Science Fair Log Book and Helpful Hints

Use what you need. You may change, add or take away pages to make this your own.

Scientific Method

What is a testable scientific question?
A scientific question is one that has a variable that can be tested. For example, how does the color of an ice cube affect how quickly it will melt? This is testable because you can change the color of the ice cubes (variable). "Why does a volcano erupt?" is not a testable question because the answer can be found by looking in a textbook.

Why do I need to do research first?
Scientists try to find out as much as they can about their topic before making a hypothesis. They are not looking for a direct answer for their question. Scientists use books, magazines, the internet, etc. to help them learn more about their topic. You need enough information to write a paragraph about your topic. Remember to include a list of your sources at the end.

What is the difference between a prediction and a hypothesis?
A prediction is an educated guess based on background knowledge or fact. A hypothesis is an educated guess that can be tested. For example we might predict what type of microorganisms we might find in pond water. We might make a hypothesis about what would happen to the heart rates of those microorganisms if we added caffeine to their water.

Why should you use if/then statements when writing a hypothesis?
A hypothesis should include both of the variables in the experiment; those things that change. Using if/then statements ensure that you include both variables. For example: If we add caffeine to pond water, then the heart rates of the microorganisms will increase.

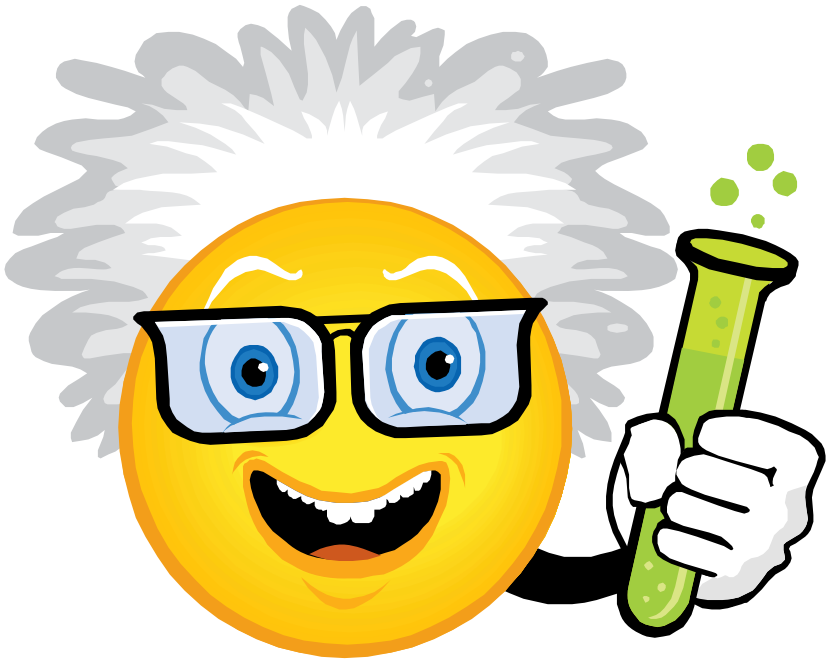
What is the difference between a manipulated and responding variable in an experiment?
The manipulated variable is what *you* change. The responding variable is what changes because of the experiment. For example: the color of the ice cube would be the manipulated variable and the time it would take each color to melt would be the responding variable.

What are constants? (Controlled Variables)
Constants are all of the factors that you keep the same in an experiment. In the melting ice cube example you would want the ice cubes to be the same size, all made of water, and given the same amount of heat.

Why are data tables used?
Data tables are used to record what happens during an experiment. They always include a title, labels, and information about both variables. (See example)

What rules should always be followed when making a graph?
Always remember that the manipulated variable goes on the x-axis, and the responding variable goes on the y-axis. The graph should always have a title, labels, and units of measurement. Use a bar graph for comparisons, or a line graph to show changes over time. (See examples) <u>Only one graph is needed.</u>

What must be in the conclusion?
The conclusion is written as a paragraph. Be sure to accept or reject your hypothesis. Explain why you accepted or rejected your hypothesis using data from the lab. Include a summary of the data- averages, highest-lowest, etc. Discuss possible errors that could have occurred in the experiment.



Science Fair Project

Student Name _____

Teacher _____

Possible Research Questions

1. Which brand of dish soap makes the most bubbles?
2. Do crickets like cheese or sugar better?
3. What makes the best insulator to keep hot things hot or cold things cold? (Styrofoam, bubble wrap, fur, foil, plastic)
4. How does the temperature affect plant growth?
5. What type of soil is best for plant growth?
6. Does cold, room-temperature, or warm water freeze fastest?
7. Does food coloring affect the time it takes water to freeze?
8. Does food coloring affect the time it takes water to evaporate?
9. Does sugar prolong the life of cut flowers?
10. What brand of diaper holds more liquid?
11. What brand of marker lasts longer?
12. How does chlorine affect plant growth?
13. What brand of batteries last longer?
14. What will cause a pinewood derby car to go faster—WD40 oil or graphite on the axel?
15. Where should the most weight be placed in order to get fastest results in a pinewood derby car—front, back, evenly distributed?
16. Which rolls farther—a Matchbox car, or a Hotwheels car?
17. What brand of paper towel is strongest when wet?
18. How does adding mass affect how far a paper airplane flies?
19. Does the color of the light affect plant growth?
20. Which brand of popcorn pops the most kernels?
21. Does an ice cube melt faster in water or air?
22. Which surface do suction cups stick to best?
23. Does salt water or fresh water evaporate faster?
24. Which cleaner removes an ink stain the best?
25. Which type of soil absorbs the most heat?
26. Which metal conducts heat the best?

Question:

_____

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I chose this question because _____

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_____

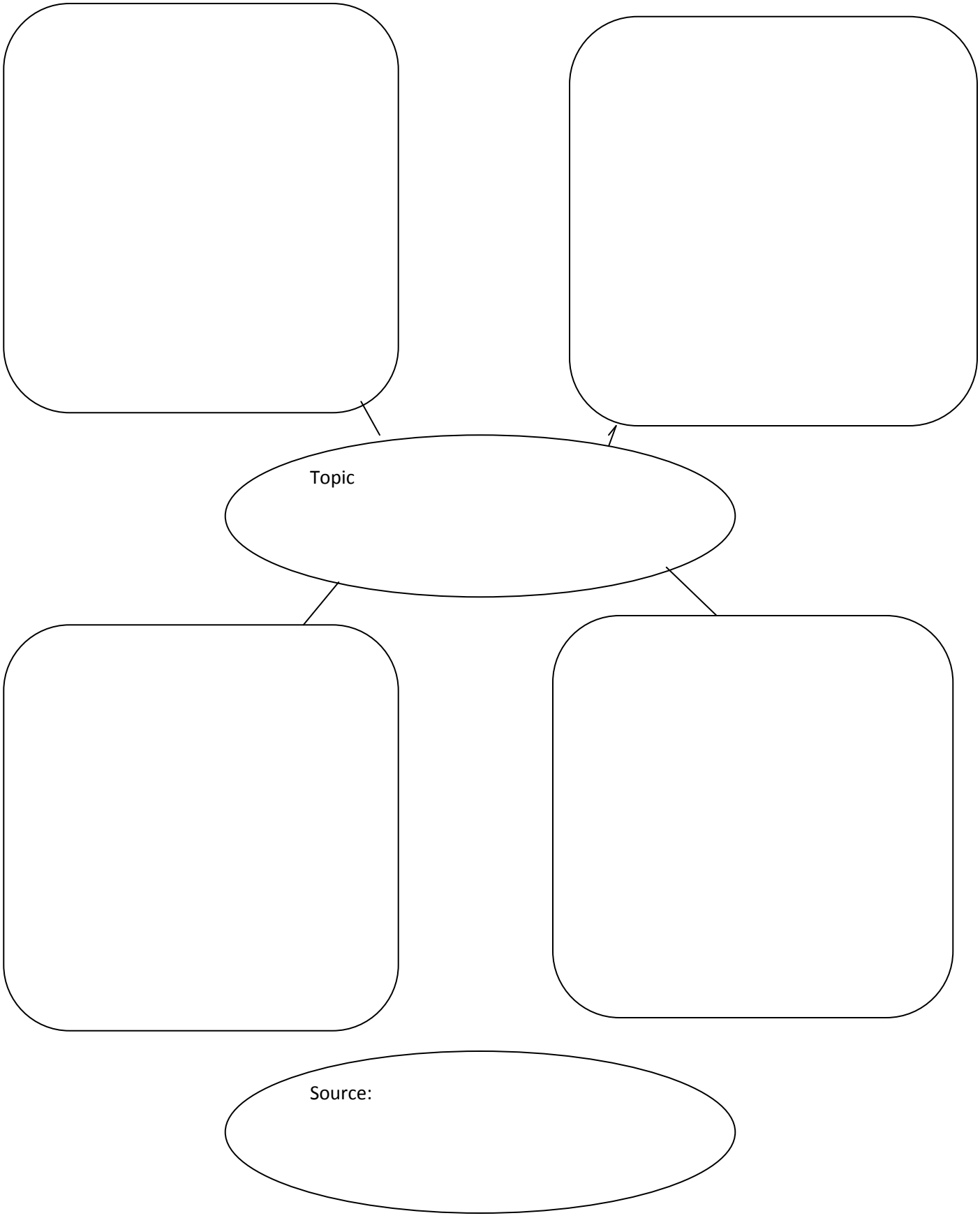
Approved _____Teacher's Initials

Approved _____ Parent's Initials

Research Keywords

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Research



Research – Summary Paragraph

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Hypothesis

If_____

then_____

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Variables

Manipulated Variable _____

Responding Variable _____

Constants (Controlled) _____

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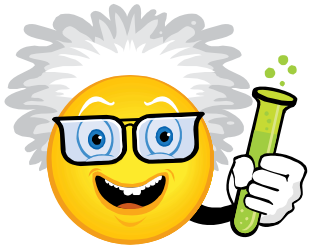
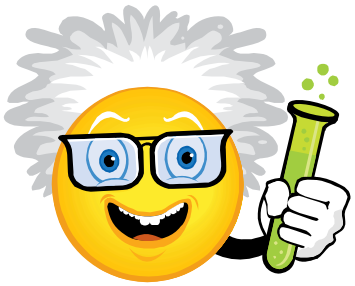


Materials

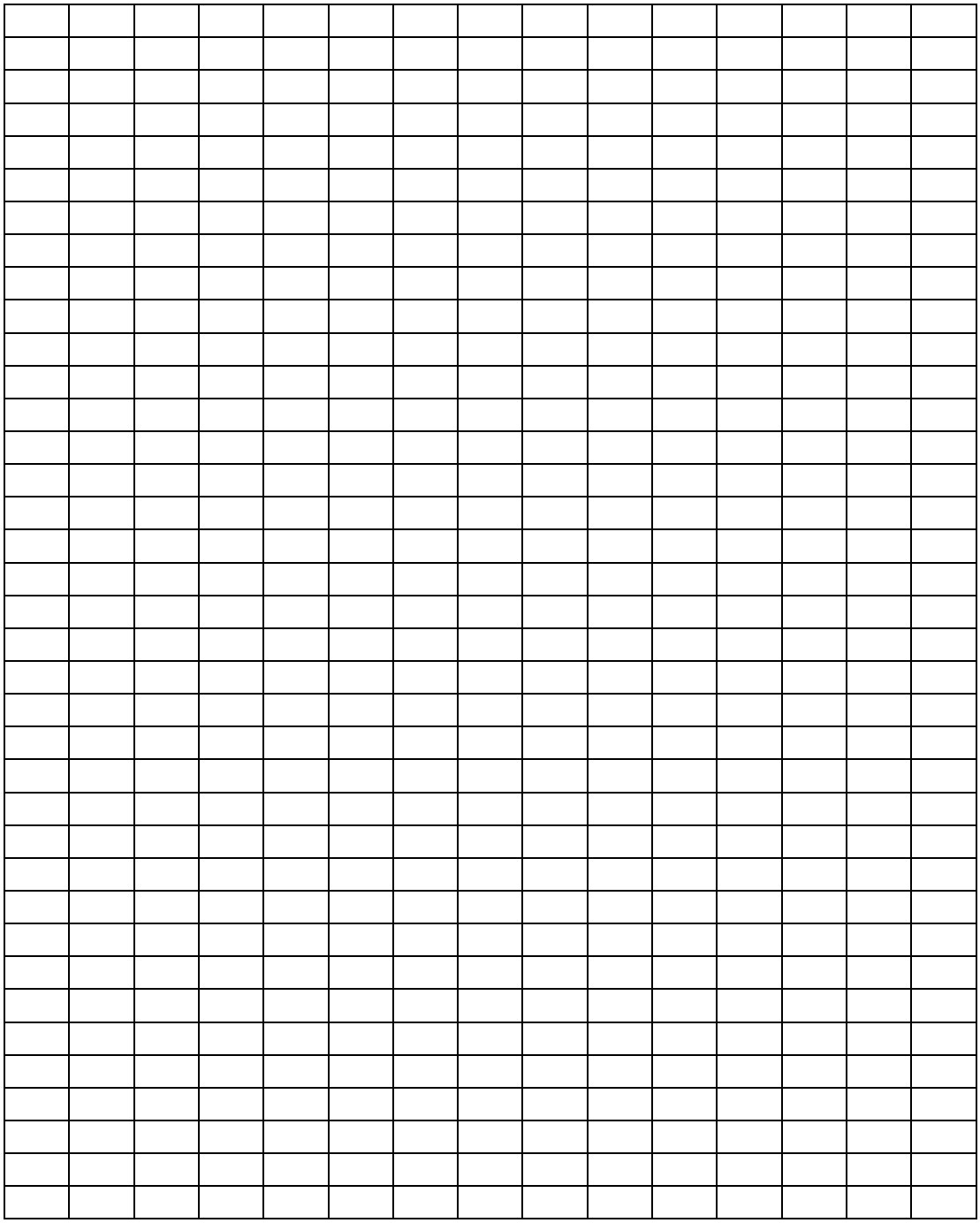
Procedures



Data

Column for the Manipulated Variable	Column for the Responding Variable				Column for Derived Quantity (Averages)
	Trials				
	1	2	3	4	

Title _____



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Line Graph – Use for experiments that show changes over time. For example, you would use a line graph to show how much a plant has grown.

Conclusion: The hypothesis was / was not supported by the data.

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Next time: _____ _____

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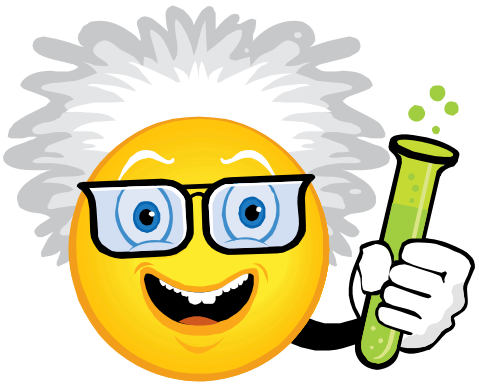
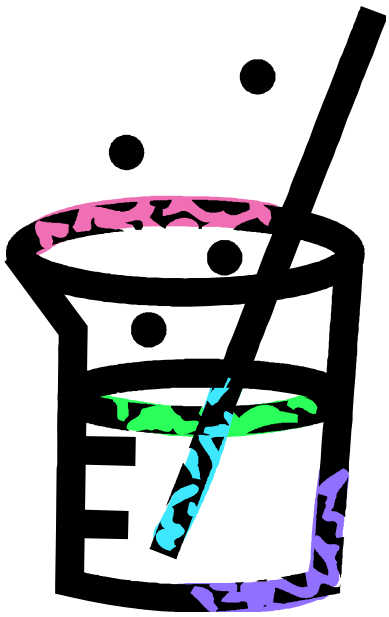


Reference & Appendix



Elementary (Grades 3-5) Judging Rubric

Student Name:	
Project Category:	
Project Location:	Project ID #:

	No Evidence	Evident but Incomplete	Evident & Complete	Superior Example
1. Presented a testable question or problem that could be addressed with an experiment or the design process	0	1	2	3
2. Proposed a hypothesis or engineering solution that gives a testable answer to the question/ problem.	0	1	2	3
3. Correctly identified one independent/ manipulated variable and one dependent/responding, measurable variable.	0	1	2	3
4. Evidence of grade-level appropriate background research.	0	1	2	3
5. Procedures are described in sufficient detail to allow replication by another person.	0	1	2	3
6. Evidence of a thorough experiment/ engineering plan with proper controls. (i.e. photos, diagrams, data tables)	0	1	2	3
7. Observations or data recorded in a log book during the experiment/ process.	0	1	2	3
8. Appropriate tools/equipment were used to collect data.	0	1	2	3
9. Data presented is relevant to the question or problem.	0	1	2	3
10. Data is displayed in an age-appropriate table and graph.	0	1	2	3
11. The data was used to answer the question or to evaluate the hypothesis or problem.	0	1	2	3
12. The conclusion was supported with evidence. (No penalty for inconclusive data)	0	1	2	3
13. The project is presented in a manner that makes the purpose, procedure, and results clear.	0	1	2	3
14. Included age-appropriate visual components to provide a detailed description of the project	0	1	2	3
15. Student displayed creativity in the question, approach, technique, and/or the explanation.	0	1	2	3
Total Score: _____/45				

Data Collection

The Effect of Paper Airplane Mass on Air Time (s)

Column for the Independent/Manipulated Variable	Column for the Dependent/Responding Variable				Column for Derived Quantity
Mass of Paper Airplane (g)	Amount of Time in Air (s) Trials				Average Air Time (s)
	1	2	3	4	
10					
20					
30					

1. Data tables should always have a title that includes both variables.
2. The titles should also include units of measurement when appropriate.
3. The independent/manipulated variable should appear in the left hand column.
4. The dependent/responding variable should appear in the right hand column.
5. When repeated trials are conducted, they are recorded in subdivisions of the dependent/responding variable column.
6. **If** derived quantities are calculated (such as averages), they are recorded in an additional column to the right.
7. When recording data in a table, the values of the independent variable are ordered. The data may be arranged from smallest to largest, or largest to smallest.

**Please note, the shaded row was for reference only, and should not be included on a data table.

Scientific Measurement

Type of Measurement	**Base Unit of Measure**	**Common Variations of the Base Unit**	**Equipment Used**
Length The distance between two points.	meter (m)	kilometer (km), centimeter (cm), millimeter (mm)	ruler, meter stick, tape, measure
Liquid Volume The amount of space taken up by a liquid.	liter (L)	milliliter (mL)	graduated cylinder, buret
Mass The amount of material in an object.	gram (g)	milligram (mg), kilogram (kg)	triple beam balance, electronic balance
Temperature A measurement of the average kinetic energy of the particles in a sample of matter.	Celsius (C)	Boiling point of water = 100 degree Celsius Freezing point of water = 0 degrees Celsius	thermometer

Title _____

_____ _____ _____

_____

Bar Graph – Use for experiments that make comparisons. For example, you would use a bar graph to compare the distance traveled by different brands of toy cars.