

Notes on lab Write up (Recap) for Dr. Mengyan

Introduction

[Ask yourself: “What is the purpose of this exercise?”, “What are we doing to test it?” and “what key information do I need to know in order to proceed?”]

- In 1 to 2 sentences, clearly state main objective(s) of exercise
 - o E.g.: “The purpose of this exercise is to test the impulse theorem.”
- In 1 to 2 sentences, give a very brief overview of how the objective was tested or completed
 - o E.g.: “This experiment measures the impulse of a collision two ways. First by measuring the change in a cart’s momentum before and after a collision and then by calculating the impulse by directly measuring the force exerted on the cart during the collision and the time during which the collision occurred.”
- With concise statements, identify the key physical principles, theories or laws and the associated equations (if appropriate) that are relevant to the experiment. If an equation is included be sure to also include a statement that identifies the parts of the equation.
Provide citation(s) for any work you reference that is not yours or derived from first principles
 - o E.g.: “Impulse is defined as $\vec{F}_{net}\Delta t$ which, by rearranging Newton’s 2nd law, we know

$$\Delta\vec{p}_{net} = \vec{F}_{net}\Delta t = Impulse \quad (1)$$

where $\Delta\vec{p}_{net}$ is the change in total momentum for the system, \vec{F}_{net} is the net force acting on the system and Δt is the time during which this interaction occurs.

[OpenStax College, College Physics. OpenStax College. 21 June 2012.
<http://cnx.org/content/col11406/latest>] “

Key Results

- In 1 to 3 sentences, state the main the overall ‘take home message’ of the lab. If there are multiple parts to the experiment you may have more than one statement
- HINT: Re-read the objective statement from the introduction and you should be able to write a key result statement for each stated objective.
E.g.: “This experiment successfully demonstrates that the impulse theorem (equation 1) is valid by comparing independent measurements of the (1) change of momentum for a cart that collides with an object and (2) the product of the net force exerted on the cart and the time during which this interaction occurred.”

Results (compare results with theory):

This should be no longer than one short paragraph.

- State your main results for the experiment and the % difference (or error) if available.
- Address how well the experimental results match [or do not match] the expectations
- State whether if the experimental objectives were satisfied
- E.g.: “The measured impulse from part one, magnetic repulsion were $\Delta\vec{p}_{net} = 0.31 \left[\text{kg} \frac{\text{m}}{\text{s}} \right]$ and $\vec{F}\Delta t = 0.33 \text{ [Ns]}$ which differ by -6.25% . The measured impulse from part two, the weak spring, were $\Delta\vec{p}_{net} = 0.45 \left[\text{kg} \frac{\text{m}}{\text{s}} \right]$ and $\vec{F}\Delta t = 0.39 \text{ [N s]}$ which differ by 14.3% . [...] The impulse theorem (equation 1) suggests that the measured impulse by either $\Delta\vec{p}_{net}$ or $\vec{F}\Delta t$ should yield the same values. [...] Since the measured impulse in parts one and two are fairly close, these data suggest that the impulse theorem is valid.”
- Of course the specific language, numbers and discussion ought to be adjusted as appropriate for the exercise

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Sources of experimental uncertainty suggested improvements to experiments)

[main areas to address: Justify any known experimental uncertainties/errors; what went well; what did not go well; improvements for future experiments] – This may be one or two short paragraphs.

- Specifically identify at least 3 sources of experimental error, for example
 - o Timer delay related to human/instrument reaction time or instrument resolution
 - o Intrinsic accuracy of equipment (e.g.: meter stick is only really accurate to ± 0.5 mm)
 - o Rolling resistance on a cart that the experiment 'expected' to be frictionless (this would introduce an acceleration slowing the cart that may not be accounted for in the theory relevant to the experiment)
 - o Aspects of experimental design that may introduce uncertainty (e.g. "we started the timer when we heard the command 'go' and this introduced some delay relating to the start time of the experiment related to the reaction of hearing the command and starting the timer. This may offset the actual start time by up to ~0.3 seconds which could then have the effect of")
- For each source of experimental error
 - o (1) Clearly and specifically identify the source or suspected source of the error
 - o (2) Specifically describe how this source of error may affect the measured parameters (will it make a value artificially higher, lower or could it do either?)
 - o (3) Suggest a way to reduce the impact of this particular source of error
- In a new paragraph, discuss any remaining issues– this is where you may make your additional statements about maybe you had a questionable measurement or calculation. If you know you did something that added uncertainty to the experiment (either intentionally or unintentionally) this is where you comment about it. If you know something happened but do not understand why it happened, still talk about it. (i.e. discuss your large or small % errors)
- NOTE: Each of these 'discussion' points can be done within a 2 to 4 sentences.