**Nature of Science Study Guide**

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| **Skills*** Students will be able to…
 | 1. Explain what physics is about.
2. Explain why mathematics is the language of science.
3. Engage in student-led discourse using Socratic method, (Social Science integration/same guidelines) Carry on productive and constructive conversations.
4. Scrutinize information (later to be empirical lab data) we all have in front of us.
5. Critique and develop arguments. x
6. Arrive at a consensus x.
7. Draw conclusions or develop models based on evidence.
8. Outline scientific methods.
9. Describe circumstances under which a hypothesis, law, or principle must be changed or abandoned.
10. Determine whether a hypothesis is scientific.
11. Distinguish between science and technology.
12. Distinguish among science, art, and religion.
13. Perform a controlled experiment and analyze the results.
14. Differentiate between independent and dependent variables.
15. Convert numbers within the metric system to others.
16. Convert numbers using unit analysis.
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| **Content*** Students will know...
 | 1. Physics is about the nature of basic things such as motion, forces, energy, matter, heat, sound, light, and the composition of atoms.
2. When scientific findings in nature are expressed mathematically, they are easier to verify or disprove by experiment.
3. Scientific methods generally include some, if not all, of the following:
4. Recognize a problem
5. Make a prediction – a hypothesis – about the answer
6. Perform experiments to test predictions
7. Formulate the simplest general rule that organizes the main ingredients: hypothesis, prediction, and experimental outcome.
8. If a scientist finds evidence that contradicts a hypothesis, law, or principle, then the hypothesis, law, or principle must be abandoned or changed.
9. To determine whether a hypothesis is scientific or not, look to see if there is a test for proving it wrong.
10. Science is a method of answering theoretical questions; technology is a method of solving practical problems.
11. Science is mostly concerned with discovering and recording natural phenomena, the arts are concerned with the value of human interactions as they pertain to the senses, and religion is concerned with the source, purpose, and meaning of everything.
12. The metric system, base units and prefixes.
13. Measurements have associated uncertainty.
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**Key Terms**

Scientific Methods:

Fact:

Hypothesis:

Independent Variable:

Dependent Variable:

Unit:

Quantity:

Metric System (SI):

Control:

Variable:

Unit Analysis:

Science:

Kilo:

Milli:

Centi:

Physics:

**Part I.** Use these words to fill in the blanks about the scientific method:

theory, law, hypothesis, variable, controls, data, conclusion, physical science, biology, physics

1. Study of living things.
2. Study of chemistry and physics – matter and energy.
3. The study of energy.
4. An educated prediction.
5. Anything that may change in an experiment. In math they call it x, y, or z.
6. The things you keep the same in an experiment. It gives you something to compare to, to prove your hypothesis.
7. After you prove your hypothesis many times it becomes this.
8. Gravity is an example of this, a theory that is generally accepted as true.
9. The information recorded in your experiment.
10. The final part of your experiment. It explains whether or not you proved your hypothesis. It also explains any errors and things that you would need to do differently next time.

**Part II.** Read this experiment and then answer the questions.

Experiment I: John Jones guessed that heavy objects fall faster than light objects. He held two books in one hand and 1 book in the other hand. He held them at the SAME height and dropped them at the SAME time. He recorded the time it took for each to reach the ground. He observed that BOTH hit the ground at the same time. He concluded that heavy and light objects reach the ground at the same time.

Experiment II: John Jones revised his first hypothesis. Now he stated that all objects fall at the same rate, assuming there is no air resistance. To test this hypothesis, he put a coin and a feather in a vacuum tube. He removed all the air. He dropped the coin and feather, without air. He noticed that BOTH hit the bottom of the tube at the same time. He concluded that all objects fall at the same rate, assuming there is no air resistance.

1. What is the hypothesis for experiment I?
2. What is the control for experiment I?
3. What is the conclusion for experiment I?
4. What is the control for experiment II?
5. When could this 2nd conclusion become a theory or law of science?
6. T or F Scientific theories are continually being revised as new information is gathered.
7. T or F Once we have established a theory, it never changes again.

**Part III** Use these words to fill in the blanks:

meter centimeter millimeter kilometer liter milliliter gram kilogram milligram weight mass volume SI English System Celsius

1. Old out of date system that uses inches, feet, yards and miles.
2. This stands for metric system.
3. Metric unit for length.
4. Metric unit for mass.
5. Metric unit for volume.
6. Amount of substance or matter in an object.
7. Basic unit of measuring temperature used in the metric system.
8. What unit would you use to measure the distance between cities?
9. What unit would you use to measure the length this room?
10. What unit would you use to measure your mass?
11. How many centimeters in a meter?
12. What is your height in centimeters? Meters?
13. How many meters in a kilometer?

**Part IV** Metric Conversion

31. 55 cm = \_\_\_\_\_\_\_\_\_\_m

32. 1 cm = \_\_\_\_\_\_\_\_\_m

33. 165 cm = \_\_\_\_\_\_\_\_\_m

34. 5 km = \_\_\_\_\_\_\_\_\_\_m

35. .43 km = \_\_\_\_\_\_\_\_\_\_\_m

36. 3.210km = \_\_\_\_\_\_\_\_\_\_\_m

37. 3 m = \_\_\_\_\_\_\_\_\_cm

38. 3.4 m = \_\_\_\_\_\_\_\_\_\_\_\_cm

39. 0.4 m = \_\_\_\_\_\_\_\_\_\_cm

40. 345 m = \_\_\_\_\_\_\_\_\_\_km

41. 1000 m = \_\_\_\_\_\_\_\_\_\_km

42. 100 m = \_\_\_\_\_\_\_\_\_

**Part V** Unit Analysis

43. 23 feet per second is how many miles per hour?

1 mile = 5280 feet

1 minute = 60 seconds

1 hour = 60 minutes

44. 75 miles per hour is how many feet per second?

1 mile = 5280 feet

1 minute = 60 seconds

1 hour = 60 minutes

45. One gallon for fifteen miles is how many dollars per day?

1 hour to travel 55 miles

1 gallon is $3.10

1 driving day is 10 hours