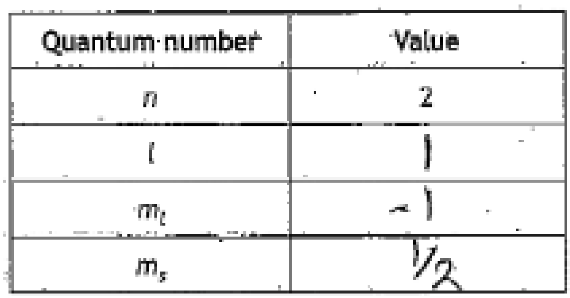
Candidate evidence

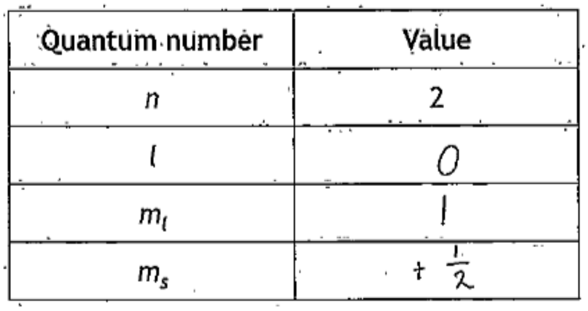
Question 1(a)(ii)

Candidate 1



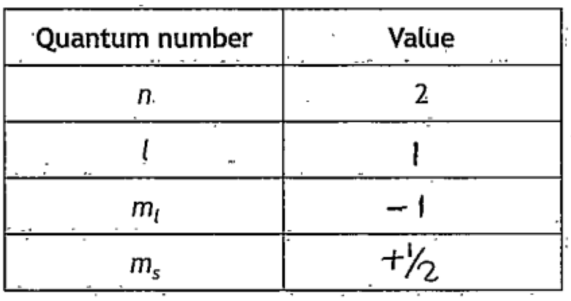
Quantum number	Value
n	2
l	1
m_l	-1
m_s	$\frac{1}{2}$

Candidate 2



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

Candidate 3



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

Question 1(b)

Candidate 1

As Nitrogen has a half-filled outer orbital 2p shell, more energy is required to remove an electron,

Candidate 2

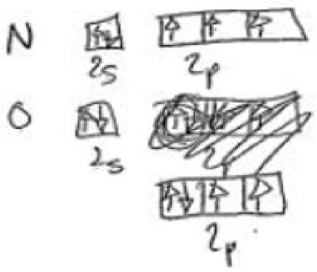
The first ionisation energy of oxygen is less than the first of nitrogen because oxygen has one more electron than nitrogen meaning less energy is required to remove the first electron.

Candidate 3

oxygen has a lower first ionisation energy because Nitrogen has a half full p-orbital. This means more energy is required to remove an electron than ~~oxygen~~ it does to remove an electron from oxygen.

Candidate 4

because Nitrogen's 2p orbital is half-filled which is more stable than Oxygen's 2p orbital which is partially filled and has repulsion between the antiparallel electrons, making it easier to remove 1mole of e⁻ from oxygen than nitrogen, and so oxygen has a lower ionisation energy



Candidate 5

There is increased stability from Nitrogens half filled 2p subshell.

Candidate 6

- nitrogen has ~~halfied~~ half filled p subshell, ~~so~~ there is a special stability accocided with a half filled subshell ~~so23~~ ~~so requires more~~ ~~ener~~

Question 2(a)

Candidate 1

$\Delta G = \Delta H - T\Delta S = 90{\cdot}3 - 298(211)$

$= -62787{\cdot}7$

< 0

$0 = \Delta H - T\Delta S$

$T\Delta S = \Delta H$

~~$T = \frac{\Delta H}{\Delta S} = \frac{90{\cdot}3}{211} = 0{\cdot}42796$~~

$< 298\,K$

not feasible

Candidate 2

$\Delta H = 90.3 \text{ kJmol}^{-1}$

$\Delta S = 211 - ((0.5 \times 192) + (0.5 \times 205))$

$= 12.5 \text{ JK}^{-1}$

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

$= 90.3 \times 10^3 - 298 \times 12.5$

$= 88775 \text{ J}$ or 88.78 kj

The reaction is not feasible at 298K

Candidate 3

$\Delta H^\circ = (90.3) - (0+0)$

$= 90.3$

$\Delta S^\circ = (211) - (\frac{1}{2} \times 192 + \frac{1}{2} \times 205)$

$= 12.5 \text{ JK}^{-1}\text{mol}^{-1}$

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

$= 90.3 - 298 \times 0.0125$

$= 86.575$

reaction is feasible at 298K as ΔG° is greater than 0.

Candidate 4

$\Delta H^\circ = 90{\cdot}3 - 0$

$\Delta H^\circ = 90{\cdot}3\ \text{kJmol}^{-1}$

$\Delta S^\circ = \Sigma S^\circ_p - \Sigma S^\circ_r = 211 - \frac{1}{2}(205+192)$

$= $ ~~[illegible]~~ ~~[illegible]~~ $12{\cdot}5\ \text{kJmol}^{-1}$

feasible $\Delta G^\circ = 0$ ~~[illegible]~~

$T\Delta S = \Delta H$ $T = \dfrac{90{\cdot}3}{\left(\frac{12{\cdot}5}{1000}\right)} = $ ~~[illegible]~~

$= 7224\ \text{K}$

no

Candidate 5

$\Delta H^\circ = \Sigma\, \Delta H^\circ_f\,(\text{products}) - \Sigma\, \Delta H^\circ_f\,(\text{reactants})$

$(90{\cdot}3) - 0)$

$= 90{\cdot}3\ \text{kJmol}^{-1}$

$\Delta S^\circ = \Sigma\, S^\circ(\text{products}) - \Sigma\, S^\circ(\text{reactants})$

~~$\Delta G^\circ = \Sigma \Delta G^\circ_f\,(\text{products}) - \Sigma \Delta G^\circ_f\,(\text{reactants})$~~

$= (211 - (205 \times 0{\cdot}5 + 192 \times 0{\cdot}5)$

$(211 - 102{\cdot}5 + 96)$

$211 - 198{\cdot}5$

$= 12{\cdot}5\ \text{JK}^{-1}\text{mol}^{-1}$

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

$= 90{\cdot}3 - 298 \times \dfrac{12{\cdot}5}{1000}$

$\Delta G^\circ = 86{\cdot}6\ \text{kJmol}^{-1}$

Candidate 6

$\Delta H = \Sigma H_{(after)} - \Sigma H_{(before)}$

$= 90.3 - 0$

$\Delta H = 90.3\ kJ\ mol^{-1}$

$\Delta S = \Sigma S_{(after)} - \Sigma S_{(before)}$

$= 211 - (\frac{1}{2}(205) + \frac{1}{2}(192))$

$\Delta S = 11.5\ J\ K^{-1}\ mol^{-1}$

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

$\Delta G = 90300 - 298 \times 12.5$

$\Delta G = 86575$

$\Delta G = 866\ kJ\ mol^{-1}$

~~The~~ A reaction is feasible if $\Delta G \leq 0$. As $\Delta G = 866\ kJ\ mol^{-1}$ this reaction is not feasible at 298 K

Question 2(b)

Candidate 1

~~gfm~~ = 30

$n = cV$

$= 5 \times$ [illegible] $\frac{2}{1000000}$

[illegible] $= 1 \times 10^{-5}$

$m = 1 \times 10^{-5} \times 30$

$= 3 \times 10^{-4}\ g\ (\times 60)\ \binom{1}{min}$

$\underline{= 0.018 g}$

Candidate 2

ppm | mg | litres

ppm | mg | kg

300 litres an hour. 120ppm of N an hour,

$300 \times 120 = \frac{36000}{1000} = \underline{36 mg/hour}$

Candidate 3

2 Parts NO in every 1000000

In 1minute they inhale $\frac{1}{1000000} \times 5 = 5\times10^{-6}$

In 1 hour = 3×10^{-4} g

Candidate 4

5 L/m → 2ppm   ppm = mg/kg

1 → 2/5

60 → 2/5 ×60

= 24 $mg^{-1}kg^{-1}$

= 0.024g

Candidate 5

5 litres per min   2ppm

5 litres perminute = 300 litres an hour

600ppm of nitrogen monoxide inhaled in one hour

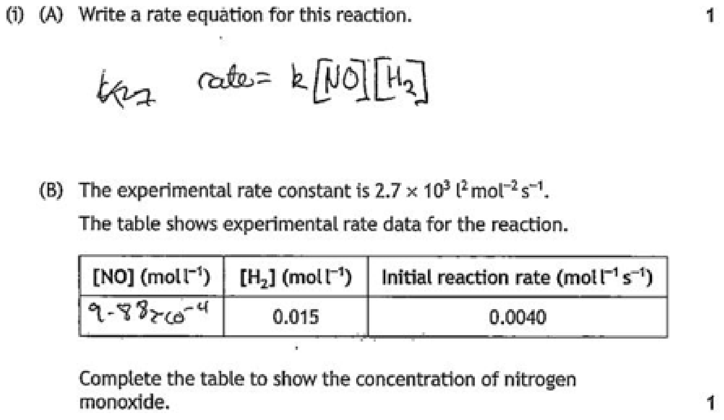
Candidate 6

1L of air : 2mg nitrogen monoxide
5L of air : 10mg nitrogen monoxide
300L of air = 600mg nitrogen monoxide

5 ×60
= 300L
per hour

Question 2(d)(i)(A) and (B)

Candidate 1



(i) (A) Write a rate equation for this reaction. 1

kr2 rate = $k[NO][H_2]$

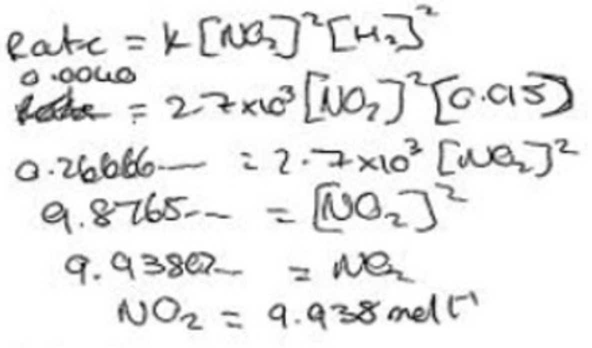
(B) The experimental rate constant is 2.7×10^3 $l^2\,mol^{-2}\,s^{-1}$.

The table shows experimental rate data for the reaction.

[NO] ($mol\,l^{-1}$)	[H_2] ($mol\,l^{-1}$)	Initial reaction rate ($mol\,l^{-1}\,s^{-1}$)
9.88×10^{-4}	0.015	0.0040

Complete the table to show the concentration of nitrogen monoxide. 1

Candidate 2



Rate = $k[NO_2]^2[H_2]^2$

0.0040

~~Rate~~ = $2.7 \times 10^3 [NO_2]^2 [0.015)$

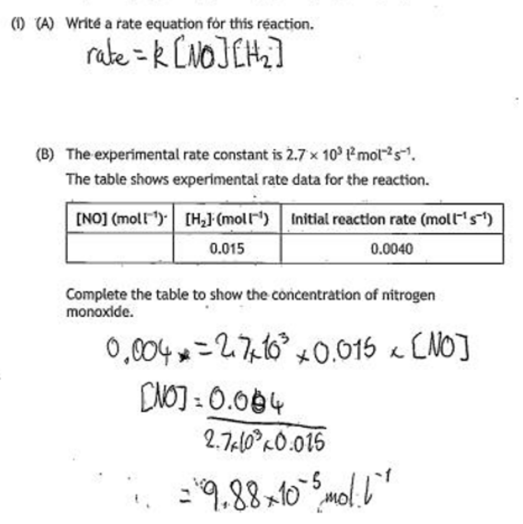
0.26666— = $2.7 \times 10^3 [NO_2]^2$

9.8765-- = $[NO_2]^2$

9.93802— = NO_2

NO_2 = 9.938 mol l^{-1}

Candidate 3



(i) (A) Write a rate equation for this reaction.

rate = $k[NO][H_2]$

(B) The experimental rate constant is 2.7×10^3 $l^2\,mol^{-2}\,s^{-1}$.

The table shows experimental rate data for the reaction.

[NO] ($mol\,l^{-1}$)	[H_2] ($mol\,l^{-1}$)	Initial reaction rate ($mol\,l^{-1}\,s^{-1}$)
	0.015	0.0040

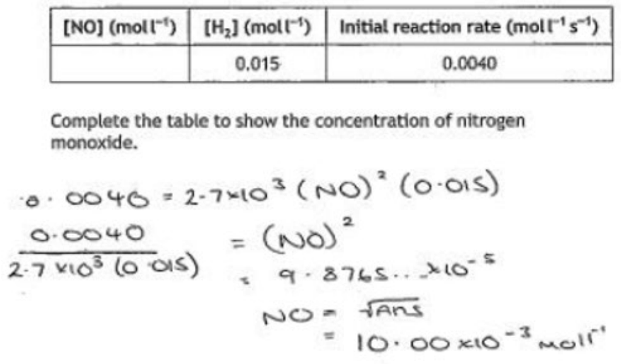
Complete the table to show the concentration of nitrogen monoxide.

$0.004 = 2.7 \times 10^3 \times 0.015 \times [NO]$

$[NO] = \dfrac{0.004}{2.7 \times 10^3 \times 0.015}$

$= 9.88 \times 10^{-5}$ mol l^{-1}

Candidate 4



[NO] (mol l^{-1})	[H_2] (mol l^{-1})	Initial reaction rate (mol l^{-1} s^{-1})
	0.015	0.0040

Complete the table to show the concentration of nitrogen monoxide.

$0\cdot0040 = 2\cdot7\times10^{3}\,(NO)^{2}\,(0\cdot015)$

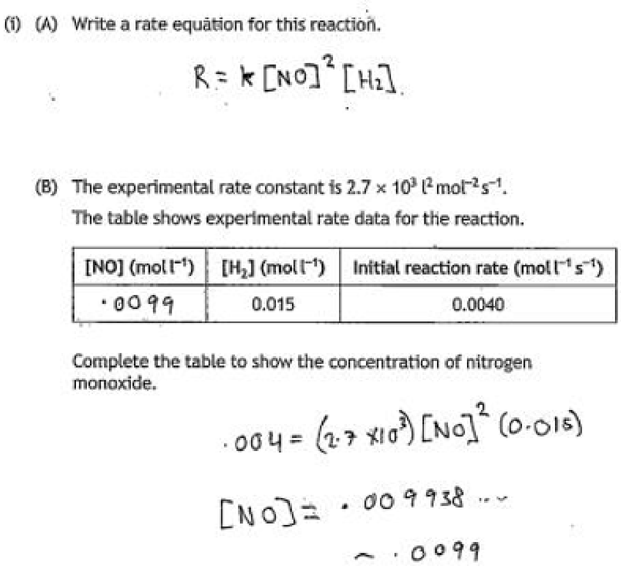
$\dfrac{0\cdot0040}{2\cdot7\times10^{3}\,(0\cdot015)} = (NO)^{2}$

$= 9\cdot8765..\times10^{-5}$

$NO = \sqrt{Ans}$

$= 10\cdot00\times10^{-3}$ mol l^{-1}

Candidate 5



(i) (A) Write a rate equation for this reaction.

$R = k[NO]^{2}[H_2]$.

(B) The experimental rate constant is 2.7×10^{3} l^{2} mol^{-2} s^{-1}.

The table shows experimental rate data for the reaction.

[NO] (mol l^{-1})	[H_2] (mol l^{-1})	Initial reaction rate (mol l^{-1} s^{-1})
·0099	0.015	0.0040

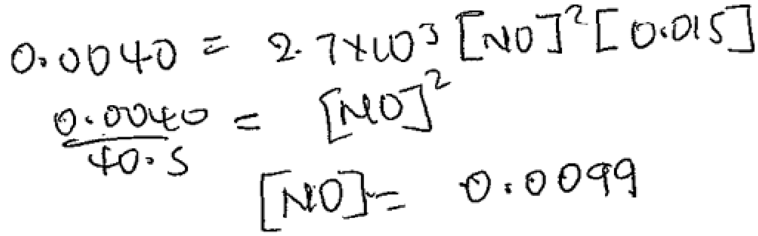
Complete the table to show the concentration of nitrogen monoxide.

$\cdot004 = (2\cdot7\times10^{3})[NO]^{2}(0\cdot015)$

$[NO] = \cdot009938\cdots$

$\sim \cdot0099$

Candidate 6



$0\cdot0040 = 2\cdot7\times10^{3}\,[NO]^{2}[0\cdot015]$

$\dfrac{0\cdot0040}{40\cdot5} = [NO]^{2}$

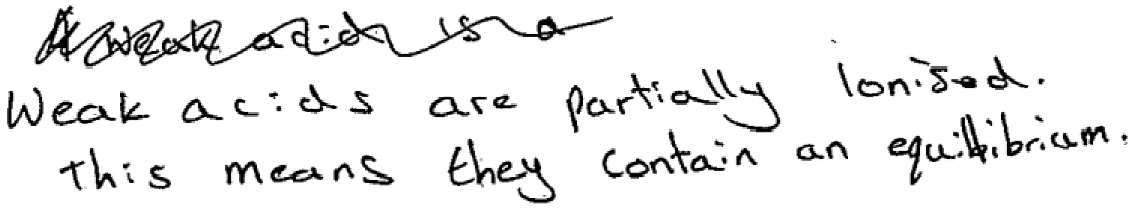
$[NO] = 0\cdot0099$

Question 3(a)

Candidate 1

An acid which only partially dissociates into its ions

Candidate 2

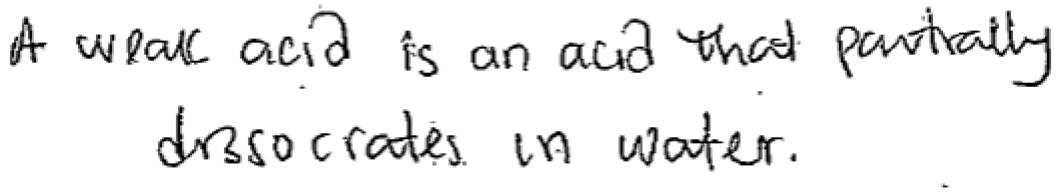


~~A weak acid is a~~
Weak acids are partially ionised.
this means they contain an equilibrium.

Candidate 3

The ions do not fully dissociate in solution.

Candidate 4



A weak acid is an acid that partially dissociates in water.

Question 3(b)(i)

Candidate 1

$pKa = -\log_{10} Ka$

$= -\log_{10} 3.75$

$= -0.57$

2

$pH = \frac{1}{2}(-0.57) - \frac{1}{2} \log_{10} 3.00 \times 10^{8}$

$pH = 4.5$

Candidate 2

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

~~$= -\log_{10}[3.75]$~~

or

$pH = 1/2\, pKa - 1/2 \log_{10} C = 1/2\,(3.2) - 1/2 \log_{10} 3.75$

$= 1.03$

Candidate 3

$ph = \frac{1}{2} pka - 1/2 \log c$

$= 1/2(3.20) - 1/2 \log(3.75)$

$= 16 - 1/2(0.57408)$

$= 15.71$

Candidate 4

$pH = \frac{1}{2} pKa - \frac{1}{2} \log_{10} 3.75$

$= \frac{1}{2}\, 3.2 - \frac{1}{2} \log_{10} 3.75$

$= 1.3$

Question 3(b)(ii)

Candidate 1

solution.

3·75 mol – 1 L

n = 3·75

m = n / gfm

= 3·75 / 20

= 0·1875 g

% by mass = $\frac{m}{gfm} \times 100$

= $\frac{0{\cdot}1875}{20} \times 100$

= 6·937 %

Candidate 2

solution.

HF

1 19 = 20

20 × 3·75 = 75

% Mass = $\frac{M}{GFM} \times 100$

= $\frac{\cancel{3}\,75}{20} \times 100$

=

375 %

Candidate 3

% by mass = ~~no. of volume~~ / mass of ~~solution~~ solution made up to 100 cm^3

HF = (1) + 19

= 20 g/mol

n = CV

= 3.75 × 100

= 0.375 mol

m = n × GFM

= 20 × 0.375

= 7.5 g

% by mass = $\frac{7.5}{100} \times 100$

= 7.5 %

Question 4(b)(i)

Candidate 1

the vibrations in the atoms/molecules can either, stretch or bend in the molecules.

cause a

Candidate 2

Because of the presence of different functional groups

Candidate 3

As different bonds absorb different amounts of infrared radiation as they vibrate, stretch and bend.

Candidate 4

the bonds vibrate at various frequencies so can only absorb specific wavelengths base on vibration frequency

Candidate 5

Because different bond have different strengths and different atoms make up different bonds ~~and~~ so each will ~~absorb infared radiation differently~~ vibrate differently.

Question 4(c)(iii)

Candidate 1

- The Hydrogen collides with compound and causes the compound to split into different structural fragments by mass and charge

Candidate 2

- The electrons are excited to a higher energy level then fall to ground state causing a photon of light to be emitted resulting in a peak on the spectrum.
- The electrons become excited because of the high energy.

Candidate 3

^1H nuclei behave like tiny magnets, and some align with the magnetic field and some align against the magnetic fields. Absorption of radio waves radiation causes the ^1H nuclei to flip to higher energy, and as they fall back to low they emit light that can be detected and plotted in a spectra correlation chart ~~against~~ in ppm.

Candidate 4

^{1}H nuclei behave like magnets. in an electromagnetic field some align with a high energy level and some with a low energy level. radiowaves cause all the ^{1}H nuclei to adopt a high energy state then when the ^{1}H nuclei drop back to their original level radiation is emitted. the intensity of the transmitted radiation is detected and recorded, causing different peaks for different ^{1}H environments.

Question 5(a)

Candidate 1

The binding of ligands along the axes causes electron repulsion, the repulsion pushes the dy^2-x^2 and dz^2 d-orbitals to higher energy states

Candidate 2

Ligands repel the electrons in d orbitals which increases the energy in some so they are no longer degenerate which causes them to split

Candidate 3

approaching ligands cause the d-orbitals to split because they have a ligand field strength that determines how far the d-orbital will split

Candidate 4

lone pairs from approaching ligands repel d-orbitals that sit directly on the x, y, z axis. These repelled orbitals increase in energy.

Question 5(b)(ii)(A)

Candidate 1

If The energy required to pair 2 electrons with opposite spins is greater than Δ, then electrons are likely to have a high spin state, whereas if $P < \Delta$, then electrons are more likely to have a lowspin state

Candidate 2

The difference in energy between subsets of d orbital with high Δ kJ mol^{-1} value has a low spin state compared to complexions with low Δ kJ mol^{-1} value.

The ligands in complex ions play a key role on the spin state.

Candidate 3

The higher the energy required to pair 2 electrons with opposite spins the larger the difference in energy between subsets of d orbitals

Higher spin states had lower difference in energy between subsets and d-orbitals

Candidate 4

The greater the energy difference between subsets of d-orbitals results in a low spin state. While those with a smaller energy difference will have a high spin state.

The energy required to pair two electrons with opposite spin has no impact on the spin state of the electrons.

Question 5(b)(ii)B

Candidate 1

hexaflurido Cobide (III)

Candidate 2

Hexaflouro colbate (III)

Candidate 3

hexaflurido Cobaltate (iii)

Candidate 4

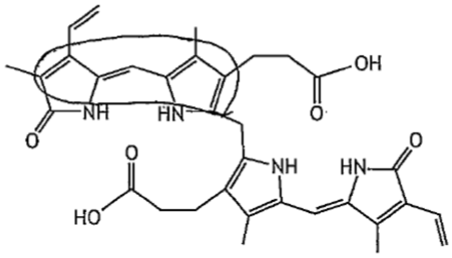
hexa fluro cobolt (III)

Candidate 5

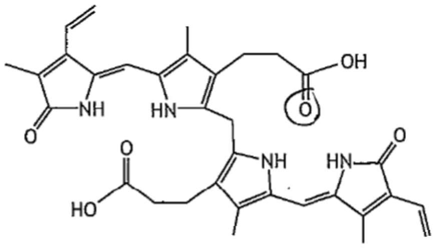
hexafluorido cobalate (III)

Question 6(a)(i)

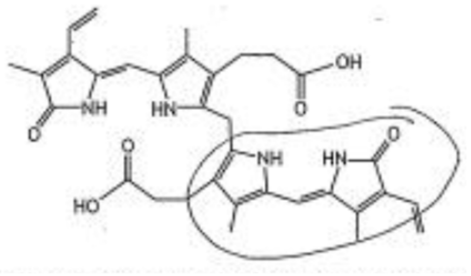
Candidate 1



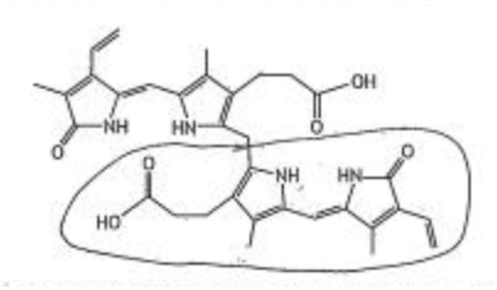
Candidate 2



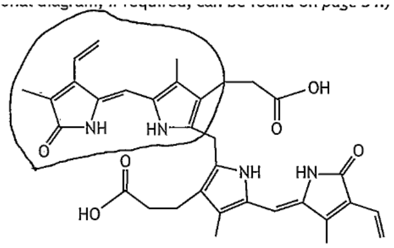
Candidate 3



Candidate 4



Candidate 5



Question 6(a)(ii)

Candidate 1

anti bonding moleculer orbitals are unoccupied molecular orbitals

Candidate 2

(LUMO)
The antibonding orbital is usually initially
(HOMO)
empty (unoccupied) whereas bonding is
occupied. Bonding is higher in energy

Candidate 3

bonding molecular orbital will be attracted to other binding orbital

Candidate 4

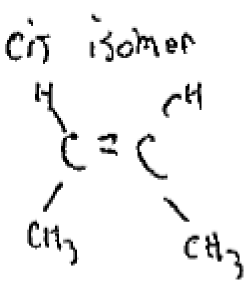
bonding molecular orbitals contains electrons

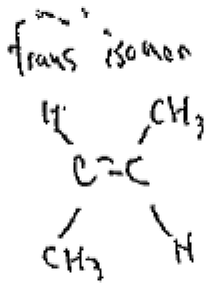
while antibonding molecular orbital does not contain electrons

Question 6(b)(i)

Candidate 1

cis and trans isomerism occurs as carbon-carbon double bonds can not rotate freely, so two versions exist with one being 'rotated' at the double bond.





Candidate 2

- Restricted rotation due to C=C
- different substituents on each carbon in the C=C

Candidate 3

cis - the halogen are on the same side of the double bond

trans - the halogens are on opposite side of the double bond

The different allow them to exist in a broader range of compounds

Candidate 4

there is a lack of rotation around the double bond (it is restricted), so the functional groups can be on the same level (cis) or different (trans)
or "plane"

Candidate 5

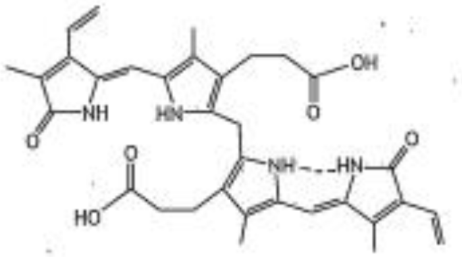
C=C double bonds lack free rotation so
So the bonded molecules Can't move around
the double bond giving rise to geometric isomers

Candidate 6

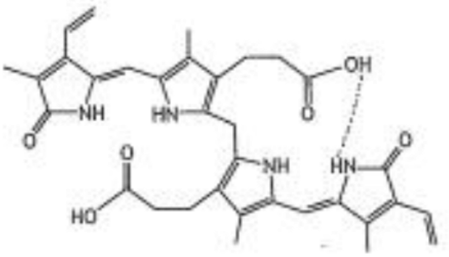
In molecules with carbon to carbon double bonds
and two different groups on each of the carbons,
restriction of rotation occurs so that a cis molecule
cannot rotate itself to become a trans molecule. This means
they must be isomers.

Question 6(b)(ii)

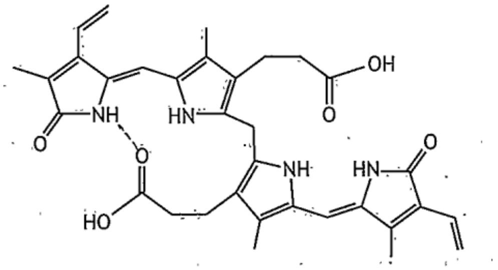
Candidate 1



Candidate 2



Candidate 3



Question 6(c)(ii)

Candidate 1

$465nm = 465 \times 10^{-9} m$

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

$f = \frac{c}{\lambda}$

$= \frac{(6.02 \times 10^{23}) \times (6.63 \times 10^{-34}) \times 0.0645}{465 \times 10^{-9}}$ $= \frac{3 \times 10^{8}}{465 \times 10^{-9}}$

$= 5.536 \times 10^{-5}$ $= 0.0645$

$= 564$ kJ mol^{-1}

Candidate 2

$E = \frac{Lhc}{\lambda \times 1000}$

$= \frac{(6.02 \times 10^{23})(6.63 \times 10^{-34})(3 \times 10^{8})}{465 \times 10^{-9} \times 1000}$

$= 2575$ kJ mol^{-1}

Candidate 3

$E = \frac{Lhc}{\lambda} = \frac{Lhc}{465 \times 1000} = (2.575 \times 10^{-7}) \times 10^{9}$

$= 257.5$ kJ mol^{-1}

Candidate 4

$$E = \frac{Lhc}{1000 \times \lambda \times 10^{-9}}$$

$$E = \frac{6.63 \times 10^{-34} \times 6.02 \times 10^{23} \times 3 \times 10^{8}}{1000 \times 465 \times 10^{-9}}$$

$$E = 257.5 \text{ kJ mol}^{-1}$$

Question 7(a)(i)

Candidate 1

Heat up crucible ~~and~~ before use to drive off moisture
Accurately weigh out fertilizer in a titring boat,
record the mass of sample
heat up sample ~~the~~ transfer to a dessicator
to cool down, a dessicator prevents a
reabsorption of water, weigh sample again,
heat up the sample and transfer to dessicator
to cool down. This process is repeated
~~the~~ till all moisture are completely dried
out from the sample and a constant mass is
obtained.

Candidate 2

- Weighing by difference is when you take a sample of the fertiliser and make sure it's as accurate and close to the range as possible, of the true value

Candidate 3

- weigh the ~~mass~~ ~~of~~ crucible, take note of mass
- weigh crucible + ~~mass~~ fertilizer
- The difference between mass of crucible + fertilizer and mass of fertilizer is the desired mass.

Question 7(a)(ii)

Candidate 1

concentration = 2.1×10^{-4} mol l^{-1}

GFM = 54.9

$m = n \times GFM$
$= 2.1 \times 10^{-4} \times 54.9$
$= 0.011529$ g

$\%$ by mass $= \dfrac{0.011529}{1000} \times 100$
$= \underline{1.15 \times 10^{-3}\ \%}$

Candidate 2

$n = 2.2 \times 10^{-5}$
$c = 2.2 \times 10^{-4}$
$v = 0.1$

$m = 1.2 \times 10^{-3}$ ← maganese
$n = 2.2 \times 10^{-5}$
gfm = 54.9

$\%$ by mass $= \dfrac{\text{Mass of maganese}}{\text{Mass of fertiliser}} \times 100$

$= 0.0212014134 3$
$= \underline{0.02\%}$

Candidate 3

The absorbance of the permanganate solution was 0.42. $= 2{\cdot}1\times10^{-4}\ \text{mol}\,l^{-1}$

Use this information and the calibration graph to calculate the percentage by mass of manganese(II) ions in the fertiliser. 2

GFM of MnO_4^-

$= 118{\cdot}9$

% by mass $= \frac{m}{GFM} \times 100$

$= \frac{5{\cdot}66}{118{\cdot}9} \times 100$

[illegible]

$= 4{\cdot}76\%$

Question 7(b)(ii)

Candidate 1

moles = c×L

$= 0{\cdot}0050 \times 0{\cdot}020$

$= 0{\cdot}0125$

×gfm

mass = n×gfm

$\frac{m}{gfm}$

= gfm = 55·8

$= 0{\cdot}0125 \times 55{\cdot}8$

$= 0{\cdot}6975g$

69·75g

m=

Candidate 2

$\frac{C_1V_1}{N_1} = \frac{C_2V_2}{N_2}$

$\frac{0{\cdot}0050 \times 21{\cdot}4}{1} = \frac{C_2 \times 25}{6}$

$0{\cdot}107 = \frac{? \times 25}{6}$

25cm3 $C_2 = 0{\cdot}02568\ \text{mol}\,l^{-1}$

250cm3 $= 0{\cdot}2568\ \text{mol}\,l^{-1}$

$n = CV = 0{\cdot}2568 \times (250 \div 1000)$

$= 0{\cdot}0642$ moles

$m = n \times gfm$ [illegible]

$= 0{\cdot}0642 \times 55{\cdot}8$

$= 3{\cdot}58g$

Candidate 3

$n = 1{\cdot}07 \times 10^{-4}$
$c = 0{\cdot}0050$
$V = 0{\cdot}0214$

6 : 1 ratio

$n = 6{\cdot}42 \times 10^{-4} \longrightarrow 25\,cm^3$
$6{\cdot}42 \times 10^{-3} \longleftarrow 250\,cm^3$

$m = 0{\cdot}358g$
$n = 6{\cdot}42 \times 10^{-3}$
$gfm = 55{\cdot}8$

mass = $\underline{\underline{0{\cdot}358g}}$

Question 7(b)(iii)

Candidate 1

- the condugated system decreases ΔE between HOMO and LUMO.
- the light absorbed ~~when electrons~~ is now in the visible region. not UV
- It absorbes green light which is the complemtry colour ~~to the~~ for purble

Candidate 2

- the colour arises as there is an energy gap between the HOMO (highest occupied molecular orbital) and LUMO (lowest occupied molecular orbital), electrons promoted to higher energy level.

Candidate 3

It has a large conjucked system
The energy gap between HOMO - LUMO is
smaller hence Short wavelength
giving us the color violet

Candidate 4

The conjugated system has ~~[illegible]~~
delocalized electrons across the
whole system. The larger the
conjusated system the smaller the
gap between the HOMO (highest
occupied molecular orbital) and
the LUMO (lowest unoccupied orbital).
Excited electrons are promoted [Turn over
to higher energy levels when they
fall back to their original state
they emit a photon. This
photon has a complementary
colour which is what our
eyes see. As diphenylbenzidine
has a large conjugated system
electrons do not need a lot of energy
to be
promoted.

Candidate 5

The presence of delocialized electron
within the beneze rings means
electron can move from HOMO to LUMO,
It emitted violent as yellow - green
is absorbed ~~with a lower~~ to promote
the electrons.
Due to the ~~absorbance o~~ abundance
of conjugate the energy requireds
of lower frequency and energy be
cause of a
smaller energy gap

Candidate 6

the conjugated system absorbs light and the electrons become excited and move from HOMO to LUMO. these electrons drop back down to ground state and release energy which is complementary to the colour violet on the ~~elec~~ visible spectrum of the electromagnetic spectrum.

Candidate 7

The higher the degree of conjugation, the smaller the HOMO – LUMO gap. In organic molecules, electrons absorb visible light to travel from lower energy levels to higher ones. The lower ones are called HOMO and higher LUMO. The smaller the gap between them, the lower energy light that needs to be absorbed to promote electron, and from energy of light, you can work out the wavelength, frequency and the colour of light absorbed and thus colour the ~~oo~~ molecule will appear as.

Question 8(b)(i)

Candidate 1

a negatve molecule or one with a lone pair of electrons.

Candidate 2

a negative ion which is attracted to positive molecules

Candidate 3

they are attracted to ~~tone~~ positive charges from electrons

Candidate 4

Nucleophile is a negative ion or electron defficient molecule that seeks out and attacks positive charges. (Nucleophiles can donate electron pairs.)

Candidate 5

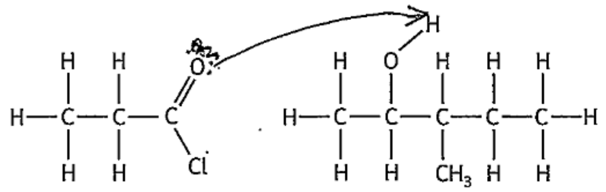
A negatively charged ion that has ~~a~~ 'lone pairs of electrons, making it attracted to other positively charged ions

Candidate 6

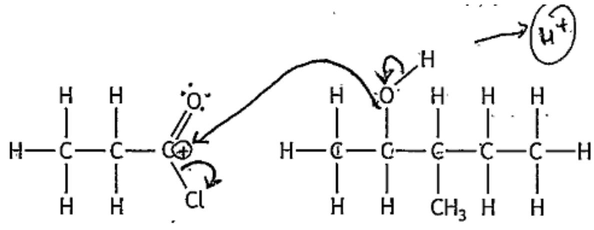
a nucleophile is an atom or group of atoms that are electron rich to seek out positive species to donate a non-bonding electron pair

Question 8(b)(iii)

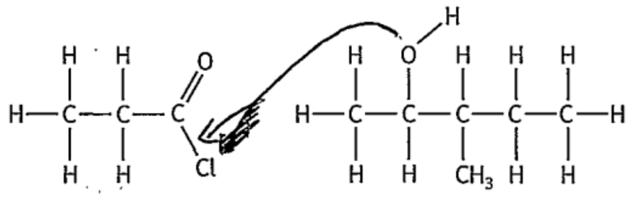
Candidate 1



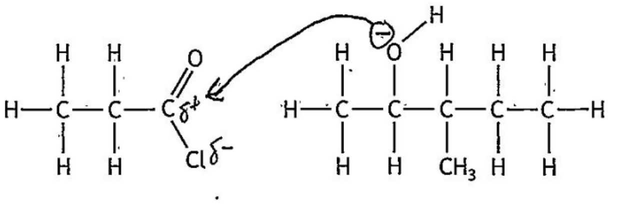
Candidate 2



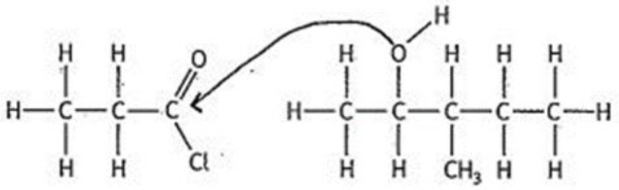
Candidate 3



Candidate 4



Candidate 5



Question 8(d)(ii)

Candidate 1

percentage yield = $\frac{\text{Actual}}{\text{Theoretical}} \times 100$

= [illegible] $\frac{12.48}{18.4} \times 100$

m = 21.8
n = ~~0.~~0.16
gfm = 140.5

m = 12.48
n = 0.16
gfm = 78

= 67.8%

Candidate 2

n chloride = $\frac{21.8}{140.5}$
= 0.155 mol

n benzo = $\frac{18.4}{182}$
= 0.101

0.101 : 0.155

C_6H_6
= 78

m = n × gfm
= 0.155 × 78
= 12.09g + 21.8
= 33.89

% yield = $\frac{18.4}{33.89} \times 100$
= 54.3%

Candidate 3

~~Theore~~ Theoretical yield :

140.5	182
1	$\frac{182}{140.5}$
21.8	$\frac{180}{140.5} \times 21.8$

$= 27.9g$

$\% = \frac{\text{actual}}{\text{theoretical}} \times 100$

$= \frac{18.4}{27.9} \times 100$

$= 65.881\ldots = 66\%$

Candidate 4

$n = \frac{m}{GFM}$

$= \frac{21.8}{140.5}$

$= 0.155\ldots.$ → $m = n \times GFM$

$= 0.155\ldots \times 182$

$= 28.24\ldots g$

$\%\ \text{yield} = \frac{A}{T} \times 100$

A: Actual

T= Theoretical

$= \frac{18.4}{28.24\ldots} \times 100$

$= 65.2\%$

Question 10(a)

Candidate 1

a drug that blocks the body natural response.

Candidate 2

Antagonist blocks the receptor site preventing the nature molecule from binding into the active site

Candidate 3

a chemical which blocks natural response from occuring by binding to the nerotransmitter

Candidate 4

substance that binds strongly to receptor, blocking any natural responses of body / chemicals binding.

Candidate 5

a drug that binds to a recepter and stops a natural biochemical process

Question 10(b)(ii)

Candidate 1

m per v
mass per volume
$0{\cdot}921 \times 154$
$= \frac{141{\cdot}8}{1000}$
$= \frac{0{\cdot}1418}{0{\cdot}5} = 0{\cdot}284$

Candidate 2

$d = \frac{m}{v}$
$m = 460{\cdot}5\,g$ $500\,cm^3$.
$n = 2{\cdot}99$.
$c = \underline{5{\cdot}98}$

Candidate 3

$\frac{1}{0{\cdot}921} \times 5 = \frac{5{\cdot}42888165\,g}{154}$
$n = 0{\cdot}03525$
$V = 0{\cdot}5$
$c = \underline{0{\cdot}07\,mol\,l^{-1}}$

Candidate 4

$0.921 \times 5 = 4.6\,g$
$n = \frac{4.6}{154} = 0.03$
$C = \frac{n}{V} = \frac{0.03}{0.5} = 0.06\,mol\,l^{-1}$

Question 11(b)(i)(A)

Candidate 1

- ~~Water~~ Soft drink and dichloromethane added to solvent extraction burette
- Its shaken to disperse Caffeine
- Caffeine rises to dichloromethane
- Soft drink at bottom is run off from burette

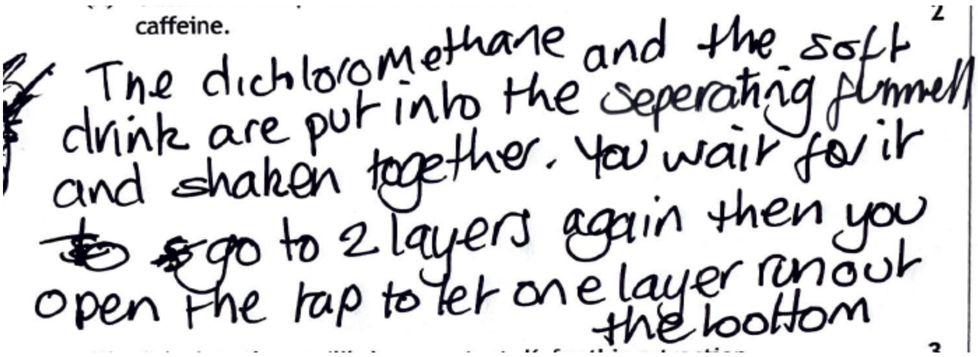
Candidate 2

- add dichloromethane to the soft drink
- leave them to seperate into two ~~layers~~ layers.
- Some caffne will disove in th dichloromethane.
- ~~to~~ Seperate the two liquds using a seperating funnel

Candidate 3

Solvent extraction relies on the Solute being
more ~~react~~ soluble in chosen then the Original mixture
In this reaction dichloromethane has been choosen so it evaporate and
not react with the Solute. A seperating funnel is used to seperate the
mixture to create two layers caffine is added to the dichloromethane which
is an organic layer and Caffeine is solution is added to the other layer,
it is station an equilibrium would be established. This process is
repeated so that the Caffine dissolves in the organic layer and to maximise
yield of product.

Candidate 4

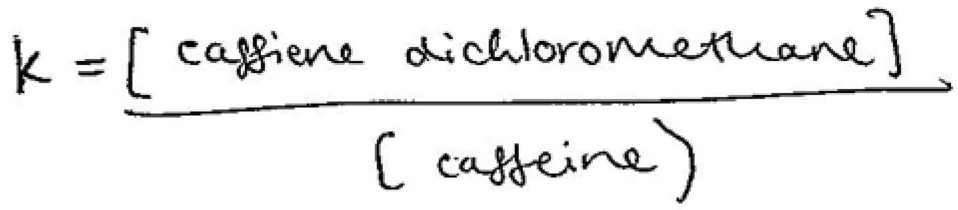


caffeine.

The dichloromethane and the soft drink are put into the seperating funnell and shaken together. You wait for it ~~to~~ ~~s~~ go to 2 layers again then you open the tap to let one layer run out the bottom

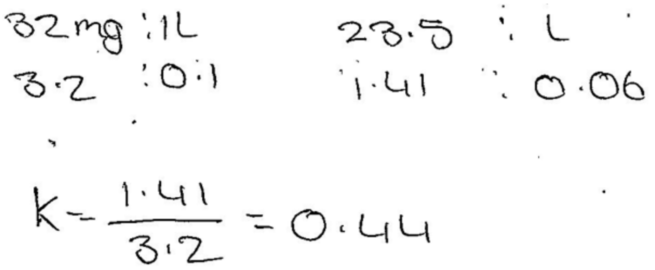
Question (11)(b)(i)(B)

Candidate 1



$K = \frac{[\text{caffiene dichloromethane}]}{[\text{ caffeine})}$

Candidate 2

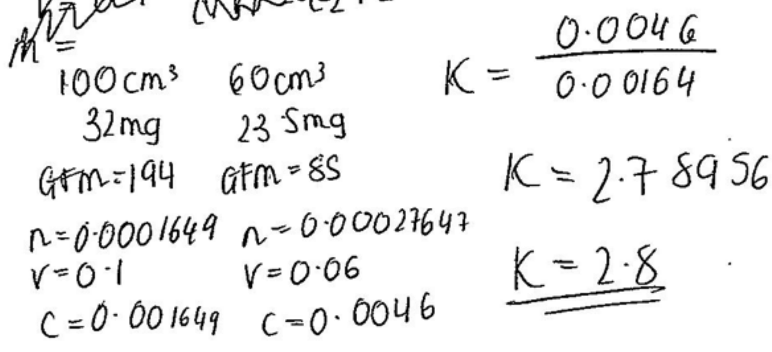


32mg : 1L   23.5 : L

3.2 : 0.1   1.41 : 0.06

$K = \frac{1.41}{3.2} = 0.44$

Candidate 3



K = at [illegible]

100cm³   60cm³ $K = \frac{0.0046}{0.00164}$

32mg   23.5mg

GFM=194   GFM=85   K = 2.78956

n=0.0001649   n=0.00027647

v=0.1   v=0.06   K = 2.8

c=0.001649   c=0.0046

Candidate 4

$$K = \frac{[\text{caffeine (dichloromethane)}]}{[\text{caffeine (aq)}]}$$

conc (dichloromethane)

$$= \frac{0.0235}{0.06} = \underline{0.3916}$$

$$K = \frac{0.3916}{0.32} = \underline{\underline{1.22}}$$

$$\text{conc (aq)} = \frac{0.032}{0.1}$$

$$= 0.32$$

Candidate 5

$$K = \frac{[\text{caffeine (dichloromethane)}]'}{[\text{caffeine (aq)}]'}$$

$$= \frac{2.02\times10^{-3}}{1.21\times10^{-3}}$$

$$K = \underline{\underline{1.67}}$$

n=m/gfm

n=cv

cv= m/gfm

n=m/gfm

= 23.5/194

caffeine gfm =194 = 0.121

n=cv

0.121 = c×60

c= 2.02×10^{-3}

n=cv

0.121=c×100

c= 1.21×10^{-3}

Candidate 6

$= C_8H_{10}N_4O_2$

96

10

56

32

194g

$$K = \frac{[\text{caffiene }(CH_2Cl_2)]}{[\text{caffiene }(H_2O)]}$$

$$K = \frac{2\times10^{-3}}{4.38\times10^{-4}}$$

$$\underline{K = 4.6}$$

sft drink

8.5mg

n= m/gfm

n= 8.5×10^{-3}/194

n= 4.38×10^{-5}

c= n/v

c= 4.38×10^{-5}/0.1

c = 4.38×10^{-4} mol l^{-1}

solvent

23.5mg

n= m/gfm

n= 23.5×10^{-3}/194

n= 1.21×10^{-4}

c= n/v

c= 1.21×10^{-4}/0.06

c= 2×10^{-3} mol l^{-1}

Q11(b)(ii)

Candidate 1

Use grade A glassware

Candidate 2

The procedure of solvent extraction should be repeated to maximise the yield of product

Candidate 3

Repeat the extration multiple times and complete it in lower volumes multipletimes rather than 1 big extraction

Candidate 4

It could be done in smaller quantities and ~~repeated~~ repeated more times to increase the yield.