Neap

Final Examination 2021

NSW Year 11 Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 2 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: 75

Section I – 15 marks (pages 2–8)

- Attempt Questions 1– 15
- Allow about 30 minutes for this section

Section II – 60 marks (pages 9–23)

- Attempt Questions 16– 25
- Allow about 1 hour and 30 minutes for this section

SECTION I

15 marks
Attempt Questions 1–15
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

1 Which of the following lists ONLY homogeneous mixtures?

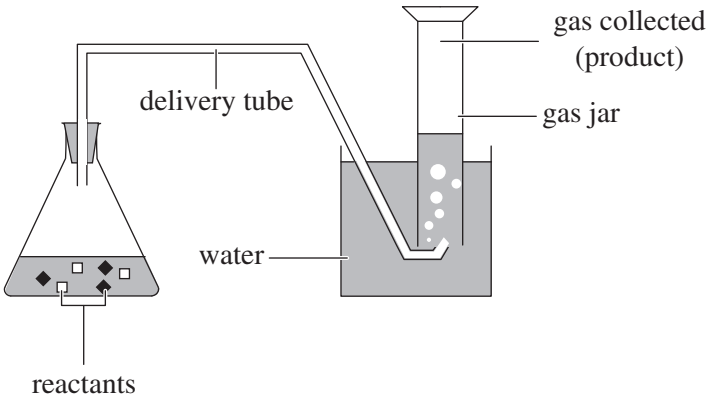
A. tap water, air, soil

B. soil, tap water, brass

C. tap water, milk, brass

D. blood, brass, wood

2 Students conducted an experiment to measure the amount of gas generated when different masses of reactants were mixed in 100.00 mL of water. The experiment is shown in the diagram.



Which of the following correctly identifies the variables of this experiment?

	Independent variable	*Dependant variable*	*Controlled variable*
A.	mass of reactants	temperature	gas collected
B.	volume of water	volume of gas collected	mass of reactants
C.	mass of reactants	volume of gas collected	temperature
D.	volume of gas collected	temperature	mass of reactants

3 When lithium and oxygen combine, a new substance is formed.

Which of the following correctly identifies the compound formed and describes what happens during this reaction?

A. Li_2O is formed, as lithium makes a cation by losing electrons and oxygen makes an anion by gaining electrons.

B. Li_2O is formed, as lithium makes a cation by gaining electrons and oxygen makes an anion by losing electrons.

C. LiO_2 is formed, as lithium makes a cation by losing electrons and oxygen makes an anion by losing electrons.

D. LiO_2 is formed, as lithium makes a cation by gaining electrons and oxygen makes an anion by losing electrons.

4 Which of the following gives the correct electron configuration for the ions in calcium chloride?

	Calcium	*Chloride*
A.	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$	$1s^2 2s^2 2p^6 3s^2 3p^5$
B.	$1s^2 2s^2 2p^6 3s^2 3p^6$	$1s^2 2s^2 2p^6 3s^2 3p^6$
C.	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^4$	$1s^2 2s^2 2p^6 3s^2 3p^4$
D.	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$	$1s^2 2s^2 2p^6 3s^2 3p^7$

5 An ore of copper, malachite, is composed primarily of copper (II) carbonate. When it is heated, it produces copper (II) oxide and carbon dioxide gas.

If a 12.95 g sample is 95% copper carbonate, how much by mass of copper oxide would be produced from its decomposition by heat?

A. 0.83 g

B. 7.92 g

C. 8.33 g

D. 9.51 g

6 When nitrogen gas and hydrogen gas are mixed in a cylinder under specific conditions, they react to form ammonia gas.

If 48.00 L of ammonia gas is produced, how many litres of nitrogen and hydrogen have reacted, assuming temperature and pressure are kept constant?

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

	Volume of nitrogen gas (L)	*Volume of hydrogen gas (L)*
A.	96.00	16.00
B.	48.00	72.00
C.	72.00	24.00
D.	24.00	72.00

7 The table shows the properties of substances *K*, *L*, *M* and *N*.

	Boiling point (°C)	*Electrical conductivity in solid state*	*Electrical conductivity in molten state*
K	750	no	yes
L	–31	no	no
M	3985	no	no
N	2862	yes	yes

Which of the following best classifies these substances?

	K	*L*	*M*	*N*
A.	ionic	covalent molecular	covalent network	metallic
B.	metallic	covalent molecular	covalent network	ionic
C.	covalent molecular	covalent network	ionic	metallic
D.	ionic	covalent network	ionic	covalent molecular

8 Compounds containing the same transition metals can appear in a wide variety of colours. The colour of a compound is linked to the oxidation state of the metal. In its oxidation state of +2, iron appears green in colour, while in its oxidation state of +3 it appears yellow.
Which of the following correctly identifies the green and yellow forms of iron?

	Green	*Yellow*
A.	$FeCl_3$	$FeCl_2$
B.	FeS_2	FeS
C.	Fe_2O_3	FeO
D.	$FeCl_2$	$FeCl_3$

9 The table shows the results obtained by students investigating the relative activity of metals *X*, *Y* and *Z* using displacement reactions. The metals were placed into solutions containing metal ions X^{2+}, Y^{2+} and Z^{2+}.

Metal	*Solution of* X^{2+}	*Solution of* Y^{2+}	*Solution of* Z^{2+}
X	no reaction	displacement	displacement
Y	no reaction	no reaction	no reaction
Z	no reaction	displacement	no reaction

Using the information in the table, which of the following gives the correct order of activity of these metals?

A. $Z < X < Y$

B. $X < Y < Z$

C. $Y < Z < X$

D. $Y < X < Z$

10 The data depicts the bond energies between atoms.

Single bond energies (kJ mol^{-1} of bonds)

	H	C	N	O	S	F	Cl	Br	I
H	436								
C	413	346							
N	391	305	163						
O	463	358	201	146					
S	347	272			226				
F	565	485	283	190	284	155			
Cl	432	339	192	218	255	253	242		
Br	366	285		201	217	249	216	193	
I	299	213		201		278	208	175	151

Multiple bond energies (kJ mol^{-1} of bonds)

C = C 602	C = N 615	C = O 799
C ≡ C 835	C ≡ N 887	C ≡ O 1072
N = N 418	N = O 607	
N ≡ N 945	O = O 498	

Which of the following is a correct arrangement of the molecules in descending order of the amount of energy required to decompose them?

A. HI, HCl, HF

B. HF, HCl, HI

C. O_2, Cl_2, H_2

D. H_2, Cl_2, O_2

11 Students were provided with an unknown solution that contained nitrate ions. The solution also contained ONE of the following ions: barium, copper, potassium or strontium. The students added the unknown solution to separate solutions of chloride, sulfate and nitrate ions, and no precipitation occurred. When they added the unknown solution to a carbonate solution, precipitation did occur. The table shows solubility data for these ions.

	Separate solutions			
Possible ions present in unknown solution	*Chloride*	*Sulfate*	*Nitrate*	*Carbonate*
Barium	no precipitate	precipitate	no precipitate	precipitate
Copper	no precipitate	no precipitate	no precipitate	precipitate
Potassium	no precipitate	no precipitate	no precipitate	no precipitate
Strontium	no precipitate	precipitate	no precipitate	precipitate

Which of the following is most likely to be the unknown solution?

A. copper nitrate

B. potassium nitrate

C. strontium nitrate

D. barium nitrate

12 When black manganese dioxide powder is added to hydrogen peroxide (H_2O_2), it catalyses the decomposition reaction of hydrogen peroxide to produce water, some of which vaporises due to the heat produced, and oxygen gas. Without the addition of the catalyst, hydrogen peroxide can be stored for several weeks without decomposing.
Which of the following is the best explanation for this?

A. The change in enthalpy is positive.

B. The change in entropy is negative.

C. The activation energy at room temperature is high.

D. The Gibbs free energy is positive.

13 Baking soda ($NaHCO_3$) is often used to extinguish fires involving fats and oils. As it decomposes it produces CO_2 gas, which further extinguishes the flame, as well as sodium carbonate and water, as shown in the equation.

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

Standard enthalpies of formation at 25°C

Substance	ΔH°_f *(kJ mol^{-1})*
$NaHCO_3$(s)	–947.7
Na_2CO_3 (s)	–1131
H_2O (l)	–285.9
H_2O (g)	–241.8
CO (g)	–110.5
CO_2 (g)	–393.5

Which of the following gives the correct calculation of H°_f for the decomposition reaction at 25°C?

A. –818 kJ mol^{-1}

B. –129.1 kJ mol^{-1}

C. +85 kJ mol^{-1}

D. +129.1 kJ mol^{-1}

14 Several chemical equations are shown.

I $\quad CO(NH_2)_2(s) + H_2O(l) \rightarrow CO_2(g) + 2NH_3(g)$

II $\quad 2NO_2(g) \rightarrow N_2O_4(g)$

III $\quad C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

Which of the following correctly identifies the equation(s) that have increasing entropy?

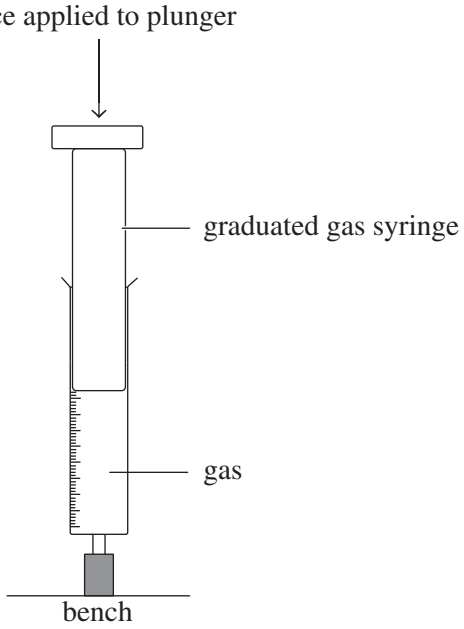
A. I and III only

B. III only

C. I, II and III

D. I and II only

15 A student pushed down as hard as they could onto the plunger of a sealed plastic syringe.



The student compressed the air inside the syringe to a volume of 11.00 mL. When they released their hand, the air inside the syringe equalised with the pressure outside, which was 1.00 atm. The final volume of air inside the syringe was 42.00 mL. The air temperature inside the syringe did not change.

Which of the following options correctly calculates the pressure inside the syringe just before it was released by the student's hand AND identifies the law used to perform this calculation?

A. 3.82×10^{-3} atm by Boyle's Law

B. 3.82×10^{-3} atm by Charles' Law

C. 3.82 atm by Boyle's Law

D. 3.82 atm by Charles' Law

NSW Year 11 Chemistry

Section II Answer Booklet

Section II

60 marks

Attempt Questions 16–25

Allow about 1 hour and 30 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 16 (4 marks)

A mixture of sand and salt was provided to a group of students for them to determine its percentage composition by mass. They added water to the sample before using filtration and evaporation to separate the components. During the evaporation step the students noticed white powder 'spitting' out of the basin onto the bench, so they turned off the Bunsen burner and allowed the water to evaporate overnight. After filtering, they allowed the filter paper to dry before weighing. An electronic balance was used to measure the mass of each component to two decimal places.

The results were recorded as shown.

- mass of the original sand and salt mixture = 17.59 g
- mass of the filter paper = 0.85 g
- mass of the dried filter paper after filtering = 13.35 g
- mass of the empty evaporating basin = 34.02 g
- mass of the evaporating basin after evaporation = 37.98 g

(a) Calculate the percentage composition by mass of sand AND salt in the mixture. **2**

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(b) Consider the definition of validity:

> Validity is the degree to which tests measure what was intended, or the accuracy of actions, data and inferences produced from tests and other processes.

Assess the validity of the experiment. **2**

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Question 17 (4 marks)

Students were given the task of researching the chemical processes that occur when Aboriginal and Torres Strait Islander peoples detoxify poisonous foods. The description was provided by a student after he watched a demonstration in an online video about the processing of rainforest tree nuts in northern New South Wales.

> The nuts were collected from the ground after shaking the trees and placed in the ground oven, which was dug into the sand beside a creek. The sand was covered in rocks and a fire was lit, then the nuts were cooked in the flames for about 10 minutes. Stones were used to crack open the nuts, which were then ground into a paste with water. The paste was placed into a special bag called a dillybag made from leaves and was placed into a stream where the water moved through it.

(a) In the space provided, draw a flow chart to summarise how the poison of rainforest nuts is removed by Aboriginal and Torres Strait peoples. **2**

Question 17 continues on page 12

Question 17 (continued)

(b) In the space provided, draw a labelled scientific diagram of the equipment you would use in a school laboratory to replace the dillybag used in the procedure described. **2**

End of Question 17

Question 18 (5 marks)

(a) Consider the compounds propionaldehyde (C_3H_6O), acetic acid ($C_2H_4O_2$) and glucose ($C_6H_{12}O_6$). **2**

Identify which TWO of these compounds have the same empirical formula and justify your choice.

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(b) A pharmaceutical company is investigating a molecule found in lemons that is believed to have health benefits. The empirical formula of the compound is $C_5H_4O_2$ and its molar mass is determined to be 288 g mol^{-1}. **3**

Calculate the molecular formula of this compound.

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Question 19 (11 marks)

Students were asked to determine an unknown concentration of hydrochloric acid. In order to do this, they collected data on how long it took for magnesium to completely react with 20.00 mL of hydrochloric acid at known concentrations and compared the reaction time with 20.00 mL of the unknown concentration of hydrochloric acid.

First, the students timed how long it took for a 1.00 cm strip of magnesium ribbon to react completely with 20.00 mL of 2.00 mol L^{-1} hydrochloric acid in a beaker. The students then repeated this step in three separate beakers with 20.00 mL samples of the 1.50 mol L^{-1}, 1.00 mol L^{-1} and 0.50 mol L^{-1} solutions of hydrochloric acid, respectively. Their results are recorded in the table.

Concentration of hydrochloric acid (mol L^{-1})	*Time taken for magnesium to completely react (seconds)*
0.50	200
1.00	150
1.50	100
2.00	50

(a) Write a balanced chemical equation for this reaction. **1**

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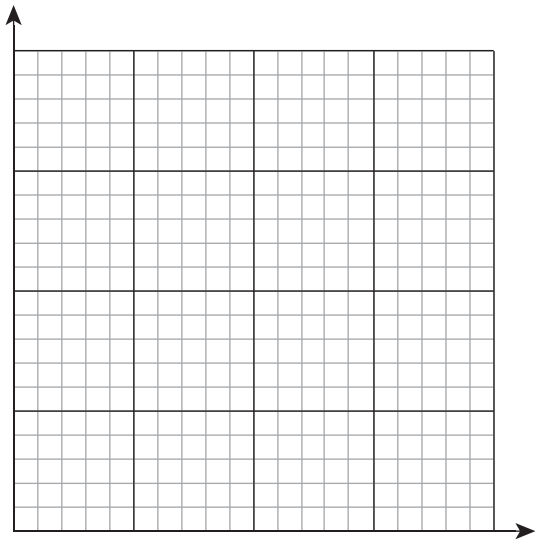
(b) Draw a graph for the results shown in the table above. **3**



Question 19 continues on page 15

Question 19 (continued)

(c) A 1 cm piece of magnesium ribbon was dropped into a beaker with 50 mL of an unknown concentration of hydrochloric acid and took 134 seconds to fully react. **1**

Using your graph in part (b), determine the concentration of this acid solution.

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(d) Explain the trend observed on the graph in part (b). **2**

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(e) A student is required to dilute 100.00 mL solution of 2.00 mol L^{-1} hydrochloric acid to produce 200.00 mL of 0.20 mol L^{-1} hydrochloric acid. **4**

Explain how the student should perform this dilution in a school laboratory. Include relevant calculations in your answer AND explain how the student should prepare any equipment they would use.

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End of Question 19

Question 20 (4 marks)

Two substances, Substance *A* and Substance *B,* are in containers that have lost their labels. Both substances are white crystalline solids. One is sodium chloride (NaCl), the other is sucrose ($C_{12}H_{22}O_{11}$). **4**

Justify ONE method you could use in a school laboratory to safely distinguish between these two substances.

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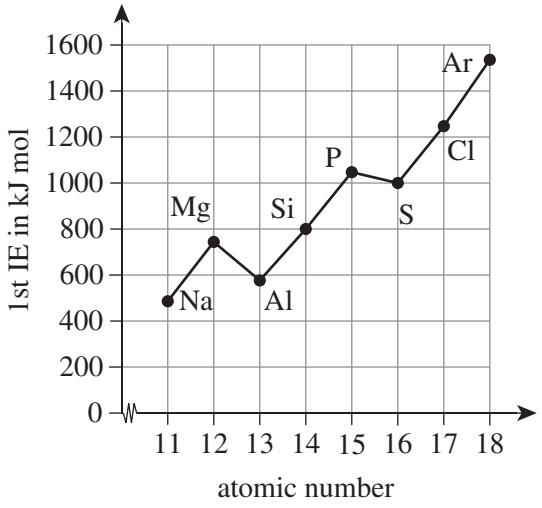
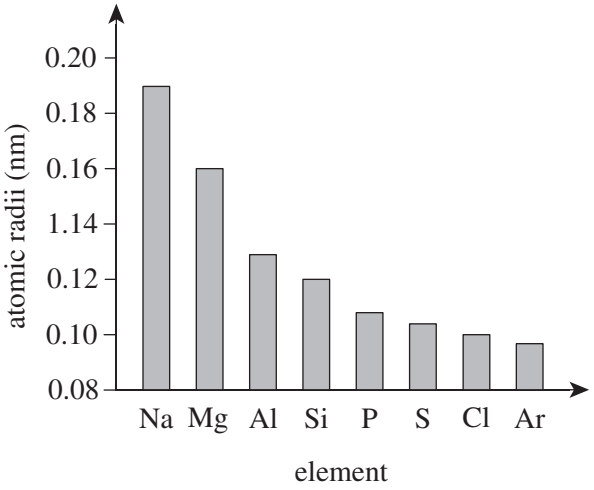
Question 21 (5 marks)

Information about elements in period 3 of the periodic table is shown. **5**

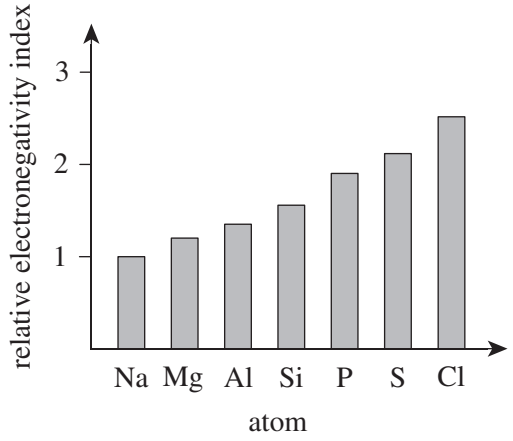
First ionisation energy for period 3



Atomic radii of period 3 elements



Electronegativity in period 3



Question 21 continues on page 18

Question 21 (continued)

Analyse the data in the graphs shown on the previous page to explain the different properties of the elements in period 3 of the periodic table.

End of Question 21

Question 22 (6 marks)

(a) Draw a fully labelled diagram to represent the galvanic cell you would construct if you were provided with electrodes of aluminium and tin. Include electrodes, electrolytes, ion flow, electron migration and a voltmeter in your diagram. **4**

(b) Give the net redox equation for the cell reaction in part (a) AND calculate the cell potential (E^{o}). **2**

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Question 23 (6 marks)

(a) Sulfur dioxide slowly reacts with oxygen in the air to form sulfur trioxide. This process is accelerated by the presence of dust, as occurs in dust storms. **2**

If 14.57 g of sulfur dioxide reacts with excess oxygen, calculate how much sulfur trioxide will form.

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(b) Draw a Lewis dot diagram for water AND carbon dioxide. **2**

(c) Carbon dioxide has a boiling point of –78.5°C, which is also the temperature at which it sublimes (goes directly from a solid to gas state). Water has a melting point of 0°C and a boiling point of 100°C. **2**

Account for the differences in these physical properties for these TWO common substances in our atmosphere.

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Question 24 (9 marks)

Urea ($CO(NH_2)_2$) is a compound found in urine. It is used widely as a fertiliser, as it reacts with water to produce ammonia and carbon dioxide according to the following reaction.

$$CO(NH_2)_2(s) + H_2O(l) \rightarrow CO_2(g) + 2NH_3(g)$$

Standard entropies and enthalpies are shown in the table.

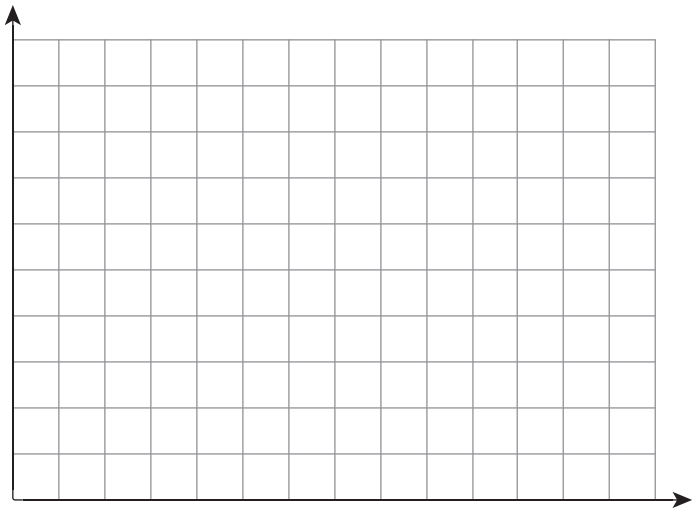
Substance	S_0 *(J mol^{-1} K^{-1})*	ΔH_0 *(kJ mol^{-1})*
$CO(NH_2)_2$ (s)	104.60	–333.19
H_2O(l)	69.96	–285.90
CO_2 (g)	213.60	–393.50
NH_3 (g)	192.50	–46.19

(a) Using your knowledge of thermodynamics, assess whether this reaction would be spontaneous at 25.0°C AND explain why it is usually carried out at higher temperatures when producing ammonia. **6**

Question 24 continues on page 22

Question 24 (continued)

(b) Draw the energy profile diagram for the reaction of urea with water. **2**



(c) On the diagram in part (b), show the effect of adding a catalyst to the reaction of urea with water. **1**

End of Question 24

Question 25 (6 marks)

Students set up an experiment where copper wire was wound into a coil and placed in a beaker containing 100.00 mL of silver acetate ($AgCH_3COO$), as shown in diagram *A*. The solution did not have a concentration displayed on its label. Diagram *B* shows the beaker after it had been left in a cupboard overnight.

diagram *A*

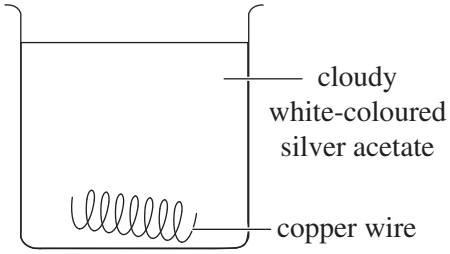
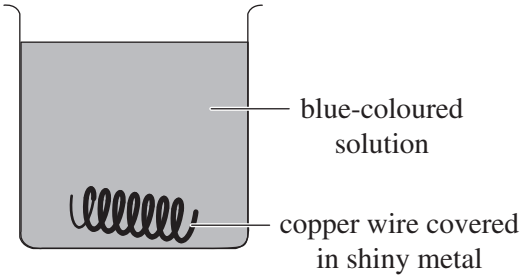


diagram *B*



(a) Write a balanced net ionic equation for this reaction. **1**

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(b) Explain why the solution changed from a cloudy white colour in diagram *A* to a blue solution with the copper wire covered in shiny silver metal in diagram *B*. **2**

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(c) The original mass of the copper wire was 5.15 g. After the solution had been left in the cupboard overnight, the shiny silver deposit was cleaned off the wire and it was rinsed, dried and reweighed, with the final mass of the wire being 4.50 g. **3**

Calculate the concentration of the silver acetate solution in moles per litre.

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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

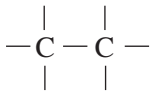
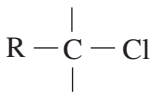
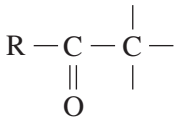
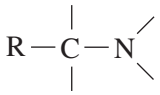
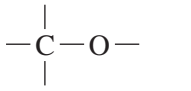
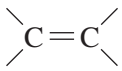
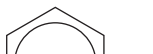
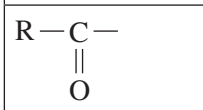
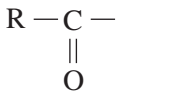
Compound	K_{sp}
Barium carbonate	2.58×10^{-9}
Barium hydroxide	2.55×10^{-4}
Barium phosphate	1.3×10^{-29}
Barium sulfate	1.08×10^{-10}
Calcium carbonate	3.36×10^{-9}
Calcium hydroxide	5.02×10^{-6}
Calcium phosphate	2.07×10^{-29}
Calcium sulfate	4.93×10^{-5}
Copper(II) carbonate	1.4×10^{-10}
Copper(II) 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.

Final Examination 2021

NSW Year 11 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 ○

STUDENTS SHOULD NOW CONTINUE WITH SECTION II