Trial Examination 2022

VCE Chemistry Unit 2

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's Name: ______________________________

Teacher's Name: ______________________________

Structure of booklet

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	5	5	55
			Total 75

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

Question and answer booklet of 19 pages

Data booklet

Answer sheet for multiple-choice questions

Instructions

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet.

You may keep the data booklet.

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

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SECTION A – MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

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

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

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1

Phosphoric acid, H_3PO_4, is a triprotic acid.

The ion HPO_4^{2-} is best described as

A. diprotic but not amphiprotic.

B. diprotic and amphiprotic.

C. monoprotic but not amphiprotic.

D. monoprotic and amphiprotic.

Question 2

The following reaction occurs in a blast furnace, producing metallic iron.

$$Fe_2O_3(l) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$$

Which one of the following statements about this reaction is correct?

A. Iron ions are the oxidant.

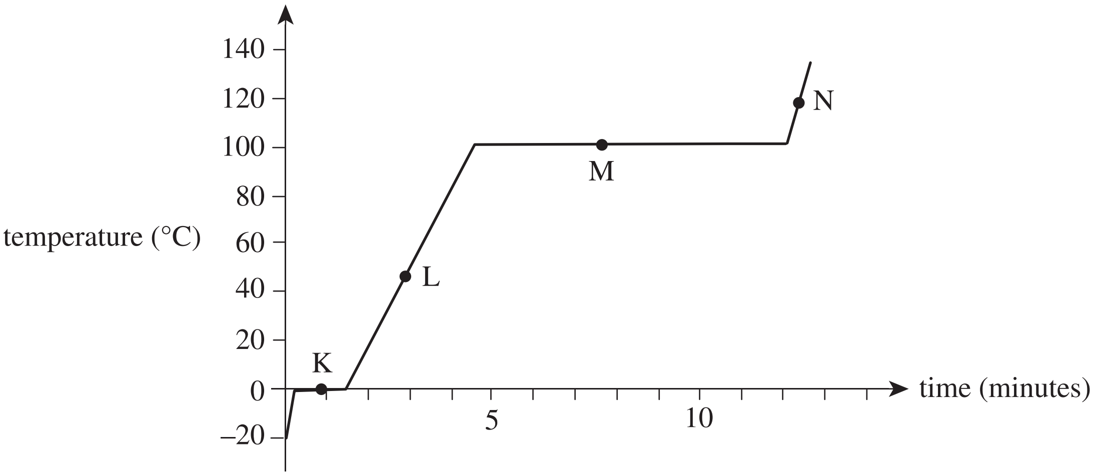
B. CO is the oxidant.

C. Carbon is reduced.

D. Oxygen atoms are oxidised.

Use the following information to answer Questions 3 and 4.

Ice at –20°C was placed in a beaker, then heated and stirred continuously. The temperature of the contents of the beaker was measured over time. The results are shown in the graph below.



Question 3

Liquid water is present in the beaker at points

A. K and L only.

B. K, L and M only.

C. L and M only.

D. L, M and N only.

Question 4

At what points on the graph is covalent bonding being disrupted?

A. K and M only

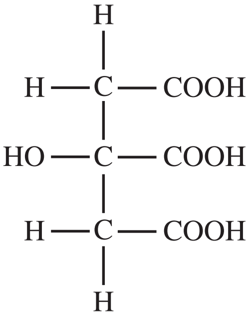
B. L and N only

C. K, L, M and N

D. none of the points

Use the following information to answer Questions 5–7.

Citric acid is found naturally in many foods and is used in food preparation. Its structural formula is shown below.



Question 5

0.100 M citric acid is best described as a

A. concentrated solution of a weak acid.

B. dilute solution of a weak acid.

C. concentrated solution of a strong acid.

D. dilute solution of a strong acid.

Question 6

30.0 mL of 1.00 M nitric acid, HNO_3, reacts with exactly 10.0 mL of a sodium hydroxide, NaOH, solution. What volume of 0.100 M citric acid will react with 10.0 mL of the same NaOH solution?

A. 10.0 mL

B. 30.0 mL

C. 100 mL

D. 300 mL

Question 7

What volume of water must be added to 150 mL of 0.100 M citric acid solution to produce a 0.0650 M solution?

A. 49.0 mL

B. 81.0 mL

C. 98.0 mL

D. 231 mL

Question 8

Which one of the following is **not** a property of water?

A. a very low specific heat capacity

B. a relatively high latent heat of vaporisation

C. a relatively high boiling point for the molecular size

D. the ability to dissolve many ionic and covalent substances

Question 9

A redox reaction is represented by the following equation.

$$2Fe(s) + O_2(g) + 2H_2O(l) \rightarrow 2Fe^{2+} + 4OH^-(aq)$$

Which one of the following is a conjugate redox pair in this reaction?

A. Fe and Fe^{2+}

B. H_2O and OH^-

C. Fe and O_2

D. O_2 and H_2O

Question 10

A covalent molecular substance is considered a weak base if it

A. ionises partially when reacting with water to produce hydronium ions.

B. reacts partially with water to produce ions that can accept a proton.

C. has a pH greater than 12 and less than 14 in aqueous solution.

D. accepts a hydrogen atom from a weak acid.

Question 11

To conduct a volumetric analysis, 250.0 mL of a 0.156 M sodium carbonate, Na_2CO_3, solution was required.

The mass of solid, anhydrous, Na_2CO_3 required to make this standard solution was

A. 2.72 g

B. 4.13 g

C. 10.9 g

D. 16.5 g

Question 12

The end point in any acid–base titration is reached when

A. equal volumes of the acid and base solutions have been mixed.

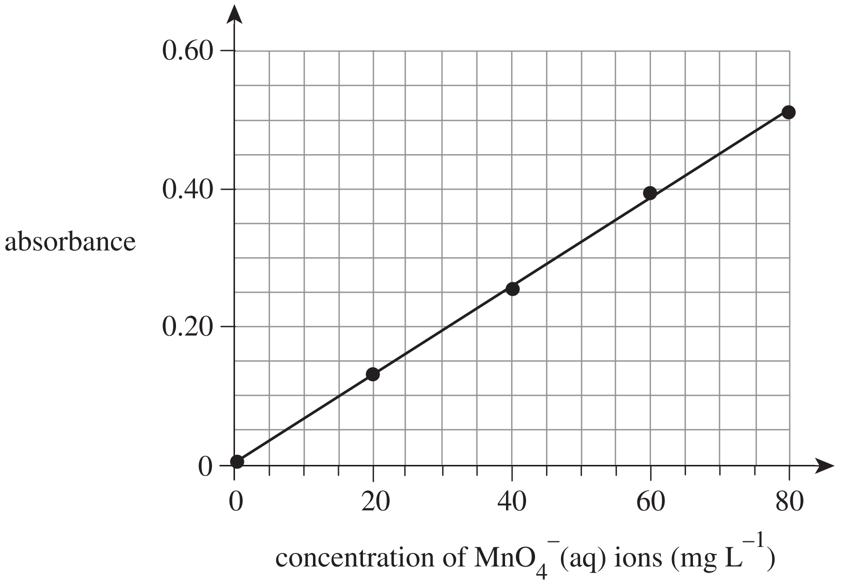
B. the reactants have been mixed in the mole ratio given in the balanced equation.

C. the pH of the solution in the reaction flask is 7.

D. the indicator shows a permanent colour change.

Use the following information to answer Questions 13–15.

Wastewater from an industrial manufacturing plant contains the purple-coloured permanganate ion, MnO_4^-. Colorimetry was used to determine the concentration of this ion in the wastewater. 20.00 mL samples of the wastewater were collected, and each sample was diluted to 250.0 mL. The absorbance of each diluted sample was read in the colorimeter with the wavelength set at 525 nm. The calibration curve used in the process is shown below.



Question 13

The main reason more than one sample of wastewater was taken is to

A. reduce uncertainty of the concentration determination by averaging results.

B. allow a larger volume to be taken when all the samples are pooled before use.

C. ensure that at least some samples can be used if there are accidental spillages.

D. enable the samples to be read at other wavelengths in the colorimeter.

Question 14

A wavelength of 525 nm was selected for this analysis because

A. MnO_4^- absorbs very weakly at this wavelength and so allows all light to pass through.

B. the water present in all the samples absorbs radiation of this wavelength.

C. only the substance under analysis has strong absorption at this wavelength.

D. it is set in the colorimeter as it is most effective for all colours.

Question 15

The absorbance of one diluted sample was 0.35.

Based on this absorbance reading, what is the concentration of MnO_4^- in the original wastewater?

A. 44 mg L^{-1}

B. 55 mg L^{-1}

C. 1.9×10^2 mg L^{-1}

D. 6.9×10^2 mg L^{-1}

Question 16

The following statements refer to water.

I Water is the only known substance that exists as a solid, liquid and gas at the Earth's surface under normal conditions.

II Of all the water on Earth, less than 1% is fresh water.

III Only about 0.5% of the fresh water on Earth is accessible for use by humans.

Which of these statements are correct?

A. I and II only

B. II and III only

C. I and III only

D. I, II and III

Question 17

Rainwater is normally slightly acidic even when there is no air pollution present.

Which one of the following gases in the atmosphere is the main cause of this acidity?

A. carbon dioxide

B. nitrogen

C. oxygen

D. nitrogen dioxide

Question 18

A 200 mL sample of water contains 0.250 mg of fluoride ions.

The concentration of fluoride in the water sample is

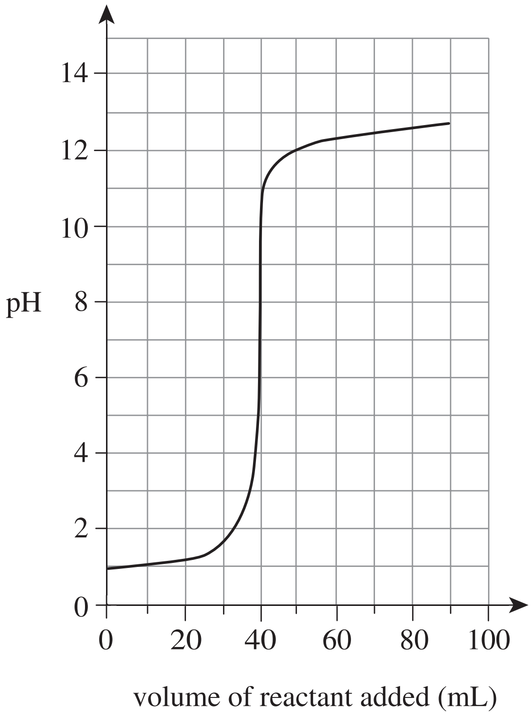
A. 1.25×10^{-2} g L^{-1}

B. 1.25×10^{-3} %(m/v)

C. 1.25 ppm

D. 6.58×10^{-2} mol L^{-1}

Question 19
The changes in pH during a titration were recorded and plotted to produce the titration curve below.



Which reactants were used in the titration?

A. a weak acid and a weak base

B. a weak acid and a strong base

C. a strong acid and a weak base

D. a strong acid and a strong base

Question 20
A strip of zinc, Zn, is placed in a beaker containing a solution of 1.0 M nickel nitrate, $Ni(NO_3)_2$.

Which one of the following would be expected to occur?

A. The green colour of the $Ni(NO_3)_2$ solution would become darker.

B. No reaction would be observed because Zn is a weak reductant.

C. The mass of the strip of Zn would decrease.

D. Zinc nitrate would precipitate from the solution.

END OF SECTION A

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided.

Give simplified answers to all numerical questions, with an appropriate number of significant figures; unsimplified answers will not be given full marks.

Show all working in your answers to numerical questions; no marks will be given for an incorrect answer unless it is accompanied by details of the working.

Ensure chemical equations are balanced and that the formulas for individual substances include an indication of state, for example, $H_2(g)$, NaCl(s).

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1 (13 marks)

Chromium is a hard, shiny metal used widely in industrial applications such as electroplating (to prevent corrosion), stainless steel production and for decorative finishes.

An experiment was set up to determine the reactivity series of the metals chromium, lanthanum, palladium and barium. Samples of each metal were placed separately in aqueous solutions of each of the other metal ions. The results of the experiment are shown in the table below.

	Cr^{3+}(aq)	**La^{3+}(aq)**	**Pd^{2+}(aq)**	**Ba^{2+}(aq)**
Cr		no reaction	reaction	no reaction
La	reaction		reaction	no reaction
Pd	no reaction	no reaction		no reaction
Ba	reaction	reaction	reaction	

a. Using the element symbols for the four metals, write the metals in order of increasing reactivity. 1 mark

b. **i.** Write the balanced ionic equation for the reaction of Cr with Pd^{2+}. 2 marks

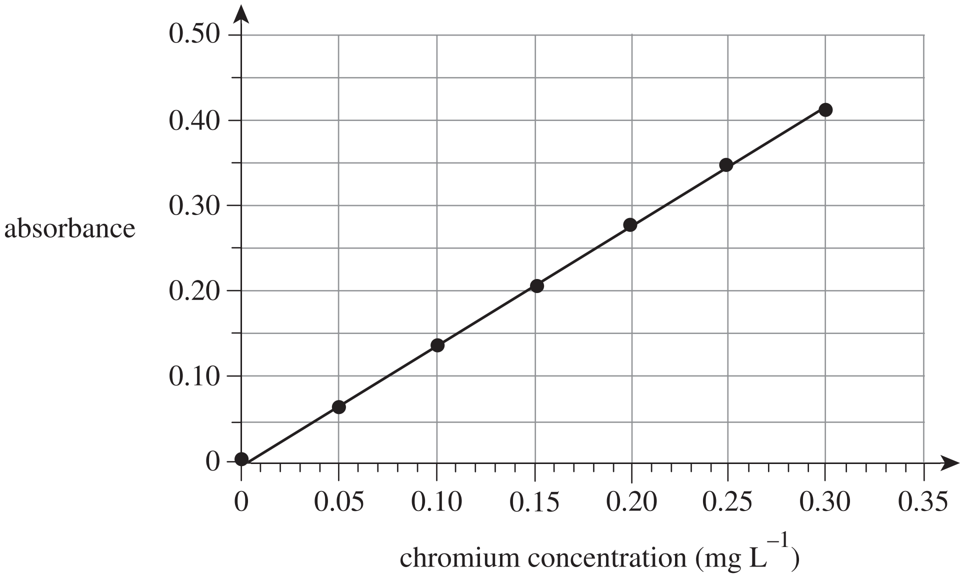
ii. Ba also reacts with Pd^{2+}.

Write the oxidation half-equation for this reaction. 1 mark

c. An electroplating factory has 500 L of waste liquid containing chromium as $Cr^{3+}(aq)$. Before the liquid can be safely discharged, Cr^{3+} is removed from the liquid using a precipitation reaction represented by the following ionic equation.

$$Cr^{3+}(aq) + 3OH^{-}(aq) \rightarrow Cr(OH)_3(s)$$

Atomic absorption spectroscopy (AAS) was used to determine the concentration of Cr^{3+} in the waste liquid so that the ions could be removed efficiently. The chromium AAS calibration curve that was used in the analysis is shown below.



1.00 mL of the waste liquid was diluted to 100.0 mL. A sample of this diluted liquid recorded an absorbance of 0.25 using the AAS analysis.

i. Determine the concentration, in mol L^{-1}, of chromium in the undiluted waste liquid. 3 marks

ii. Calculate the mass, in grams, of chromium in the 500 L of waste liquid. 1 mark

iii. Another 500 L batch of waste liquid was found to contain 10.0 g of chromium.

Calculate the mass of solid $Cr(OH)_3$, in grams, that will be produced when this 500 L of waste liquid undergoes the precipitation reaction. 3 marks

iv. Explain how the $Cr(OH)_3$ precipitate is likely to be removed so that the waste liquid can be safely discharged. 2 marks

Question 2 (9 marks)

a. A solution of 1.0×10^{-3} M ethanoic acid, CH_3COOH, a monoprotic acid, has a pH of 3.9.

i. Determine the hydrogen ion concentration in a 1.0×10^{-3} M CH_3COOH solution at 25°C. 1 mark

ii. State the pH of a 1.0×10^{-3} M hydrochloric acid solution, HCl. 1 mark

b. **i.** Write the balanced ionic equation for the reaction of zinc with dilute HCl. 2 marks

ii. Write the balanced chemical equation for the reaction of CH_3COOH with solid potassium carbonate. 2 marks

iii. Write the balanced chemical equation for the reaction of dilute HCl with solid magnesium oxide. 2 marks

c. The reactions in **part b.** all produce a salt.

Define a salt in this context. 1 mark

Question 3 (11 marks)

The water from a drain located near an industrial manufacturing complex was investigated for contaminants.

a. Explain the meaning of the term 'contaminant'. 1 mark

b. Outline **two** procedures that should be used when sampling the drain water to ensure that appropriate samples for analysis are obtained. 2 marks

c. The drain water was analysed to determine the levels of sodium chloride, NaCl.

i. Using gravimetric analysis, a 10.0 L sample of drain water was treated with silver nitrate solution. 0.0126 g of silver chloride, AgCl, precipitate was obtained.

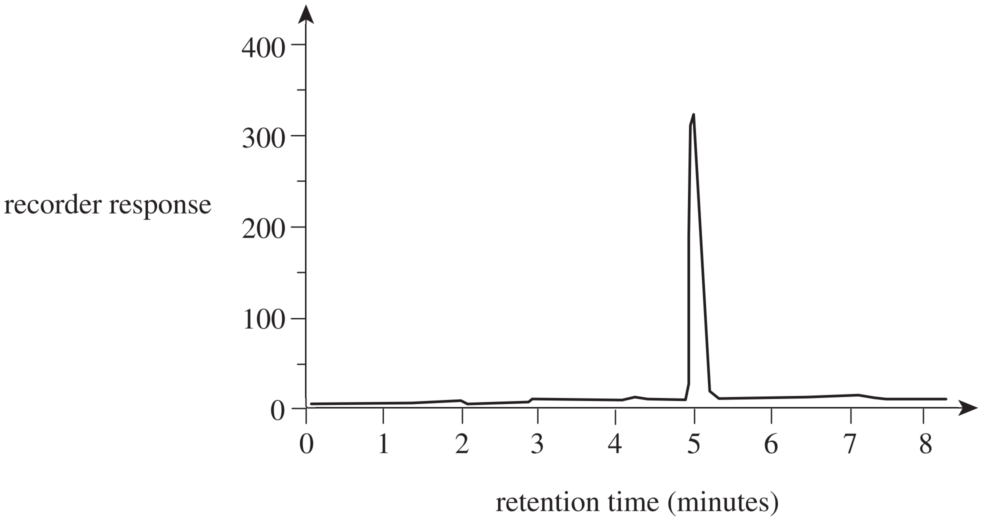
Calculate the concentration of NaCl, in g L^{-1}, in the water. 3 marks

ii. State **one** important assumption that was made in the gravimetric analysis in **part c.i.** 1 mark

iii. Suggest **one** analytical method other than gravimetric analysis that could be used to determine the level of NaCl in the drain water. 1 mark

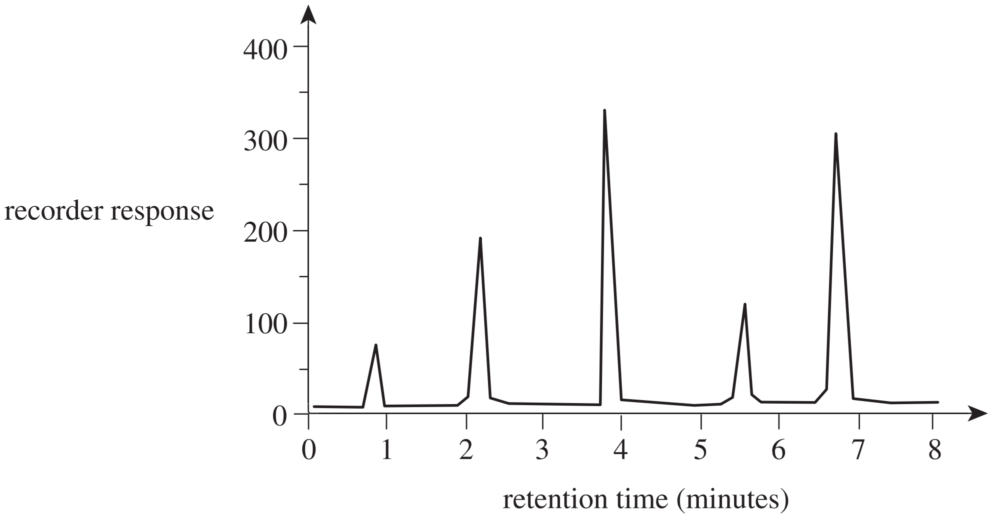
d. High-performance liquid chromatography (HPLC) was used to analyse the drain water for the presence of the pesticide alpha-Naphthylthiourea (ANTU). The output of the HPLC analysis of a pure sample of ANTU is shown in Graph 1 below.

Graph 1



A water sample from the drain was analysed using the same HPLC column under identical conditions and produced the output shown in Graph 2 below.

Graph 2



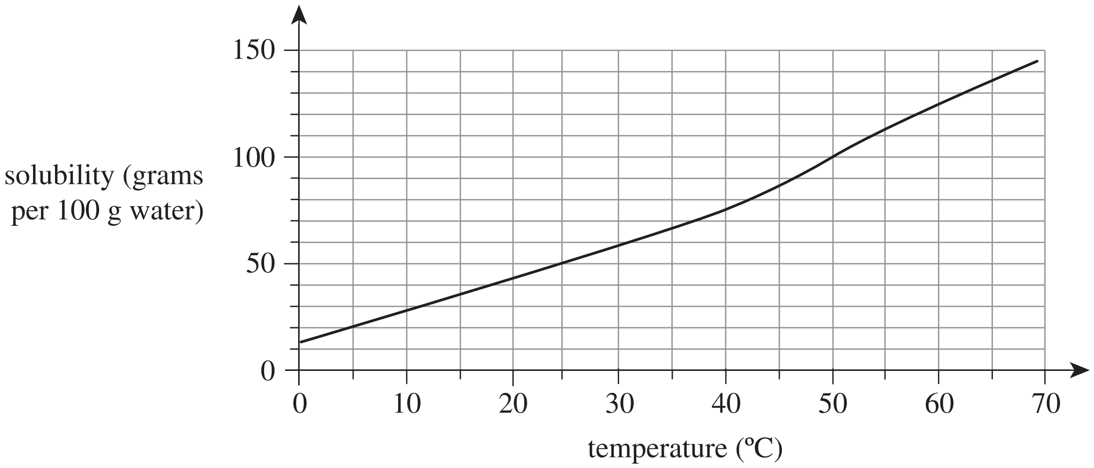
i. Explain whether the drain water does or does not contain ANTU. 2 marks

ii. State **one** conclusion other than your answer for **part d.i.** that can be drawn from the HPLC output in Graph 2. 1 mark

Question 4 (15 marks)

Water is known as the universal solvent because it dissolves many solids, liquids and gases.

a. The solubility of soluble solids generally increases as temperature increases. The solubility curve of the ionic compound potassium nitrate is shown below.



i. When solid potassium nitrate dissolves in water, bonds are broken and other bonds are formed.

Explain the dissolving process by naming the bond types broken and the bond types formed. 3 marks

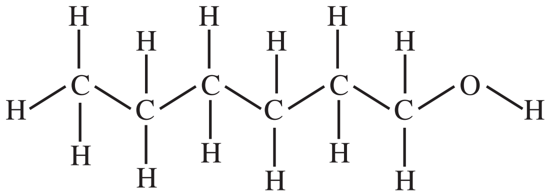
ii. 40 mL of a saturated solution of potassium nitrate at 50°C was placed in a beaker. The temperature was then lowered to 40°C.

How many grams of potassium nitrate will crystallise in the beaker? 3 marks

iii. Another 40 mL of a saturated solution of potassium nitrate at 50°C was placed in a second beaker. 10 mL of water was then added to this beaker.

What is the minimum temperature at which the solution in this beaker would remain saturated? 2 marks

b. The molecular structure of hexanol is shown below.



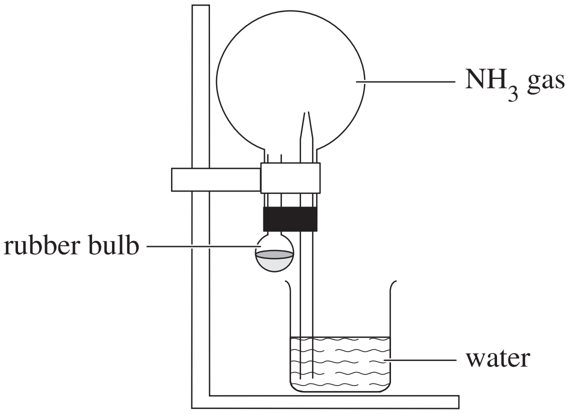
Explain why hexanol is insoluble in water. 2 marks

c. The solubility of gases in water decreases when temperature is increased. The solubilities of the gases oxygen and ammonia in water at different temperatures are shown in the following table. The solubilities are given in grams of gas per 100 grams of water.

	0°C	**20°C**	**60°C**
Oxygen (O_2)	0.0069	0.0043	0.0023
Ammonia (NH_3)	89.7	52.9	16.8

i. With reference to structure and bonding, and using a labelled diagram, explain why NH_3 gas is very soluble in water at all the temperatures shown in the table. 3 marks

ii. NH_3 gas is so soluble in water that it can be used in the 'fountain experiment', which is set up as shown in the following diagram.



In this experiment, when water from the rubber bulb is squirted into the round flask filled with NH_3 gas, all the gas immediately dissolves in the water and the pressure inside the flask decreases greatly. Atmospheric pressure pushes the water from the beaker up the thin tube into the round flask, producing a fountain.

Explain whether O_2 gas could be used instead of NH_3 gas in this set-up to produce the same fountain effect. 2 marks

Question 5 (7 marks)

a. Write the equation for the self-ionisation reaction of water. 2 marks

b. The values for the ionic product of water (K_w) at various temperatures are shown in the following table.

Temperature (°C)	0	15	35	45	55
K_w (M^2)	1.14×10^{-15}	4.51×10^{-15}	2.09×10^{-14}	4.01×10^{-14}	7.29×10^{-14}

At 55°C, the pH of a solution of nitric acid (HNO_3), which is a strong acid, is 3.7.

Calculate the hydroxide ion concentration in the solution. 2 marks

c. A sample of pure water at 30°C was heated until the temperature reached 50°C.

i. How does the pH of the water change as the water is heated? 2 marks

ii. Circle the term below that best describes the water at 50°C. 1 mark

acidic neutral basic

END OF QUESTION AND ANSWER BOOKLET

Neap

Trial Examination 2022

VCE Chemistry Unit 2

Written Examination

Data Booklet

Instructions

This data booklet is provided for your reference.
A question and answer booklet is provided with this data booklet.

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1. Periodic table of the elements

atomic number — 79 — symbol of element — **Au**
relative atomic mass — 197.0
name of elecment — gold

1 **H** 1.0 hydrogen																	2 **He** 4.0 helium
3 **Li** 6.9 lithium	4 **Be** 9.0 beryllium											5 **B** 10.8 boron	6 **C** 12.0 carbon	7 **N** 14.0 nitrogen	8 **O** 16.0 oxygen	9 **F** 19.0 fluorine	10 **Ne** 20.2 neon
11 **Na** 23.0 sodium	12 **Mg** 24.3 magnesium											13 **Al** 27.0 aluminium	14 **Si** 28.1 silicon	15 **P** 30.1 phosphorus	16 **S** 32.1 sulfur	17 **Cl** 35.5 chlorine	18 **Ar** 39.9 argon
19 **K** 39.1 potassium	20 **Ca** 40.1 calcium	21 **Sc** 45.0 scandium	22 **Ti** 47.9 titanium	23 **V** 50.9 vanadium	24 **Cr** 52.0 chromium	25 **Mn** 54.9 manganese	26 **Fe** 55.8 iron	27 **Co** 58.9 cobalt	28 **Ni** 58.7 nickel	29 **Cu** 63.5 copper	30 **Zn** 65.4 zinc	31 **Ga** 69.7 gallium	32 **Ge** 72.6 germanium	33 **As** 74.9 arsenic	34 **Se** 79.0 selenium	35 **Br** 79.9 bromine	36 **Kr** 83.8 krypton
37 **Rb** 85.5 rubidium	38 **Sr** 87.6 strontium	39 **Y** 88.9 yttrium	40 **Zr** 91.2 zirconium	41 **Nb** 92.9 niobium	42 **Mo** 96.0 molybdenum	43 **Tc** (98) 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** 183.8 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** (210) polonium	85 **At** (210) astatine	86 **Rn** (222) radon
87 **Fr** (223) francium	88 **Ra** (226) radium	**89–103** actinoids	104 **Rf** (261) rutherfordium	105 **Db** (262) dubnium	106 **Sg** (266) seaborgium	107 **Bh** (264) bohrium	108 **Hs** (267) hassium	109 **Mt** (268) meitnerium	110 **Ds** (271) darmstadtium	111 **Rg** (272) roentgenium	112 **Cn** (285) copernicium	113 **Nh** (280) nihonium	114 **Fl** (289) flerovium	115 **Mc** (289) moscovium	116 **Lv** (292) livermorium	117 **Ts** (294) tennessine	118 **Og** (294) oganesson

57 **La** 138.9 lanthanum	58 **Ce** 140.1 cerium	59 **Pr** 140.9 praseodymium	60 **Nd** 144.2 neodymium	61 **Pm** (145) 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 homium	68 **Er** 167.3 erbium	69 **Tm** 168.9 thulium	70 **Yb** 173.1 ytterbium	71 **Lu** 175.0 lutetium

89 **Ac** (227) actinium	90 **Th** 232.0 thorium	91 **Pa** 231.0 protactinium	92 **U** 238.0 uranium	93 **Np** (237) neptunium	94 **Pu** (244) plutonium	95 **Am** (243) americium	96 **Cm** (247) curium	97 **Bk** (247) berkelium	98 **Cf** (251) californium	99 **Es** (252) einsteinium	100 **Fm** (257) fermium	101 **Md** (258) mendelevium	102 **No** (259) nobelium	103 **Lr** (262) lawrencium

The value in the brackets indicates the mass number of the longest-lived isotope.

2. Electrochemical series

Reaction	**Standard electrode potential (E^0) in volts at 25°C**
$F_2(g) + 2e^- \rightleftharpoons 2F^-(aq)$	+2.87
$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightleftharpoons 2H_2O(l)$	+1.77
$Au^+(aq) + e^- \rightleftharpoons Au(s)$	+1.68
$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-(aq)$	+1.36
$O_2(g) + 4H^+(aq) + 4e^- \rightleftharpoons 2H_2O(l)$	+1.23
$Br_2(l) + 2e^- \rightleftharpoons 2Br^-(aq)$	+1.09
$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$	+0.80
$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$	+0.77
$O_2(g) + 2H^+(aq) + 2e^- \rightleftharpoons H_2O_2(aq)$	+0.68
$I_2(s) + 2e^- \rightleftharpoons 2I^-(aq)$	+0.54
$O_2(g) + 2H_2O(l) + 4e^- \rightleftharpoons 4OH^-(aq)$	+0.40
$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$	+0.34
$Sn^{4+}(aq) + 2e^- \rightleftharpoons Sn^{2+}(aq)$	+0.15
$S(s) + 2H^+(aq) + 2e^- \rightleftharpoons H_2S(g)$	+0.14
$2H^+(aq) + 2e^- \rightleftharpoons H_2(g)$	0.00
$Pb^{2+}(aq) + 2e^- \rightleftharpoons Pb(s)$	– 0.13
$Sn^{2+}(aq) + 2e^- \rightleftharpoons Sn(s)$	– 0.14
$Ni^{2+}(aq) + 2e^- \rightleftharpoons Ni(s)$	– 0.25
$Co^{2+}(aq) + 2e^- \rightleftharpoons Co(s)$	– 0.28
$Cd^{2+}(aq) + 2e^- \rightleftharpoons Cd(s)$	– 0.40
$Fe^{2+}(aq) + 2e^- \rightleftharpoons Fe(s)$	– 0.44
$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s)$	– 0.76
$2H_2O(l) + 2e^- \rightleftharpoons H_2(g) + 2OH^-(aq)$	– 0.83
$Mn^{2+}(aq) + 2e^- \rightleftharpoons Mn(s)$	–1.18
$Al^{3+}(aq) + 3e^- \rightleftharpoons Al(s)$	–1.66
$Mg^{2+}(aq) + 2e^- \rightleftharpoons Mg(s)$	–2.37
$Na^+(aq) + e^- \rightleftharpoons Na(s)$	–2.71
$Ca^{2+}(aq) + 2e^- \rightleftharpoons Ca(s)$	–2.87
$K^+(aq) + e^- \rightleftharpoons K(s)$	–2.93
$Li^+(aq) + e^- \rightleftharpoons Li(s)$	–3.04

3. Chemical relationships

Name	Formula
number of moles of a substance	$n = \frac{m}{M}; \quad n = cV$

4. Physical constants and standard values

Name	Symbol	Value
Avogadro constant	N_A or L	6.02×10^{23} mol^{-1}
specific heat capacity of water	c	4.18 kJ kg^{-1} K^{-1} or 4.18 J g^{-1} K^{-1}
density of water at 25°C	d	997 kg m^{-3} or 0.997 g mL^{-1}
ionic product for water	K_W	1.00×10^{-14} mol^2 L^{-2} at 298 K (self-ionisation constant)

5. Unit conversions

Measured value	Conversion
1 litre (L)	1 dm^3 or 1×10^{-3} m^3 or 1×10^3 cm^3 or 1×10^3 mL

6. Metric (including SI) prefixes

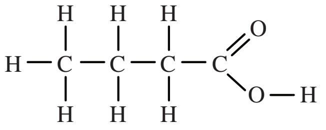
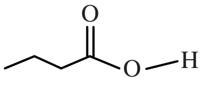
Metric (including SI) prefixes	Scientific notation	Multiplying factor
giga (G)	10^9	1 000 000 000
mega (M)	10^6	1 000 000
kilo (k)	10^3	1000
deci (d)	10^{-1}	0.1
centi (c)	10^{-2}	0.01
milli (m)	10^{-3}	0.001
micro (μ)	10^{-6}	0.000001
nano (n)	10^{-9}	0.000000001
pico (p)	10^{-12}	0.000000000001

7. Acid–base indicators

Name	**pH range**	**Colour change from lower pH to higher pH in range**
thymol blue (1st change)	1.2–2.8	red → yellow
methyl orange	3.1– 4.4	red → yellow
bromophenol blue	3.0– 4.6	yellow → blue
methyl red	4.4–6.2	red → yellow
bromothymol blue	6.0–7.6	yellow → blue
phenol red	6.8–8.4	yellow → red
thymol blue (2nd change)	8.0–9.6	yellow → blue
phenolphthalein	8.3–10.0	colourless → pink

8. Representations of organic molecules

The following table shows different representations of organic molecules, using butanoic acid as an example.

Formula	**Representation**
molecular formula	$C_4H_8O_2$
structural formula	
semi-structural (condensed) formula	$CH_3CH_2CH_2COOH$ or $CH_3(CH_2)_2COOH$
skeletal structure	

9. A solubility table

High solubility	**Low solubility**
Compounds containing the following ions are soluble in water. • Na^+, K^+, NH_4^+, NO_3^-, CH_3COO^- • Cl^-, Br^-, I^- (unless combined with Ag^+ or Pb^{2+}) • SO_4^{2-} (however $PbSO_4$ and $BaSO_4$ are not soluble, Ag_2SO_4 and $CaSO_4$ are slightly soluble)	Compounds containing the following ions are generally insoluble, unless combined with Na^+, K^+ or NH_4^+. • CO_3^{2-}, PO_4^{3-}, S^{2-} • OH^- ($Ba(OH)_2$ and $Sr(OH)_2$ are soluble, $Ca(OH)_2$ is slightly soluble)

END OF DATA BOOKLET

Neap

Trial Examination 2022

VCE Chemistry Unit 2

Written Examination

Multiple-choice Answer Sheet

Student's Name: ______________________________

Teacher's Name: ______________________________

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out.
Marks will **not** be deducted for incorrect answers.
No mark will be given if more than **one** answer is completed for any question.

All answers must be completed like this example: ▨A B C D

Use pencil only

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

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