Student Number ……

MC /20	Carrington /20	Noyes /30	Faulder /30	TOTAL /100

Student name: ……

Sydney Technical High School

2021

Trial Higher School Certificate Examination

Chemistry

Total marks – 100

Section I

Part A – 20 marks
- Attempt Questions 1-20
- Allow about 40 minutes for this part

Part B – 80 marks
- Attempt Questions 21-34
- Allow about 2 hours 20 minutes for this section

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using **BLACK** pen
- Draw diagrams using pencil
- Approved calculators may be used
- Write your student number in the space provided

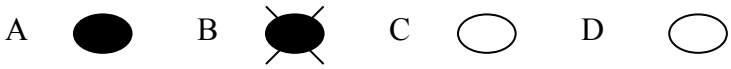
Part A – 20 marks
Attempt Questions 1-20
Allow about 40 minutes for this part

Use the multiple-choice answer sheet.

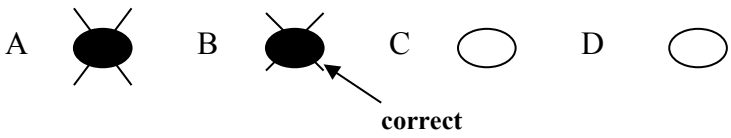
Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.



If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



Student Number ……

Multiple Choice Answer Sheet

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

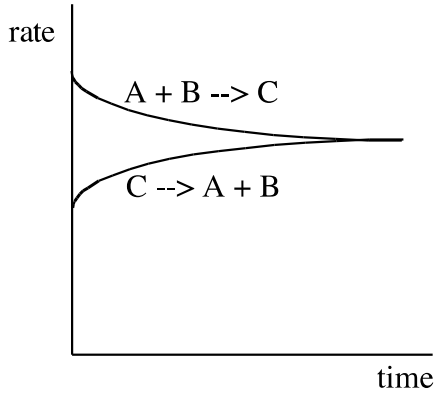
Part A – 20 marks
Attempt Questions 1-20
Allow about 40 minutes for this part

Use the multiple choice answer sheet for Questions 1-20

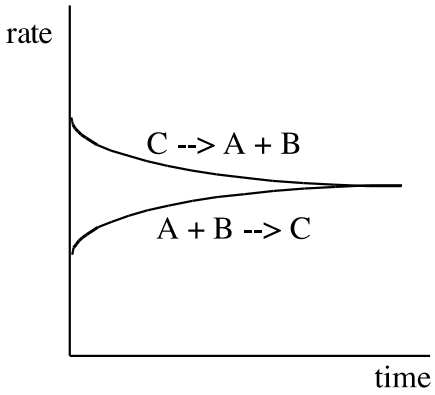
1. Consider an equilibrium system: A + B C.

Which of the following graphs represent a system reaching equilibrium by *shifting the equilibrium position to the left*?

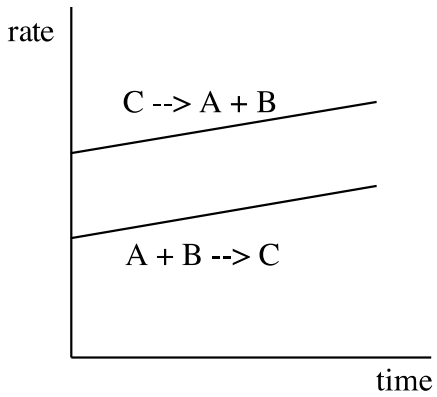
A.



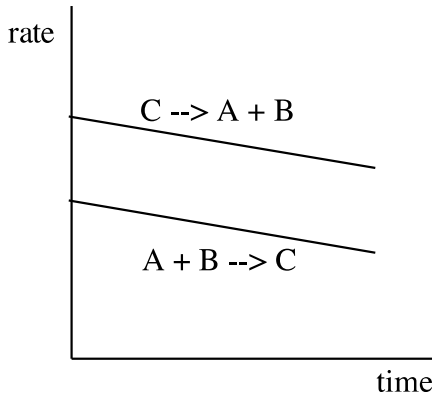
B.



C.

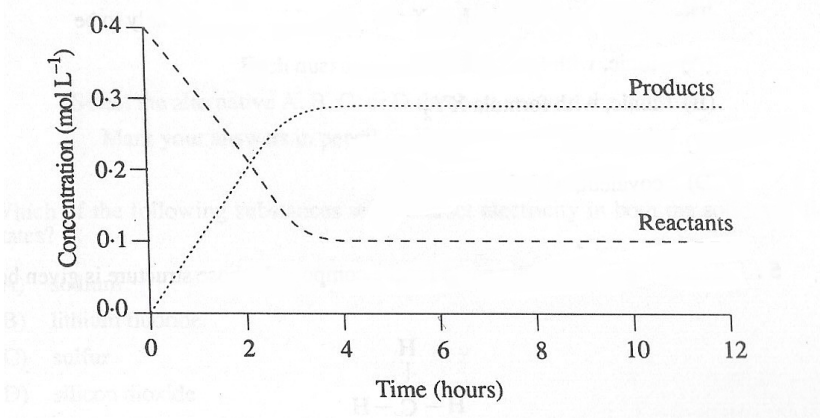


D.



2. The graph below shows how the concentration of reactants and products change over time for the reaction:

$$CH_3COOC_2H_5 + H_2O \rightleftharpoons CH_3COOH + C_2H_5OH$$



From this graph it can be determined that:

A. The equilibrium concentrations were 0.2 mol L^{-1}
B. The forward reaction stopped after four hours
C. The system reached after two hours
D. The reaction did not go to completion

3. Arrange the following reactions in order of their increasing tendency to reach completion.

I $4NH_{3(g)} + 3O_{2(g)} \rightleftharpoons 2N_{2(g)} + 6H_2O_{(g)}$ $K = 1.0 \times 10^{228}$

II $2HF_{(g)} \rightleftharpoons H_{2(g)} + F_{2(g)}$ $K = 1.0 \times 10^{-13}$

III $2NOCl_{(g)} \rightleftharpoons 2NO_{(g)} + Cl_{2(g)}$ $K = 4.7 \times 10^{-4}$

III $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$ $K = 5.0 \times 10^{-31}$

(NOTE : For each reaction, the equilibrium constant was determined under different conditions.)

A. I, III, II, IV
B. III, II, IV, I
C. IV, II, III, I
D. I, IV, II, III

4. When an aqueous solution of silver nitrate is mixed with an aqueous solution of potassium bromate, a precipitate of silver bromate is formed. Solid potassium bromate is soluble in water. What happens if a few crystals of potassium bromate are added to the solution containing precipitated silver bromate.

A. No effect on the equilibrium system
B. More silver bromate precipitates
C. The Ksp value changes
D. More silver bromate dissolves

5. Mercury (II) oxide when heated in air decomposes as follows:

$$2HgO_{(s)} \text{ <-> } 2Hg_{(l)} + O_{2(g)}$$

The formation of *oxygen* will be favoured by

A. carrying out the reaction in oxygen rather than air, at the same pressure.
B. carrying out the reaction at a lower pressure.
C. addition of metallic mercury to the mercury (II) oxide.
D. carrying out the reaction in a sealed container.

6. Which of the following is <u>not</u> a conjugate acid-base pair (in that order)

A. H_3PO_4, $H_2PO_4^-$
B. HBF_4, BF_4^-
C. HSO_4^-, SO_4^{2-}
D. HPO_4^-, $H_2PO_4^-$

7. The table below shows values of the ionisation constant of pure water, measured at various temperatures, but under constant pressure.

Temperature of water (°C)	**0**	**25**	**50**	**75**
K_W	1.1×10^{-15}	1.0×10^{-14}	5.5×10^{-14}	2.0×10^{-13}

Which one of the following statements regarding pure water is correct?

A. The reaction in which water molecules self-ionise releases energy.

B. Values of both the pH and the pOH of water at 5°C must exceed 7.0.

C. Water becomes slightly acidic at very hot temperatures, as its pH decreases.

D. Increasing temperature affects the K_w, but the pH of pure water remains at 7.0.

8. What would happen to the pH if 1mL of 0.5 $molL^{-1}$ HCl was added to 50mL of a buffer solution with a pH of 7.

A. There would be a large increase in the pH

B. There will be a large decrease in the pH

C. The pH will increase only slightly

D. The pH will decrease only slightly

9. Four bottles were found, missing their labels, but they were known to contain aqueous ammonia, 0.1M NaOH, rainwater, and 0.1M HCl.

A student tested each solution with universal indicator, and compared her results with the colour reference chart shown below.

pH	1	2	3	4	5	6	7	8	9	10	11	12	13
Colour	Red		Orange		Yellow		Green	Dark Green		Blue		Purple	

Which row of the table below shows the results of her investigation?

	Ammonia (aq)	**0.1 M NaOH**	**0.1 M HCl**	**Sydney Rainwater**
A	Blue	Purple	Red	Dark green
B	Blue	Blue	Orange	Green
C	Purple	Purple	Red	Yellow
D	Orange	Red	Red	Yellow

10. A solution was obtained by boiling flowers in water. After various substances were added to separate samples of the solution, the colour of each was noted.

Substance added	*Colour observed*
0.1 mol L^{-1} HCl(*aq*)	Bright pink
0.01 mol L^{-1} HCl(*aq*)	Bright pink
0.001 mol L^{-1} HCl(*aq*)	Pale yellow
Distilled water	Bright yellow
0.001 mol L^{-1} NaOH(*aq*)	Bright yellow
0.01 mol L^{-1} NaOH(*aq*)	Bright yellow

Which of the following titrations would it be appropriate to use this solution as an indicator?

A. HCl (aq) + NH_3 (aq)

B. HCl(aq) + NaOH (aq)

C. CH_3COOH(aq) + NH_3(aq)

D. CH_3COOH(aq) + NaOH (aq)

11. A sample of water from a stream, suspected to be contaminated with metal ions, was analysed. The results of some tests on the water are recorded in the table.

Test	*Result*
Add dilute HCl	No change
Add Na_2SO_4 solution	White precipitate formed
Flame test	Pale green colour

What is the most likely containment in the water?

A. Ba^{2+}

B. Ca^{2+}

C. Cu^{2+}

D. Fe^{3+}

12. During the reaction of magnesium with dilute sulfuric acid to produce hydrogen gas, the pH of the reaction mixture would:

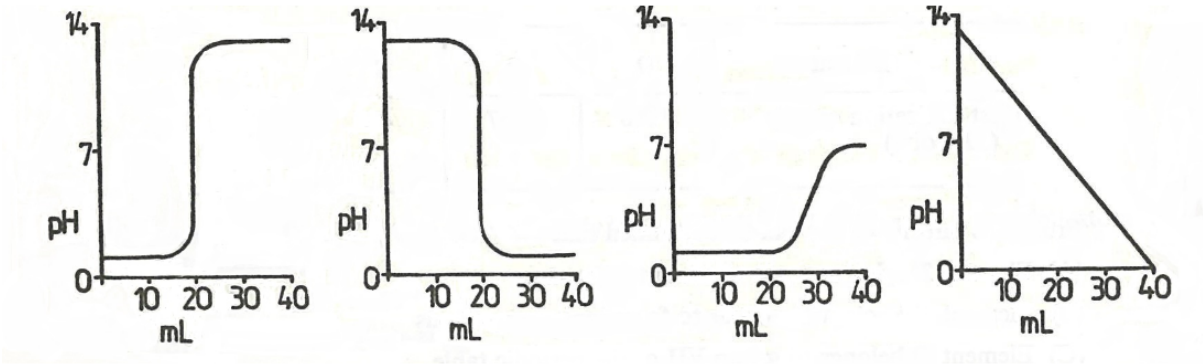
A. fall from a high level

B. rise from a low level

C. stay consistent from a low level

D. stay consistent from high level.

13. A sodium hydroxide solution of concentration 0.1 $molL^{-1}$ was added dropwise to 20mL of hydrochloric acid of concentration 0.1 $molL^{-1}$. The pH change is best shown by:



A B C D

14. Which of the following is an amine?

A. $CH_3CH_2NH_2$
B. CH_3CONH_2
C. CH_3CH_2CN
D. $C_2H_5CONH(CH_3)$

15. Which of the following is a functional group isomer of pentanoic acid?

A. Pentan-1-ol
B. Butanoic acid
C. Ethyl propanoate
D. 2-methybutanoic acid

16. Polyethene is a polymer that has a wide range of uses. It can be produced as a high-density product (HDPE) or a low density form (LDPE) that is softer and more flexible. Compared to LDPE, HDPE has:

A. A higher softening temperature due to a greater degree of branching of the polymer chain
B. A higher softening temperature due to a smaller degree of branching of the polymer chain
C. A lower softening temperature due to a greater degree of branching of the polymer chain
D. A lower softening temperature due to a smaller degree of branching of the polymer chain

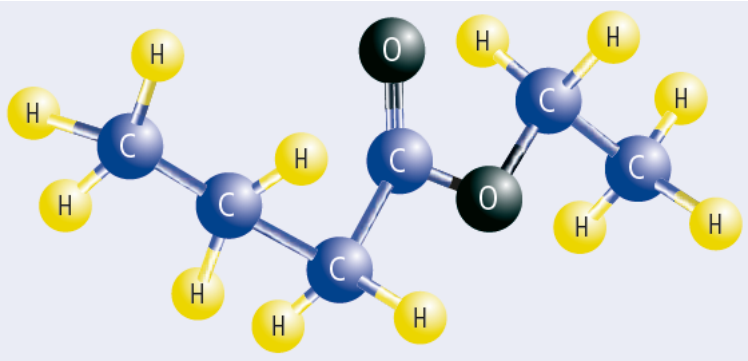
17. What is the systematic name for $CH_3CH_2CH_2CH(CH_3)_2$?

A. 1,1-dimethylbutane
B. 2-methylpentane
C. 2-methylpentene
D. propyldimethylmethane

18. Raoul is working with his classmates to measure the enthalpy of combustion of 2-methybutan-2-ol. In the experiment, 100.0g of water increases the temperature from 22.72 C to 77.04 C and 0.793g of 2-methybutan-2-ol is used? The molar heat of combustion is:

A. 22.7 kJ/mole
B. -22.7 kJ/mole
C. -25.2 kJ/mole
D. 25.2 kJ/mole

19. The two reactants that could be used to form the compound below are?



A. Ethanoic acid and butan-1-ol
B. Pentanoic acid and ethanol
C. Pentanoic acid and pentan-1-ol
D. Butanoic acid and ethanol

20. In the industrial manufacture of soap, the blended fats (eg beef tallow and coconut oil) are mixed with concentrated sodium hydroxide in large vats and steam jets are used to heat the mixture. Following saponification, hot brine is added. The soap curd separates from the aqueous layer. the aqueous layer is pumped out and processed to extract the glycerol. Water is added to the soap curd. The soap is then vacuum dried before pressing into soap bars, flakes or powders.

Select the correct response about the soap making process

A. The hot brine is added to precipitate out the soap curd
B. The glycerol extracted is used to manufacture more soap
C. Saponification is an example of the acidic hydrolysis of a fat
D. Water is added to hydrate the soap before processing to form soap bars

Part B –80 marks

Attempt Questions 21-34
Allow about 2 hours and 20 minutes for this part

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Show all relevant working in questions involving calculation.

Carrington
/20

Question 21 (13 marks)

A group of students carried out the decarbonation of a bottle of soda water.

6 grams of salt was weighed. A full bottle of unopened soda water, 500mL beaker and stirring rod were all weighed together and were found to weigh 1500g. All of the soda water was poured into the beaker and the salt was added. Salt reduces the solubility of carbon dioxide. The mixture was stirred in order to dissolve the salt. The mixture was initially in a dark cool area of the lab and then left in a sunny spot in the lab after 15 minutes. The experiment was undertaken for a total of 30 minutes. It was noticed that the bubbles of carbon dioxide were more profuse in the warm sunny spot. After the 30 minutes had elapsed, everything was reweighed together. The final mass was 1498 grams. Assume the total loss of mass was solely due to the loss of the carbon dioxide. A week later they carried out the experiment again and achieved similar results.

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(a) Write the equations for the dissolution of carbon dioxide from the atmosphere in water. **2**

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(b) Using the experimental observations predict whether this equilibrium is endothermic or exothermic in the forward direction. **1**

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(c) Room temperature fizzy drinks go flatter than cold fizzy drinks. Explain the

change in pH and entropy as the drink goes flatter. **3**

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(d) Calculate the volume of gas released from the soda water. **3**

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(e) Explain the reliability and validity of this experiment. 4

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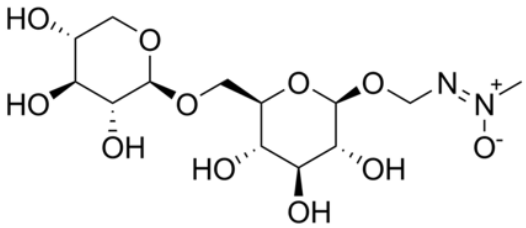
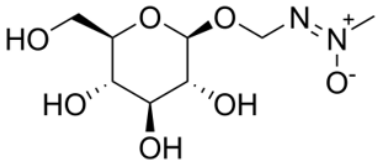
Question 22 (3 marks)

The seeds of cycad plants are used by Aboriginal and Torres Strait Islander peoples to make bread. However, these seeds contain toxins, TWO of which are illustrated below.



macrozamin



cycasin

Explain the process used to remove these toxins with reference to the features of each molecule.

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Question 23 (4 marks)

Consider the following system at equilibrium.

$$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

(a) In one such system at 300°C the concentration of PCl_5 left at equilibrium is approximately 40 % of its initial concentration. Explain if the percentage left over at 500°C compares with this. Is it higher/lower/no change? **2**

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(b) In two different vessels, both at 300°C, the equilibrium concentrations of three substances were measured. The results are shown below.

Substance	Concentrations (mol L^{-1})	
	Vessel I	Vessel II
PCl_5	0.10	0.05
PCl_3	0.30	0.60
Cl_2	0.20	?

Calculate the equilibrium concentration of chlorine in vessel II. Show all working. **2**

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Question 24 (4 marks**)**

Hydrazine (N_2H_4) is common to rocket fuel, spandex suits, power stations and car airbags. Like ammonia, it is classified as a Bronsted-Lowry base when it reacts with water. A 0.15 mol L^{-1} solution has a pH of 10.70. Calculate the *K*b for hydrazine.

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Question 25 (5 marks)

'Biofuels are set to replace fossil fuels in the future.'

Discuss this statement. Include chemical equations.

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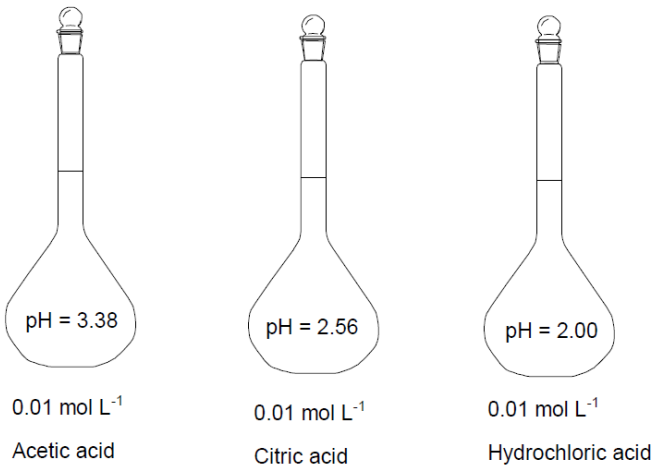
Question 26 (3 marks)

Explain the difference in pH between the three acids in the diagram.



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Question 27 (5 marks)

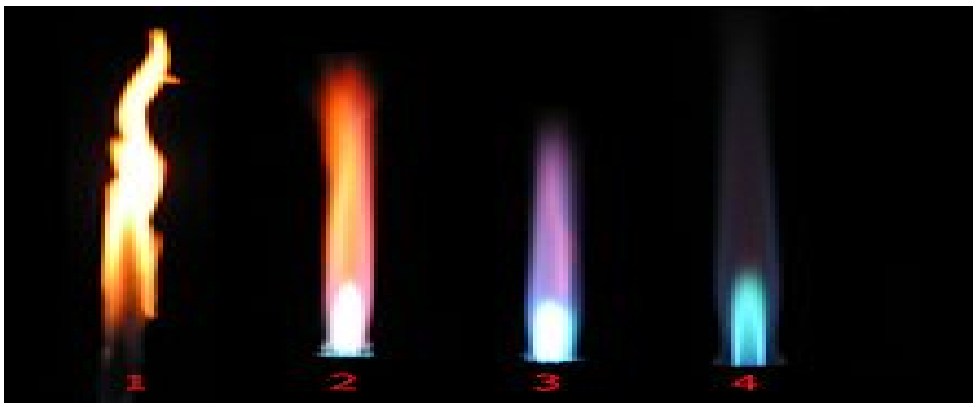
A sample of impure sodium carbonate required 24.65 mL of an HCl solution for titration.

A 0.2204 g sample of pure sodium carbonate required 20.06 mL of the HCl solution of the same concentration.

Calculate the mass of sodium carbonate in the impure sample. Include a balanced equation in your answer.

Question 28 (7 marks)

Flame tests, as shown below, can be used to distinguish between metal ions.



(a) Explain why metal ions give out coloured light when heated. **3**

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(b) Addition of excess potassium iodide solution can be used for the detection of lead ions.

(i) Write an equation for the reaction.
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(ii) Calculate the number of moles of lead ions in a solution which produces 1.5 g of solid. **2**

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(iii) Why would a flame test not be appropriate to test for this metal ion. **1**

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Question 29 (5 marks)

The production of wine possesses strict regulations in which the content of volatile acid, mainly present as acetic acid, be no greater than 1.20 g L^{-1} for non-red wines. One technique to determine the volume of volatile acid is to distil a sample of the wine and then titrate the distillate with a solution of sodium hydroxide. It can be assumed that the only volatile acid present is acetic acid.

20.00 mL of this particular white wine is distilled, and the distillate made up to 100.00 mL in a volumetric flask. 10.00 mL of this solution is then titrated with approximately 20.0 mL sodium hydroxide.

Using calculations, which of the following concentrations of NaOH is the most appropriate to use for the titration;

- 2.00×10^{-2} mol L^{-1}
- 2.00×10^{-3} mol L^{-1}
- 2.00×10^{-4} mol L^{-1}

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Question 30 (1 mark)

Calculate the pH of a 0.0010 mol/L solution of potassium hydroxide.

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Student Number ……

Faulder	/30

Question 31 (3 Marks)

Outline a procedure to distinguish between hexan-1-ol, cyclohexene and cyclohexane

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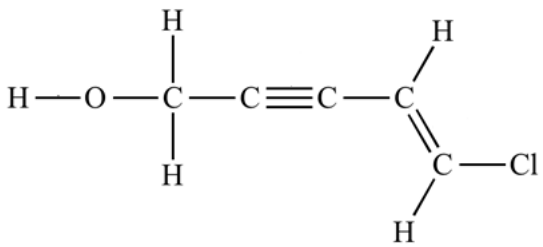
Question 32 (3 Marks)

Explain the shape of the molecule around each carbon atom



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Question 33 (6 marks**)**

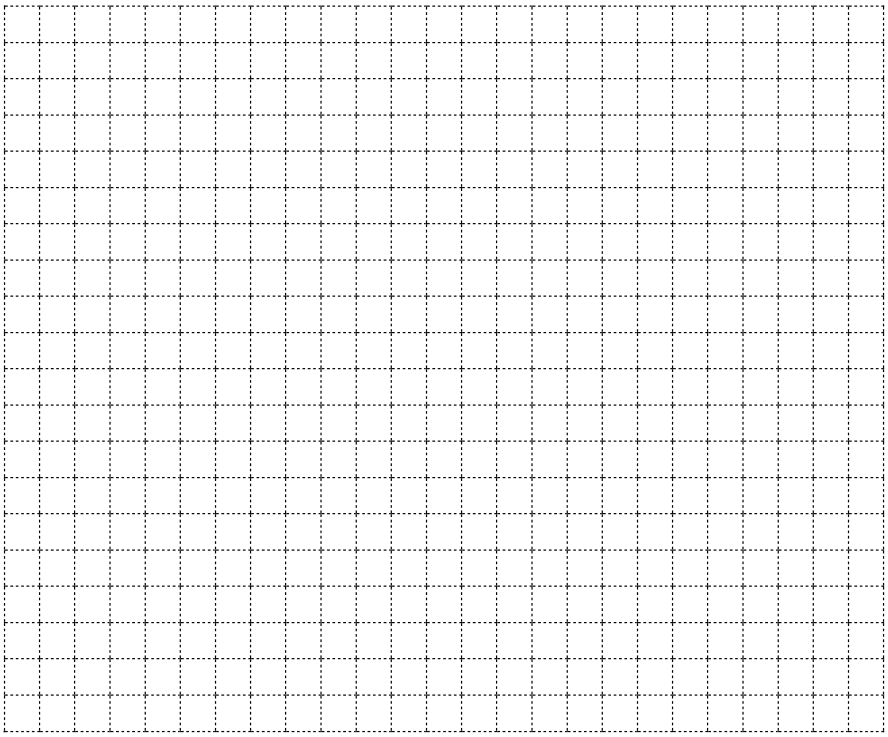
The tables below illustrate the boiling points of similar mass molecules from the alkenes, the aldehydes and the amines.

Alkene	Relative molecule mass (g mol^{-1})	Boiling Point (^oC)
Ethene	28.1	-104
Propene	42.1	-47
But-1-ene	56.1	-6
Pent-1-ene	70.1	30

Aldehyde	Relative molecule mass (g mol^{-1})	Boiling Point (^oC)
Methanal	30.0	-21
Ethanal	44.1	21
Propanal	58.1	46
Butanal	72.1	75

Amines	Relative molecule mass (g mol^{-1})	Boiling Point (^oC)
Methylamine	31.1	-6
Ethylamine	45.1	17
1-Propylamine	59.1	49
1-Butylamine	73.1	78

(a) Use the grid below to graph the boiling point against relative molecular mass for all the molecules in the 3 tables on the previous page. Draw a different line of best fit for each homologous series. ***3***



(b) Account for the differences in the boiling points within and between the homologous series. **3**

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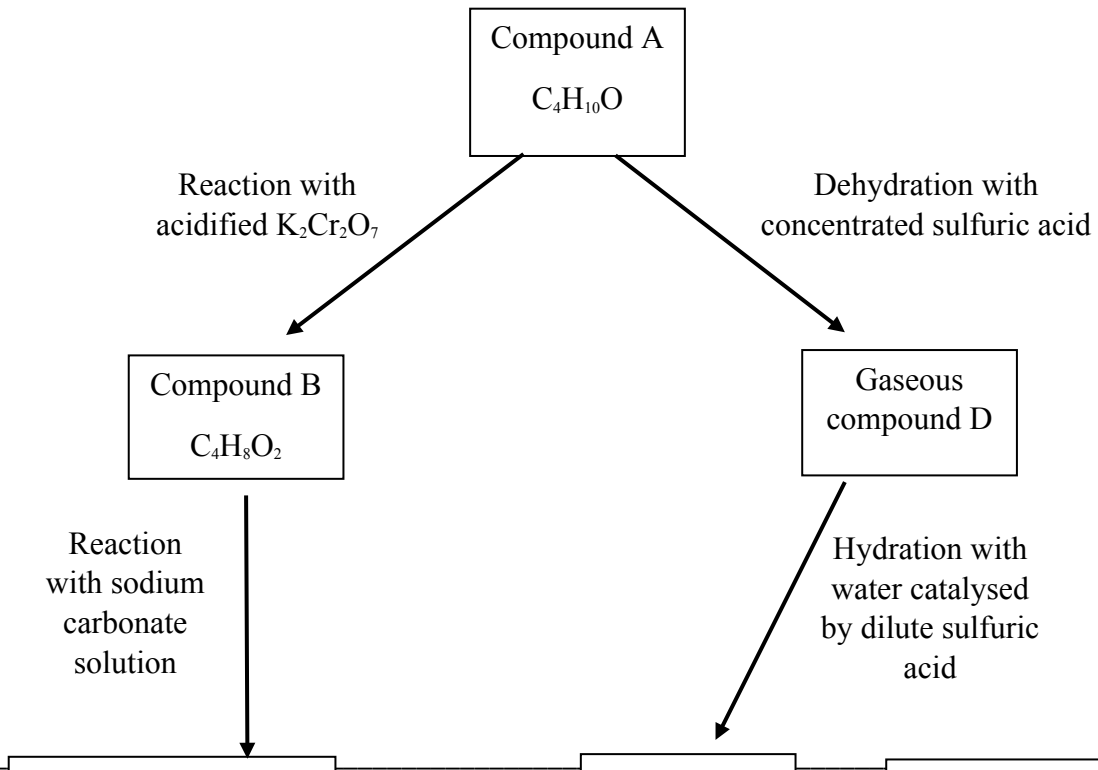
Question 34 (6 Marks)

Consider the following reaction sequence.



Identify and draw structural formulae for compounds A, B, C, D, E and F. Justify your reasoning.

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2019 | HIGHER SCHOOL CERTIFICATE EXAMINATION

Chemistry

FORMULAE SHEET

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

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

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

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

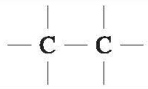
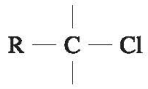
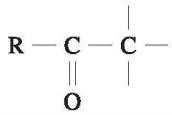
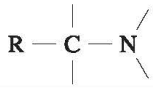
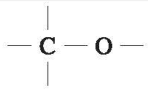
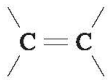
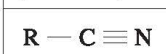
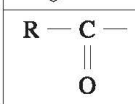
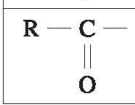
Compound	K_{sp}	*Compound*	K_{sp}
Barium carbonate	2.58×10^{-9}	Lead(II) bromide	6.60×10^{-6}
Barium hydroxide	2.55×10^{-4}	Lead(II) chloride	1.70×10^{-5}
Barium phosphate	1.3×10^{-29}	Lead(II) iodide	9.8×10^{-9}
Barium sulfate	1.08×10^{-10}	Lead(II) carbonate	7.40×10^{-14}
Calcium carbonate	3.36×10^{-9}	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}

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

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	122
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

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 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.

YEAR 12 CHEMISTRY TRIAL-2021

VERY IMPORTANT:

The HSC is marked online like we have marked this. The markers MUST be able to read your writing or you will not get the marks you deserve!

Marking Guidelines and Sample Answers

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

CARRINGTON

Question 21

(a)

Marking guidelines	Marks
• Writes all three equations with states	2
• Correctly writes an equation	1

Sample answer

$CO_{2\ (g)} \rightleftharpoons CO_{2(aq)}$

$CO_2(aq) + H_2O(l) \leftarrow\!\rightarrow H_2CO_3(aq)$

$H_2CO_3(aq) \leftarrow\!\rightarrow H^+(aq) + HCO3^-(aq)$

Comment: many students did not include the 3 equations especially (i)

(b)

Marking guidelines	Marks
• Identifies that the forward reaction is exothermic	1

Sample answer

The equilibrium is exothermic as the equation is reversed as temperature is increased.

(c)

Marking guidelines	Marks
• Explains and the rise in pH and entropy according to Le Chatelier's principal	3
• Explains the rise in pH OR entropy OR • Explains Le Chatelier's principal correctly linked to question • Identifies that **both** pH and entropy increases	2
• Identifies that the reaction shifts to the left hand side OR • Identifies an aspect of Le Chatelier's Principle OR • Identifies pH OR • Identifies entropy increases	1

Sample answer

The warm temperature causes the equilibrium to shift to the left-hand side and *form CO_2 gas this increases the entropy of the system* as the particles are more random in the gas than in the solution.. The pH will rise as the carbon dioxide gas escapes which means that there will be less carbonic acid in the drink and therefore less hydrogen ions. Less hydrogen ions means a rise in pH.

(d)

Marking guidelines	Marks
• Correctly calculates the volume of carbon dioxide	3
• Calculates moles of carbon dioxide And • Volume of gas with consequent error	2
• Calculates correct mass of carbon dioxide	1

Sample answer

mass of salt = 6g

mass of bottle, lid, beaker and stirring rod = 1500 g

Total mass before = 1506g

Total mass after = 1498 grams

- Mass of CO_2 expelled = 1506- 1498 = 8g
- Moles CO_2 = 8/44= 0.18
- Volume of gas

  V= 0.18 x 24.79

  = 4.46 L

Comment: Many students did not read the data correctly

(e)

Marking guidelines	Marks
• Thoroughly discusses the concepts of reliability and validity linked to the experiment	4
• Identifies the experiment was not reliable and not valid • Partially discusses the concept of reliability and validity	3
• Partially discusses the concept of reliability Or validity OR • Identifies the experiment was not reliable and not valid	2
• Identifies the experiment was not reliable OR valid	1

Sample answer

This experiment was not reliable because it was not repeated enough times *in the same conditions.* The **variables were not kept consistent.**

This was not a valid experiment because you could not be sure that all the carbon dioxide had been dispelled from solution. Also, if you don't have both accurate and reliable measurements then this will not be a valid experiment.

Note. A good site is :

Evaluating research data- accuracy, validity and reliability (hschub.nsw.edu.au)

Question 22

Marking guidelines	Marks
• Describes the process of leaching. AND • Explains structural features from each molecule that allows it to be soluble in water	3
• Describes the process of leaching. OR • Identifies structural features from *each molecule* that allows it to be soluble in water	2
• Identifies that either compound is soluble in water OR • Describes the process of leaching	1

Sample answer

Leaching involves submerging the ground up powder from the cycad seeds inside a bag in running water for up to 4 weeks, depending on the type of seed.
Each molecule is polar due to the -OH functional groups, hence allowing them to be soluble in water.
In grinding the seeds, it increases the surface area available for the water to pass through. The remaining carbohydrate is insoluble and can be cooked to make bread.

NOTE:_To answer this question you must tell me what leaching is! This question overlapped with module 7 and the polar bonding (you need to be specific)

Question 23 (a)

Marking guidelines	Marks
• Identifies that the reaction is endothermic and lower And • Describes what happens	2
• Identifies that the reaction is endothermic or lower OR • Identifies [PCl_5] decreases	1

Sample answer

Lower. The forward reaction is *endothermic.* Thus, at a higher temperature more of the PCl_5 decomposes to form the products, leaving less PCl_5 present at equilibrium.

(b)

Marking guidelines	Marks
• Calculates equilibrium constant for I And • Calculates [Cl_2}	2
• Calculates equilibrium constant for I	1

Sample answer

Equilibrium constant value in vessel I is the same as that in vessel II.

K= [PCl_3] [Cl_2] /[PCl_5]

K_I = (0.3 X 0.2) / 0.01 = 0.60

In II , [Cl_2] = (0.60 X 0.05) / 0.05 = 0.05 mol L^{-1}

NOYES

Question 24

Marking guidelines	Marks
• Provides balanced equation • Calculates concentration of [OH-] • Provides *K*b expression • Calculates *K*b	4
• Mostly correct working with wrong answer.	3
• Partially correct working OR • Correct answer with no working	2
• Calculates $[H^+]$	1

Sample answer

$N_2H_4\ (aq) + H_2O\ (l) \rightleftharpoons N_2H_5^+(aq) + OH^-\ (aq)$

$[H^+] = 10^{-pH}$

$= 10^{-10.70}$

$= 1.995 \times 10^{-11}$

$[H^+][OH^-] = 1.0 \times 10^{-14}$

$=$

$[OH^-] = \dfrac{1.0 \times 10^{-14}}{1.995 \times 10^{-11}}$

$= 5.0119 \times 10^{-4}$

$Kb = \dfrac{[N_2H_5][OH^-]}{[N_2H_5]}$

$= \dfrac{x^2}{0.15}$

$= \dfrac{(5.0119 \times 10^{-4})^2}{0.15}$

$= 1.67 \times 10^{-6}$

(You must write the equation to show how it is classified as a Bronsted-Lowry base when it reacts with water…and you need to write the Kb expression as marks are awarded. Do not skip steps!)

Question 25

Marking guidelines	Marks
• Discusses the replacement of fossil fuels by biofuels. • Includes chemical equations	5
• Briefly discusses the replacement of fossil fuels by biofuels. • Includes a chemical equation	3-4
• Briefly discusses the replacement of fossil fuels by biofuels. OR • Includes a chemical equation	2
• Identifies an aspect of Biofuels or fossil fuels	1

Sample answer

Fossil fuels including, coal, petroleum and natural gas are a dwindling, non-renewable resource. They are the basis for the fuel and petrochemical industry. Fossil fuels are easy to use as very little processing is required before the consumer can use them. This makes them very convenient and relatively cheap, but because they are finite resources they will eventually run out and so other sources need to be found.

Biofuels include biogas, bioethanol and biodiesel and are renewable resources that are made from natural products. When they undergo combustion they tend to burn completely forming only carbon dioxide and water, unlike fossil fuels which burn both completely and incompletely. Bioethanol also produces less moles of carbon dioxide per mole of fuel burnt (& also less energy) than octane and its combustion can therefore result in less greenhouse gas emission.

Eg Octane $C_8H_{18}(l) + 25/2\ O_2(g) \rightarrow 8CO_2(g) + 9H_2O(l)$

$C_8H_{18}(l) + 23/2\ O_2(g) \rightarrow 7CO_2(g) + C(g) + 9H_2O(l)$

Ethanol $C_2H_6O(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

Biogas can be easily made from the decomposition of rubbish and sewage. This does take a long time to produce but in the future, this is a sustainable way of producing gas that can be piped directly to the consumers for use.

Bioethanol comes from the fermentation of sugar solutions (from crops) in an anerobic environment at a temperature of 37^o C in the presence of yeast.

$C_6H_{12}O_6(aq) \rightarrow 2CO_2(g) + C_2H_6O(l)$

The ethanol obtained can then be distilled in order to purify it. This ethanol can then be used as a fuel for cars which will need to be modified to run on only bioethanol.

There are some disadvantages to ethanol as a fuel. A lot of arable land is needed to grow the crops and this can take away land from food production. Spills are difficult to contain as they mix with the water (due to the polar nature of the ethanol) and cannot be skimmed off the top. These spills are however, non-toxic and biodegradable. Additionally the cost of producing 1L of ethanol is considerably higher than that of producing 1L of octane.

Biodiesel can be produced from any fatty acid including corn, palm, coconut and peanut oils. Most biodiesel currently being produced uses waste vegetable oil from restaurants and industrial food processes. In this way the cost of production is minimised and they can compete commercially with diesel rom fossil fuels. Biodiesel (20%) can be mixed with radular diesel in cars without modification to engines. A high percentage biodiesel engine is currently being tested in trains, aircraft and heavy vehicles. Therefore in the future biodiesel could replace diesel produced from fossil fuels.

Question 26

Marking Guidelines	Marks
• Thorough explanation for the reasons of the pH of each solution in relation to ionisation of the weak and strong acids • Provides at least equations	**3**
• Provides an explanation for each and no equations • Provides an explanation for only two and one equation	**2**
• Provides an explanation of one and/or writes one equation	**1**

Sample Answer

HCl is a strong acid which completely ionises in solution and so the hydrogen ion concentration is equal to the concentration of the acid.

For example $HCl + H_2O \longrightarrow Cl^- + H_3O^+$

Acetic and citric acid are weak acids which do not completely ionise in solution.

$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$

The hydrogen ion concentration of a 0.1M acetic acid(monoprotic) is less due to less ionisation than that of a 0.1M citric (triprotic) and therefore has a higher pH than citric acid

Question 27

Marking guidelines	Marks
• Writes correct equation with states • Correct answer with full working and sig figures	5
• Writes correct equation with no states OR wrong sig fig incorrect • An answer with full working	4
• Mostly correct calculation • Writes an equation for the reaction	3
• Partially correct calculation OR • Partially correct equation Or • Correct answer with no working	2
• Identifies an aspect of the calculation	1

Sample Answer

$Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$

n $Na_2CO_3(s)$ in pure sample is : 0.2204 / 22.99 x 2 + 12.01 + 16.00 x 3

=0.2204 / 105.99= 0.00207944moles

2 nHCl reacting is therefore = n $NaHCO_3(s)$ =0.00207944moles x 2 = 0.00415888

[HCl] = n / V(L) = 0.00415888 moles / 0.0206 =0.20188752mol/L

In impure sample [HCl] =0.20188752mol/L & V reacting = 24.65 mL

n of HCl reacting with impure sample is C x V(L) = 0.20188752 x 0.02465 = 0.00497653

2nHCL = n $NaHCO_3$

g $NaHCO_3$ = n x MM = (0.00497653 / 2) x 105.99= 0.26373121 g = 0.2637g

Please Note:

Whenever you write an equation they are marking states! 0.2204g is a solid.

Always calculate the moles as this is what they are marking.

Don't round off until the last number, in the HSC they will not give full marks if you do!

Question 28

(a)

Criteria	Marks
• Explains the production of colour	3
• Partial explaination	2
• Identifies an aspect of the colour	1

Sample answer

A colour is produced in a flame test as a result of an electron absorbing or emitting heat and moving up from a ground state to an excited state of vice versa. As the electron moves it emits light of a specific wavelength which can be seen as a colour.

(b) (i)

Criteria	Marks
• Writes a correct equation with states	1

Sample answer

$Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI_2(s)$

(b)(ii)

Criteria	Marks
• Correctly calculates the number of moles	2
• Identifies an aspect of the calculation	1

Sample answer

$nPbI_2 = g/MM = 1.5 / (207.2 + 2x\ 126.9) = 1.5 / 461 = 0.0032538$

$n\ Pb^{2+} = nPbI_2 = 0.0032538 = 0.00325$

(mass for moles is in grams)

(b)(iii)

Criteria	Marks
• Identifies that lead is toxic	1

Sample answer

Lead is toxic and only precipitation tests are used to identify this ion.

Question 29

Marking guidelines	Marks
• Converts mass of acetic acid into concentration • Calculates diluted solution of acetic acid • Calculates moles of acetic acid used in titration • Calculates concentration of NaOH required in titration • Identifies most appropriate concentration of NaOH to use.	5
• Provides FOUR relevant steps	4
• Provides THREE relevant steps	3
• Provides TWO relevant steps	2
• Any relevant information	1

Sample Answer

$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

$c(CH_3COOH) = 1.2\ g\ L^{-1}$

$=$

$= 1.998 \times 10^{-2}\ mol$

$\therefore c(CH_3COOH) = 1.998 \times 10^{-2}\ mol\ L^{-1}$

$c(CH_3COOH)$ "diluted" $= 3.997 \times 10^{-3}\ mol\ L^{-1}$ (20 ml to 100 ml)

$n = 3.997 \times 10^{-3}\ mol$ in 100 ml

$n(CH_3COOH)$ "in titration" $= 3.997 \times 10^{-3}\ mol \times 0.01\ L$

$= 3.997 \times 10^{-5}\ mol$

$\therefore c(NaOH)$ "required" $=$

$c = 1.998 \times 10^{-3}\ mol\ L^{-1}$

The best concentration to use is $2.00 \times 10^{-2}\ mol\ L^{-1}$

Question 30

Criteria	Marks
• Correctly calculates the pH	1

Sample answer

$KOH \rightarrow K^+ + OH^-$

pOH = -log [OH-] = -log 0.0010 = 3.00

pH = 14 -pOH = 14 -3 =11

FAULDER

Question 31

Marking Criteria	Marks
• Clearly outlines a procedure including quantities, substance and equipment • Includes results to demonstrate identification of each	**3**
• Outlines a procedure or • Includes some results to demonstrate identification	**2**
• One correct statement	**1**

Suggested Answer

Test 1

1. Place 2mL of hexan-1-ol, hexene and hexane into separate test tubes
2. Add 2mL of bromine water to each, stopper and mix well

Test 2

3. Place 2mL of hexan-1-ol, hexene and hexane separately into 3 more test tubes
4. Add 3 drops of acidified 0.1M K2Cr2O7 or KMnO4 into each, stopper and mix well

Test 1

One test tube will mix with the bromine water forming one layer and will remain orange/brown in colour. This will be identified as hexan-1-ol. Another test tube will form two layers with Br water and after shaking the orange/brown Br layer will decolourise resulting in two colourless layers. This will be identified as hexene. The last test tube will also form two layers and after shaking the orange/brown Br will dissolve in the top layer, identifying this as hexane.

Test 2

The test tube containing hexan-1-ol will be identified as the orange $K_2Cr_2O_7$ will change from orange to green or the purple $KMnO_4$ will decolourise. The other two test tubes will remain unchanged in colour.

NOTE The question asked for a procedure – quantities, substance and equipment. Please become familiar with the volumes of the test tubes. The normal one you use (medium) has a volume of 10mL and the large one is 25mL therefore you cannot put these volumes or larger in the test tube.

The idea is that you are doing a qualitative test and therefore only need a small amount eg 2mL. Also remember the hazard issues with the Br test.

Think about the band 6 descriptors - designs and plans investigations to obtain accurate, reliable, valid and relevant primary and secondary data, evaluating risks, mitigating where applicable,

- **communicates scientific understanding succinctly, logically,**

You cannot get full marks if you do not demonstrate this.

Also, a number of you confused the $KMnO_4$ (purple to colourless) and $K_2Cr_2O_7$(orange to green) and don't forget to say acidified!

Question 32

Marking Criteria	Marks
• Explains the shape of the molecule around each carbon atom	**3**
• Describes the shape of the molecule	**2**
• Identifies each shape	**1**

Suggested Answer

The most left carbon atom has 4 single bonds. The geometric arrangement around this carbon atom is tetrahedral because this arrangement for the four electron pairs minimises repulsion.

The next two carbon atoms are joined by a triple bond. The triple bond counts as a single centre of electron density. Therefore, the shape of the molecule around these two carbon atoms is linear because each carbon atom is surrounded by only two centres of electron density. A linear shape minimises electron repulsion.

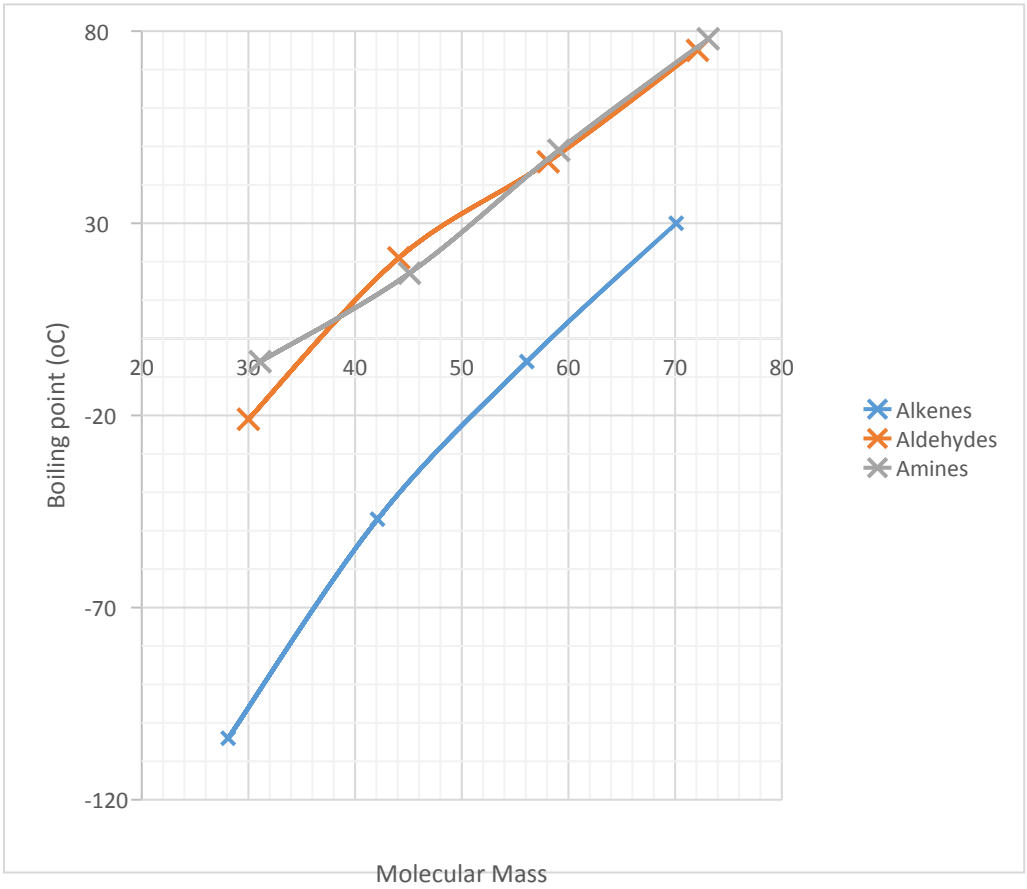
The last two atoms are joined by a double bond. Therefore, here there are two pairing electrons in the double bond which count as a single centre of electron density. The geometric arrangement of 3 electron pairs that minimises repulsion is triangular planar.

NOTE: Most of you only identified the shape. If you refer to SOLO then you were at level 1 (you knew something). If you identified the type of bond single, double and triple then you were at the next level – listed a number of pieces of information. To get the explain verb you have to link those statements ie why do they have that shape around those bonds.

Question 33

(a)

Marking Criteria	Marks
• Draws graph which includes data from all three tables • Correct axis • Correct line of best fit • Includes legend	**3**
• Substantially correct	**2**
• Partially correct	**1**



(b)

Marking Criteria	Marks
• Accounts for the differences in the boiling points	3
• Describes some reasons for the differences	2
• Identifies one reason for the differences	1

Suggested answer

Alkenes are composed of only nonpolar C – C, C – H bonds and contain the nonpolar C=C functional group. Therefore, all alkenes are non-polar and the only intermolecular forces influencing them are weak dispersion forces.

As successive members of a homologous series differ by a – CH_2 – group, they have successively longer carbon chains.

As the length of the carbon chain increases, the overall forces of attraction between molecules also increases. This occurs because of the increased strength of temporary dipoles within the molecules. The strength of dispersion forces determines the boiling point so as the chain length increases, the strength of the dispersion forces increases and as a result the boiling point increases. This can be seen in the graph, as the relative molecular mass increases from 28.1 to 70.1 the BP increases from -104 to 30.

Both aldehydes and amines also follow this trend of increasing BP as relative molecular mass increases due to the strength of dispersion forces increasing. As well as dispersion forces, both these groups contain polar functional groups =O for aldehydes and NH_2 for amines. Both these functional groups undergo dipole – dipole for aldehydes and hydrogen bonding for amines which are stronger intermolecular forces of attraction than dispersion forces. As a result, both aldehydes and amines have higher boiling points than corresponding alkenes.

In amines though, N is less electronegative than O so even though amines have hydrogen bonding, the strength of the force is similar to the dipole – dipole of the aldehyde and as a result they have very similar boiling points.

Note: The graph was poorly done. You cannot draw the line so that it is easier for you to discuss the trend. A lot of you swapped the second points. Not all lines are straight. If you did not like the 2nd point for the aldehyde and you thought it was an anomaly, then label it so on the graph because then your line is justified. Don't forget to label the lines or use a key/legend.

There were two trends – homologous series and functional group, you had to discuss both.

There are four types of forces – dispersion (all molecules), dipole-dipole, ion-dipole, hydrogen bonding which is a special type of dipole-dipole. Learn them!!!!!

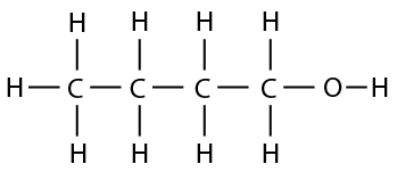
Question 34

Marking Criteria	Marks
• Correctly identifies and draws structures for each compound • Correctly justifies each choice showing reasoning	6
• Identifies and draws correct structures for most compounds • Justifies choices	5
• Identifies and draws correct structures for some compounds • Justifies choices OR • Identifies and draws structures for all compounds with no reasoning	4
• Identifies and draws correct structures for some compounds OR • Correctly identifies with justification OR • Correctly draws structures with justification	3
• Identifies or draws correct structures or • Justifies some choices	2
• Identifies one compound or draws one correct structure or justifies one choice	1

Suggested Answer

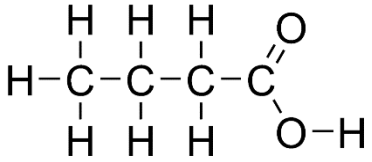
The two reaction conditions that compound A experiences indicates that compound A must be an alcohol. Compound B reacts with sodium carbonate which indicates that it must be a carboxylic acid. Only primary alcohols will be oxidised by acidified dichromate solutions to produce carboxylic acids. Secondary alcohols produce ketones and tertiary alcohols do not react at all.

Therefore, compound A is butan-1-ol



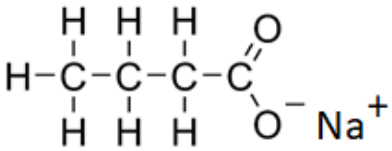
Butan-1-ol

And compound B is butanoic acid



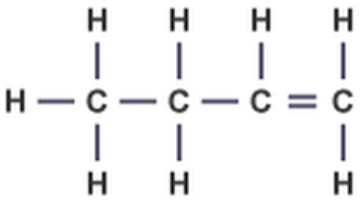
Acid plus a carbonate react to produce a salt plus carbon dioxide and water. In the case of butanoic acid and a carbonate the salt produced, Salt C, is sodium butanoate and the gas is carbon dioxide.

$$2CH_3CH_2CH_2COOH + Na_2CO_3 \rightarrow 2CH_3CH_2CH_2COONa + CO_2 + H_2O$$

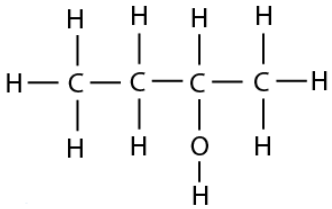


Sodium butanoate

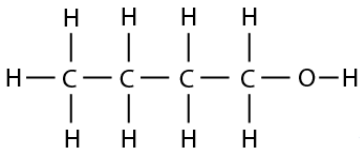
Alcohols are dehydrated by conc sulfuric acid to form alkenes. Dehydration removes the OH from one carbon and H from another to form water. This causes the formation of a double bond. Therefore butan-1-ol will be dehydrated to form but-1-ene which is compound D.



Hydration of but-1-ene with dilute sulfuric acid will add H and OH from a water molecule across the double bond. This will form two products – the major product butan-2-ol which is compound F (as the most stable C atom is the one in position 2) and a minor product butan-1-ol which is compound A.

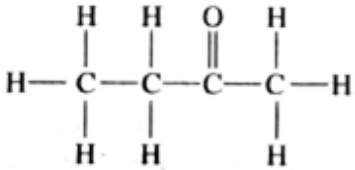


Butan-2-ol



Butan-1-ol

As Butan-2-ol is a secondary alcohol it will only be able to undergo oxidation with the acidified dichromate ion to form a ketone. This is confirmed as ketones cannot undergo further oxidation. Therefore, compound F is butanone.



Butanone

Note: The yellow highlighted parts are the justification. You need to record what you were thinking to enable you to deduce the name of the compound formed. Repeating what was given is not justifying but it can be referred to.

Also be very careful how you draw your structures, some were very sloppy and for structural diagrams you must SHOW EVERY BOND and that includes the bond between O and H. You have been told this multiple times and yet you are still making the same mistake!!!

AND I don't care how compounds are named in your textbook. IUPAC changed the naming years ago so DO NOT put the number in front, it must be included in the name.

Last point, salts are ionic. There is not a covalent bond between the O and Na. If you meant it to be a negative sign then draw it so there is no confusion.

Overall:

This was a good exercise for the HSC – I could not see some diagrams very well because your image was too pale – use black pen or a strong pencil. If markers can't see it they cannot mark it.

The scan does not distinguish between a poorly rubbed out line or point (in the graph and structures) or one you want. If markers can see it, they mark it!!