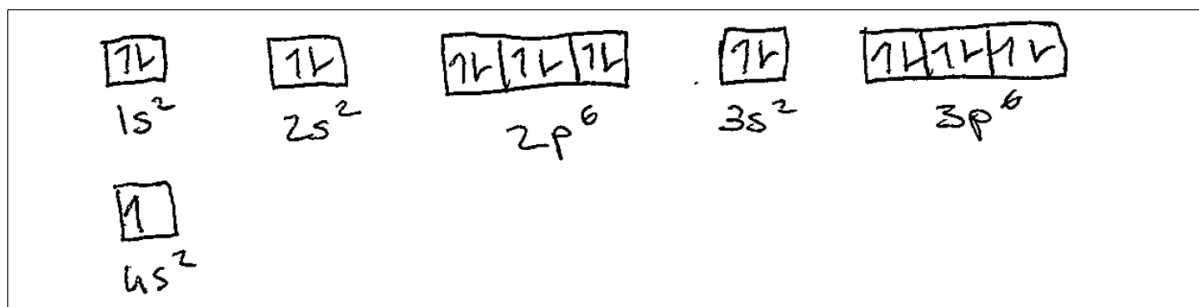
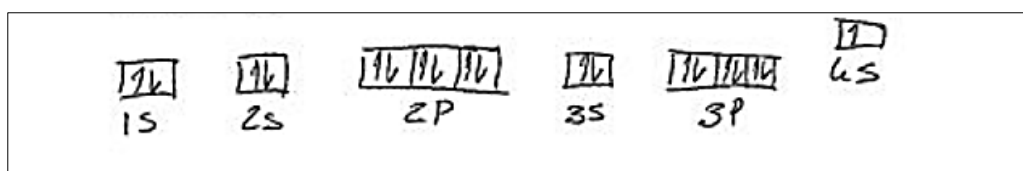


Question 1(a)

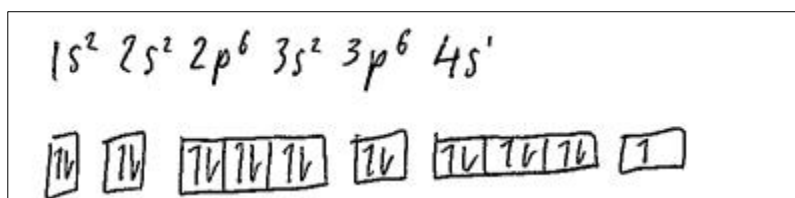
Candidate 1



Candidate 2



Candidate 3



Question 1(b)

Candidate 1

Quantum number	n	l	m_l	m_s
Value	4	0	0	$+\frac{1}{2}$

Candidate 2

Quantum number	n	l	M_l	m_s
Value	4	0	0	$+\frac{1}{2}$

Question 1(c)(ii)

Candidate 1

These lines represent the transitions between energy levels, electrons are quantised between levels. They are the energy required to excite an electron to a higher level.

Candidate 2

(ii) Explain why a series of lines is produced. ^{multiple wavelengths absorbed + emitted.} 1
 electrons are excited to higher energy levels and fall back towards ground state to produce lines as they emit wavelengths of light.

Candidate 3

- Electrons fall down to lower energy levels, emitting light. Different transitions results in different ~~wavelengths~~ lines produced at different wavelengths.

Candidate 4

When the electron drops back down to a lower energy level that corresponds with a wavelength

Candidate 5

Once the electrons are promoted they can fall back down to lower energy levels and will absorb/emitt a complementary colour: producing a line

Candidate 6

Due to different electron transitions between different energy levels.

Candidate 7

When electrons drop to lower energy levels a photon is emmitted which produces a line for each electron.

Question 1(c)(iii)(A)

Candidate 1

$$E = \frac{hc}{\lambda}$$

$$419 = \frac{(6.02 \times 10^{23} \times 6.63 \times 10^{-34} \times 3 \times 10^8)}{\lambda}$$

$$\lambda = \frac{(6.02 \times 10^{23} \times 6.63 \times 10^{-34} \times 3 \times 10^8)}{419}$$

$$\lambda = 2.857..$$

$$\lambda = \underline{\underline{2.86}}$$

Candidate 2

$$\frac{6.02 \times 10^{23} \times 6.63 \times 10^{-34} \times 3 \times 10^8}{419}$$

$$= 0.00114782291$$

$$= 0.0011$$

Candidate 3

$$\lambda = \frac{hc}{E} = \frac{6.02 \times 10^{23} \times 6.63 \times 10^{-34} \times 3 \times 10^8}{419}$$

$$= 2.857 \times 10^{-4} \text{ m}$$

$$= \underline{\underline{285.7 \text{ nm}}}$$

Candidate 4

$$419 \text{ kJ mol}^{-1} \quad \lambda = \frac{hc}{E}$$

$$E = \frac{hc}{\lambda}$$

$$= \frac{2.1197378}{419000}$$

$$= 285 \text{ nm}$$

Question 1(c)(iii)(B)

Candidate 1

the wavelength would be bigger

Candidate 2

$E = 376 \text{ kJ mol}^{-1}$
 $E \text{ of K} > E \text{ of Cs}$
 $\therefore \lambda \text{ of K is smaller compared to } \lambda \text{ of Cs}$

Candidate 3

The ^{shortest} wavelength of caesium will ~~be~~ have lower energy than potassium

Candidate 4

The shortest wavelength of caesium would be $3.1 \times 10^{12} \text{ nm}$ it would ~~be~~ ~~comparable to potassium~~ have a lower frequency than potassium 372

Question 2(a)(i) and (ii)

Candidate 1

Using information from the table, calculate

(i) ΔS° in $\text{J K}^{-1} \text{mol}^{-1}$

$$\Delta S^\circ = (-16 + 205) - (-70.7) \\ = \underline{\underline{210.3 \text{ J K}^{-1} \text{mol}^{-1}}}$$

(ii) the temperature, in K, at which the reaction becomes feasible.

$$\Delta G = \Delta S T = \Delta H \quad \Delta G = 0 \quad \Delta H_f^\circ = 90.7 \text{ kJ mol}^{-1}$$

$$\frac{\Delta H}{\Delta S} = T$$

$$T = \frac{90.7 \times 10^3}{210.3} = 431.2 \rightarrow \underline{\underline{431 \text{ K}}}$$

Candidate 2

Using information from the table, calculate

(i) ΔS° in $\text{J K}^{-1} \text{mol}^{-1}$

$$\begin{aligned}\Delta S &= \sum S(\text{products}) - \sum S(\text{reactants}) \\ &= (20.7) - (76 + 102.5) \\ &= -107.8 \\ &= -0.1078 \text{ kJ}\end{aligned}$$

(ii) the temperature, in K, at which the reaction becomes feasible.

$$\begin{aligned}\Delta G &= \Delta H - T\Delta S & \Delta H &= -90.7 \\ -90.7 - T(-0.1078) &= 0 \\ 0.1078T &= 90.7 \\ T &= 841 \text{ K}\end{aligned}$$

Candidate 3

Using information from the table, calculate

(i) ΔS° in $\text{J K}^{-1} \text{mol}^{-1}$

$$\Delta = (76 + 205) - (70.7)$$

$$= \underline{\underline{210.3 \text{ J K}^{-1} \text{mol}^{-1}}}$$

(ii) the temperature, in K, at which the reaction becomes feasible.

$$\Delta H^\circ = \sum \Delta H_f^\circ (\text{products}) - \sum \Delta H_f^\circ (\text{reactants})$$

$$= (0 + 0) - (-90.7)$$

$$= 90.7$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G + T\Delta S = \Delta H$$

$$T\Delta S = \Delta H - \Delta G$$

$$T = \frac{\Delta H - \Delta G}{\Delta S}$$

$$T = \frac{(90.7) - (0)}{(210.3)} = \underline{\underline{0.43 \text{ K}}}$$

Candidate 4

Using information from the table, calculate

(i) ΔS° in $\text{J K}^{-1} \text{mol}^{-1}$

$$\begin{aligned}\Delta S &= (76 + \frac{1}{2} 205) - (-70.7) \\ &= (76 + 102.5) - (-70.7) \\ &= 178.5 - (-70.7) \\ &= 107.8 \text{ J K}^{-1} \text{ mol}^{-1}\end{aligned}$$

(ii) the temperature, in K, at which the reaction becomes feasible.

$$\begin{aligned}\Delta H &= (0 + 0) - (-90.7) \\ &= 0 + 90.7 \\ &= 90.7 \text{ kJ mol}^{-1}\end{aligned}$$

$$\Delta G = \Delta H - T\Delta S$$

$$0 = 90.7 - T(0.1078)$$

$$-90.7 - T(0.1078) = 90.7$$

$$T = \frac{90.7}{0.1078}$$

$$T = \frac{90.7}{0.1078}$$

$$= 841.372$$

$$= 841.4 \text{ K}$$

Question 2(c)

Candidate 1

- By using the absorption and transmission values of mercury
- varies in wavelength

Candidate 2

The intensity of energy absorbed by the sample shows how concentrated the mercury in the sample is. The more energy absorbed the greater the concentration of mercury.

The lines on the spectrum will represent the different energy levels in a mercury atom.

It should be known the lines known to be produced from a mercury atom that should be looked at for intensity of energy absorbed.

Candidate 3

A sample of hair is energised (heated) to excite the electrons in its atoms. This produces a black line on the absorption spectrum as the atoms absorb the energy and the electrons are promoted. The amount of light absorbed at each wavelength corresponding to the concentration of the element. Mercury has a unique AS.

Candidate 4

By recording the absorption of light.
Mercury is within 310 nm to 579 nm
The greater the peak on the absorption spectrum, the greater the concentration.

Candidate 5

a higher concentration would absorb more light, which would create larger energy gap between electron levels

Candidate 6

create a calibration curve
with known concentrations of
mercury plot a graph of
concentration vs lines produced on
spectrum
then carry out an atomic absorption
spectroscopy with the hair
then read off your graph to
determine the concentration.

Question 3(a)(i)(A)

Candidate 1

reaction 2, the ΔG° value for 2 is lower showing the reaction is more likely to be feasible.

Candidate 2

reaction 1 $\Delta G = -7.3$
reaction 2 $\Delta G = -244.3$

reaction 2 is more likely

Candidate 3

Reaction 1 $\Delta G^\circ = -7.3$

Reaction 2 $\Delta G^\circ = -244.3$

~~$\Delta G^\circ = -7.3$~~
 ~~$\Delta H^\circ = -105$~~
 ~~$T = 298$~~

Reaction 2 as since

ΔG° is more negative

it is the most feasible.

Candidate 4

$$\text{reaction 1: } -40.3 + 33 = -7.3$$

$$\text{reaction 2: } -237 + 33 = -204$$

Reaction 2. ΔG is well below 0, making the reaction more feasible.

Question 3(a)(i)(B)**Candidate 1**

ΔG° is in standard conditions

Candidate 2

* ΔG° is theoretical whereas ΔG is determined as an actual value by experiment

Candidate 3

As the entropy of the reactants and products is different in each reaction.

Candidate 4

BECAUSE CONDITIONS SUCH AS TEMPERATURE AND PRESSURE CAN CHANGE THE VALUE OF ~~THE~~ ΔG

Candidate 5

The reaction may not be carried out at standard temperatures and pressures.

Candidate 6

due to environmental conditions such as temperature affecting the entropy of substances.

Candidate 7

It is unlikely that the temperature for each reaction will be the same every time and since $\Delta G = \Delta H - T\Delta S$, this will lead to different ΔG values. That may not correspond to the ΔG° value (which is consistent across reactions).

Question 3(a)(ii)(B)**Candidate 1**

it absorbs light with a wavelength of 435-480nm (blue light) and reflects light in the range of 580-595nm (yellow)

Candidate 2

When the cyanide ligands bind to iron, the iron 3d orbital is split into sub levels. For electrons to move up sub levels (d-d transitions) they require energy. The wavelength of energy absorbed for d-d transitions results in the complex emitting the complementary colour. If Yellow is emitted, this means blue (435-480nm) was absorbed.

Candidate 3

The difference in HOMO & LUMO is between 435 and 480 nm meaning blue is absorbed and yellow is seen

Candidate 4

As the ligand binding causes the d orbitals in iron to split, allowing d-d transitions to occur. When an electron becomes excited it is promoted to a higher energy d orbital and when it drops down it emits a photon of yellow light.

Question 3(b)(i) and (ii)

Candidate 1

(i) Calculate the number of moles of excess $\text{Ag}^+(\text{aq})$ ions in the 500 cm^3 standard flask.

$n = CV$
 $n = 0.0503 \times 0.0137$
 $n = 0.00068911$

mole ratio
 $\text{Ag}^+ : \text{SCN}^-$
 $1 : 1$
 $0.00068911 : 0.00068911$

Ag^+ - unreacted
 $n = 0.00068911$

(ii) Calculate the percentage by mass of sodium chloride in this cheese.

Moles ~~reacted~~ =
 Ag^+
 $n = CV$
 $n = 0.1 \times 0.05$
 $n = 0.005$

Moles reacted = $0.005 - 0.00068911$
 $= 0.00431089$

NaCl
 $m = n \times \text{gfm}$
 $m = 0.00431089 \times 58.5$
 $m = 1.266$

% by mass = $\frac{1.266}{5.27} \times 100 = 23.9\%$

Candidate 2

- (i) Calculate the number of moles of excess $\text{Ag}^+(\text{aq})$ ions in the 500 cm^3 standard flask.

$$\frac{500 \text{ cm}^3}{1} = \frac{13.7 (0.0503)}{1}$$

$$\begin{aligned} 500 \text{ cm}^3 &= 0.68911 \\ c_1 &= 0.001378... \text{ mol l}^{-1} \\ n &= 0.5(0.001378...) \\ n &= 0.000689 \text{ moles} \end{aligned}$$

- (ii) Calculate the percentage by mass of sodium chloride in this cheese.

original :

$$n = 0.005 \text{ moles}$$

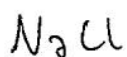
used in the reaction:

$$n = 0.004311 \text{ moles}$$

excess:

$$n = 0.000689 \text{ moles}$$

0.004311 moles of Cl^- , so 0.004311 moles of NaCl



$$n = 0.004311 \text{ moles}$$

$$\text{GFM} = 58.5 \text{ g}$$

$$m = 0.252 \text{ g}$$

$$\% \text{ by mass} = \frac{0.252}{5.27} \times 100$$

$$= 4.78\%$$

Question 5(a)(i)(A)**Candidate 1**

Complexometric titration

Candidate 2

complemetrix titration

Question 5(a)(i)(C)**Candidate 1**

due to the lone pairs present on the EDTA ligand are attracted to calcium centre (+).

Question 5(a)(ii)(B)**Candidate 1**

so the concentration is accurately known and it is useful for the calculations of titration to determine the concentration of the Ca^{2+} .

Candidate 2

So the concentration of Ca^{2+} can be determined by finding the number of mols of EDTA that reacted, which can only be known if EDTA is standardised and of a known concentration

Question 5(b)

Candidate 1

$$\text{Ca}^{2+} \text{ conc} = 0.00247 \text{ mol l}^{-1}$$

$$n = \frac{m}{\text{gfm}}$$

$$m = n \times \text{gfm}$$

$$= (0.00247)(100.1)$$

$$= 0.247247 \text{ g l}^{-1} \times 1000$$

$$= 247.247 \text{ mg l}^{-1} \therefore \underline{\text{Hard}}$$

$$\begin{array}{r} \text{CaCO}_3 \\ \downarrow \\ 40.1 \\ \downarrow \\ 12 \\ \downarrow \\ 716 \times 3 = 48 \\ \hline 100.1 \end{array}$$

Candidate 2

$$M = n \times \text{GFM}$$

$$M = 0.00247 \times 100.1 =$$

$$M = 0.247247 \text{ g} \rightarrow \text{mg} = \underline{24.7 \text{ mg l}^{-1}}$$

Candidate 3

hard

Candidate 4

$$C = 0.00247 \text{ mol l}^{-1}$$

$$n = C \times V$$

$$n = 0.00247 \times 0.05$$

$$n = 1.235 \times 10^{-4} \text{ moles in } 50 \text{ cm}^3$$

$$2.47 \times 10^{-3} \text{ moles in } 1 \text{ L}$$

$$m = n \times \text{gfm}$$

$$m = 2.47 \times 10^{-3} \times 100.1$$

$$m = 0.249717 \text{ g l}^{-1}$$

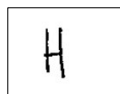
$$= 249.717 \text{ mg l}^{-1}$$

$$= 250 \text{ mg l}^{-1}$$

$\therefore$ The water is hard

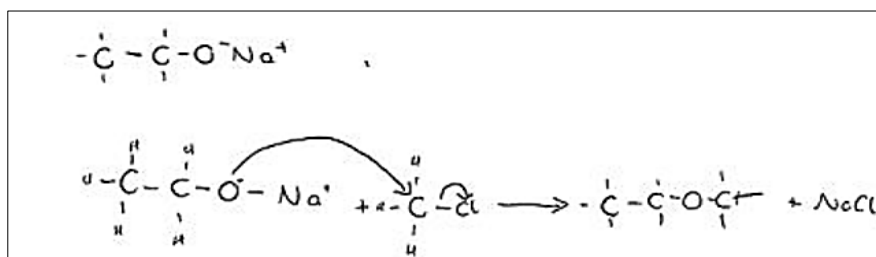
Question 6(a)(i)

Candidate 1

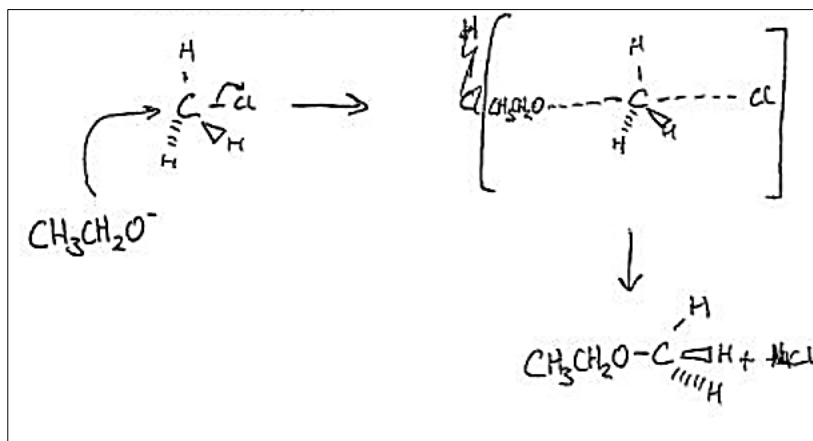


Question 6(a)(iii)

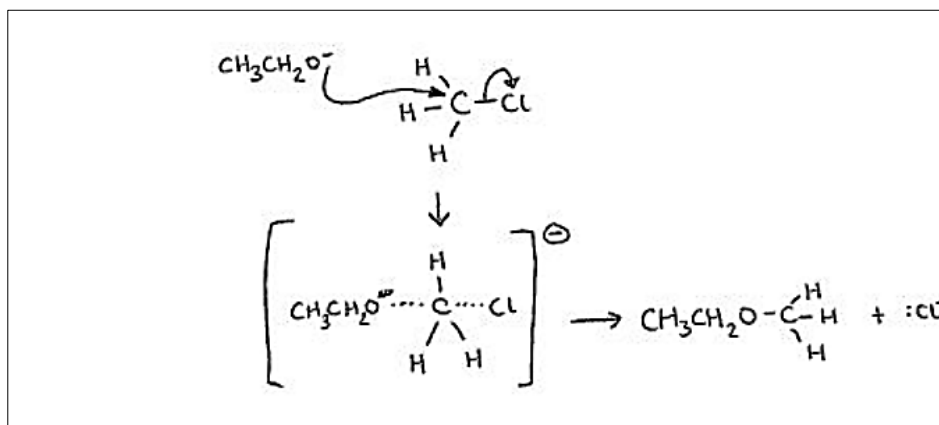
Candidate 1



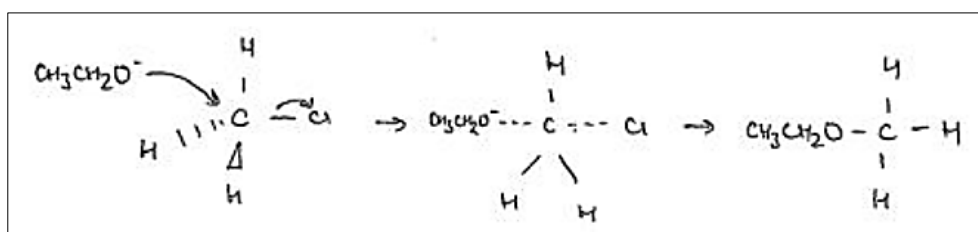
Candidate 2



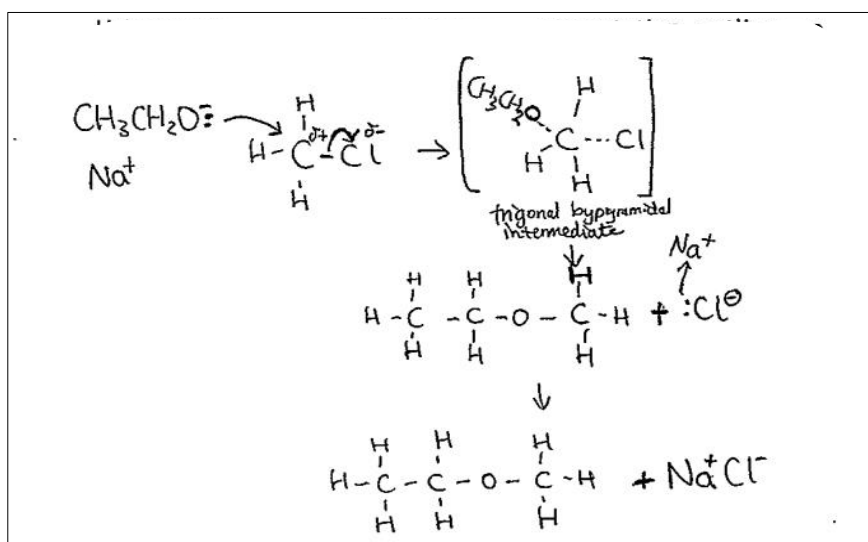
Candidate 3



Candidate 4



Candidate 5



Question 6(a)(iv)**Candidate 1**

ethyl methyl ether

Candidate 2

2-methoxyethane

Question 6(b)(ii)**Candidate 1**

$$3.15 \times 10^{-6} \text{ mol l}^{-1} \text{ s}^{-1} = k [0.12 \text{ mol l}^{-1}] [0.04 \text{ mol l}^{-1}]$$
$$k = \underline{\underline{0.00065625 \text{ l mol}^{-1} \text{ s}^{-1}}}$$

Candidate 2

$$3.15 \times 10^{-6} = k \times 0.12 \times 0.04$$
$$k = \frac{3.15 \times 10^{-6}}{0.12 \times 0.04}$$
$$k = 0.00065625$$
$$= \underline{\underline{0.00066 \text{ mol}^{-1} \text{ l s}^{-1}}}$$

Candidate 3

$$\begin{aligned}
 \text{rate} &= k [\text{CH}_3\text{O}^-] [\text{CH}_3\text{Cl}] \\
 3.15 \times 10^{-6} &= k (0.12)(0.04) \\
 &= k (4.8 \times 10^{-3}) \\
 k &= 6.56 \times 10^{-4} \quad \Rightarrow \underline{\underline{6.56 \times 10^{-4} \text{ L mol}^{-1} \text{ s}^{-1}}}
 \end{aligned}$$

Candidate 4

$$\begin{aligned}
 \text{Rate} &= k [\text{CH}_3\text{O}^-] [\text{CH}_3\text{Cl}] \\
 3.15 \times 10^{-6} &= k [0.12] [0.04] \\
 k &= \frac{3.15 \times 10^{-6}}{(0.12)(0.04)} \\
 k &= 0.00065625 \quad \text{mol}^2 \text{s}^{-1} \quad \left| \begin{array}{l} \text{mol}^2 \text{mol}^{-1} \\ \text{mol}^{-1} \text{s}^{-1} \end{array} \right. \\
 k &= 0.00066 \text{ mol}^2 \text{s}^{-1}
 \end{aligned}$$

Question 6(b)(iii)

Candidate 1

$$\begin{aligned}
 E_a &= 2.303 \times (8.314) \times 500 \times \log \left(\frac{718}{604 \times 10^{-4}} \right) \\
 E_a &= 58160 \text{ J K}^{-1} \text{ mol}^{-1} \\
 E_a &= \underline{\underline{58.2 \text{ kJ mol}^{-1}}}
 \end{aligned}$$

Candidate 2

$$\begin{aligned} E_a &= 2.303 \times \frac{8.314}{1000} \times 500 \times \log\left(\frac{718}{6.04 \times 10^{-4}}\right) \\ &= -8.4944 \\ &= -8.494 \text{ kJ mol}^{-1} \end{aligned}$$

can activation energy
be negative?
Or is it $\log \frac{718}{6.04 \times 10^{-4}}$

in that case

$$E_a = 58.16 \text{ kJ mol}^{-1}$$

Question 7(a)(ii)(A)(I)**Candidate 1**

As it is lacking electrons
whereas the nucleophile is electron rich

Candidate 2

carbon atom becomes a
positive carbocation that
attracts nucleophiles.

Candidate 3

Because it is ^{positive} + and nucleophiles are
electron rich

Candidate 4

as the carbon atom bears a
partial charge and therefore
attracts nucleophiles

Candidate 5

~~so~~ This is because the oxygen atom in the
bond takes both electrons in the bond as it is highly
electronegative causing the carbon to become
electron deficient.

Question 7(a)(ii)(A)(II)**Candidate 1**

The pi bond is less stable than the sigma bond.

Candidate 2

less energy is required to break the bond. π bonds are less stable. Oxygen has greater pull on e^- .

Question 7(a)(ii)(B)**Candidate 1**

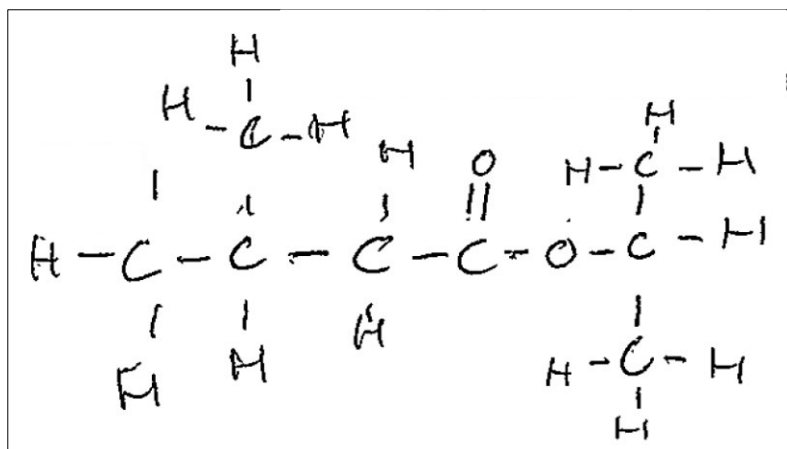
it is donating a hydrogen

Candidate 2

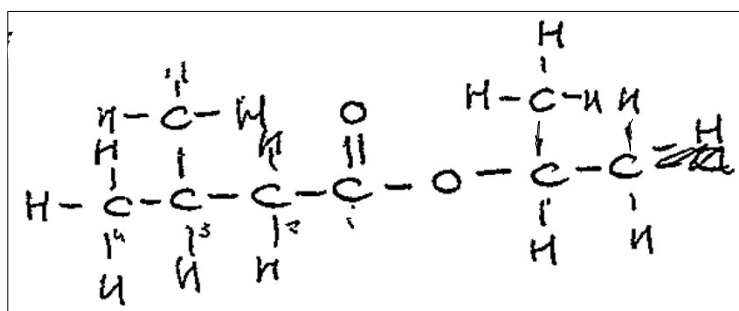
it loses a proton.

Question 7(b)

Candidate 1



Candidate 2



Question 7(c)(ii)

Candidate 1

This is because it only has one alkyl group attached and so is more positive (is electron deficient) ~~while the other propanoate has~~ this will form the most stable molecule.

Candidate 2

because the other carbon has methyl groups attached to it so its easier to attack the circled one

Candidate 3

It has the most hydrogens attached.

Candidate 4

Because there are less bulky alkyl groups surrounding it so it can attack to form the carbocation.

Candidate 5

~~It is not~~ Steric hindrance does not occur as it is only attached to one other R group.

Question 8(a)(ii)

Candidate 1

- Mix vanillin is a suitable solvent ~~that~~
- heat gently to dissolve any impurities
- Cool down in a desiccator (to prevent reabsorption of moisture)
- filter using vacuum pump & Buchner funnel
- Wash, and dry crystals
- Dry crystals till a constant mass

Candidate 2

A small volume of hot solvent should be added to the reaction mixture and hot filtration should be done to remove insoluble impurities. The mixture should be cooled, the pure substance will solidify into crystals. Mixture should be filtered and solids washed and dried. The soluble impurities will be left in the filtrate.

Candidate 3

- dissolve in solvent
- evaporate off soluble impurities with heat
- leave to crystallise
- filter, wash and dry crystals to get rid of insoluble impurities
- pure sample obtained!!! (carefully)

Candidate 4

- add minimum hot solvent
- filter
- cool
- dry

Question 8(a)(iii)

Candidate 1

Sorry for
is probably
really hard to
to read

$16 = \frac{m}{3.16}$
 $0.16 = \frac{m}{3.16}$
 $m = \frac{0.16}{3.16}$
 $= 0.0506$
 $= 0.051g$

$\times 100$
theoretical
yield
 $0.16 = \frac{m}{2.9287}$
 $0.16 = 2.9287 \times m$
 $m = \frac{0.16}{2.9287} = 0.0546g$
 $M = 0.055g$ (P)

$M = 1 \times 100$
 $1 = \frac{m}{100}$
 $100 = \frac{m}{1}$
 $m = 100$

$1:1$ $n = 0.0922...$
 $m = 100 \times 1.92$
 $= 192$
 $= 2.9287$

too easy for 2 marks
probably missing something

Candidate 2

$n(\text{eugend}) = 0.01926829268 \text{ moles} = n(\text{valillin})$
 $m(\text{theoretical}) = 2.928780488g$

$\% \text{ Yield} = \frac{\text{Actual}}{\text{Theoretical}} \times 100$

$\text{Actual} = \frac{16}{100} \times 2.928780488$

$\text{Actual} = 0.4686048781g$
 $= 0.47g$

Candidate 3

$$\begin{aligned}
 16\% &= \frac{3.16}{\text{theoretical}} \\
 &= \frac{3.16}{16} \\
 &= 0.1975 \text{ g}
 \end{aligned}
 \quad
 \begin{aligned}
 n &= \frac{m}{M_r} \\
 &= \frac{0.1975}{164} \\
 &= 0.001204... \\
 m &= 0.001204 \times 152 \\
 &= 0.183
 \end{aligned}$$

Candidate 4

$$\begin{aligned}
 \therefore \text{yield} &= \frac{\text{actual}}{\text{theoretical}} \times 100 \\
 16\% &= \frac{\text{actual}}{3.04} \times 100 \\
 \text{actual} &= \frac{0.16}{3.04} \times 100 \\
 &= 0.0526... \\
 &= 0.05 \text{ g}
 \end{aligned}
 \quad
 \begin{aligned}
 n &= m / gfm \\
 &= 3.16 / 164 \\
 &= 0.019.. \\
 &= 0.02 \\
 m &= n \times gfm \\
 &= 0.02 \times 152 \\
 &= 3.04 \text{ g}
 \end{aligned}$$

Question 8(a)(iv)

Candidate 1

Impurities make the melting point range wider and decrease the melting point.

Candidate 2

The Impurities will lower the melting point range and broaden the temperature range over which the substance melts compared to the pure sample, due to the disruption of intermolecular bonding in the crystal lattice, ~~due to~~ as a result of the impurities.

Candidate 3

impurities increases the range of melting point, as different substances within the mixture will melt at different ~~times~~ points

Candidate 4

impurities may increase melting point range compared to a pure sample of vanillin.

Candidate 5

The melting point range would increase if there were impurities.

~~The value of the~~

The first value of the melting point range would increase but the 2nd last number would remain at 81°C if there were impurities

Candidate 6

The impurities mean the melting point range is wider and higher

Question 8(b)(ii)**Candidate 1**

oxidation - acidified
potassium
dichromate

Candidate 2

Copper (II) oxide

Candidate 3

acidified dichromate

Candidate 4

hot copper (II) oxide

Candidate 5

potassium dichromate.

Candidate 6

not copper oxide

Question 10(a)(ii)

Candidate 1

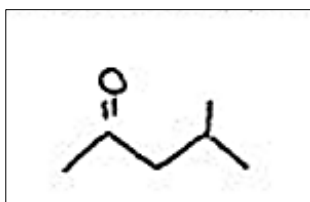
$$\begin{aligned}
 \text{pH} &= \frac{1}{2} \text{pK}_a - \frac{1}{2} \log_{10} C \\
 \frac{\text{pH}}{\frac{1}{2} \text{pK}_a} &= -\frac{1}{2} \log_{10} C \\
 C &= 2.04 \times 10^{-4} \text{ mol l}^{-1}
 \end{aligned}
 \qquad
 \begin{aligned}
 \frac{2.75}{2.98 \times \frac{1}{2}} &= -\frac{1}{2} \log_{10} C \\
 1.845 \times 2 &= -\log_{10} C \\
 3.6913 &= -\log_{10} C \\
 C &= 10^{-3.6913}
 \end{aligned}$$

Candidate 2

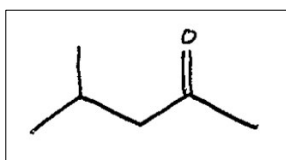
$$\begin{aligned}
 2.75 &= \frac{1}{2} \times 2.98 - \frac{1}{2} \log_{10} C \\
 1.26 &= -\frac{1}{2} \log_{10} C \\
 -2.52 &= \log_{10} C \\
 C &= 10^{-2.52} \quad C = 0.003 \text{ mol l}^{-1}
 \end{aligned}$$

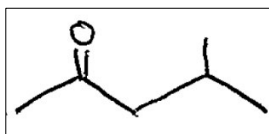
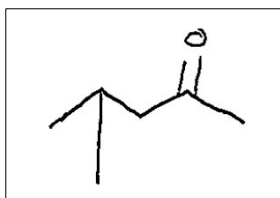
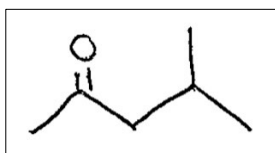
Question 10(b)(i)

Candidate 1



Candidate 2



Candidate 3**Candidate 4****Candidate 5****Question 10(b)(ii)(B)(I)****Candidate 1**

$$K = \frac{\text{tartaric acid (MIBK)}}{\text{tartaric acid (aq)}}$$

Candidate 2

$$K = \frac{[\text{tartaric acid (MIBK)}]}{[\text{tartaric acid (aq)}]}$$

Candidate 3

$$K = \frac{[\text{tartaric acid (MIBK)}]}{[\text{tartaric acid}]}$$

Candidate 4

$$K = \frac{[\text{tartaric acid (MIBK)}]}{[\text{tartaric acid (aq)}]}$$

Question 10(b)(ii)(C)

Candidate 1

Instead of using 50cm³ of each, and reacting them in one go, use smaller volumes of each eg use 25cm³ of each ~~and~~ for 2 'goes' (or better use 10cm³ of each and react a total of 5 times)

[Turn over]

Candidate 2

Use smaller volumes of MIBK and repeat several times. Several smaller volume of solvent extractions removes a greater total than one large volume extraction

Candidate 3

do smaller samples ~~to~~ which will maximise extractions

Question 10(c)(ii)(B)

Candidate 1

$$4 = \frac{\alpha_{\text{observed}}}{1.35 \times \cancel{200}2}$$

$$4 = \frac{\alpha_{\text{observed}}}{2.7}$$

$$\alpha_{\text{observed}} = 4 \times 2.7$$

$$= \underline{\underline{10.8 \text{ g}^{-1} \text{ cm}^3 \text{ dm}^{-1}}}$$

Candidate 2

$$4 = \frac{\alpha_{\text{observed}}}{1.35 \times 200}$$

$$4 = \frac{\alpha_{\text{observed}}}{270}$$

$$\alpha_{\text{observed}} = 270 \times 4$$

$$= 1080 \text{ degrees}$$

Candidate 3

$$[\alpha] = \frac{\alpha_{\text{observed}}}{c \times L}$$

$$5.23 = \frac{\alpha_{\text{observed}}}{1.35 \times 20}$$

$$\alpha_{\text{observed}} = 141.75^\circ$$

Candidate 4

$$[\alpha] = 4$$

$$c = 1.35$$

$$l = 20\text{cm} (2\text{dm})$$

$$\frac{[\alpha]}{c \times l} = \alpha_{\text{observed}}$$

$$\frac{4}{1.35 \times 2} = \underline{\underline{1.48^\circ}}$$

Question 11(a)(ii)

Candidate 1

the sigma bond, the end on end overlap of unhybridised p orbitals, requires large amounts of energy to break, so the pesticide and enzyme are likely to remain bonded

Candidate 2

The pesticide binds to the enzyme via a hydrogen bond, these are strong bonds so will take more energy to break and will stay bound to the enzyme for longer.

Candidate 3

very strong bond
between pesticide
and enzyme

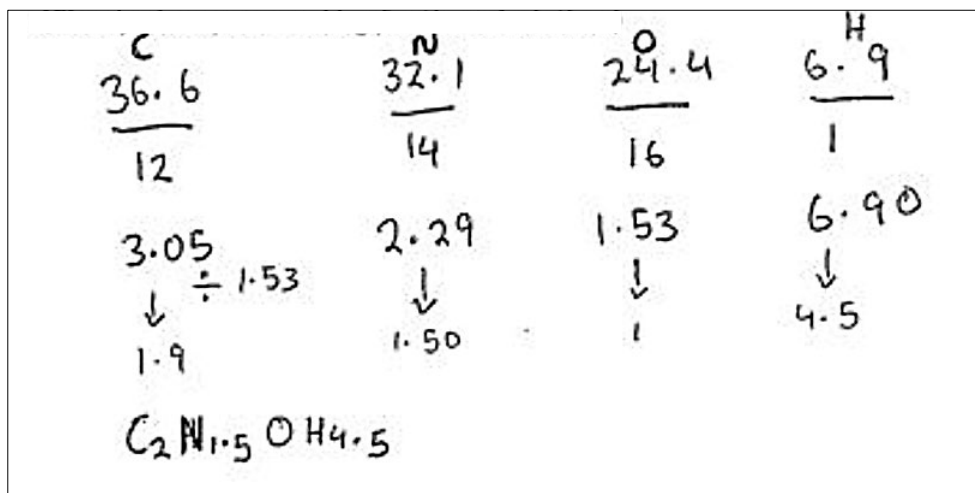
Question 11(b)(i)**Candidate 1**

inhibitor

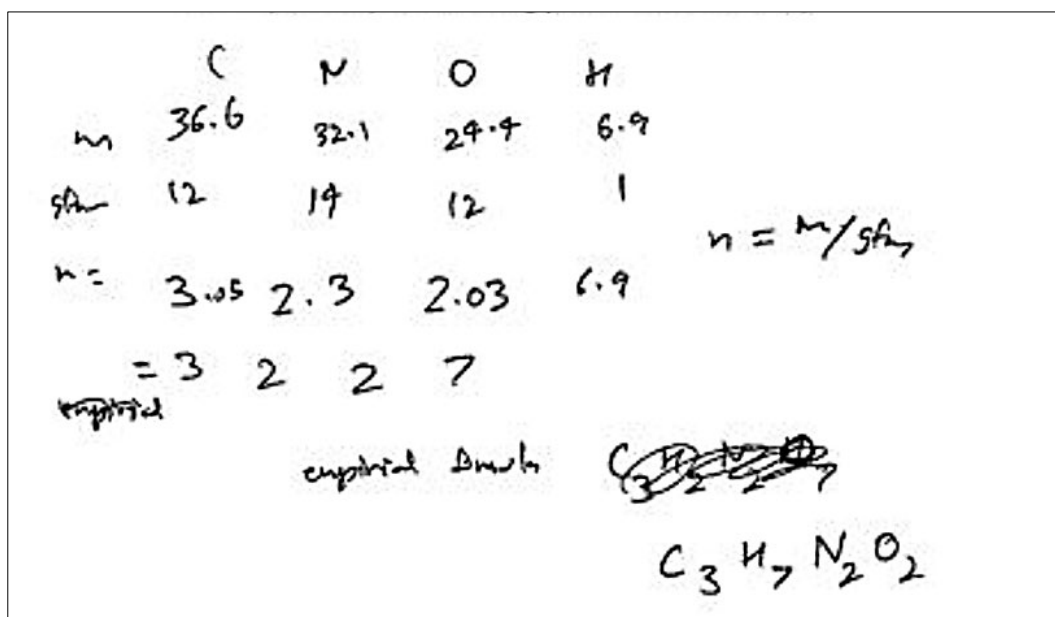
Candidate 2

antagonist (inhibitor)

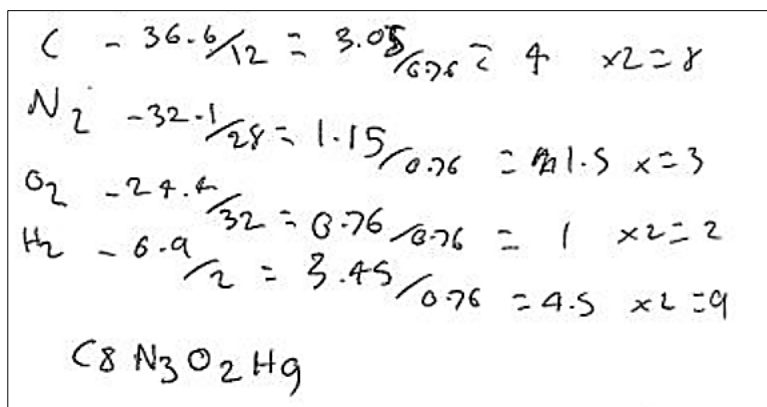
Candidate 3

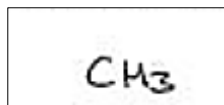
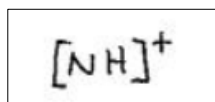
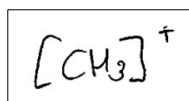
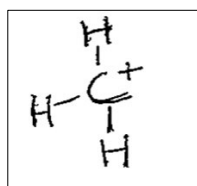


Candidate 4



Candidate 5



Question 12(b)(ii)**Candidate 1****Candidate 2****Candidate 3****Candidate 4****Question 12(d)****Candidate 1**

There would be a ~~single~~ lone peak.

Candidate 2

they would all be singlets

Candidate 3

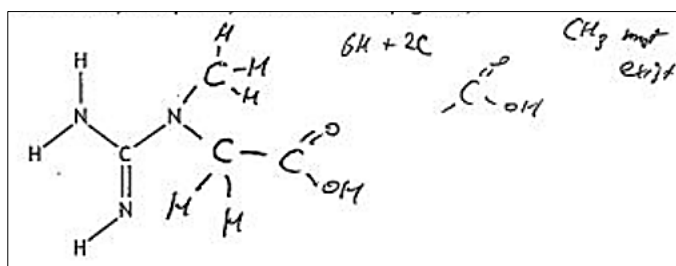
There will only be one peak.

Candidate 4

they would not split

Candidate 5

There would only be a singlet present in the spectrum

Question 12(e)**Candidate 1****Candidate 2**