Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **IA Advanced Planning Part 2** Date: \_\_\_\_\_\_\_\_\_Period: \_\_\_\_

**Plan A**

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| --- |
| **Research Question:** |
| **Independent variable (the variable you will change) =****Dependent variable (the variable you will measure) =****Control variables:**  |
| **How will you measure your dependent variable (what technique(s) will you use)?****What is the source of your procedure (give a reference to a book, webpage etc.)** |

**Plan B**

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| --- |
| **Research Question:** |
| **Independent variable (the variable you will change) =****Dependent variable (the variable you will measure) =****Control variables:**  |
| **How will you measure your dependent variable (what technique(s) will you use)?****What is the source of your procedure (give a reference to a book, webpage etc.)** |

**Some Common Quantitative Analytical Techniques in Chemistry**

The Vogel book has a much more extensive list but here is a list of the top 3

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| **Volumetric Analysis –** Determining an unknown amount of chemical by measuring volumes |
| The most common form is a **titration**, but it could be measuring the volume of a gas produced and then using gas law equations to determine the unknown chemical. In essence you are doing: Δ, eqn., Δ**Titration example**: let’s say you wanted to know the concentration of HCl:1. start with an equation for reaction involving the chemical you are trying to determine:

HCl is an acid so it will react with an alkali (base) like sodium hydroxide NaOH + HCl 🡪 NaCl + H2O1. Make a **standard solution**of the alkali (in this case) this was you **know** accurately its concentration.
2. Take an known volume (using a **pipette**) of this standard solution and put it in a conical flask. So if you have the concentration and the volume you can work out how many moles you have of it. That’s the first Δ
3. Using a burette, measure the volume of your unknown chemical (HCl in this case) required to react completely with your known chemical (NaOH in this case). You need an **indicator**so you can see when you’ve reacted all your chemicals. The point where all the chemicals have now reacted is called the **End Point.**
4. Since you’ve already done the first Δ, and you know the mole ratio from your equation, you can now work out the concentration of your unknown using the Δ again because concentration = no. moles ÷ volume and you have the number of moles from your equation step and you have the volume from your burette readings.

**Other points to note*** There are a few other ways of doing titrations such as using electrical conductivity measurements to know when the end point has been reached, but that only works for specific reactions (typically reactions that form precipitates).
* Sometimes titrations can be classified based on the type of reaction being done. In the example above this can be called an “acid/base titration” or a “neutralization titration”. The other two main types are redox titrations (when doing a redox reaction) or complexometric titration which involves transition metals. Most of our IAs will be acid/base or redox titrations. Redox reactions are studied in IB topic 9.
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| **Gravimetric Analysis -** Determining an unknown amount of chemical by measuring mass |
| This is common for reactions that: * produce gases because you can measure mass lost.
* Form precipitates because they can be filtered off and weighed
* Chemicals that decompose on heating, you can measure mass lost e.g. CuCO3(s) 🡪CuO(s) + CO2(g)
 |
| **Colorimetric Analysis-** Determining an unknown amount of chemical by color intensity  |
| Any chemical that makes a transparent colored solution can be used to determine concentration using a special piece of equipment called a colorimeter. Mrs. Roy has one and we will have one with our grant money. You make up a series of solutions of known concentration for the chemical you want to know. You measure each of absorbance or transmission of light through these solutions using the colorimeter and plot a calibration graph. Think, the more concentrated the solution, the darker its color, the more light it absorbs/the less that it transmits through. You then measure the absorbance or transmission of your unknown solution and then using your calibration graph you can read off what its concentration is. |