

## IB Physics Summer Assignment (2023)

The focus of this summer will be on two parts of your Internal Assessment (IA).

- Complete the Personal Engagement piece of your IA
- Complete the Exploration piece of your IA

These two pieces of your IA start off the reader into your thought process and are pivotal in *building* your Internal Assessment and designing one at a high level.

Read each attachment given to you with this assignment regarding these key components. Here are some key components.

### **Personal Engagement:**

Does your topic choice play a role in your personal engagement mark?

Short answer, yes. But not a lot. The reader will identify the topic first, and then see if there is a relevant and authentic connection to the writer of the IA. Now, this is 8% of your IA mark total. The default mark is 1 / 2 points. So, to get that additional point (which is 4 % of your IA score and 0.8% of your IB score). Do not agonize over this too much. Just pick a topic and research question that interests you. And if there is a personal connection – then make that connection clear in your report. It's not just a paragraph. It'll be assessed throughout your IA holistically.

Here is the criteria for maximum points for the personal engagement piece:

***The evidence of personal engagement with the exploration is clear with significant independent thinking, initiative or creativity. The justification given for choosing the research question and/or the topic under investigation demonstrates personal significance, interest or curiosity. There is evidence of personal input and initiative in the designing, implementation or presentation of the investigation.***

To summarize, make sure that through your introduction and throughout your IA, you have hit these points of emphasis. Your opening statement in your IA should be a good introduction to this.

### **Exploration:**

This piece is the first impression of how your research, data, analysis and communication will be set up for the reader. In this section, focus on these parts:

#### **The Research Question**

You won't specifically start off with the research question. You will ease into it. Begin the exploration with a little bit of background into the topic itself. This is a great time to include research that was done previously that relates to your IA's topic.

#### **Background Information**

This introduction should streamline to a research question that is well stated and shows FOCUS regarding your IA. All the information in the background needs to be relevant, appropriate for IB level content (vigor) and enhances the understanding. Notice ENHANCES is the key term here. If you are simply stating content that we can read online or through a syllabus, this does not constitute enhancement.

### Methodology

Variables listed that are content-specific, and on topic are pivotal here. You also need to make sure that everything that's included has much detail. This includes the setup, materials, a diagram(s) of your setup (important) and making sure that your method and choice of data processing is CLEAR and relevant.

### Safety and Ethical Considerations

A lot of IA's may not have safety and ethical considerations when done in a lab bubble. But what about applying them to real-life scenarios and applications? Take careful consideration before you mention that your lab does NOT have any safety or ethical considerations. You know, it may not. But don't summarily dismiss this piece.

So, there are the two focus points of your summer assignment. To key in on your research question, to establish an introduction that hits on the personal engagement piece (at a high level), and then completing the exploration section of your IA. The rest of it will be addressed throughout the school year. **Read the attached rubric with this assignment. It is important to understand what the IB program and readers are seeking when reading and marking your IA.**

- Complete the Personal Engagement piece of your IA
- Complete the Exploration piece of your IA

See IA Ideas at the end of this document

## Personal Engagement

1	2
The evidence of personal engagement with the exploration is <b>limited</b> with <b>little</b> <i>independent thinking, initiative or creativity</i> .	The evidence of personal engagement with the exploration is <b>clear</b> with <b>significant</b> <i>independent thinking, initiative or creativity</i> .
The justification for research question and/or the investigation topic <b>choice does not demonstrate</b> <i>personal significance, interest or curiosity</i> .	The justification for research question and/or the investigation topic <b>choice demonstrates</b> <i>personal significance, interest or curiosity</i> .
There <b>is little</b> evidence of <i>personal input and initiative</i> in the designing, implementation or presentation of the investigation.	There <b>is</b> evidence of <i>personal input and initiative</i> in the designing, implementation or presentation of the investigation.

- Thinking, initiative or insight for investigating chosen topic is given
- Justification indicates personal interest, significance or curiosity for chosen design & presentation is given

## Part I - Exploration

### 1.1 | Research Question

1	2	3	4	5	6
Investigation topic is identified; Research question of <b>some relevance</b> is <b>stated</b> but <b>not focused</b>		Investigation topic is identified; Research question is <b>relevant</b> but <b>not fully focused</b>		Investigation topic is identified; Research question is <b>relevant, fully focused</b> and <b>clear</b>	

- A grammatically correct question about a precise relationship is asked
- A sufficiently detailed question to stand alone and be self explanatory is asked
- A specific measurable dependent variable is included
- A specific independent variable to be manipulated is included

### 1.2 | Background Information

1	2	3	4	5	6
Background information is <b>superficial</b> or of <b>limited relevance</b> and <b>does not aid</b> the understanding of context of the investigation.		Background information is <b>mainly appropriate, relevant</b> and <b>aids</b> the understanding of the context of the investigation.		Background information is <b>entirely appropriate, relevant</b> and <b>enhances</b> the understanding of the context of the investigation.	

- A well organized essay with paragraphs is given with an introduction, body and conclusion
- The introduction includes an observation that leads to the research question
- All key variables relevant to the experiment are investigated
- References scientific theory and any relevant equations or known relationships
- All information is clearly supported with references
- At least 3 appropriate sources with authors have been used
- There is no plagiarism (this will give a zero)

### 1.3 | Investigation Methodology

1	2	3	4	5	6
Investigation methodology is <b>appropriate</b> : addresses research question to a <b>very limited</b> extent; few of the significant factors that may influence the relevance, reliability and sufficiency of the collected data considered.		Investigation methodology is <b>mainly appropriate</b> : addresses the research question with limitations; some of the significant factors that may influence the relevance, reliability and sufficiency of the collected data considered.		Investigation methodology is <b>highly appropriate</b> : addresses research question; All or nearly all significant factors that may influence the relevance, reliability and sufficiency of the collected data considered.	

#### Variables

- Independent Variable, Dependent Variable and Controlled Variables are given and correct
- A very brief description of how the independent variable is modified is given
- A very brief description of how the dependent variable is measured is given
- Controlled variables include all significant variables that could affect the dependent variable
- A very brief description of why each controlled variable must be kept constant is given

#### Hypothesis (this is required for Biology reports but optional for Physics)

- The hypothesis can be supported through scientific research and reasoning
- A precise relationship between the independent and dependent variables is predicted
- There is an outcome listed

#### Methodology: Apparatus, Diagram, Method

- All materials are clearly listed with details (type, amount, size, volume, concentration...) with uncertainties
- Labelled diagrams and/or photographs clearly showing the setup of apparatus is included
- What was done and an explanation of why is given for each step
- How the independent variable was manipulated is clearly described
- How the listed controlled variables were kept controlled in the experiment is described
- The use and method of random sampling is described where relevant

#### Methodology: Choice of Data Processing

- The reliability of the methodology is established through sufficient repetition
- The number of dependent variable measurements and why this amount is described
- A very brief explanation about how experimental uncertainty is calculated is given

### 1.4 | Safety and Ethical Considerations

1	2	3	4	5	6
<b>Limited awareness</b> of the significant safety, ethical or environmental issues relevant to the investigation methodology		<b>Some awareness</b> of the significant safety, ethical or environmental issues relevant to the investigation methodology		<b>Full awareness</b> of the significant safety, ethical or environmental issues relevant to the investigation methodology	

- Comment on possible hazards, environmental, ethical and social impacts of the work
- Itemize how to deal with to minimize the impact

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1. How does temperature affect the spring constant of a spring?
2. How does temperature affect the speed of sound in a solid (or liquid)?
3. How does the cross-sectional area of a football affect the terminal velocity?
4. How does the diameter of a string affect the fundamental frequency?
5. How does sugar concentration affect the refractive index of water?
6. How does temperature affect the viscosity of fluids?
7. How does the length of a violin/guitar string affect the sustain time of the violin/guitar string after being plucked with a constant force?
8. How does the temperature affect the range of flight of an elastic band?
9. How does the temperature affect the internal resistance of a battery?
10. How does the angle of rotor blades affect the lift force of a toy helicopter?
11. How does the number of coils affect the efficiency of an electric motor?
12. How does the temperature affect the efficiency of a transformer?
13. How does the magnetic field strength of magnets affect the efficiency of an electric motor?
14. How does temperature of a copper wire affect the Young Modulus?
15. How does the concentration of salt in water affect the specific heat capacity?
16. How does the cross-sectional area of a sail on a toy boat affect the initial acceleration?
17. How does temperature affect the restitution of a bouncing ball?
18. How does the cross-sectional area of card attached to a vibrating mass affect the displacement of the mass after twenty oscillations?
19. How does the radius of a football affect the impulse on the football when kicked?
20. How does the mass added to an inflated balloon affect the terminal velocity of the falling balloon?
21. How does the width of rotor blades on a paper helicopter affect the terminal velocity of a paper helicopter?
22. How does the paddle area of a waterwheel affect the efficiency of the waterwheel when converting into electrical energy?
23. How does the angle of initial release of a pendulum affect the subsequent calculation of 'g' from the pendulum?
24. How does the temperature of water in a wine glass affect the resonant frequency of sound produced when the wine glass is struck and the rim begins to freely vibrate?

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25. How does the volume of water in a wine glass affect the resonant frequency of sound produced when the wine glass is struck and the rim begins to freely vibrate?
26. How does the temperature of grease affect the depth of crater created when a mass is dropped from a known height?
27. How does the distance between panes of glass in double glazing affect the rate of heat loss?
28. How does the number of panes of glass in double/triple/quadruple glazing affect the rate of heat loss?
29. How does the cross-sectional area of the pipe in a siphon affect the volumetric flow rate of the water in the siphon?
30. How does the height of a ramp affect the time taken for a cylinder to roll down the ramp?
31. How does the distance between two towers sustaining a flat metallic bar affect the vertical depression/sag produced when a known mass is added?
32. How does the breadth of a flat bridge affect the vertical depression/sag produced when a known mass is added?
33. How is the time period of oscillation of a solid sphere on a curved track affected by the radius of the solid sphere?
34. How does temperature affect the magnetic field strength of a permanent magnet?
35. How does the mass of dust covering a solar panel affect the efficiency of the solar panel?
36. How does the mass of a block affect its recoil distance after being impacted by a constant external force?
37. How is the slit spacing produced from a laser dependent on the distance from the screen?
38. How does the temperature of rubber affect the coefficient of static friction between the rubber and a surface?
39. How does the temperature of a guitar string affect the frequency produced when plucked at a constant force and left to vibrate freely?
40. How does the density of a liquid affect the angle subtended by the diffracted waves when the liquid is passed through a single slit in a ripple tank?
41. How does the radius of a copper pipe affect the time taken for a magnet to drop through it?
42. How does the resistivity of a metal pipe affect the time taken for a magnet to drop through it?
43. How does temperature affect the viscosity of castor oil?
44. How the temperature of a lubricant applied to the bottom of a solid affects the coefficient of dynamic friction when the solid is pulled along a surface?
45. How does the diameter of coil on a battery copper coil train affect the speed of train?

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