Neap

HSC Trial Examination 2020

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 • For questions in Section II, show all relevant working in questions involving calculations
Total marks: 100	**Section I – 20 marks** (pages 2–8) • Attempt Questions 1–20 • Allow about 35 minutes for this section **Section II – 80 marks** (pages 9–26) • Attempt Questions 21–32 • Allow about 2 hours and 25 minutes for this section

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.

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1. A student carried out an investigation into the behaviour of cobalt(II) chloride when it is heated in an open test tube. The following extract is from the rough notes written by the student:

1.	*A few spatulas of hydrated cobalt(II) chloride were put into a test tube. The cobalt(II) chloride was a pink solid.*
2.	*The test tube was heated carefully using a Bunsen burner flame. When heated, the cobalt(II) chloride gave off a vapour.*
3.	*The solid was allowed to cool. When cooled, the remaining solid was blue.*
4.	*Water was added to the solid. The solid became pink, and the test tube became warm.*

Based on the information given, what should the student conclude?

(A) The procedure shows a reversible reaction.
(B) The procedure shows an equilibrium reaction.
(C) Cobalt(II) chloride is an ionic substance.
(D) Cobalt(II) chloride decomposes when heated.

2. Which one of the following correctly identifies the conjugate acid–base pairs present in the equilibrium mixture shown?

(A) $\underset{\text{acid 1}}{CH_3COOH(l)} + \underset{\text{base 1}}{H_2O(l)} \rightleftharpoons \underset{\text{base 2}}{CH_3COO^-(l)} + \underset{\text{acid 2}}{H_3O^+(aq)}$

(B) $\underset{\text{acid 1}}{CH_3COOH(l)} + \underset{\text{base 2}}{H_2O(l)} \rightleftharpoons \underset{\text{base 1}}{CH_3COO^-(l)} + \underset{\text{acid 2}}{H_3O^+(aq)}$

(C) $\underset{\text{base 1}}{CH_3COOH(l)} + \underset{\text{acid 1}}{H_2O(l)} \rightleftharpoons \underset{\text{acid 2}}{CH_3COO^-(l)} + \underset{\text{base 2}}{H_3O^+(aq)}$

(D) $\underset{\text{acid 2}}{CH_3COOH(l)} + \underset{\text{base 2}}{H_2O(l)} \rightleftharpoons \underset{\text{acid 1}}{CH_3COO^-(l)} + \underset{\text{base 1}}{H_3O^+(aq)}$

3. Separate 25.0 mL samples of 0.10 mol L^{-1} ethanoic acid solution and 0.10 mol L^{-1} hydrochloric acid solution are prepared.

Which one of the following statements about the samples is correct?

(A) Both samples will react with 1.00 g of magnesium ribbon at the same rate.
(B) Both samples have the same electrical conductivity.
(C) The concentration of H_3O^+ ions is greater in the ethanoic acid solution.
(D) Both samples will react completely with 25.0 mL of 0.10 mol L^{-1} sodium hydroxide solution.

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4. Which row of the table correctly identifies the links between changes in entropy and enthalpy for combustion reactions and photosynthesis?

	Entropy change		*Enthalpy change*	
	Combustion	*Photosynthesis*	*Combustion*	*Photosynthesis*
(A)	increases	decreases	endothermic	exothermic
(B)	decreases	increases	exothermic	endothermic
(C)	increases	decreases	exothermic	endothermic
(D)	decreases	increases	endothermic	exothermic

5. Half of a 2 mol sample of hydrogen chloride gas dissociates to form hydrogen and chlorine, as shown in the following equilibrium reaction:

$$2HCl(g) \rightleftharpoons H_2(g) + Cl_2(g)$$

How many moles of gas are present in the equilibrium mixture in total?

(A) 1
(B) 2
(C) 3
(D) 4

6. Which one of the following statements does NOT apply to static equilibrium?

(A) The rates of the forward and reverse reactions are zero.
(B) There is no exchange between reactants and products.
(C) The rate of exchange between reactants and products is steady.
(D) The concentration of reactants and products does not change.

7. The following table shows the colour changes and pH ranges of three indicators:

Indicator	*Colour change (low pH to high pH)*	*pH range*
bromophenol blue	yellow to blue	3.0–4.5
methyl red	red to yellow	4.5–6.3
alizarin	yellow to red	10.2–12.0

The indicators were used to test a liquid. The following table shows the final colours of the liquid:

Indicator	*Final colour*
bromophenol blue	blue
methyl red	yellow
alizarin	yellow

Which one of the following substances was tested?

(A) vinegar (pH 2.1)
(B) rain water (pH 5.2)
(C) distilled water (pH 7.0)
(D) bleach (pH 12.1)

8. Which one of the following statements about buffers is correct?

(A) Buffers can be made from a weak acid and its salt.
(B) Buffers have a pH very close to 7.
(C) Buffers prevent changes in pH when large amounts of acids or bases are added.
(D) Buffers have equal numbers of hydrogen ions and hydroxide ions.

9. In an aqueous solution, an iron(III) ion (Fe^{3+}) reacts with a thiocyanate anion (SCN^-) to form the iron(III) thiocyanate ($Fe(SCN)^{2+}$) complex. This is an equilibrium reaction.

What is the correct equilibrium expression for this reaction?

(A) $Fe^{3+}(aq) + SCN^-(aq) \rightleftharpoons Fe(SCN)^{2+}(aq)$

(B) $Fe^{3+}(aq) + SCN^-(aq) \rightarrow Fe(SCN)^{2+}(aq)$

(C) $\dfrac{Fe(SCN)^{2+}(aq)}{Fe^{3+}(aq) + SCN^-(aq)}$

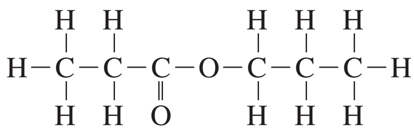
(D) $\dfrac{[Fe(SCN)^{2+}(aq)]}{[Fe^{3+}(aq)] \times [SCN^-(aq)]}$

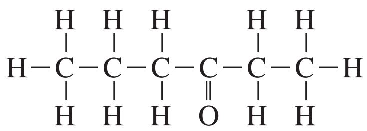
10. 250 mL of 0.1 mol L^{-1} sodium hydroxide is added to 100 mL of 0.4 mol L^{-1} hydrochloric acid.

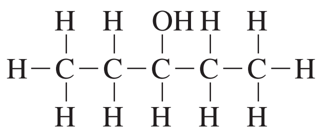
What is the resulting pOH?

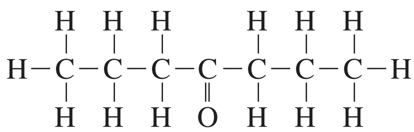
(A) 1.4
(B) 2.3
(C) 11.7
(D) 12.6

11. Which one of the following structural formulae represents hexan-3-one?

(A) 

(B) 

(C) 

(D) 

12. The molar absorptivity for sodium penicillin G at 634 nm is 3.91×10^3 L mol^{-1} cm^{-1}. A tablet containing penicillin G was dissolved in a 10.0 mL standard flask, and a sample of the resulting solution was placed into a 1.00 cm cuvette. A reading of 0.552 was obtained for its absorbance at 634 nm.

How much sodium penicillin G did the tablet contain?

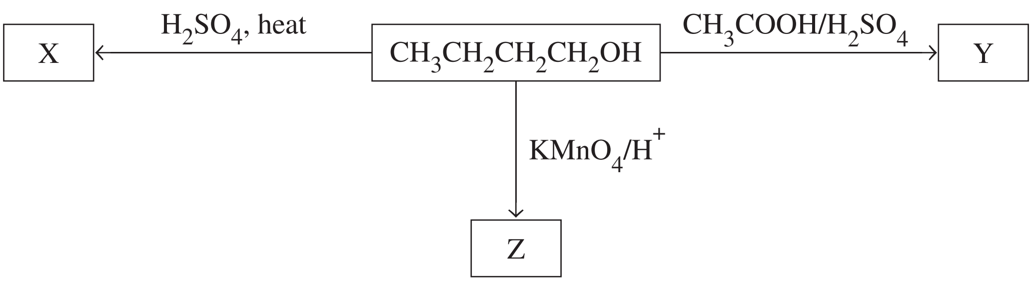
(A) 1.41×10^{-6} mol
(B) 5.63×10^{-3} mol
(C) 8.95×10^{-3} mol
(D) 3.40 mol

13. The molar heat of combustion of $CH_3CH_2CH_2CH_2OH$ is –2670 kJ mol^{-1}.

What is the minimum mass of $CH_3CH_2CH_2CH_2OH$ that, when burnt, would release sufficient heat energy to raise the temperature of 1.000 kg of water from 25.00°C to 100.0°C? Assume no loss of heat to the surroundings.

(A) 0.176 g
(B) 8.70 g
(C) 74.1 g
(D) 470 g

14. Consider the reaction sequence below.



Which row of the table correctly identifies X, Y and Z?

	X	*Y*	*Z*
(A)	but-1-ene	(1-butyl) ethanoate	butanoic acid
(B)	butane	hexanoic acid	butan-1-ol
(C)	but-2-ene	ethyl butanoate	butanoate
(D)	cyclobutane	butyl acetate	butanal

15. The most appropriate technique to determine levels of the Pb^{2+} ion in blood is

(A) mass spectrometry.
(B) infrared spectroscopy.
(C) atomic absorption spectroscopy.
(D) ultraviolet-visible spectroscopy.

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16. It is suspected that a stream is contaminated with metal ions. A sample of water from the stream was analysed. The results are recorded in the table.

Test	*Reaction*
adding dilute HCl solution	There is no visible reaction.
adding Na_2SO_4 solution	A white precipitate forms.
flame test	The flame turns pale orange/red.

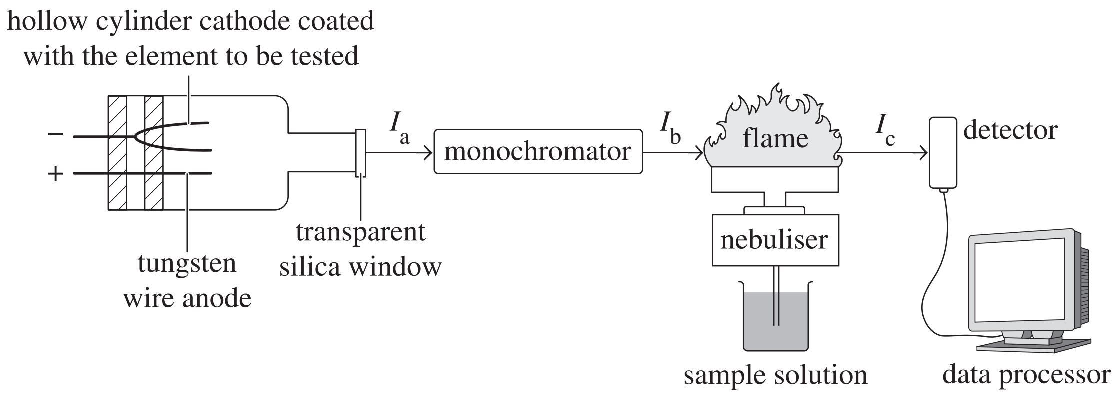
What is the most likely contaminant in the water?

(A) Ba^{2+}
(B) Ca^{2+}
(C) Cu^{2+}
(D) Fe^{2+}

17. The compound with the formula $(CH_3)_3COH$ is a

(A) primary alcohol.
(B) secondary alcohol.
(C) tertiary alcohol.
(D) quaternary alcohol.

18. The following diagram of an atomic absorption spectrophotometer (AAS) shows the intensity of light at various points within the spectrometer.



The absorbance of the sample solution is given by the relationship

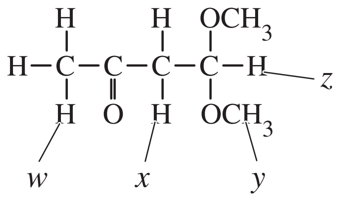
(A) $\dfrac{I_a}{I_b}$

(B) $\dfrac{I_b}{I_c}$

(C) $\log\dfrac{I_b}{I_c}$

(D) $\log\dfrac{I_a}{I_c}$

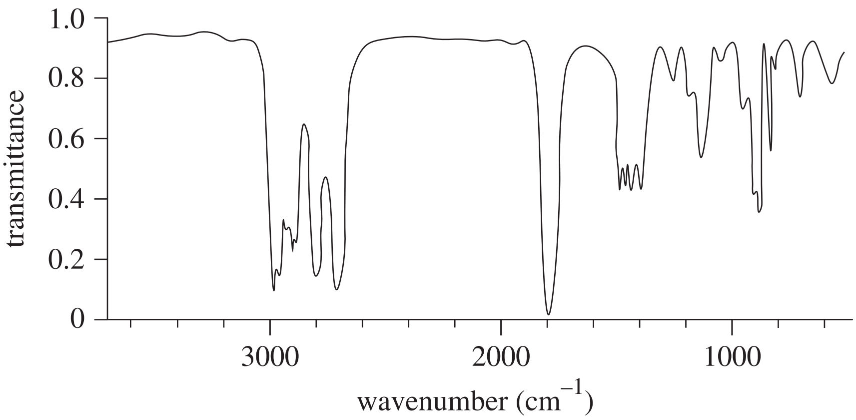
19. Consider the following molecule.



Which one of the labelled hydrogens gives a triplet signal in a ^{1}H NMR spectrum?

(A) hydrogen *w*
(B) hydrogen *x*
(C) hydrogen *y*
(D) hydrogen *z*

20. The infrared spectrum of an unknown sample is shown below.



What is the unknown sample most likely to be?

(A) butanal
(B) butanoic acid
(C) hex-3-ene
(D) propanol

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Section II

80 marks
Attempt Questions 21–32
Allow about 2 hours and 25 minutes for this section

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.

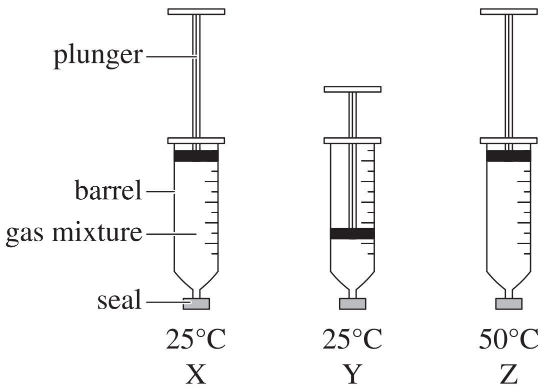
Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Question 21 (6 marks)

Nitrogen dioxide is brown and dinitrogen tetroxide is colourless. They form an equilibrium mixture as shown by the following equation: **6**

$$2NO_2(g) \rightleftharpoons N_2O_4(g) \qquad \Delta H = -58 \text{ kJ mol}^{-1}$$

A sealed gas syringe can be used to investigate the properties of a fixed mass of gas. An equimolar mixture of nitrogen oxide and dinitrogen tetroxide was set up as shown in X in the following diagram. The conditions were then varied as shown in Y and Z.



Complete the table by describing the colour of the gas mixtures in X, Y and Z. Include any comparisons to the initial colour of X and justify your answers.

	Colour	*Justification*
X		
Y		
Z		

Question 22 (7 marks)

Bromomethane, CH_3Br, is manufactured by reacting methanol with hydrogen bromide according to the following equilibrium equation:

$$CH_3OH(g) + HBr(g) \rightleftharpoons CH_3Br(g) + H_2O(g)$$

It is a toxic, odourless and colourless gas used as an insecticide.

(a) Predict what would happen to the rate of production of bromomethane (the rate of the forward reaction) if the water was continuously removed. Explain your answer. **2**

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(b) Predict what would happen to the rate of production of bromomethane if the temperature was increased at constant pressure. Justify your answer. **2**

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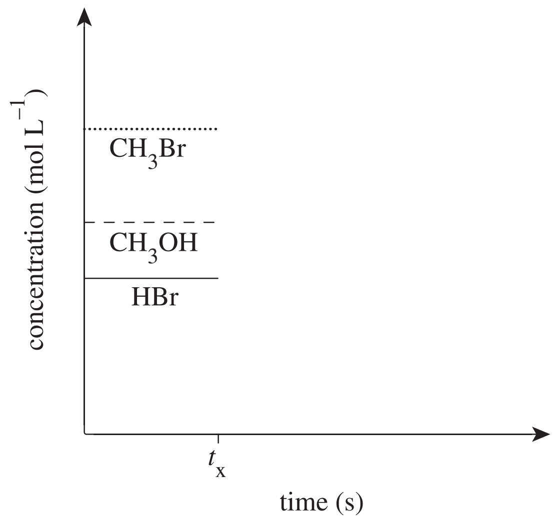
(c) The following graph shows the equilibrium concentrations of three of the compounds involved in the reaction at 298 K. A small amount of methanol was added at time t_x. **3**



Sketch the concentrations of the three compounds after time t_x.

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Question 23 (7 marks)

A student was researching calcium sulfate ($CaSO_4$) and calcium carbonate ($CaCO_3$).
Their first step was to look at the solubility constants (K_{sp}) and equilibrium expressions for the two compounds.

(a) Discuss the solubilities of these two compounds at 25°C. **2**

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(b) Derive the equilibrium expression for calcium sulfate and use this to calculate the solubility (in mol L^{-1}) for calcium sulfate. Show your working. **2**

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(c) Outline ONE practice of Aboriginal and Torres Strait Islander Peoples that uses solubility equilibria. **3**

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Question 24 (7 marks)

Neutralisations are common chemical reactions and can be useful in many situations.

(a) A student spilt some hydrochloric acid solution (HCl) and was told to sprinkle powdered sodium carbonate (Na_2CO_3) on the spillage. **1**

Write a balanced equation for the reaction.

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(b) As part of the Chemistry course, you have carried out a practical investigation to measure the enthalpy of neutralisation.

(i) What is meant by the term 'enthalpy of neutralisation'? **1**

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(ii) Describe how you carried out this investigation. **5**

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Question 25 (4 marks)

(a) Outline the principles of the Arrhenius model for classifying acids and bases. Support your answer with at least TWO chemical equations. **3**

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(b) Sodium hydrogen carbonate (bicarbonate) forms the hydrogen carbonate ion in aqueous solution. Consider the following reactions of this ion: **1**

$$HCO_3^-(aq) + NH_4^+(aq) \rightleftharpoons H_2CO_3(aq) + NH_3(aq)$$

$$HCO_3^-(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + CO_3^{2-}(aq)$$

Identify the behaviour shown by this species.

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Question 26 (9 marks)

The concentration of a sample of nitric acid was determined using 1.01 mol L^{-1} ammonia solution. A 25.0 mL aliquot (portion) of the ammonia solution was added to a conical flask and a few drops of methyl orange were added. The mixture was shaken, giving a pale yellow colour. The end points of four titrations are shown in the table.

Titration number	*Volume of HNO_3 (mL)*
1	37.8
2	36.1
3	36.2
4	36.0

(a) 'Equivalence point' and 'end point' are terms often used regarding titrations. **3**

Using the titrations described above, explain the difference between the two terms.

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(b) Write a balanced equation for the reaction. **1**

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Question 26 continues on page 15

Question 26 (continued)

(c) Calculate the concentration of the acid. Show your working and explain how you came to a value for the end point. **3**

(d) Using the axes provided, sketch the shape of the expected titration curve for this titration. Label the axes appropriately. **2**

End of Question 26

Question 27 (4 marks)

Explain how the surfactant properties of the sodium salts of long chain fatty acids help to clean grease from dirty dishes. Draw a diagram of a micelle to support your answer. **4**

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Question 28 (4 marks)

Propene can be polymerised in different ways to produce different polymers. Heating propene to a high temperature under high pressure produces polymer A. Using a Zieglar–Natta catalyst, a lower temperature and lower pressure produces polymer B.

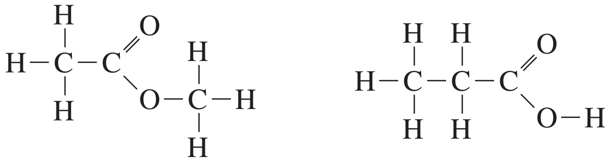
(a) Draw a structural diagram of polypropene. **1**

(b) Complete the table by identifying polymer A and polymer B, and listing TWO of properties of each. **3**

	Polymer A	*Polymer B*
Name		
Properties		

Question 29 (9 marks)

The diagram shows the structural formulae of two compounds.



methyl ethanoate propanoic acid

(a) Why are these two compounds classed as functional group isomers? **2**

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(b) A student designed a procedure to distinguish between methyl ethanoate and propanoic acid. A small sample of methyl ethanoate was placed into a test tube and dissolved in water. In a separate test tube, a similar sized sample of propanoic acid was dissolved in a similar volume of water. A small volume of $NaHCO_3$ solution was added to each test tube. **3**

Describe the expected observations for each test tube. Include relevant net ionic equations.

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Question 29 continues on page 19

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Question 29 (continued)

(c) The table lists the boiling points of some straight chain alkanoic acids and their isomeric straight chain methyl esters. **4**

Alkanoic acid	*Boiling point (°C)*	*Methyl ester*	*Boiling point (°C)*	*Difference between boiling points (°C)*
$CH_3(CH_2)_3CO_2H$	186	$CH_3(CH_2)_2CO_2CH_3$	102	186 – 102 = 84
$CH_3(CH_2)_4CO_2H$	205	$CH_3(CH_2)_3CO_2CH_3$	126	205 – 126 = 79
$CH_3(CH_2)_5CO_2H$	223	$CH_3(CH_2)_4CO_2CH_3$	150	223 – 150 = 73
$CH_3(CH_2)_6CO_2H$	239	$CH_3(CH_2)_5CO_2CH_3$	174	239 – 174 = 65
$CH_3(CH_2)_7CO_2H$	253	$CH_3(CH_2)_6CO_2CH_3$	194	253 – 194 = 59

Explain the patterns of boiling points shown in the table.

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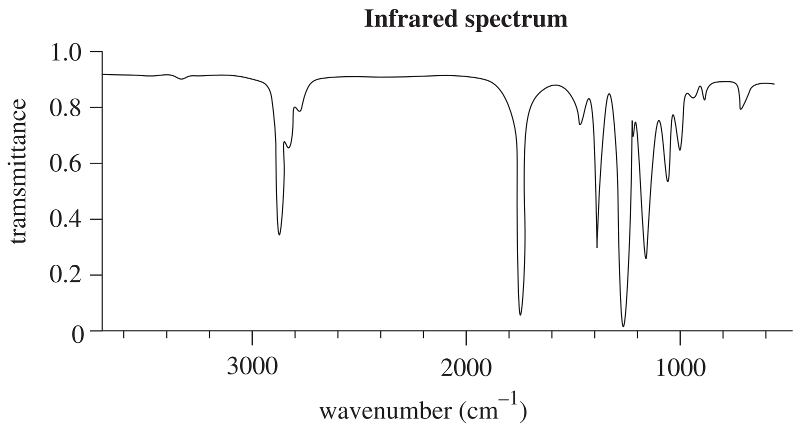
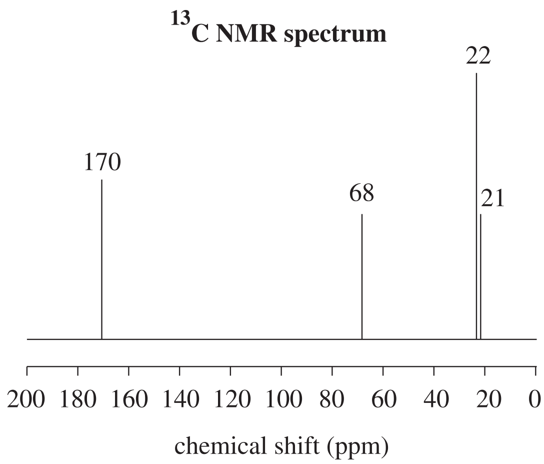
End of Question 29

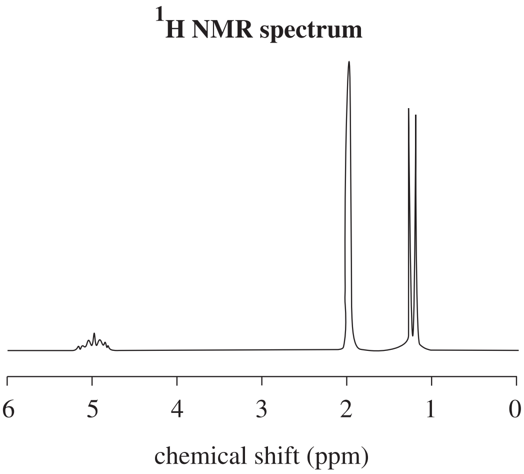
Question 30 (8 marks)

A chemist finds an unlabelled bottle containing a large quantity of compound Y, a colourless liquid. Elemental analysis gives a molecular formula of $C_5H_{10}O_2$. Compound Y does not decolourise bromine water, nor does it produce CO_2 when added to $NaHCO_3$ solution.

To identify the molecular structure of compound Y, a sample is submitted for spectroscopic analysis. The following data were obtained.







¹H NMR data		
Chemical shift (ppm)	*Relative peak area*	*Peak splitting*
1.2	6	doublet (2)
2.0	3	singlet (1)
5.0	1	septet (7)

Question 30 continues on page 21

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Question 30 (continued)

(a) Draw the structural formula of compound Y. Justify your answer with reference to all THREE of the provided spectra. **6**

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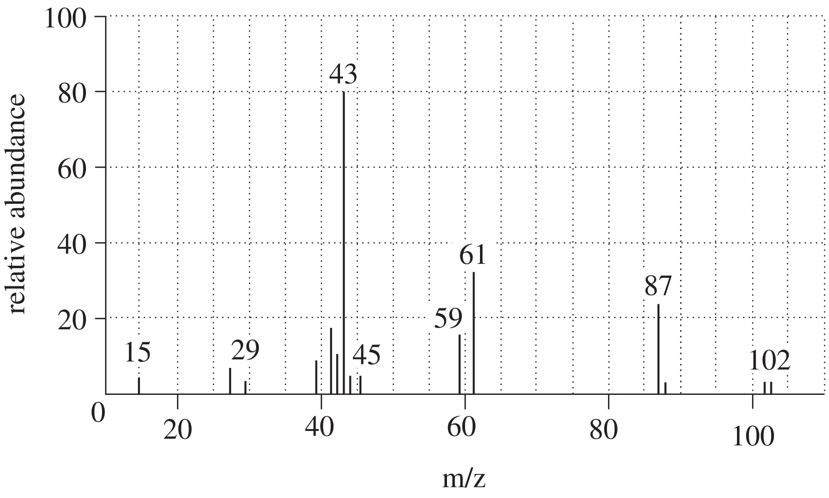
Question 30 continues on page 22

Question 30 (continued)

(b) The diagram shows the mass spectrum of compound Y. **2**



Explain how the molecular ion and mass spectrum splitting pattern can assist with determining the identity of the compound.

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End of Question 30

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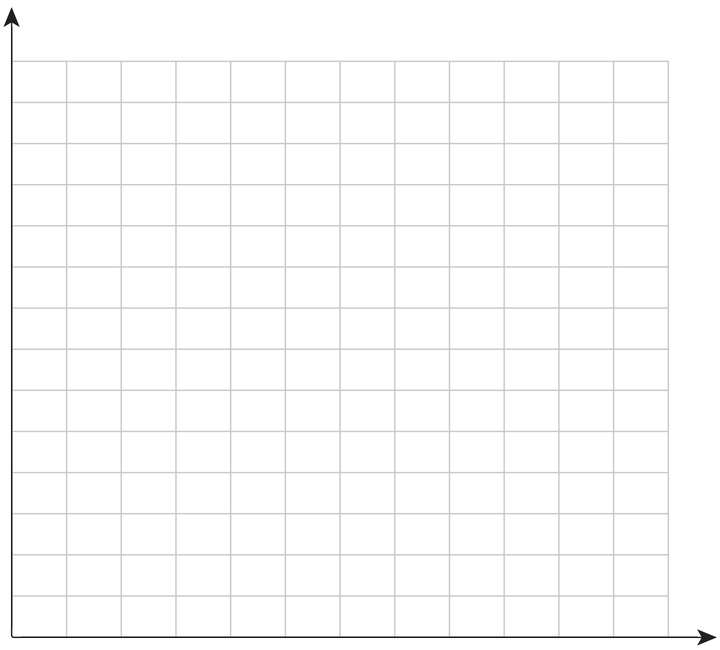
Question 31 (8 marks)

Brass is an alloy of copper and zinc.

To determine the percentage of copper in a particular sample of brass, an analyst prepared a number of standard solutions of copper(II) ions and measured their absorbance using an atomic absorption spectrometer (AAS). The results are given in the table.

Cu^{2+} concentration ($mg\ L^{-1}$)	*Absorbance*
0	0
50.00	0.060
100.0	0.120
200.0	0.240
300.0	0.360
400.0	0.480
500.0	0.600

(a) Draw and label the absorbance versus concentration calibration curve for Cu^{2+}. **3**



Question 31 continues on page 24

Question 31 (continued)

A 19.8 mg sample of the brass was dissolved in acid, and the solution was made up to 100 mL in a volumetric flask. The absorbance of this test solution was found to be 0.150.

(b) Calculate the percentage by mass of copper in the brass sample. **3**

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(c) When using AAS techniques, the presence of Zn^{2+} in the sample does not affect the measurement of Cu^{2+} in the sample. **2**

Explain this observation.

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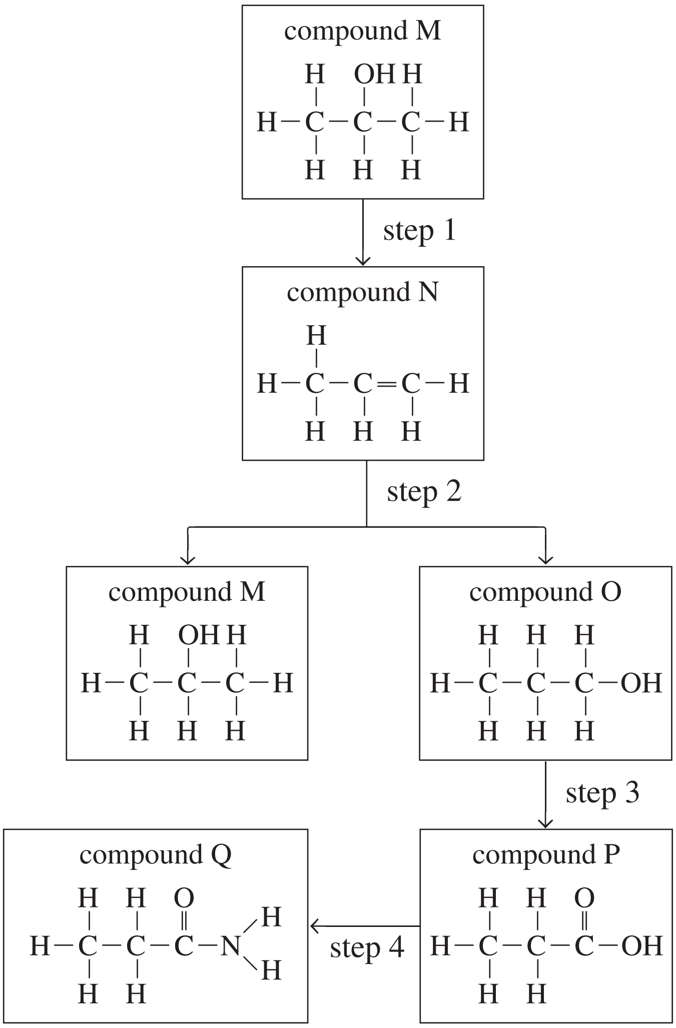
End of Question 31

Question 32 (7 marks)

The diagram shows a reaction scheme that can be used to synthesise propanamide. **7**



Identify the reagents and conditions needed to achieve each step of this synthetic scheme and explain how NMR and mass spectroscopic techniques could be used to identify the isomeric compounds M and O.

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End of paper

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Section II extra writing space

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

FORMULAE SHEET

$n = \frac{m}{MM}$	$c = \frac{n}{V}$	$PV = nRT$
$q = mc\Delta T$	$\Delta G° = \Delta H° - T\Delta S°$	$\text{pH} = -\log_{10}[\text{H}^+]$
$pK_a = -\log_{10}[K_a]$	$A = \varepsilon lc = \log_{10}\frac{I_o}{I}$	

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

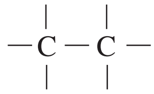
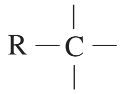
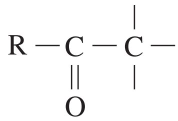
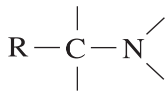
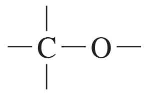
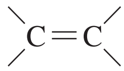
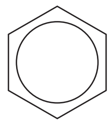
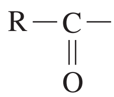
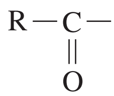
Solubility constants at 25°C

Compound	K_{sp}	*Compound*	K_{sp}
Barium carbonate	2.58×10^{-9}	Lead(II) bromide	6.60×10^{-6}
Barium hydroxide	2.55×10^{-4}	Lead(II) chloride	1.70×10^{-5}
Barium phosphate	1.3×10^{-29}	Lead(II) iodide	9.8×10^{-9}
Barium sulfate	1.08×10^{-10}	Lead(II) carbonate	7.40×10^{-14}
Calcium carbonate	3.36×10^{-9}	Lead(II) hydroxide	1.43×10^{-15}
Calcium hydroxide	5.02×10^{-6}	Lead(II) phosphate	8.0×10^{-43}
Calcium phosphate	2.07×10^{-29}	Lead(II) sulfate	2.53×10^{-8}
Calcium sulfate	4.93×10^{-5}	Magnesium carbonate	6.82×10^{-6}
Copper(II) carbonate	1.4×10^{-10}	Magnesium hydroxide	5.61×10^{-12}
Copper(II) hydroxide	2.2×10^{-20}	Magnesium phosphate	1.04×10^{-24}
Copper(II) phosphate	1.40×10^{-37}	Silver bromide	5.35×10^{-13}
Iron(II) carbonate	3.13×10^{-11}	Silver chloride	1.77×10^{-10}
Iron(II) hydroxide	4.87×10^{-17}	Silver carbonate	8.46×10^{-12}
Iron(III) hydroxide	2.79×10^{-39}	Silver hydroxide	2.0×10^{-8}
Iron(III) phosphate	9.91×10^{-16}	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
 Cl or Br		10–70
		20–50
		25–60
	alcohols, ethers or esters	50–90
		90–150
R—C≡N		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

 TENCHEM_QA_20.FM

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	79
Symbol	**Au**
Standard Atomic Weight	197.0
Name	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** Nehonium	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 (Febuary 2010 version) is the principal source of all other data. Some data may have been modified.

Neap

HSC Trial Examination 2020

Chemistry

SECTION I
MULTIPLE-CHOICE ANSWER SHEET

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

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