original point of equilibrium, the new equilibrium that forms

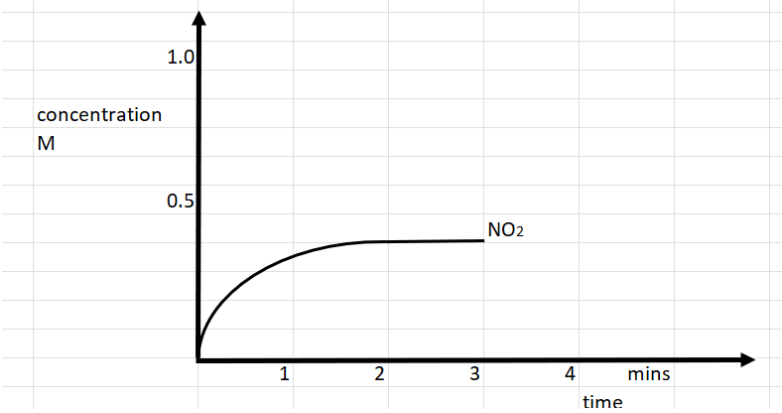
A. will have a lower value of *K* and a less intense brown colour.
B. will have a less intense brown colour and a smaller amount of bromine.
C. will have a less intense brown colour and a smaller value of *K*.
D. will have a more intense brown colour and faster forward and back reaction rates.

Use the following information to answer Questions 11 and 12.

The equation for the decomposition of dinitrogen tetroxide decomposing to NO_2 is

$$N_2O_4(g) \rightleftharpoons 2NO_2(g) \qquad \Delta H > 0$$

A 2.0 mol sample of N_2O_4 is added to a 2.0 L empty reactor. The concentration of the NO_2 formed is shown on the graph below.



Question 11
Select the correct statement about the gases in this mixture **at the 1 minute mark**.

A. $Q < K$, indicating the forward reaction needs to be favoured to reach equilibrium.
B. Only the forward reaction is occurring as the system has not reached equilibrium.
C. The system will not reach equilibrium unless the temperature is increased.
D. The coefficients in the equation show the $[NO_2]$ must be greater than the $[N_2O_4]$.

Question 12
Use the graph to determine the equilibrium constant for the reaction

$$2NO_2(g) \rightleftharpoons N_2O_4(g)$$

A. 0.10 M
B. 0.20 M
C. 1.5 M^{-1}
D. 5.0 M^{-1}

Question 13
Hydrogen gas can be obtained in an alkaline electrolyser. The solution used is usually potassium hydroxide, KOH. The half-equation occurring at the cathode in this cell is

A. $2H_2O(l) + 2e^- \rightarrow 2OH^-(aq) + H_2(g)$
B. $2OH^-(aq) + H_2(g) \rightarrow 2H_2O(l) + 2e^-$
C. $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 2e^-$
D. $2H_2O(l) + O_2(g) + 2e^- \rightarrow 4OH^-(aq)$

Question 14

A charge of 24100 coulomb is passed through a solution of tin (IV) chloride, $SnCl_4$.
The amount of tin, in mol, deposited in this cell will be

A. 0
B. 0.0624
C. 0.125
D. 0.250

Question 15

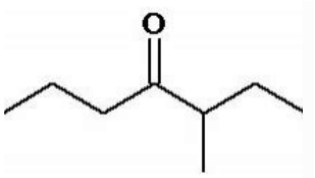
A student is conducting a titration to determine the ethanol content of a solution. The ethanol is titrated against a potassium dichromate solution. The flask used is placed on a hot plate as the rate of reaction at room temperature is slow. The titres obtained by the student in successive trials are

21.6 mL 15.4 mL 12.8 mL 23.9 mL

The titres obtained suggest that

A. there is a systematic error in the procedure leading to inconsistent titres.
B. the lack of concordant titres is due to a low reproducibility in the titration procedure.
C. the precision of the titres is low due to a lack of repeatability in the titration procedure.
D. the titration has a mix of random and systematic errors but the results are accurate.

Question 16



The IUPAC name for the molecule above is

A. 2-methylhexan-3-one
B. 3-methylheptan-4-one
C. butyl butanoate
D. 5-methylheptan-4-one

Question 17

The atom economy of the reaction between 1-chloropropane and ammonia, NH_3, is

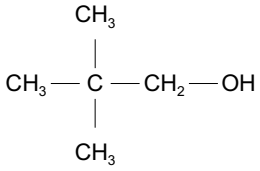
A. 61.8 %
B. 62.8 %
C. 82.2 %
D. 100 %

Question 18

An organic compound is heated with acidified dichromate solution, $Cr_2O_7^{2-}$. The colour of the solution changes to green. The organic product formed is purified and added to a solution of sodium hydrogen carbonate. A vigorous reaction occurs and a gas is evolved. The original organic compound at the start of this pathway could be

A. butan-1-ol
B. butanoic acid
C. but-1-ene
D. butan-2-ol

Question 19

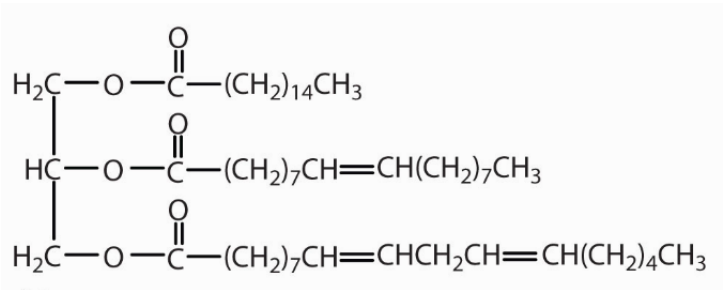


Select the alternative that correctly states the number of hydrogen and carbon environments in the molecule above.

	number of hydrogen environments	number of carbon environments
A.	2	2
B.	2	3
C.	3	3
D.	4	4

Question 20

The molecule below is an example of a triglyceride.



A transesterification reaction is conducted to convert 0.20 mol of the triglyceride to biodiesel. The iodine number of the biodiesel formed is

A. 0.60 mol
B. 50.8 g
C. 76.1 g
D. 152 g

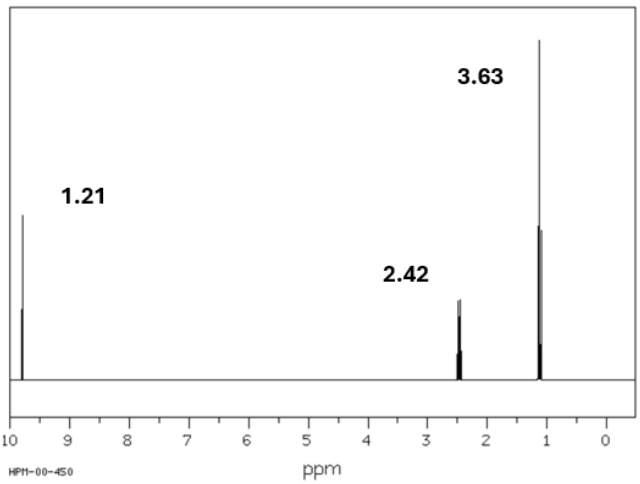
Question 21
An amino acid forms an ion with a charge of 2+ in acidic conditions. The amino acid could be

A. aspartic acid.
B. serine.
C. valine.
D. lysine.

Question 22
Animals can consume starch from plants and convert the starch to glycogen which can then be stored in the liver. In this process,

A. hydrolysis reactions break the glycosidic bonds and new peptide bonds are formed.
B. hydrolysis breaks the glycosidic bonds but condensation reactions form new ones.
C. condensation reactions break the glycosidic bonds and hydrolysis forms new ones.
D. a transesterification reaction occurs replacing ester bonds with new ester bonds.

Question 23
A proton-NMR is shown below.



The numbers near each peak reflect the relative area of the peak. The spectrum does not contain any singlet peaks.

The spectrum shown is of

A. propanal
B. propan-1-ol
C. propanoic acid
D. propanone

Question 24

A sample of the ester ethyl ethanoate was hydrolysed completely by heating it with a catalyst. The resulting solution was then distilled. The first fraction was collected at a temperature of 79 °C. This fraction will be

A. water
B. ethanol
C. ethanoic acid
D. ethyl ethanoate

Question 25

Rhubarb is a plant often added to desserts or cakes. Its sharp taste is due to the presence of oxalic acid, $C_2H_2O_4$. The concentration of oxalic acid can be determined through a redox titration with potassium permanganate. The half-equation for the reaction of the oxalic acid is

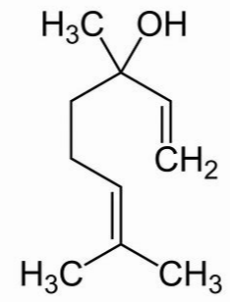
$$C_2H_2O_4(aq) \rightarrow 2CO_2(g) + 2H^+(aq) + 2e^-$$

In a particular titration, using 20.0 mL aliquots of oxalic acid, the mean titre of 0.100 M $KMnO_4$ was 10.0 mL. The concentration of the oxalic acid solution is

A. 0.0125 M
B. 0.0250 M
C. 0.1250 M
D. 0.250 M

Question 26

The compound below is known as linalool. It can be extracted from herbs such as basil. It is popular as an antimicrobial due to its pleasant floral odour.



Select the correct statement about linalool.

A. Linalool will be completely non-polar and will not react with bromine.
B. Linalool contains no chiral carbon atoms and it is a secondary alcohol.
C. Linalool contains one chiral carbon atom and it is a tertiary alcohol.
D. Linalool will react with $K_2Cr_2O_7$, leading to a colour change.

Question 27
Which of the following is **not** an essential part of a scientific investigation?

A. A consideration of all possible independent and dependent variables.
B. Listing of references used that guided the direction of the investigation.
C. A consideration of the health and safety guidelines relevant to the investigation.
D. Discussion of the accuracy, precision and validity of measurements.

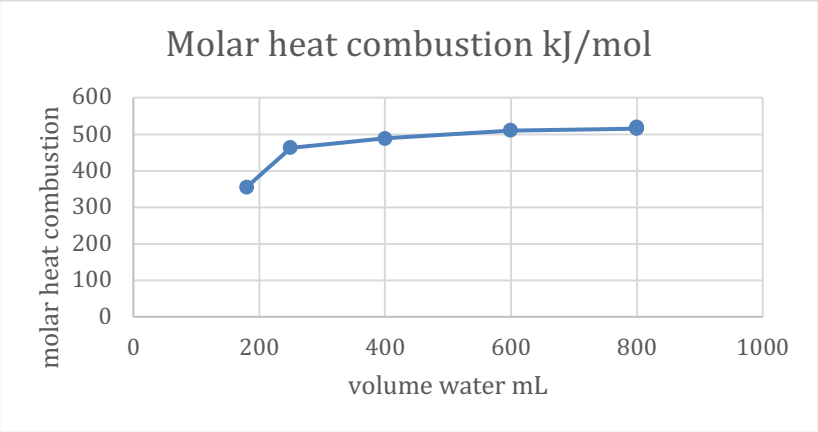
Question 28
The enzyme alcohol dehydrogenase converts methanol in the body to the toxic compound methanal. This reaction does not occur to a significant extent if ethanol is also present with methanol. A likely reason for the change in toxicity is that

A. ethanol and methanol react to form a compound that does not fit the enzyme site.
B. ethanol hydrolyses the enzyme back to its individual amino acids.
C. ethanol changes the pH of the solution limiting the enzyme functionality.
D. the similar shape of ethanol allows it to occupy the enzyme active site.

Use the following information to answer Questions 29 and 30.

A student is investigating the effect of varying the volume of water used when calculating the heat of combustion of ethanol. Samples of ethanol are burnt under a steel can containing water. The volume of water used in the container is varied. The temperature rise of the water is used to estimate the heat of combustion. The same mass of ethanol is used in each trial. The data in the table below shows that the student conducted 5 trials with increasing volumes of water and then repeated the experiment (Trials 6 and 7) using the same volume of water as in Trial 5.

Trial number	volume water mL	Molar heat combustion kJ/mol
1	180	355
2	250	463
3	400	488
4	600	510
5	800	515
6	800	520
7	800	515



Question 29

A valid conclusion that can be drawn from the graph is that

A. the range of the results shows that the experiment is not repeatable.
B. increasing the volume of water used leads to more accurate results.
C. a systematic error must be present in the experiment.
D. there is a linear relationship between heat of combustion and volume of water used.

Question 30

Trials 5, 6 and 7 can be used to show that

A. the precision of the results is relatively high.
B. the accuracy of the results is relatively high.
C. the reproducibility of the results is relatively high.
D. energy transfer to the water is 100 % efficient when a high volume is used.

END OF SECTION A

Instructions for Section B

Answer all questions in the spaces provided.

To obtain full marks for your responses you should

- give simplified answers with an appropriate number of significant figures for all numerical questions; unsimplified answers will not be given full marks.
- show all working in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.
- make sure all chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, $H_2(g)$; NaCl(s)

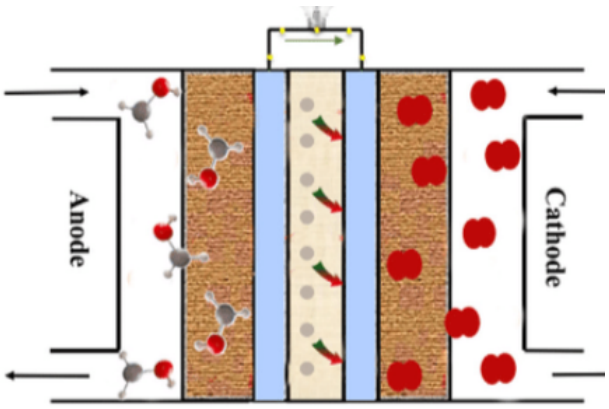
Question 1 (12 marks)

Methanol is a popular solvent and a fuel. It is usually manufactured from fossil fuels such as methane and coal. Hence, its use adds to the pressures of CO_2 emissions and climate change.

a. Write a balanced equation for the complete combustion of methanol and use the axes provided to draw an energy profile diagram for this reaction. 3 marks

Question 1 (continued)

b. Methanol can also be used in a fuel cell, such as the direct contact methanol fuel cell (DCFC) drawn below.



i. Write half-equations for the reactions occurring in this cell under acidic conditions.

anode: _____ 1 mark

cathode: _____ 1 mark

ii. Calculate the mass of methanol required to produce 1.00 MJ of energy, assuming the cell is operating with an efficiency level of 72%. 3 marks

_____

_____

_____

iii. Determine the volume of CO_2 at SLC produced in this process. 1 mark

_____

_____

c. Methanol is considered to be biomethanol if it is made from biogas, rather than natural gas. Explain how the use of biogas improves the sustainability of methanol.

3 marks

_____

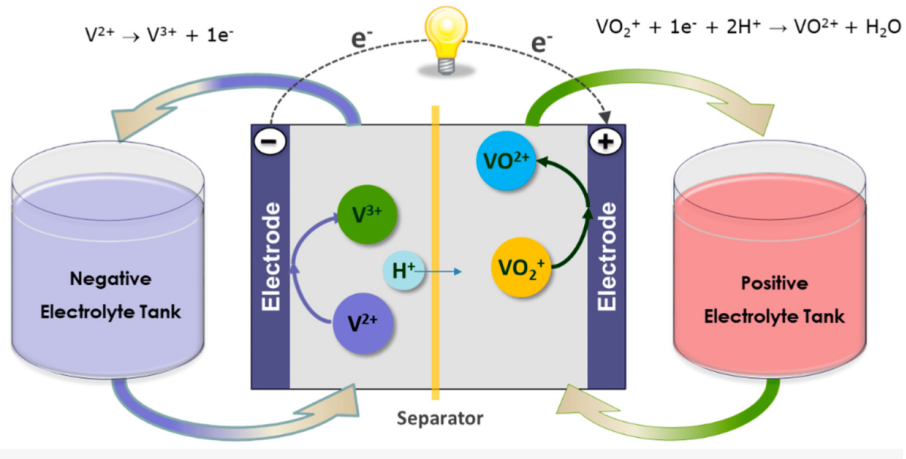
_____

_____

_____

Question 2 (8 marks)

The vanadium flow battery was invented at the University of New South Wales in the 1980s. The system employs two electrolyte solutions stored in separate tanks that are pumped through the half-cells. The electrolytes interact through the membrane. The cell is rechargeable, when an external power supply is used to reverse the discharge reactions. An aqueous electrolyte is used with vanadium ions dissolved in dilute sulfuric acid.



a. The diagram shows the ion movement in the cell during discharge. Use the diagram provided to complete the questions below for the half-equations and overall equations occurring during **recharge**.

i. anode half-equation: _____ 1 mark

ii. cathode half-equation: _____ 1 mark

iii. overall equation: _____ 1 mark

iv. What is the oxidation state change of vanadium at the anode during recharge? 1 mark

_____

b. **i**. A vanadium flow battery is not considered to be a fuel cell. State one difference between these two types of cells (vanadium flow battery and fuel cell). 1 mark

_____

ii. Both the vanadium flow battery and a fuel cell use porous electrodes. The electrodes for a fuel cell, however, are far more expensive than for the vanadium flow battery. Suggest one reason for the different costs. 1 mark

_____

Question 2 (continued)

c. The cell produces a voltage somewhere between 1.2 and 1.6 volts. State two factors that will impact this voltage. 2 marks

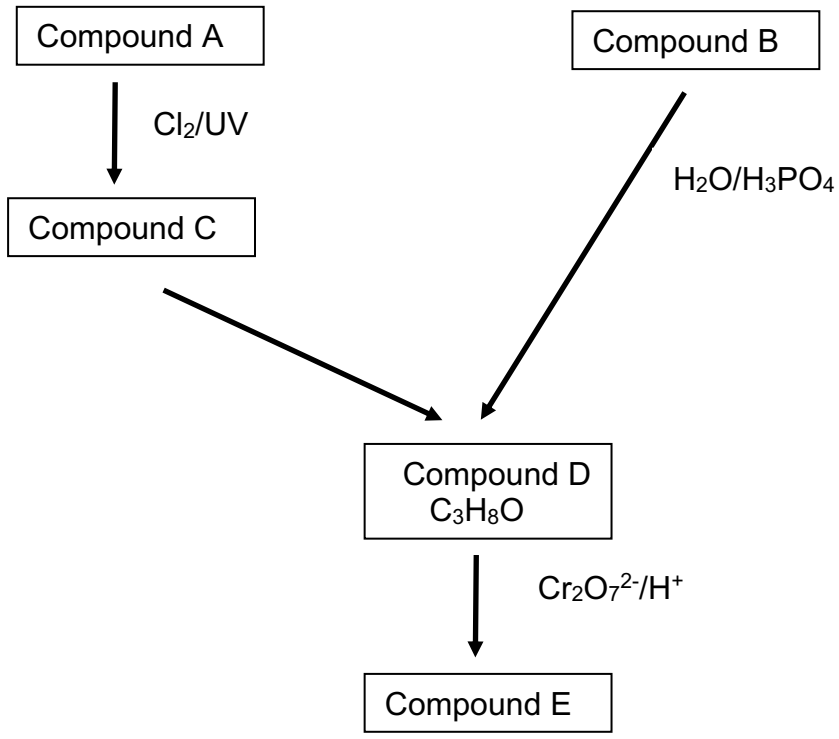
_____

_____

_____

Question 3 (6 marks)

The flowchart below refers to the pathway used to produce Compound E. Some of the reagents and catalysts required are shown on the diagram and the molecular formula of Compound D is known to be C_3H_8O.



Testing of Compound E shows that it does not react with magnesium or with sodium hydrogen carbonate, $NaHCO_3$.

a. Use the information provided to draw and name Compound E. 2 marks

Name: _____

Question 3 (continued)

b. Draw a skeletal structure for Compound D. 1 mark

c. **i**. Write a balanced equation for the formation of Compound D from Compound B. (states not required) 1 mark

_____

ii. What is the atom economy of this reaction? 1 mark

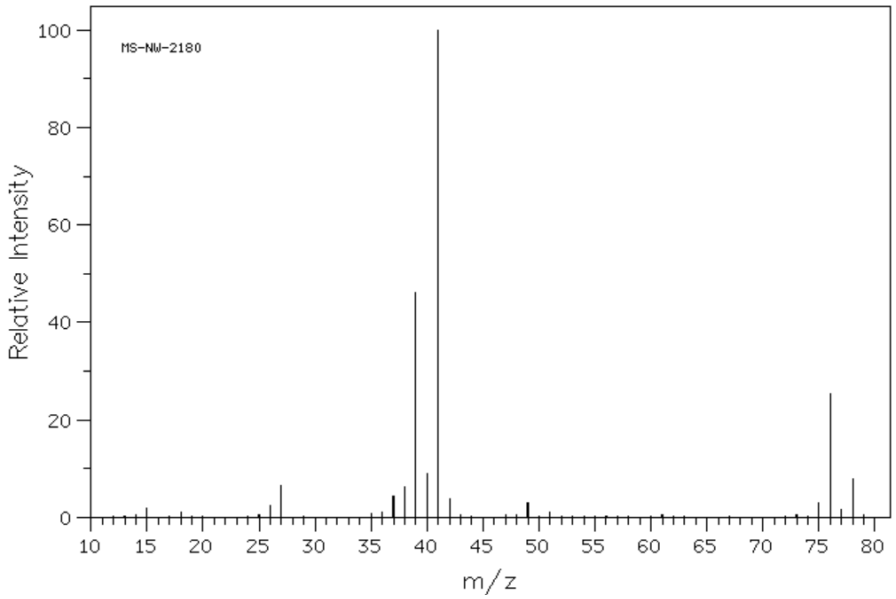
_____

d. Draw a structural isomer of Compound C. 1 mark

Question 4 (11 marks)

An organic compound, referred to in this Question as Compound A, is known to contain carbon, hydrogen and one other element.

The mass spectrum of Compound A is shown below.



a. **i**. The presence of the two parent molecular ion peaks on this spectrum can be used to determine the identity of the third element in Compound A.

What is this third element? Justify your answer. 2 marks

_____

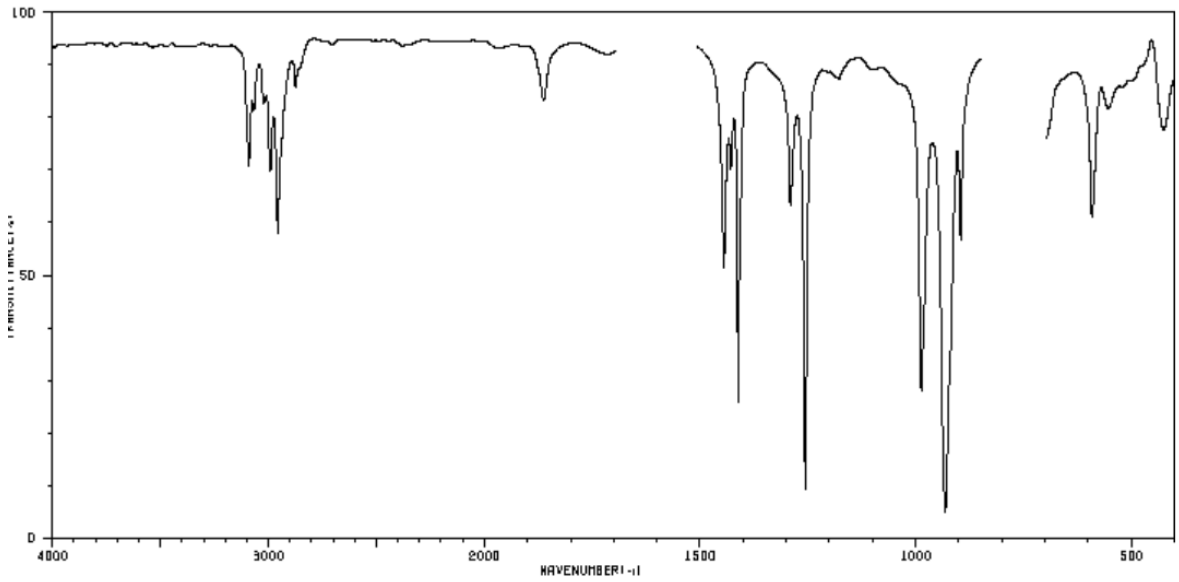
_____

ii. What is the likely molecular formula of Compound A? 1 mark

_____

Question 4 (continued)

b. The infrared spectrum of Compound A is shown below. Sometimes, the absence of absorptions is as informative as the absorptions that are present.



State two absorption values that indicate that Compound A does **not** contain oxygen. Include in your answer the relevant functional group.

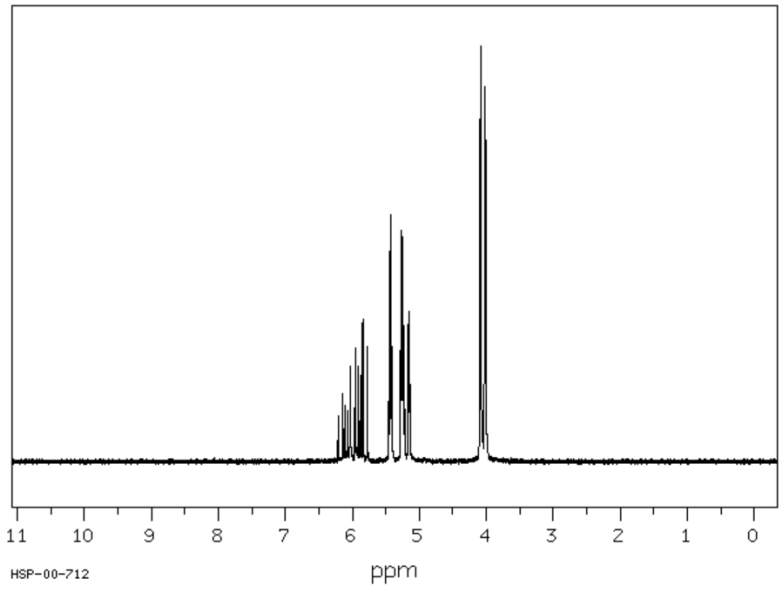
2 marks

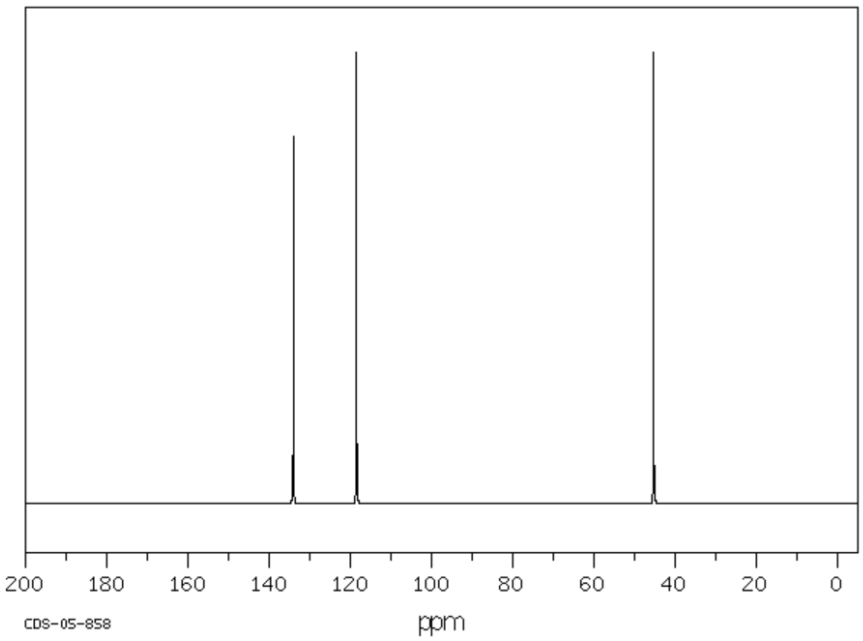
Absorption 1: _____

Absorption 2: _____

Question 4 (continued)

c. The spectra below are, respectively, the proton-NMR and the carbon-13 NMR. (All of the peaks on the proton-NMR between 5 and 5.5 ppm are actually one environment.)





i. How many carbon environments does Compound A have? _____ 1 mark

ii. Is it likely that Compound A contains a - CH_3 group? Justify your answer. 2 marks

_____

_____

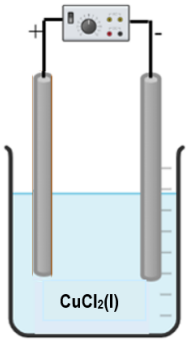
_____

Question 4 (continued)

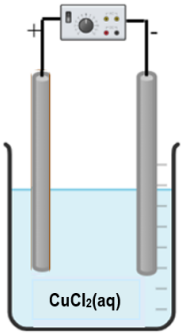
d. **i**. Draw a possible structure for Compound A. 2 marks

ii. Name Compound A. _____ 1 mark

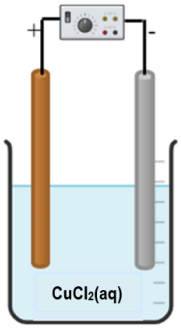
Question 5 (8 marks)
A chemistry class is investigating the electrolysis of copper chloride. As part of their investigation, they set up the three electrolytic cells shown below. The solution is heated in Cell A.



Cell A  Pt electrodes



Cell B: Pt electrodes



Cell C: Cu anode

a. Write three different half-equations for the reactions occurring at the anode in each cell. 3 marks

Cell A: _____

Cell B: _____

Cell C: _____

b. In which cell(s) does the mass of the cathode change as the cell operates? 1 mark

_____

c. Which cell requires the lowest voltage to operate? _____ 1 mark

d. A voltage of 4.0 V is applied for 4.0 mins to each of the cells. Will the same mass of copper be deposited in each cell during this time? Discuss your answer. 3 marks

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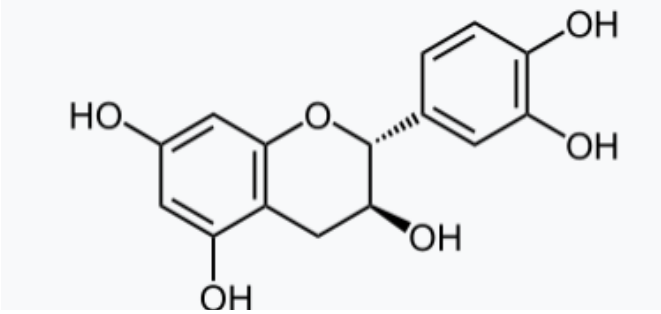
Question 6 (8 marks)

Catechin is a compound found in plants such as tea and cocoa. It is a vasodilator, a substance that can help relieve issues with high blood pressure by expanding the diameter of arteries. The structure of catechin is shown below.



a. Label on the diagram any chiral carbon atoms in catechin. 2 marks

b. Discuss the choice of a suitable solvent that could be used to extract catechin from plants. 2 marks

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_____

c. There are several forms of catechin but only one form is effective in the human body. Explain the likely cause of this variable degree of effectiveness. 2 marks

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_____

d. Fungi contain an enzyme catechin oxygenase that degrades catechin. For that reason, a patient taking catechin is advised to avoid mushrooms unless they are also taking a competitive inhibitor to prevent the degradation of catechin.
Explain how the competitive enzyme inhibitor will work with catechin. 2 marks

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Question 7 (9 marks)

a. Capric acid is the sole fatty acid in one of the triglycerides found in coconut oil. This triglyceride is hydrolysed in the body by the enzyme lipase.

i. The fatty acid referred to in the question does not have an iodine number. Why is that? 1 mark

_____

ii. Draw a molecule of the biodiesel that is formed from a transesterification reaction between this fatty acid and methanol. 2 marks

iii. Lipase has an optimum pH of 8. Explain what this means in the context of digestion of a triglyceride. 2 marks

_____

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_____

b. **i**. Draw the zwitterion of aspartic acid. 1 mark

ii. Draw aspartic acid at pH 11. 1 mark

iii. Aspartic acid is part of the formation of ionic bonds between different sections of a protein chain. Select a suitable 2-amino acid that aspartic acid can form an ionic bond with and draw that bond.

2 marks

Question 8 (11 marks)

A chemistry class is using redox titrations to determine the vitamin C content of a range of fruits and vegetables. Aliquots of the plant or vegetable juice are added to flasks and titrated against an iodine solution added from the burette. Starch indicator added to the juice changes to a blue colour when iodine is in excess. The students are able to use an iodine solution labelled 0.100 M that was prepared for the class of the previous year who completed a similar investigation.

The overall equation for the reaction is

$C_6H_8O_6(aq) + I_2(aq) \rightarrow C_6H_6O_6(aq) + 2H^+(aq) + 2I^-(aq)$

A summary of one student's results is shown below.

***Hypothesis**: Oranges will have the highest Vitamin C level of common fruits and vegetables.*

Preparation of fruit and vegetable juices

- *10 mL from a 2.0 L carton of 'Freshie' orange juice*
- *10 g blended Capsicum, diluted to 100 mL*
- *10 g blended Tomato, diluted to 100 mL*
- *10 g of Kakadu plum powder, diluted to 100 mL*

Fruit/vegetable	***Mean titre Iodine, mL***
Freshie	*34.4*
Capsicum	*17.8*
Tomato	*12.2*
Kakadu plum	*24.5*

***Conclusion**: My hypothesis has been validated – the Vitamin C content of orange juice is higher than that of other fruits and vegetables.*

a. Identify the following variables in the student's testing:

i. Independent variable 1 mark

_____

ii. Dependent variable 1 mark

_____

b. Write equations for the two half-equations occurring during the titration. 2 marks

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Question 8 (continued)

c. Describe the expected colour change that should occur when tomato juice is tested. 2 marks

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_____

d. Discuss the student's conclusion. 3 marks

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e. State two design changes you would make to improve the reproducibility of the student's results. 2 marks

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Question 9 (12 marks)

One of the most used chemicals in the world is sulfuric acid, H_2SO_4. It can be produced from waste industrial emissions of SO_2 from mining companies. There are several steps to the production of sulfuric acid but the critical step is the reversible conversion of SO_2 to SO_3. The equation for the reaction is

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \quad \Delta H = -198$ kJ

The conditions usually used by industry to maximise the yield of the reaction are:

- 450 ºC
- high pressure
- vanadium pentoxide catalyst, V_2O_5 (catalyst is laid out in layers, placed at several levels)
- excess air
- SO_3 removed quickly after manufacture.

a. An understanding of equilibrium principles can be used to explain the choice of conditions used in this process. Demonstrate your understanding of these principles by

i. explaining why 450 ºC is a suitable compromise temperature. 2 marks

_____

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_____

ii. explaining why a high pressure should be used. 2 marks

_____

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iii. explaining why a catalyst is used and how its efficiency is maximised in this process. 2 marks

_____

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_____

iv. explaining why the SO_3 produced is separated quickly from the unreacted gases. 2 marks

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_____

Question 9 (continued)

b. List one sustainability goal that the above conditions address and explain how it is addressed. 2 marks

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c. List one green chemistry principle that the above conditions address and explain how it is addressed. 2 marks

_____

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Question 10 (5 marks)

The table below lists the viscosity levels of three organic compounds.

compound	**viscosity** cP at 25 ^{0}C
ethanoic acid	1.06
octane	0.74
octanoic acid	4.11

Use your knowledge of chemical bonding and homologous series to explain the differences in viscosity of these three compounds.

Your answer should
- define viscosity
- incorporate a discussion of properties of members of a homologous series
- explain how chemical structure impacts bonding.

(An understanding of the unit used in the viscosity table is not required)

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End of question and answer book

2024 Kilbaha VCE Chemistry Trial Examination

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