# Experiment 1: Gravimetric analysis

|  |  |
| --- | --- |
| Question on screen | answer |
| What does ‘weigh accurately a mass of approximately 0.3g’ actually mean? | It's not important what the actual mass is, as long as the mass is known to the correct level of precision. |
| Why don’t we use tap water? | Tap water contains ions which could affect the experimental results. |
| Why don’t we add the acid before the water? | In the name of safety, acid should always to added to water not water to acid. |
| What is the happening here?  What initial observations suggest there was a chloride in the original solid? | Silver chloride forms – precipitate. Silver chloride is white, showing chloride is present. |
| Why do we add more silver nitrate solution? | To ensure that all the chloride has been precipitated. |
| Why is a hotplate preferable? | It is safer and easier to maintain a constant temperature. |
| What is the likely composition of the filtrate? | Silver nitrate that hasn't reacted with the chloride ions, metal ions (from the unknown chloride) and nitric acid. |
| Why do we wash the precipitate with the wash-solution? | The wash-solution (nitric acid) gets rid of any ions that could affect the results e.g. carbonate. |
| What is the aim of this step?  Why is it more effective to do this step quickly? | Pouring from the beaker quickly reduces the amount of solid remaining in the bottom of the original beaker. |
| Why is this step necessary? What is its purpose? | To ensure that there are no further chloride ions in the filtrate. |
| How do you know that all the water has left the residue? | No further decrease in mass. |
|  |  |

# Experiment 2: Identification of unknown solutions by qualitative analysis

There are no on-screen questions.

|  |  |
| --- | --- |
| Question | Answer |
|  |  |

# Experiment 3: Preparation of a soluble salt by titration

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why does touching wall of flask with tip of pipette cause some of the liquid to leave? | The liquid adheres to the flask walls |
| Why does the indicator turn pink? | Phenolphthalein is pink in alkaline conditions. |
| Why is it important to remove the funnel? | The funnel can drip liquid into the burette – which effects volume of liquid in the burette. |
| Why is it important to remove the air bubble? | If bubble was present the burette would contain less liquid than is recorded – which effects results. |
| Why is it important to swirl the flask? | Swirling flask ensures thorough mixing of contents and thence consistent concentration of contents in flask. |
| Why is it important not to add more after the solution turns colourless completely? | Adding more acid would lead to results which didn't reflect the end-point accurately. |
| Why is it important not to round-off measurements during calculations? | Rounding-off too early decreases accuracy of final result (and increases percentage error). |
| Why is it important not to include the indicator this time? | Addition of indicator would render salt impure. |
| Why is it important to add exactly the same volume of acid the second time? | The volumes represent the stoichiometric point, when concentrations of OH- andH+ are equal, and so they shouldn't be changed the second time of titration. |
| Why is it important to heat gently? | It's safer and avoids the mixture 'spitting'. |
| Why not evaporate all of the water using the hot-plate? | Slow evaporation over a longer period allows crystals to form. This doesn't happen if a hotplate / Bunsen is used for more than the initial period of evaporation. Excessive heating could form the anhydrous salt or even decompose the salt. |
|  |  |

# Experiment 4: Standardisation of an acid solution

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it useful to weigh approximately the empty weighing bottle first? | In order to get a rough idea how much the combined mass of bottle and contents would be. |
| Why is it not important that traces of solid remain in the weighing bottle | The weighing method takes this into account by using the difference in mass. |
| Why is it important not to add the whole 250cm3 of water | In case the water's meniscus goes above the graduation-line of the flask. |
| Why is it important to rinse the beaker, rod and funnel? | To ensure that all traces of reagents have been transferred to the standard flask. |
| Why is it better to use a Pasteur pipette to make the water up to the graduation mark? | This allows addition of water drop by drop and avoids going above the graduation mark. |
| Why is it important to invert the flask several times? Why not just shake flask from side to side? | To ensure thorough mixing of contents and thence consistent concentration throughout. This is not achieved as well by a side-to-side action. |
| Why is it important to label all solutions? | In terms of health and safety, it's good practice. A lot of the solutions look similar. |
| Why is it important not to rinse the burette using water? | If water is used, there could be remaining droplets on the inner walls of the burette, which have a diluting effect on the acid. |
| Why is it important to remove the funnel? | The funnel could release drops of reagent into the burette – which effects the volume. |
| Why is it important to remove air bubbles? | If bubbles are present then the burette would contain less liquid than is recorded – which effects results. |
| Why is it important to rinse the volumetric pipette with sodium carbonate solution?  Why not rinse using water? | If water is used, then any remaining drops on the inner wall of burette could dilute the carbonate. |
| Why is it important not to add too many drops of indicator? | This could effect the concentration of the flask reagents. |
| Why is it important not to force the liquid out of the pipette? | Most standard pipettes are manufactured so that they retain a number of drops of liquid in the jet – the 25.0cm delivered by the pipette does not include the remaining drops. |
| Why use a white tile under the conical flask? | In order to see the end-point clearly – some changes in colour are difficult to see. |
| Why is it important to slow the flow rate from the burette as the end-point approaches? | In order to avoid 'over-shooting' the end-point. Some end-points involve a sudden colour change. |
| How do you know the end-point is close?  Why is it important to swirl flask continually? | A circle appears in the area of entry of burette liquid into conical flask liquid. The circle can be colourless or pink for example – depending on the indicator.  Swirling the flask contents ensures thorough mixing and thence consistency in concentration throughout. |
| Why are non-concordant titre values not used to calculate the mean titre? | In order to reduce the error in the final value. |
|  |  |

# Experiment 5: Back-titration

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it important to grind the chips to a powder? | To ensure a large surface area in order that the acid reacts with the limestone quicker. |
| Why is it important not to round-off measurements? | Rounding-off at each stage increases the error at the end. |
| Why does heating the mixture help? | To ensure the reaction goes to completion. |
| Why allow to return to room temperature? | Hot liquids can warm the glassware, which then changes its volume and thence the error changes. Hot reagents have a higher reaction rate than those at room temperature. |
| Why is it important that the NaOH is standardised? | Each calculation involved with the reagent of unknown concentration is based on that of the standard solution e.g. NaOH. If the standard solution concentration is inaccurate then so will be any concentration calculated from it. |
|  |  |

# Experiment 6: Double titration

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why not add both indicators at the start? | The colour of one indicator will mask that of the other. |
| Why use phenolphthalein first? | Phenolphthalein's colour change occurs in weakly basic conditions. As the acid reacts with the carbonate to produce hydrogencarbonate (weak base) the first end-point occurs. |
| Why is it important not to agitate the flask more than necessary? | Carbon dioxide in the air can dissolve in the flask contents to form carbonate (which could affect results). |
| Why is a white tile useful? | The white background makes it easier to recognise the colour change at the end-point. |
|  |  |

# Experiment 7: Indirect determination of the enthalpy of reaction

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why not use a glass beaker as a calorimeter? | Glass is not a good insulator compared to polystyrene. The loss of heat to the surroundings would be substantial using glass (which affects ΔT). |
| Why wait a while before measuring temperature? | It's important to ensure that the temperature of the reagents is stable before starting the reaction. Some could be at a different temperature to that of the room (depending on where they are stored). |
| Why is it important to have the thermometer at eye-level? | In order to avoid parallax error. |
| Why is it important to measure the HCl temperature for this initial period? | It is important that the temperature change in the calorimeter is due to the reaction only. Some reagents could be at a temperature that is different to that of the room. |
| Why use foil to cover the calorimeter? | To reduce losses in heat. |
| Why is it important to keep stirring the mixture? | To ensure consistent temperature in the calorimeter by dispersing the heat throughout. This gives a smooth curve on the graph. |
| Why is it important to keep foil in place whilst measuring the temperature? | It reduces losing heat to the room, which could result in a value ΔT being less than expected. |
| Why is the temperature dropping? Where is the heat going? | Heat is escaping to the room. |
| Why is it important to re-weigh the emptied weighing boat? | In order to calculate the actual mass of solid that was transfered to the calorimeter and taking into account that traces would remain on the inner walls of the weighing-boat. |
| Why is it important to extrapolate to point of mixing (3min.) and not measure ΔT from point 3min. 30s? | The extrapolation method compensates for loss of heat during mixing of reagents. If the 3 min. 30s point were to be used as a reference for ΔT then the value of ΔH would be less than expected. |
|  |  |

# Experiemnt C8: Determination of an enthalpy change of combustion

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it important to keep the lid on the burner when not being used? | The fuel is volatile and evaporates easily at room temperature. This could lead to incorrect masses being recorded. |
| Why is it important to know the initial temperature of the water? | The aim is to measure temperature change and so it is necessary to know the initial temperature. |
| Why is it important to remove the lighted splint quickly after igniting the wick? | Heat from the burning splint as well as the burning fuel would also increase the temperature of the water. This could lead to invalid results. |
| Why is it not important to try to achieve a temperature rise of exactly 40 oC. | As long as the value of ΔT is known it's actual value isn't important – even though error becomes more significant the smaller the value of ΔT. |
| Why does the cap extinguish the flame? | The cap restricts oxygen supply to the wick. |
|  |  |

# Experiment C9: Investigation of rate of reaction by gas-collection method.

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it better to clamp syringe at a low height? | If the barrel falls out of the syringe, it has less chance of breaking if positioned close to the bench. |
| Why do you have to do this quickly? | To avoid losing gas. |
| What could happen if gas is allowed to continue to fill syringe? | The barrel could be pushed out of the syringe. |
| How do you produce a different concentration of HCl? | Dilute using de-ionised water. |
| What is the relationship between the two variables? | Positive correlation (proportional). |
|  |  |

# Experiment C10: A study of an 'iodine clock' reaction.

|  |  |
| --- | --- |
| Question of screen | Answer |
| Why is it important to keep each volume the same? | Fair test. |
| Why is is not important to be exact with the starch volume? | The starch doesn't react with the peroxide. |
| With what is the hydrogen peroxide reacting? | Iodide. |
| What is being produced as the hydrogen peroxide reacts?  What other reaction is also occurring? | Iodine and water. |
| What other reaction is also occurring? | The iodine and thiosulphate are reacting. |
| Why has the colour changed? | The starch and the iodine produce a coloured complex. |

# C11: Nucleophilic substitution reaction

|  |  |
| --- | --- |
| Question on screen | Answer |
| What is ‘bumping’? How do the anti-bumping granules work? | This is the knocking sound heard when small volumes of liquid are heated to boiling – caused by the rapid creation of large bubbles of gas at the bottom of the liquid. The anti-bumping granules provide a nucleus for smaller bubbles to form instead. |
| What does refluxing do?  What does the gauze do? | The liquids boil, condense and then flow back into the flask.  A gauze disperses heat over a wider area. |
| Why should the joints not be slack? | Gases could escape. |
| What are the advantages of a heating-mantle compared to Bunsen burner? | A more consistent temperature is achieved when using a mantle ac it's easier to control. |
| What is the purpose of the thermometer? | Show the temperature of the vapour entering the condenser. |
| What temperature does the product distil? | This is indicated by the thermometer as the liquid drips out of the condenser. |
| How could you test for the product? | Sodium (or potassium) dichromate (VI) solution (colour change: orange to green). |
|  |  |

# Experiment C12: Preparation of an ester and separation by distillation

|  |  |
| --- | --- |
| Question on screen | Answer |
| What is ‘bumping’?  How do the anti-bumping granules work? | This is the knocking sound heard when small volumes of liquid are heated to boiling – caused by the rapid creation of large bubbles of gas at the bottom of the liquid. The anti-bumping granules provide a nucleus for smaller bubbles to form instead. |
| Why does swirling make it safer? | Swirling disperses heat which is released when concentrated acid reacts exothermically.` |
| What is the boiling temperature of ethyl ethanoate? | 77.1oC |
| Why is the water-bath temperature important? | It goes no higher than 100oC. It's safer than using a flame due to flammable reagents and products. |
| What is the purpose of the gauze? | Disperse the heat. |
| Is the water running into the condenser? | Water in through the bottom of the condenser. Water out through top of condenser. |
| Why is the location of the thermometer bulb important? | The bulb should be positioned at the same level as the side-arm which leads to the condenser. |
| What is the ‘distillate’? | The ester |
| What is the boiling temperature of the product?  Why is it important to consider at this stage? | 77.1oC  The thermometer indicates the boiling temperature of the distilled product. |
| How does this temperature compare to published data? | If the measured temperature is not the same as the published temperature, this could be due to contamination of sample. |

# Experiment C13: Construction of electrochemical cells and measurement of Ecell

|  |  |
| --- | --- |
| Question on screen | Answer |
| What is a half-cell? | A piece of metal in a solution containing the metal ions e.g. a strip of copper in a copper(II) sulfate solution. |
| What equilibrium exists in the two half-cells | Dynamic equilibrium |
| Why is it important to have a high-resistance voltmeter? | In order to avoid the voltmeter taking current from the cell. |
| Why is the salt-bridge important? | The salt-bridge allows ions to move from one beaker to the other. |
| Which metal is the best at winning electrons? | The metal with the most positive electrode potential. |

# Experiment C14: A simple redox titration

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it important to not to use water from the tap? | Tap water contains ions. These ions could affect the reaction occuring in the flask. |
| Why is it important to invert the flask? | This ensures thorough mixing of the flask contents. |
| Why do we measure manganate(VII) solutions from the TOP of the meniscus? | The dark colour of the manganate(VII) solution makes the bottom of the meniscus difficult to see. |
| Do you know where to look on the burette in order to find out how many significant figures should be recorded? | The tolerance of the burette should be noted (+/- on the side) and used to calculate %-error. This then is used to determine the appropriate number of significant figures. |
|  |  |

# C15: Estimation of copper in copper(II) salts

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it important to have a precise digital balance? | The less precise the balance the greater the error. |
| Why is it important to rinse and keep the rinse-water? | The rinse-water contains some of the original solid. |
| Why is it important to swirl thoroughly? | To ensure that the copper(II)sulphate and the iodide have reacted completely. |
| What reaction occurs between the KI and the copper(II) sulphate? |  |
| With what is the starch reacting? | Free iodine (I2) |
| When the starch loses its blue-black colour, what does this tell you? | The free iodine has reacted with the thiosulphate. |
|  |  |

# Experiment C16: Determination of the order of a reaction.

|  |  |
| --- | --- |
| Question on screen | Answer |
| With which reagent is the thiosulfate reacting? | I2 |
| Why does it take time for the blue-black colour to appear? | This is the time required for the iodine to use up all the thiosulfate. |
| What sort of line do you expect? | straight |
| What is the relationship between the two variables? | First Order I.e. if one variable double then the other variable doubles also |

# Experiment C17: Determination of an equilibrium constant.

|  |  |
| --- | --- |
| Question on screen | Answer |
| What is happening in the flasks during this period? | An equilibrium is being established in the 'reaction' flask. The alcohol and acid react to produce an ester, whilst the ester decomposes to produce alcohol and acid. |
| How do you calculate the mass?  How do you convert mass into number of moles? | Density X Volume |
| How do you convert mass into number of moles? | Mass / Molar Mass |
| What colour-change are you expecting? | Colourless to pink. |
|  |  |

# Experiment C18: Titration using a pH-probe

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it important to swirl the beaker? | To ensure that the reagents are mixed thoroughly. |
| Why is it important to wash the electrode? | To ensure valid measurements (I.e. the probe is measuring the liquid pH which is in the flask at the time). |
| How do you identify the equivalence point? | pH7 |
|  |  |

# Experiment C20: Synthesis of a liquid organic product

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why is it necessary to work in a fume cupboard? | Some of the reagents are volatile and the concentrated acid releases hydrogen chloride which is an irritant as it reacts with water in the air and creates a 'fog' (fumes) of hydrochloric acid. |
| Why is it better to use a stopper or plug? | In order to prevent the fumes from escaping. |
| Why cool the acid? | The reaction is exothermic and can be dangerous if allowed to over-heat. |
| What is the role of the calcium chloride? | A drying-agent (absorb water) |
| What type of reaction is occurring? | Nucleophilic substitution |
| What is contained in the aqueous layer? | Water, acid, 2-methylpropan-2-ol. |
| What is the role of the hydrogencarbonate? | Neutralise any acid |
| What causes the froth? | Bubbles of carbon dioxide gas created by the reaction between hydrogencarbonate and the acid. |
| What do you know about the comparative density of the upper layer? | It's less than that of the lower layer. |
| What is the role of the magnesium sulfate? | Drying agent. |
| Why does the milky colour disappear after adding the magnesium sulfate? | The milky colour is an emulsion of water in the organic layer. It disappears as the water is absorbed by the drying agent. |
| What could happen if too much sulfate is added? | Some of the product could get absorbed by the drying agent and thus reduce yield. |
| What is the stoichiometry of the reaction? | 1:1 |

# Experiement C21: Synthesis of a solid organic product.

|  |  |
| --- | --- |
| Question on screen | Answer |
| What is the role of phosphoric acid? | catalyst |
| What is the role of phosphoric acid? | Aspirin (2-ethanoyloxybenzencarboxyilic acid) and ethanoic acid |
| How do you know the solid has dissolved? | It disappears from sight. |
| Why is the beaker placed in an ice bath? | To speed up the precipitation |
| Why use minimum amount of ethanol? Why warm ethanol? | In order to create a saturated solution of aspirin and not the impurities. |
| Why warm ethanol? | In order to ensure a saturated solution in warm ethanol but not in the cold ethanol, so that crystallisation occurs as the solution cools. |
| Where are the impurities at this stage? | In the liquid surrounding the crystals. |
| How can you assess whether your sample is pure? | Measure the melting-temperature. |

# Experiment C22: Two-step synthesis

|  |  |
| --- | --- |
| Question on screen | Answer |
| What forms above 10 oC? | Nitration could occur on more than one carbon in the benzene ring if the temperature is higher. |
| Why the need to wash the product with ethanol? | To remove any impurities that could be present on the solid. |
| Why the need to use a minimum volume of hot methanol? | To create a saturated solution of desired product but not of the impurities. |
| What’s the reason for adding acid at this stage? | The product exists as the sodium salt. By adding acid the free carboxylic acid is released, which is less soluble and therefore easier to isolate. |
| Why use only a minimum volume of HCl? | In order to create a saturated solution at a temperature which is higher than room temperature. |
| How do you know how pure your sample is? | Measure the melting-temperature |
| What affects percentage yield? | Reaction conditions e.g. temperature and also the number of steps in the method. |
|  |  |

# Experiment C23: Planning a sequence of tests to identify organic compounds.

No questions to answer

|  |  |
| --- | --- |
| Question on screen | Answer |
|  |  |

# Experiment C24: Paper chromatography

|  |  |
| --- | --- |
| Question on screen | Answer |
| Why use pencil? | Graphite is insoluble in the solvent. |
| Why leave gaps? | The dots tend to spread as they dissolve in the solvent and so enough room is needed to avoid spots merging. |
| Why have a small dot? | It's important to try to concentrate the inc into as small a space as possible (so that clear separation is achieved) |
|  |  |