**Mr Hearn's IA guide**

Let's start with brainstorming:

BOX 1a

In this box, list any number of things that interest you. Anything at all (we will narrow it down to science later). This can include hobbies, interests, activities, objects, etc. Try to list as MANY things here as you can. Ex: Video Games, Bikes, Deejaying, airplanes, planets

Let's narrow the scope

BOX 1b

Using your list from Box 1a, "is there anything from your list that you would like to know more about or that you think could be modified or improved?" "Is there any data you'd like to dig into about this subject?" "Why are you interested in this topic?" (You don't have to do this for everything on your list from 1a).

Box 1c

Using Box 1b, make a question(s) you'd like to have answered about your topic. Avoid yes/no answer questions. What relevance does your question have to real life? (How can its answer benefit you or others?)

Box 1d

Can your question(s) from Box 1c be related to any Physics topics, equations, theories and/or laws? If so, which ones? If not, can the question be revised to include Physics topics?

Box 1e There are several different acceptable approaches to an IA from the IB programme. Place a check (or circle) next to the method that would be best for answering your research question. Don't think about what you would do here, think about the manner that seems most appropriate.

| | **IA Criteria given by IB** | **Teacher Clarifications** |
|---|---|---|
| | **Hands-on investigations** –This includes many traditional experiments. Investigations are not restricted to syllabus content, and the concepts and skills required need only be in line with the level of the course the student is taking | Choose an IV /DV and then select values of control variables that make those measurements easier and able to take on a wide range of values. Usually involves comparing to a known value / constant / empirically determined engineering properties. |

| | | |
|---|---|---|
| | **Modeling and spreadsheet investigations** –Here the student may process primary or secondary data and analyse it with a computer model. Spreadsheets and graphing software can be used in all investigation types. In some cases, real data can be compared to ideal or theoretical data by using a spreadsheet. | More advanced: Typically involves using a mathematical model to make a prediction of how a variable will change over time as a result of certain choices in parameter. Uncertainty comes from computer rounding and step sizes used in calculation. Examples: Predict temperature change for a simple climate model. Predict motion including velocity-dependent forces like drag. |
| | **Database investigations** –Here the student would access online databases for scientific information. They would design a method to answer their research question using the database, and perhaps graph or model their results. Teachers with large classes may encourage students to take this approach. | You should investigate several sources for information, and choose the best, but you must understand/explain how others collected this data,and explain/propagate uncertainties. Usually good for interesting, complex data. Could involve comparing to professional results using the same data. Examples: astronomical data for orbits, brightnesses , velocities; particle accelerator data, nuclear / quantum data |
| | **Computer-simulation investigations** – Investigations may involve computer simulations. Here, students can obtain information or data that will be processed to discover something that goes beyond the simulation's routine. Students can also combine a hands-on investigation with a computer model and compare the results. Students may also combine real data with a mathematical model. | You should be able to set at least one variable as a control variable in addition to your IV/DV. Explain why you set that control variable at the value you did. You must investigate SEVERAL simulations and justify why you chose this one. It MUST allow you to estimate and propagate uncertainties.Examples: Shooting charged particles into electric/magnetic fields, making measurements of phenomena too fast for hands-on data. |
| | **Hybrid investigations** –It is understood that students might perform any combination of the above investigation types. The types are not exclusive categories but rather illustrate the wide range of acceptable investigation types. | Examples: Using a database to look up specific heat capacities of materials, then testing them using hands-on data.Using database data as input to a modeling/spreadsheet calculation, as for nuclear reaction rates or radioactive decay.Collecting hands-on data to compare to the results of a simulation |

*Modified from Mrs. Hotchkiss's IB Year 2 Summer Assignment

***!!STOP HERE AND RECEIVE APPROVAL BEFORE MOVING ON TO THE NEXT SECTION!!***

Enhancing Design/Data Collection (Varies based on method of IA)

| Box 2a In this box, list your variables needed to research your question. If not incorporating hands on experimentation, skip to Box 2c. | | | | |
|---|---|---|---|---|
| Variable | IV, DV, C | Meaning of Variable in Words | Standard Unit | Instrument to measure the variable |
| | | | | |
| | | | | |
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| | | | | |

| Box 2b For each variable you listed as a control variable, briefly explain how you will successfully control the variable. For each measured variable, list the limitations/uncertainties you may encounter with equipment. |
|---|
| |

Box 2c List everything you will need for this investigation. Briefly state why each material is needed.

Box 2d List the steps you are going to take to answer your question. You can keep it general here, but in your IA you will need to be thorough in your steps. At the end of your list, state what data you are hoping to collect and how it will help answer your research question. If experimental, you will need to change your IV at least 5x and conduct at least 5 trials. Be sure to take pictures when you actually conduct your design!

Box 2e What are some limitations of your design? How might those limitations affect your evidence and/or ability to conclusively answer your research question? Are there any limitations you can fix before the investigation?

!!At this point you should begin collecting your data!!

Data Presentation

Box 3a How will you present your data? List the titles of your tables and graphs here that will be necessary to grant evidence. You should have more than one graph/table here!

Box 3b What mathematical model (equation) can you gather from your graph/table? What kind of relationship is displayed between your variables? (Proportional, inverse, exponential, etc)

Box 3c Does your graph/tables include uncertainties? (The answer SHOULD BE YES)

Box 3d Is there any other descriptions of your data that cannot be quantified? (Look, smell, feel, etc) Describe that data.

Box 3e Answer your question. Reference your graphs/tables and any other data you've collected. How do your limitations (Box 2c & 2e) of your investigation affect your data? Use CER.

*Claim: Answer the question*

*Evidence: Data you've collected that supports your claim. (State your limitations here)*

*Reasoning: How the evidence provided allows you to make an adequate claim. (Within the scope of your limitations.)*

Box 3f Discuss ways that you can improve your investigation. If you were going to do this again, how could you do it better? Provide at least 3 ways to improve the investigation.

How the IA is assessed

| **Personal Engagement** | **Exploration** | **Analysis** | **Evaluation** | **Communication** | Total |
|---|---|---|---|---|---|
| 2 (8%) | 6 (25%) | 6 (25%) | 6 (25%) | 4 (17%) | 24 (100%) |

Be sure to include a bibliography of every source you used!

You should include a title page with your research question and your word count DO NOT PUT YOUR NAME ON IT! You will be given a personal code to put there later. For now, leave your name out of the entire paper.

YOU NEVER PROVE ANYTHING! DO NOT SAY "I PROVED…."

Your personal engagement piece is to be woven throughout the entire document, not one paragraph.

Be sure to look at the rubric as you construct your paper.

Label graphs and tables "Figure 1", "Table 1", etc. This will make it easier to reference in your conclusion section.