The Design Process

ask

Define the problem.

Write the question in your own words.

What is it?
Who has it?
Why is it important to solve?

imagine

Brainstorm some possible solutions.
Learn new content and skills needed.
Research and generate ideas.
Identify criteria and specify constraints.

plan

THINK!
SKETCH!
LABEL!
Select an approach.
Develop a design.
What does the best possible solution look like?

create

Make a prototype.
Does your prototype look like your planning sketch?

test

Test and evaluate your solution based on the established criteria.

Collect data.

What worked?
What didn't?

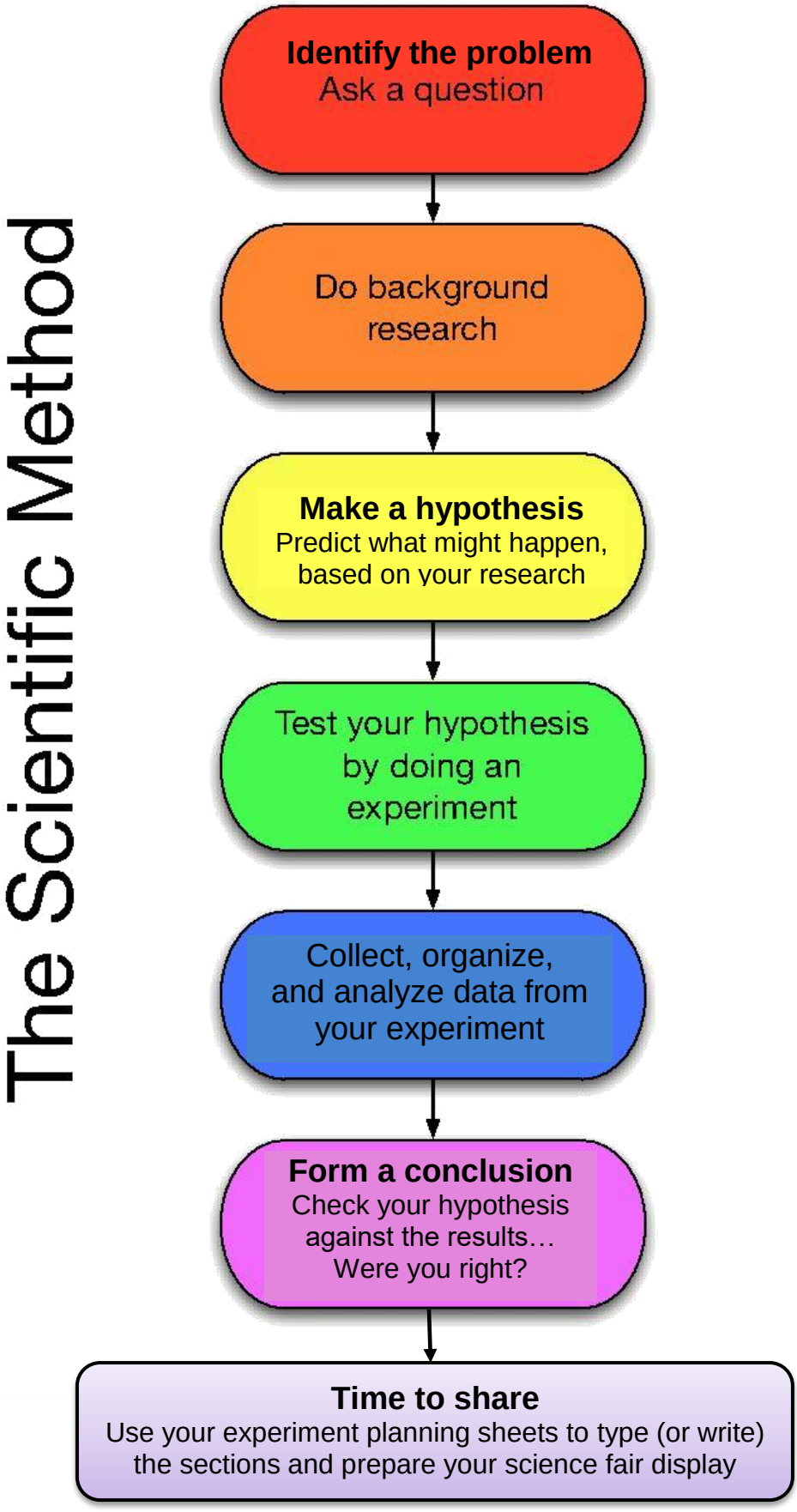
improve

Refine your design.
How can you modify your design to make it better?

share

What steps did you take to get your model to work?
What is the best feature of your design?
What else would you change?

Here are the Steps for the Scientific Method:



The Scientific Method

The 5 Steps of the Scientific Method

1. Ask a Question

What is it that you want to know?

Start with an idea that you are unsure about.

Use your senses to observe & do some research about the topic and question you have.

2. Hypothesize!

Make an educated guess as to what will happen when you test.

3. Do an Experiment

Plan how to test your hypothesis

Gather materials needed

Design your experiment

4. Evaluate your Data

Record, evaluate and think about your data.

What happened?

5. Draw a Conclusion

Did your experiment answer your question?

Was your hypothesis correct?
Why or why not?

1 Ask a Question

What are some things you are curious or unsure about?

- _____
- _____
- _____

Finish the sentences:

What happens when . . .

I wonder why . . .

Write a list of the questions you have:

_____

_____

_____

_____

Write down the question you want to explore the most right now:

_____

Observations & initial research:

_____

_____

_____

_____

_____

_____

_____

2 Make a Hypothesis

Based on the information you gathered, you'll make an educated guess about the answer to your question.

Write out the question you want to test:

_____

Make your question testable:

- Does changing _____ affect _____?
- If I change _____, will it affect _____?
- How does changing _____ affect _____?

Write the final question in it's testable form:

_____

How do you think you might test this question? What kind of experiment could you perform?

_____

_____

_____

_____

My Hypothesis

Here's what I **think** is going to happen:

3 Do an Experiment

Identify the variables in your experiment:

Independent Variable:

A good experiment will have only one independent variable.

(What will **you** be changing?)

Dependent Variable:

(What will you be measuring?)

Materials needed:

- _____
- _____
- _____
- _____
- _____
- _____

Controlled Variable(s):

(What is staying the same?)

Procedure

4 Evaluate Your Data

Record what happened when you performed your experiment, along with the final result:

5 Draw a Conclusion

Did your experiment answer your question? Explain why or why not.

Was your hypothesis correct? ☐ Yes ☐ No

Here are some things I learned from this experiment:

Final reflections and other questions this experiment made me wonder about:

Scientific Method

Use this page to write down information for your experiment.

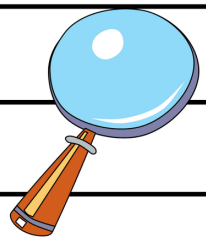
Question:

Hypothesis:

Experiment:

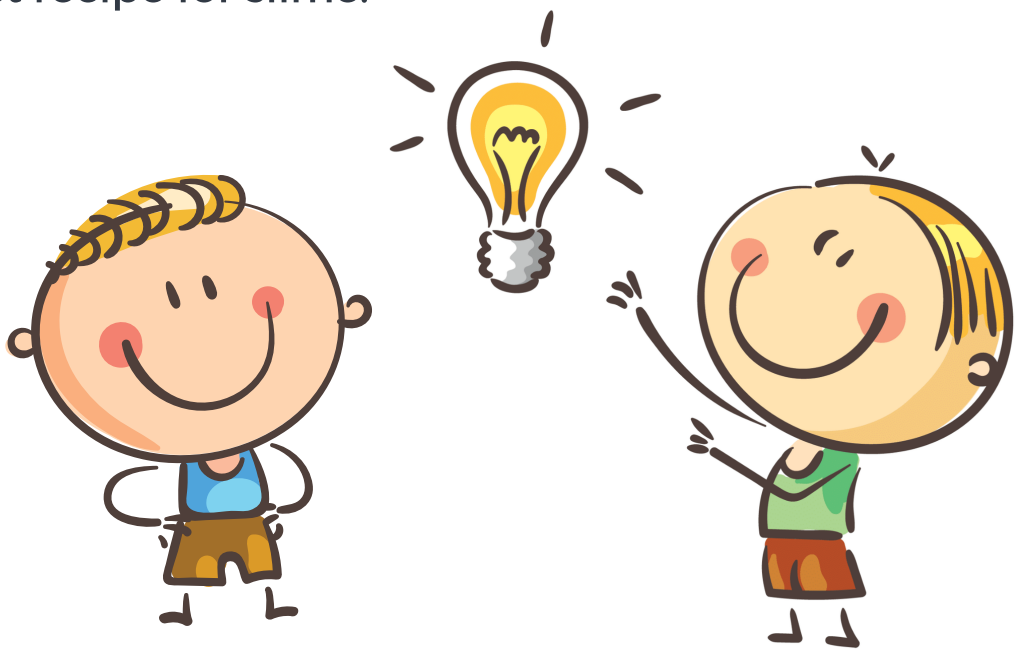
Data:

Conclusion:



10 Science Experiment Ideas

1. Solubility of common household substances.
2. Cleanliness of items we use daily.
3. Liquid density experiments.
4. Designing the best paper airplane.
5. Can you keep fruit from turning brown?
6. Plant growth and fertilizers.
7. Compare household soaps and disinfectants.
8. Effect of sugar substitutes on taste.
9. Coke and Mentos Experiments
10. Best recipe for slime.

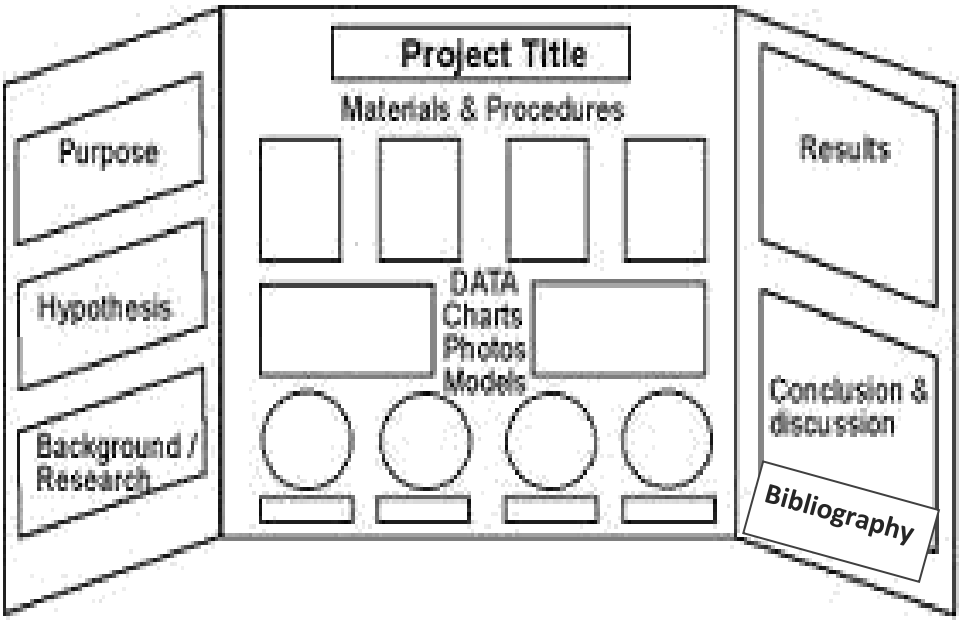


Testable Questions for Science Fair Projects

- Does the type of liquid affect how fast an ice cube melts?
- Does changing the temperature of water affect the buoyancy of an egg?
- Does the amount of Mentos (white candy) affect the height of the pop explosion? (remember you cannot use brand names on your board or journal)
- Does the type of wood affect how long it burns?
- Does the flavor of ice cream affect how fast the ice cream melts?
- Does changing the wingtip direction affect an airplane's flight?
- Does the type liquid given to a plant affect its growth?
- Does changing the movement of water affect the shade (color) of the water?
- Does changing the height of a ramp affect how far a car will travel?
- Does the type of liquid affect how fast ice will melt?
- Does the type of shoe worn during a 20 yard dash affect the speed in which you can run?
- Does changing the size of a paper airplane affect how far it flies?
- How does the type of liquid affect how much a penny will corrode in 5 minutes?
- How does changing the amount of baking soda and vinegar affect the height of an explosion? (careful to change only one: baking soda **or** vinegar)
- Does changing the type of liquid affect how quickly a nail will corrode (rust)?
- Does the brand of detergent affect how thoroughly it gets a grass stain out?
- How does the type of light affect how quickly a plant will grow?
- Does surface temperature of a glass affect fingerprints?
- Do artificial sugars attract ants?
- What is the effect of pH on the lifespan of tadpoles?
- Do fertilizers affect the health of earthworms?
- Does the type of insulation on the wire affect the strength of an electromagnet?
- What effect does temperature have on the strength of different types of magnets?
- On which surface can a snail move the fastest-dirt, cement, or grass?
- What is the effect of light on rate of seed germination?
- Do mint leaves repel ants, worms, or isopods?
- What is the effect of increased or decreased oxygen on plant growth?
- Does the direction seeds are planted affect plant growth?
- Is there an effect on evaporation rates when forming crystals from sugar and sugar substitutes?
- Does the length of the wire affect the power of the circuit?
- Can you make an electromagnet stronger by adding more electric cells to the circuit?
- Which antacid is the most effective in neutralizing an acid?
- What materials provide the best insulation?
- Which electromagnet design is the strongest?
- Through what material does sound travel the best?
- What material is the best to keep heat in?
- Does temperature affect the life of a battery?
- What material filters oily water the best?
- Will more air inside a basketball make it bounce higher?
- Does the thickness of the wire affect the power of the circuit?

- Does the length of the wire affect the strength of an electromagnet?
- Does an earthworm react to light, partial shade, or darkness?
- What type of soil filters polluted water the best?
- Does surrounding color affect an insect's eating habits?
- What is the effect of different amounts of chlorine on plant growth- large amount, small amount, or no chlorine?
- What is the effect of different amounts of air movement on plant growth?
- Do ants prefer artificial sweeteners, natural sugar, or hard candy?
- What is the effect of a magnetic field on plant growth?
- Can mealworms or other invertebrates be taught to go through a maze?
- How does the temperature of a tennis ball affect the height of its bounce?
- How does the air pressure of a soccer ball affect how far it travels when kicked?
- Which increases your heart rate more: walking up and down real stairs or using a stair-master?
- How does the temperature of water affect the time its takes to freeze into ice cubes?
- How will adding different flavors of Kool-Aid to water affect the water's boiling point?
- Which brand of popcorn leaves the fewest unpopped kernels?
- Does the flavor of gelatin affect the amount of time it takes to set?
- Given the same amount of water, how does pot size affect the amount of time it takes to boil?
- Which type of bread turns moldy first: store bought or bakery bread?
- How does a light bulb's wattage affect the amount of heat detected above a light?
- Which can support more weight: paper or plastic grocery bags?
- What brand of paper towel is most absorbent?
- Does a no name stain remover work just as well as a brand name?
- Does the color of a shirt affect the amount of heat it absorbs?
- How does temperature affect the growth of mold?
- Do different brands of batteries last longer than others?
- Which stays fresher longer: organic or non-organic fruit?
- Can people use their sense of hearing alone to tell apart a penny, nickel, dime, and quarter?
- Can blindfolded people tell the difference between bottled water and tap water?
- How does increasing the height of a ramp affect how far a ball rolls down the ramp?
- How does caffeine affect people's heart rate?
- Which type of container traps the most heat: a shoe box covered in aluminum foil, plastic wrap, or wax paper?
- Do thunderstorms happen more often in the afternoon than in the morning?
- Which kind of gum keeps its flavor longer: sugar free or regular?
- Does having worms in soil help plants grow faster?
- What is the effect of salt on the boiling temperature of water?
- How does talking on a cell phone or listening to music affect reaction time?
- Do earthquakes tend to occur at certain times of day?
- How does temperature affect a magnet?

Step Seven: Prepare Your Display



1. Title of Project (Problem studied in form of question)
2. Purpose- why you did the project
3. Hypothesis
4. Background description – summary of research
5. Materials, Procedure, Variables
6. Data Charts and Graphs
7. Photos with Captions
8. Results summary
9. Conclusion
10. Bibliography
11. You may bring appropriate samples to add to your display (see rules and safety sections).
12. Bring your completed planning packet to the Science Fair.

Hints for Your Board

- ✓ Keep lettering neat and a dark color like black or blue.
- ✓ Frame your work with a complimentary color.
- ✓ Lay out your papers before you glue.
- ✓ Use a ruler to keep it straight.
- ✓ Type or print very neatly.
- ✓ No Cross Outs. Erase Neatly.
- ✓ No tape should be showing! Glue sticks work well!
- ✓ Space your items.
- ✓ Fill empty space with drawings or clip art, but do not clutter.
- ✓ Use a larger font for titles.
- ✓ Each section should be titled.
- ✓ Follow the sample display format as closely as possible. It makes it easier to read.
- ✓ Yellow is a hard color to read for lettering. Only use it to frame a picture.
- ✓ Do not use too much color.
- ✓ Keep it simple and attractive.
- ✓ Be creative with your title to invite the audience to read it.
- ✓ Place your notes or sample materials (if appropriate) in front of your board along with your completed packet.
- ✓ Use photos to document your experiment. Ask your parent to be your photographer.