

Section One: Multiple-choice**25% (50 marks)**

1. D	2. C	3. C	4. C	5. D
6. A	7. C	8. A	9. C	10. C
11. B	12. D	13. C	14. B	15. C
16. C	17. A	18. D	19. B	20. C
21. C	22. C	23. C	24. D	25. B

Section Two: Short answer**35% (70 marks)****Question 26.****(9 marks)**

A French brand of bottled vinegar called Vinaigre comprises a dilute solution of 7.50 g of acetic acid (CH_3COOH) in every 250 g of solution – call this solution X.

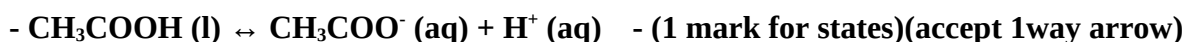
- (a) Calculate the number of moles of acetic acid in the 250 g of solution X. (2 marks)

$$- n(\text{C}_2\text{H}_4\text{O}_2) = \frac{7.50}{60.052} = 0.1249 = 0.125 \text{ mol}$$

- b) Assuming that the volume of 250 g of Vinaigre solution X is 250 mL, what is the concentration of acetic acid in moles per litre? (1 mark)

$$- - c = \frac{n}{v} = \frac{0.1249}{0.25} = 0.500 \text{ mol L}^{-1}$$

- c) Write the equation for the ionisation of acetic acid. (2 marks)



- d) Acetic acid is classified as a **weak** acid. Explain what this means. (2 marks)

- **A weak acid is one that is not completely ionised in solution**
 - **1 mole of acid would give less than 1 mole of hydrogen ions or approx 1% ions.**

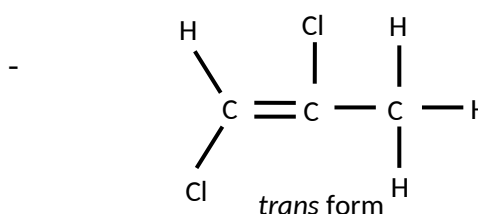
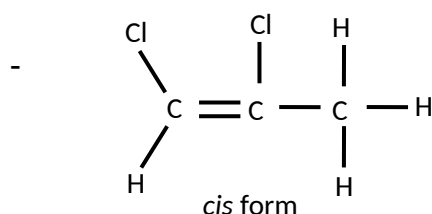
- e) If the degree of ionisation of acetic acid is quoted as 1.3%, use your answer to part (b) to find the concentration of hydrogen ions in solution X. (2 marks)

- **1.3% of 0.500 mol** - **$= 6.49 \times 10^{-3} \text{ mol L}^{-1} \text{ H}^+$ ions.**

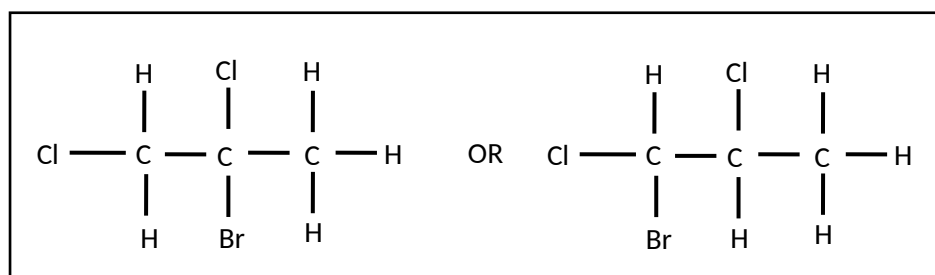
Question 27**(8 marks)**

An organic compound has a formula $\text{C}_3\text{H}_4\text{Cl}_2$ and can exist as several different isomers.

- (a) One form of $\text{C}_3\text{H}_4\text{Cl}_2$ has a *cis* and *trans* isomer. Draw in the **Cl** and **H** atoms onto the basic structures shown below to show these two isomers. (2 marks)



- b) The *trans* form of $C_3H_4Cl_2$ shown above reacts with HBr under suitable conditions. Draw below the structural form of the resulting organic compound formed as a product in this reaction. (2 marks)



(2 mks)

(1 mk)

- c) A chemist claimed she had produced the compound 2,2-dichloropropene. Comment on this claim. (2 marks)

- 2,2-dichloropropene cannot exist.
- The 2nd carbon atom would need to have to have 5 bonds attached to it
- This is impossible as carbon can only have 4 bonds

- d) A chemist found the reaction was occurring too slow and decided to try using a catalyst. Explain how the catalyst would change the reaction rate? (2 marks)

The catalyst increases the rate of reaction by offering an alternative pathway that uses less energy, that is, the activation energy is lower.

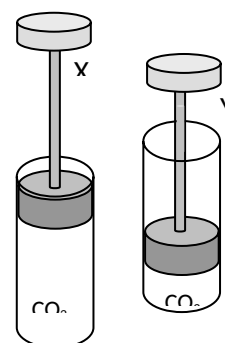
More particles will have this lower energy hence they will react and the rate increases.

Question 28

Two positions of the same syringe are shown here.

A syringe shown in position X is filled with 540 mL of CO_2 at STP and then compressed to a smaller volume, as in position Y which is the same cylinder afterwards at the same temperature.

- (a) Explain why the pressure in the cylinder has changed in going from position X to position Y in terms of the kinetic theory of gases (2 marks)



(8 marks)

- As the volume of the cylinder is reduced the spacing between the particles becomes less but the speed remains constant.
 - The particles now have less distance to travel between collisions and so the collision rate with the walls increases, which increases the force on the wall and hence the pressure will be greater.
- (b) Calculate the mass of CO_2 in the cylinder s shown by diagram X. (3 marks)

- Formula is $n = \frac{V}{22.71}$

- $\frac{0.540}{22.71} = 0.02378 \text{ mol}$

- Also $m = nM = 0.02378 \times 44.01 = 1.05 \text{ g.}$

(c) How does the mass of gas when in position X compare with the mass of gas when in position Y? (1 mark)

- **Matter is conserved, so the mass will be the same as before.**

(d) In going from position X to Y the gas volume was changed from 540 mL to 180 mL at the same temperature. Calculate the new pressure of the CO_2 inside the syringe at position Y. (2 marks)

- $P_1V_1 = P_2V_2$ (Boyle's Law)

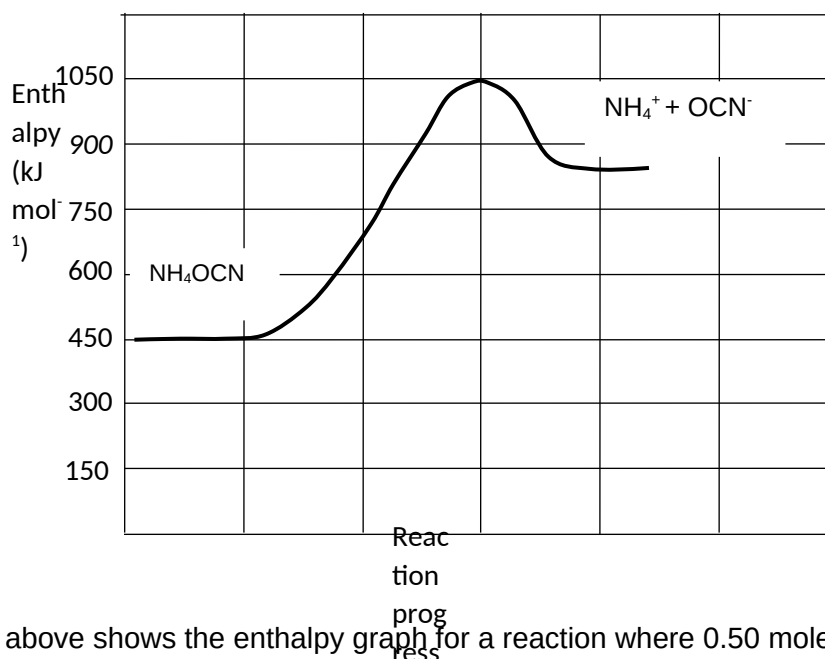
Standard pressure = 100 kPa

$100 \times 0.540 = P_2 \times 0.18$

- $P_2 = 300 \text{ kPa (or 3 atmospheres)}$

Question 29

(9 marks)



The diagram above shows the enthalpy graph for a reaction where 0.50 mole of ammonium cyanate (NH_4OCN) crystals dissolves in water: $\text{NH}_4\text{OCN (s)} \rightarrow \text{NH}_4^+(\text{aq}) + \text{OCN}^-(\text{aq})$

(a) Which are stronger, the NH_4^+ to OCN^- bonds in the NH_4OCN crystals or the ion-dipole bonds existing between H_2O and NH_4^+ ions and H_2O and OCN^- ions? Explain. (2 marks)

- **The ion-dipole bonds of H_2O -to- NH_4^+ and H_2O -to- OCN^- must be stronger than the ionic bonds in NH_4OCN crystals (NH_4^+ to OCN^-)**
- **Because the graphs shows the separated ions have a higher enthalpy (bond energy) value.**

(b) As the ammonium cyanate crystals dissolve how would this affect the surrounding solution?

(1 mark)

- As the crystals dissolve they must absorb energy from the surroundings – hence the solution must get colder.

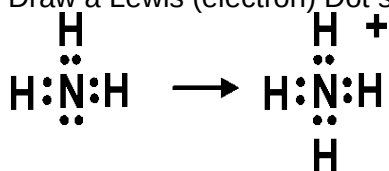
(c) What is the value for the Activation Energy for this reaction? (1 mark)

- $E_a = 1050 - 450 = 600 \text{ kJ mol}^{-1}$

(d) What is the value for ΔH for this reaction? (Show the correct units) (2 marks)

- ΔH is about 380 kJ mol^{-1} - (830 – 450) (accept 380-400)

(e) Draw a Lewis (electron) Dot structure for ammonia and the ammonium ion, NH_4^+ . (3 marks)



- (correct electron numbers)

- (all atoms have 8 e's)

- (brackets shown with charge)

Question 30

(8 marks)

Consider the elements in Period 3 of the periodic table.

(a) Explain why chlorine has a higher 1st ionisation energy than magnesium. (3 marks)

- Moving to the right of the Periodic table, the no. of protons in the nucleus is increasing.

- Chlorine placed in the same energy level but has more protons attracting the valence electrons (3rd shell)
which produce a greater attraction for the outer electrons

- If the force of attraction is greater for chlorine then more energy will be needed to pull the outer electron from the atom – Ionisation Energy.

(b) Which has the higher ionisation energy, iodine or chlorine? (1 mark)

- Chlorine has the higher ionisation energy

(c) The S-Cl bond is a polar covalent bond. Explain what causes this polarity. (3 marks)

- The S and Cl atoms share the electron pair of the bond so they both have a stable 8 configuration.

- However, the Cl atom has more protons and will attract the bonding pair to a greater extent (greater electronegativity)

- Thus the bond pair is pulled closer to the chlorine, making it slightly more negative and making the Cl – S bond polar (+ and – ends)

(d) How does the polarity of molecules affect their physical properties? (1 mark)

- Due to the molecules having + and – ends, adjacent molecules will be attracted to each other by electrostatic forces, raising the energy required to separate them and therefore raising the boiling point compared with non-polar molecules.

Question 31

(9 marks)

Compound X is a strong electrolyte, compound Y is a weak electrolyte and compound Z is a non-electrolyte.

- (a) Explain the differences between compounds X, Y and Z when dissolved in water in terms of their degree of ionisation and give an example of each type of substance. (6 marks)
- **Substance X will be an ionic salt, made from an acid and a base or a strong acid or strong base - they all fully dissociate in water.**
 - **Substance Y is covalent but will partially dissociate in water**
 - **Substance Z is covalent and produces no ions in solution**
 - **Example of a compound like X: NaCl, etc, including partially soluble salts**
 - **Example of a compound like Y: CH_3COOH , NH_3 or any weak acids and bases**
 - **Example of a compound like Z: Sugar, kerosene or non-ionic organics.**
- (b) Explain how you could tell the difference between water solutions containing 1 mole per litre of each of these substances. (2 marks)

- **To see which solution conducts best:**
- **Highest current recorded would be X, next highest would be Y and the non-conducting solution (zero current) would be Z.**

A farmer uses bore water pumped up from an aquifer which has been found to contain about 1% salt. Name a method by which the farmer could obtain pure drinking water from this salty bore water. (1 mark)

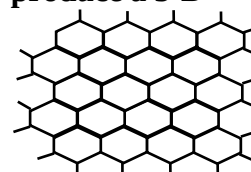
- **The farmer would have to use distillation apparatus (de-ionising column, desalination etc)**

Question 32

(10 marks)

- (a) Explain why carbon can form 3 dimensional structures, like diamond, but sulfur cannot. (3 marks)

- **Carbon has 4 valence electrons which means it has a bonding capacity of 4.**
- **4 bonds would repel each other according to the VSEPR theory to produce a 3-D tetrahedral structure.**
- **Sulfur has only 3 bonding pairs which would repel into a 2-D planar structure.**



Graphene

- (b) Explain why Graphene is a good conductor of electricity and yet diamond does not conduct at all. (2 marks)

- **In graphene carbon is only using 3 of its 4 valence electrons for bonding and hence each carbon atom has a spare electron available for conduction (delocalised).**
- **Diamond uses all 4 of its valence electrons for bonding and hence has none available to conduct charge.**

- (c) Determine the empirical formula of a compound containing 78.22% carbon, 4.38 % hydrogen and possibly sulfur. (3 marks)

Element	C	H	S
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Percentage	78.22%	4.38%	17.40%
No of moles	6.513	4.345	0.5427
Simplest ratio	12	8	1

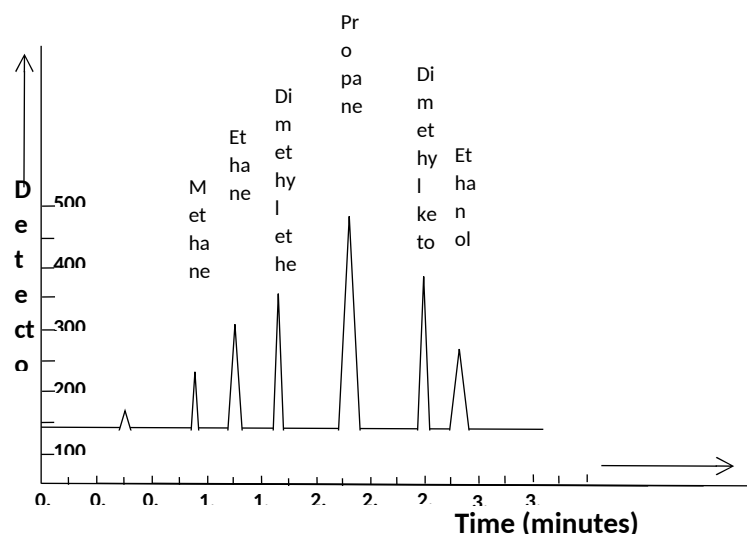
Many women's make-up products contain nanoparticles of titanium dioxide which give the skin an attractive bright sheen. The size of the TiO_2 particles is around 100 nanometres. Skin pores are small holes in the skin which allow entrance to the blood stream and are about 50 micrometres wide ($50 \times 10^{-6} \text{ m}$). (1 nanometre = 10^{-9} m)

(d) Explain why there might be concern over the use of nanoparticles in women's make-up. (2 marks)

- The pores (holes) in the skin are much larger than the nanoparticles used in make-up
- This means that nanoparticles can pass through the skin pores into the bloodstream and might cause medical problems.

Question 33

(9 marks)



Above is the detector read-out from a high performance gas chromatography apparatus analysing the organic residues inside a chemical reaction tank using a polar stationary phase in the column. The mobile phase used was helium which has a column retention time of 0.6 minutes, as seen from the graph.

(a) Which compound in the tank was present in the greatest concentration? (1 mark)

- Propane was present in the largest concentration as the peak is highest.

(b) Which compound had a Retention Factor of 0.34? Show calculations. (3 marks)

$$R_f = \frac{T_{He}}{T_s} \text{ so } 0.34 = \frac{0.6}{T_s}$$

$$T_s = \frac{0.6}{0.34} = 1.75 \text{ minutes}$$

- This time corresponds to the substance dimethyl ether.

(c) Which compound being tested is the least polar? Explain. (3 marks)

- Methane is the least polar
- A low polarity molecule would not be attracted to the polar stationary phase and so would pass through the instrument more quickly
- Methane takes the shortest time, apart from the mobile phase (1.15 minutes), hence is least attracted

(d) By considering the bonding types, explain why the Retention Time for ethanol would be the

greatest.

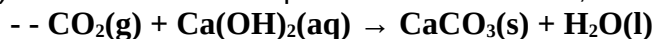
(2 marks)

- **Ethanol is highly polar as it can form hydrogen bonds**
- **This would make it highly attracted to the polar stationary phase and hence pass through the machine in the longest time.**

Section Three: Extended answer**Question 34****(16 marks)**

(a) Write a balanced equation for this reaction, including states.

(2 marks)

(b) Calculate how many grams of calcium carbonate would be produced if 100 L of pure CO₂ at STP was dissolved in an excess of calcium hydroxide solution.

(3 marks)

$$n(\text{CO}_2) = \frac{V}{22.71} = \frac{100}{22.71} = 4.403 \text{ mol}$$

Ratio CO₂ : CaCO₃ is 1 : 1 so

$$n(\text{CaCO}_3) = 4.403 \text{ mol}$$

$$m = nM = 4.403 \times (40.08 + 12.01 + 3 \times 16)$$

$$m = 441 \text{ g.}$$

In one such sequestering experiment performed in the laboratory, as above, 150 L of CO₂ collected at STP produced 6.00 x 10² g of calcium carbonate.

(c) From this figure, calculate the percentage efficiency of the experimental set-up.

$$(\% \text{ Efficiency} = \frac{\text{Mass produced}}{\text{Calculated mass}} \times 100)$$

(3 marks)

$$n(\text{CO}_2) = \frac{V}{22.71} = \frac{150}{22.71} = 6.605 \text{ mol}$$

This should produce 6.605 mol of CaCO₃

$$\text{Mass of CaCO}_3 \text{ expected} = 6.605 \times 100.09 = 661.1 \text{ g}$$

$$\% \text{ efficiency} = \frac{\text{Actual mass}}{\text{Expected mass}} \times 100 = \frac{600}{661} \times 100 = 90.8 \%$$

d) How many more times soluble is SO₂ compared with CO₂ at a temperature of 10°C? Show your working

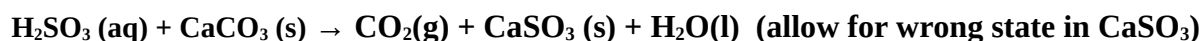
(2 marks)

$$\text{Ratio of SO}_2 : \text{CO}_2 \text{ masses at } 10^\circ\text{C is } 148 : 0.24$$

$$\text{Simple ratio is } 617 : 1 \text{ (range } 580\text{-}620)$$

e) Write a balanced equation for the reaction of sulfurous acid (H₂SO₃) reacting with marble (CaCO₃) – an acid/carbonate reaction.

(2 marks)



f) If the pH is 3.5, what is the H⁺ ion concentration?

(1 mark)

$$[\text{H}^+] = -\text{inv log } [3.5] = 3.16 \times 10^{-4}$$

g) Using the CO₂ graph, estimate the extra volume of CO₂ (measured at STP) absorbed at night time when the tank temperature has changed from 20° to 10°.

(3 marks)

$$\text{At } 10^\circ\text{C } 0.24 \text{ g of CO}_2 \text{ in } 0.1 \text{ L then mass in } 50 \text{ L} = 0.24 \times (50/0.1) = 120 \text{ g}$$

- At 20° C 0.17 g of CO₂ in 0.1 L then mass in 50 L = $0.24 \times (50/0.1) = 85 \text{ g}$

Difference in mass absorbed = $120 - 85 = 35 \text{ g}$

- $n(\text{CO}_2) = m/M_r = 35/44.01 = 0.7953 \text{ mol}$

$V(\text{CO}_2) = 22.71 \times 2.613 = 18.1 \text{ L}$ (accept 16.5-19.5 L) (36 mL if they don't allow for 50L)

Question 35

(16 marks)

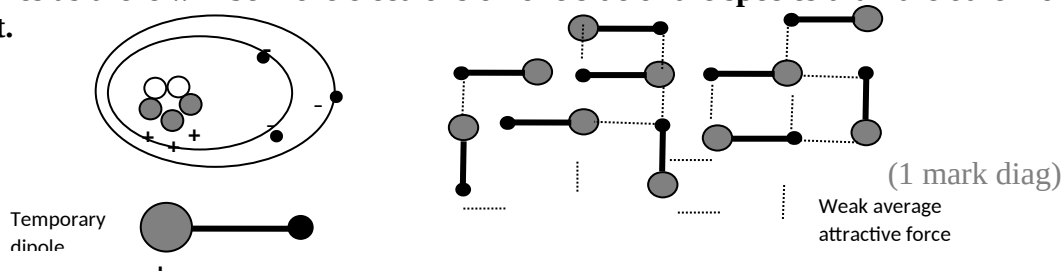
Alkane	Boiling point (°C)
CH ₄	-162
C ₂ H ₆	-89
C ₃ H ₈	-42
C ₄ H ₁₀	-0.5
C ₅ H ₁₂	36

Above is a table of boiling points of some alkanes.

(a) Name the intermolecular force that is responsible for the rise in boiling points seen (1 mark)
- **Dispersion forces.**

(b) Explain, using diagrams, how this intermolecular force arises which allows one non-polar molecule to be attracted to another non-polar molecule. (3 marks)

- **Dispersion forces are caused by an attraction between temporary molecular dipoles**
- **These are formed because of the unequal distribution of electrons around atoms or molecules as there will be more electrons on one side of the species than the other for an instant.**



(c) Refer to methane to explain what is meant by a **polar** bond and state whether the methane **molecule** is a polar. Explain your answer. (3 marks)

- **A polar bond exists between the H and the C in a methane molecule**
- **because the C is more electronegative and attracts the pair of electrons in the C-H bond**
- **Due to its opposing configuration the dipole vectors cancel out in methane and hence it is non-polar overall.**

(d) Explain why the arrangement of bonds in methane is said to be **tetrahedral**, rather than a flat cross planar configuration. (3 marks)

- **Each bond is an area of negative charge which will be repelled as far away as possible by the adjacent charge in another bond.**
- **There are 4 bonds between carbon and hydrogen**
- **VSEPR: In 3 dimensions, the furthest 4 bonds can separate is in a tetrahedral configuration, not as a planar cross.**

(e) Water has a molar mass similar to methane, and yet its boiling point is more than 200 degrees higher (100°C). Explain why there is such a large difference in boiling points of these two substances. (3 marks)

- **Water is a polar molecule and methane is non-polar**
- **This means that the intermolecular forces in water (H-bonds) are large and need more energy to separate i.e. higher temperature for boiling**
- **Methane molecules have only dispersion forces attracting them which are weak and hence need less heat (lower temperature) to separate them into the gaseous form**

An unknown hydrocarbon X has a ratio of 2 hydrogen atoms for every carbon atom in its molecule. The molar mass of X was determined by mass spectrometer to be around 56 g mol^{-1} .

- f) Use these data to determine the molecular formula of X. (3 marks)
- **If molecular formula were CH_2 then molar mass would be $12.01 + 2 \times 1.008 = 14.026$**
If molecular formula were C_2H_4 then molar mass would be $2(12.01 + 2 \times 1.008) = 28.052$
If molecular formula were C_3H_6 then molar mass would be $3(12.01 + 2 \times 1.008) = 42.078$
 - **If molecular formula were C_4H_8 then molar mass would be $4(12.01 + 2 \times 1.008) = 56.105$**
(several trials)
 - **This last formula would give a molar mass of close to 56.1 so the molecular formula must be C_4H_8 .**

Question 36 (16 marks)

- (a) Write the ionic equation for this precipitation reaction. (2 marks)



- (b) State a method he could use to separate this precipitate out from the water and explain the separation principle involved. (2 marks)

- **The process of Filtration would separate the precipitate and retain it in the paper.**
- **The filter paper has holes in which are smaller than the size of the particles of silver chloride and so they become trapped in the paper whilst the liquid passes through.**

- (c) Calculate the mass of silver chloride that would be expected from the 5.00 L of lake water. (3 marks)

- **$n = cV = 3.75 \times 10^{-4} \times 5 = 1.875 \times 10^{-3} \text{ mol}$**
- **$n(\text{AgCl}) = n(\text{Ag}) = 1.875 \times 10^{-3} \text{ mol}$**
- **$m(\text{AgCl}) = 1.875 \times 10^{-3} \times (107.9 + 35.45)$**
- **$m = 0.268 \text{ g}$.**

Having removed the silver from the lake water, the farmer attempted to produce pure water from the remaining 5.00 L of impure water.

- (d) State the name of the process by which pure water could be obtained from impure water and list the apparatus that would be used. (3 marks)

Process name: - **Distillation or ion exchange**

Labelled Diagram: or list- **flask containing murky water being heated**

- **Liebig condenser with cold water entering**

Or ion exchanger with ion exchange column.

After the water had been purified in this way, the remaining solid from the 5.00 L of lake water was found to be calcium nitrate leached from the soil around the lake, which had a mass of 3.76 g.

- (e) Calculate the concentration of nitrate ions that would have been present in the lake water. (3 marks)

- $n(\text{Ca}(\text{NO}_3)_2) = \frac{3.76}{(40.08 + 14.01 \times 2 + 16 \times 6)} = 0.02291 \text{ mol}$
- $n(\text{NO}_3^-) = 2 \times n(\text{Ca}(\text{NO}_3)_2) = 0.0458 \text{ mol}$
- $c = \frac{n}{V} = \frac{0.0458}{5} = 9.17 \times 10^{-3} \text{ mol L}^{-1}$

f) Calculate the percentage of nitrogen in this fertilizer and the mass of nitrogen that would be added to the soil around the lake by the use of 150 kg of this fertilizer. (3 marks)

$$\begin{aligned} \text{\% of nitrogen} &= \frac{2 \times 14.01}{(2 \times 14.01 + 4 \times 1.008 + 3 \times 16)} \times 100 = 35.0 \% \\ - \frac{35}{100} \times 150 &= 52.5 \text{ kg of nitrogen.} \end{aligned}$$

Question 37 (17 marks)

a) Which element would have an ion with a charge of 2^- and explain why it becomes charged in this way. (3 marks)

- **Element g (oxygen) would have a 2^- ion as it has 6 valence electrons**
- **Because, by gaining 2 electrons it would achieve a noble gas structure**
- **which is particularly stable**

(b) (i) Which of the elements shown would form a covalent compound? _____

(1 mark)

- **Elements F and G would form a covalent compound (CO)**

(ii) Give two possible formulas for this compound (use the proper elemental symbols from the Periodic Table for this) (2 marks)

- **CO and CO₂**

(iii) Explain why these compounds would be covalent, rather than ionic. List two physical properties they would both exhibit. (3 marks)

- **No metal ion is involved**
- **The two elements would have to share electrons as they both have a high electronegativity**
- **By sharing one or more pairs of electrons, both elements can achieve a stable octet of valence electrons.**
- **Low melting point, nil conductivity, solids are soft.**

(c) (i) List four physical properties you would expect elements D and E to exhibit. _____ (2 marks)

- **high melting point, electrical conductivity, heat conductivity, malleable, ductile, shiny, dense solid**

(ii) One of these elements was found to have 3 main isotopes. Name the instrument That is used to determine the atomic masses of these isotopes. (1 mark)

The mass spectrometer is used to determine the atomic mass of an isotope.

(d) The first four ionisation energies of element b are 736 kJ mol^{-1} , 1450 kJ mol^{-1} , 7740 kJ mol^{-1} and $10500 \text{ kJ mol}^{-1}$ respectively.

Explain why the ionisation energies for successive electrons being removed from the atom have this pattern. (3 marks)

- **This element has 2 electrons in its valence shell (e.g. Magnesium)**
- **Ionisation energies from the 1st to the 2nd show a rising trend as the electron has to be removed from an increasing core charge core charge attracting the electron (736, 1450)**
- **The 3rd ionisation energy is so high because both valence electrons would have been removed from a shell much closer to the nucleus and the 7740 kJ value represents the energy needed to pull an electron from a full shell below, which is extremely stable (noble gas structure)**

(e) Which of the elements A – H, when bonded with hydrogen would produce a bond with the highest polarity? Explain why.

(2 marks)

- **Element G would give the most polar bond with hydrogen as it has the highest electronegativity in the list.**

Question 38

(15 marks)

a) Explain, in terms of atomic structure, why ions of lead (Pb^{2+}) would preferentially absorb this particular wavelength λ_{Pb} . (3 marks)

- **The particular wavelength λ_{Pb} represents a particular energy jump in the lead atom**
- **This energy is the amount absorbed when an electron is promoted from the lowest energy level (ground state) to another existing within the lead atom.**
- **Hence only this wavelength would be absorbed by the metal ion**

(b) From the absorbance graph above estimate the wavelength that should be used in order to best detect the Pb^{2+} ions in the milk powder solution. (1 mark)

- **Answer a) is correct λ_{Pb} from the graph is $283 \text{ nm} \pm 2 \text{ nm}$**

(c) Explain why you chose your answer to part b)? (1 mark)

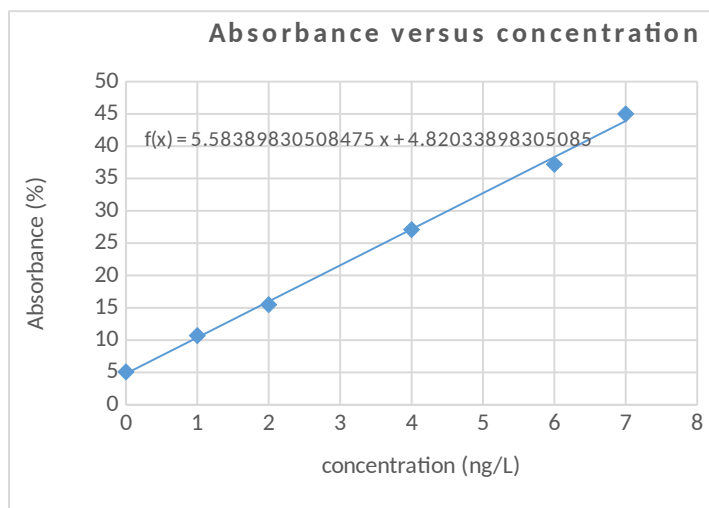
- **From the graph, at this wavelength the most energy is absorbed.**

For Experiment 2, solutions with known concentrations of lead were used to see how Absorption depends upon Concentration. The table below displays known concentration values and their corresponding Absorbance values. **Note:** Concentrations are measured in nanograms (ng) per litre (1 nanogram = 1×10^{-9} g)

Table

Concentration (ng per litre)	Pure water 0.00	1.00	2.00	4.00	6.00	7.00
Absorbance (%)	5.1	10.4	15.5	26.3	37.2	42.8

(d) Use the grid below to plot a labelled graph of absorbance on the vertical axis against concentration on the horizontal axis. (5 marks)



- Graph plotted in correct orientation (1 mark)
- Good scaling to fit paper (1 mark)
- Labelled axes (1 mark)
- Points correct (1 mark)
- Line of best fit drawn (1 mark)

A sample of the milk powder to be tested was then added to water to make up a 100 mL solution and analysed in the Absorption Spectrometer for 3 trials.

The following results were obtained:

Trial	Trial 1	Trial 3	Trial 3	Average value
Absorbance (%)	24.3	24.7	24.0	

(e) (i) Calculate the average value of absorbance and insert this in the end column above.

(1 mark)

Trial	Trial 1	Trial 3	Trial 3	Average value
Absorbance (%)	24.3	24.7	24.0	24.3

(ii) From the value you obtained for average absorption in part (i), calculate the concentration of lead in the foreign milk powder – expressed in ng L^{-1} . Show all construction lines on the graph and working below.

(1 mark)

- **Construction lines shown**
- **A figure of 24.3 absorbance gives a concentration value of 3.5 ng L^{-1} from the graph (allow ± 0.1)**

(iii) Express that answer to part (ii) in parts per million of lead in the solution i.e. the number of grams of lead in 1 million grams of solution (assume the solution has a mass of 1000 g per litre.)

(2 marks)

- **$3.5 \text{ ng in 1 litre} = 3.5 \times 10^{-9} \text{ g in 1000 g of solution}$**

In 1000,000 g of solution there would be $3.5 \times 10^{-9} \times 1000 \text{ g} = 3.5 \times 10^{-6} \text{ g per million grams}$

- **$= 3.5 \times 10^{-6} \text{ parts per million.}$**

(f) An alternative way of determine the amount of lead in the milk would be to precipitate the lead ions out by adding sodium sulfate and weighing the precipitate.
Name alternative solution of a compound that could be used to form a precipitate with lead ions, apart from sodium sulfate.

(1 mark)

- **Sodium iodide (carbonate, phosphate, etc) would also form a precipitate.**