

The Scientific Method

MCCHS Honors Physics 2014-15

The Scientific Method

- When scientists look at the world, they see a network of rules and relationships that determine what will happen in a given situation.
- Everything you will study in this course was learned because someone looked out at the world and asked questions about how things work.
- There is no single procedure that scientists follow in their work. However, there are certain steps common to all good scientific investigations. These steps are called the *scientific method*.

The Scientific Method

- Most scientific work is not so easily separated.
- Exploratory experiments can be performed as a part of the first step to generate observations that can lead to a focused question.
- A revised hypothesis may require more experiments.

Ask a Question

Do research

Construct a Hypothesis

Test your hypothesis by doing an experiment

Analyze you data and draw a conclusion

Report your results (was your hypothesis correct?)

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- The physical world is very complex. Physicists often use **models** to explain the most fundamental features of various phenomena.
- Powerful models have been created to successfully describe nature. Most models used in physics are **mathematical models**.
- Simple models are usually developed first. It is often easier to study and model parts of a system or phenomenon one at a time. These simple models can then be combined into more comprehensive models.

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- Physicists decide which parts of the phenomenon are relevant and which parts can be **disregarded**.
- Many observations can be made about the situation, including the environment, surroundings, size, spin, weight, color, time, speed, and sound. It's often way too much!
- Typically, a single object and the items that **immediately affect it** are the focus of attention.
- This is often called the **ideal case**.

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- A scientific **hypothesis** is a reasonable explanation for observations: one that can be **tested** with additional experiments.
- The process of simplifying and modeling a situation can help you determine the relevant variables and identify a hypothesis for testing.

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- Models help guide experimental design.
- A hypothesis must be tested in a controlled experiment.
- In an experiment to test a hypothesis, you must change one variable at a time to determine what influences the phenomenon you are observing.

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- The best physics models can make predictions in new situations.
- Even if some experiments produce results that support a certain model, at any time another experiment may produce results that do not support the model.
- When this occurs, scientists repeat the experiment until they are sure that the results are not in error. If the unexpected results are confirmed, the model must be abandoned or revised.

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- That is why the last step of the scientific method is so important.
- A conclusion is valid only if it can be verified by other people.
