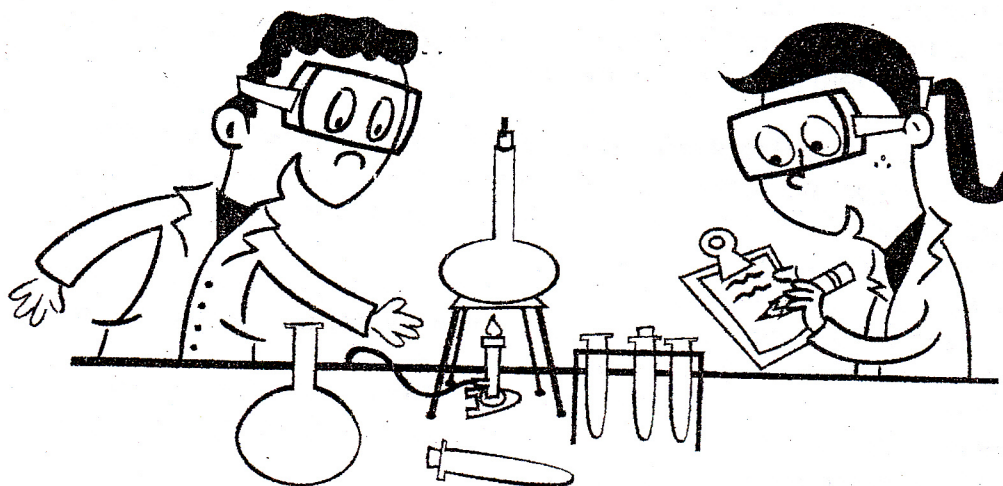


Steps to the Scientific Method

Name: _____ Date: _____

Your teacher has just announced that there's going to be a science fair this year, and that your project needs to follow the scientific method—the step-by-step process that scientists follow when they perform an experiment. Where should you begin? Step One: Don't panic! Step Two: Check out the cheat sheet below. It outlines the scientific method.



1. Make an observation. Then, propose a research question based on your observation.

A good science-fair project question is testable and measurable. For example: *Which brand of bubble gum keeps its flavor longest?* You can test this by chewing different brands of gum and measuring how long the flavor lasts for each brand. The best questions are usually ones that you have a genuine interest in answering.

2. Identify the variables.

A science-fair project involves *variables*, or things that change or could be changed. There are two types of variables: independent and dependent variables. An *independent variable* is one that you change on purpose. For instance, if you were experimenting to find out which brand of gum keeps its flavor longest, you may choose to test three different brands of bubble gum. The *dependent variable*, or the factor that responds to a change in the independent variable, would be the amount of time that the flavor lasts.

You'll also want to identify your *constants*, or things that will stay unchanged. For instance, you might test only bubble gum that is sugar free. And to make sure that the amount of gum you test is equal each time, you might choose to test only sticks of gum—not gumballs.

3. Research your topic to learn more about it.

Research comes in many forms. You can research a topic by going to the library, performing Internet research, interviewing a scientist, or even speaking with experts at museums, zoos, hospitals, and so on. For our example, you might interview a spokesperson or scientist from a bubble-gum company.

4. Develop a hypothesis, or a possible answer to your question.

Your *hypothesis* should be based on your research. It is important to remember that it is okay if your hypothesis turns out to be wrong. You can learn a lot from any hypothesis—whether it is right or wrong. Your science-fair project will help you test your hypothesis.

5. Design an experiment that will help you answer your research question.

Come up with an experiment *procedure*. This list of steps should be detailed enough so that anyone could read it and repeat the experiment exactly as you performed it.

You will want to run several trials. That means that you'll want to repeat your experiment several times. The more times you repeat the experiment, the more reliable your results will be.

Record your experiment results in a journal. The more notes you take, the easier it will be to type up your report (more on that later). Also, take photos to document your work as you go.

6. Draw conclusions from your results and type up a report that explains your project, results, and conclusions.

The report should be typed and include neat and colorful charts and graphs.

Sample Project One: Stretch Test

Name: _____ Date: _____

Below is an example of a science project from start to finish.
You can use this as your guide as you work on your own project.

Project Topic: How a Person's Flexibility Changes
Throughout a Workout

Project Title: Stretch Test

1. My Question

The question I plan to answer with my experiment is: Are people able to stretch farther before or after hanging in a forward bend?

2. My Purpose

Rewrite your question to complete the following sentence. The purpose of my experiment is to: find out when people are most flexible—at the start or end of a workout.

3. My Variables

My independent variable, or the one thing I plan to change, is: the total length of time spent hanging in a forward bend before giving a stretch test.

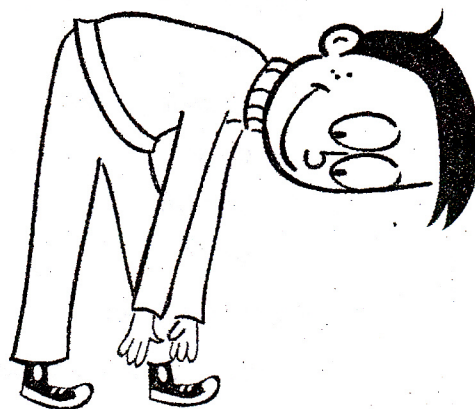
My dependent variable, or the change I will measure, is: the distance that people stretch.

My controlled variables, or the things I will keep the same, are: people will perform the same stretch test. I will make sure that the room temperature stays constant throughout the workout because people's muscles loosen up in warmer temperatures. I will have people perform the stretch test three days in a row, always at the same time of the day.

4. My Research

Go to the library, perform Internet research, or interview an expert to gather information about your topic. Keep notes on your findings:

It is best to do light stretching before a workout and a more thorough stretching routine after a workout. Stretching your muscles when they're cold increases your risk of pulled muscles. Source: Mayo Clinic staff, Stretching: Focus on flexibility, The Mayo Clinic, <http://www.mayoclinic.com/health/stretching/HQ01447>



Sample Project One: Stretch Test

(continued)

5. My Hypothesis

A *hypothesis* is a possible answer to a research question. Reread your question in Step 1. Based on my research, my hypothesis is:

The longer a person works out before stretching, the farther the person will be able to stretch.

6. My Procedure

Materials:

ruler
masking tape
clock
pencil
paper

Procedure Steps:

1. Place a ruler on the floor.
2. Use masking tape to tape the ruler to the floor.
3. Ask a person to sit on the floor with his or her legs straight out in front and heels lined up with the ruler's 5-inch mark. Have the person separate his or her heels by 12 inches.
4. Have the person lean forward, arms stretched straight out in front as far as he or she can reach.
5. When he or she can't stretch forward comfortably any more, have the person put his or her fingertips down on the ruler. Record this distance (measure from the 0-inch mark).
6. Have the person stand up and hang in a forward bend for one minute.
7. Repeat Steps 3 through 5.
8. Have the person stand up and hang in a forward bend for another minute.
9. Repeat Steps 3 through 5 once more.
10. Repeat the experiment with the same person for three days in a row. Perform the experiment at the same time each day.

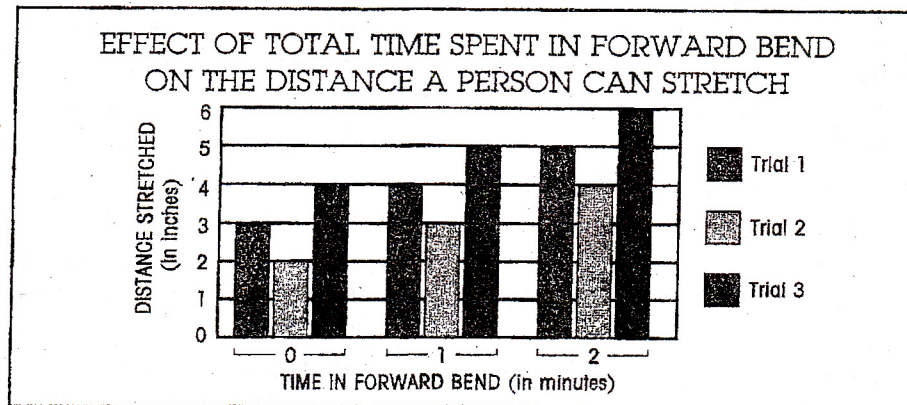
Sample Project One: Stretch Test

(continued)

7. My Data

Independent Variable: Total length of time in forward bend	Dependent Variable: Distance stretched (in inches)			
	Trial 1	Trial 2	Trial 3	Average
0 minute	3 inches	2 inches	4 inches	3 inches
1 minute	4 inches	3 inches	5 inches	4 inches
2 minutes	5 inches	4 inches	6 inches	5 inches

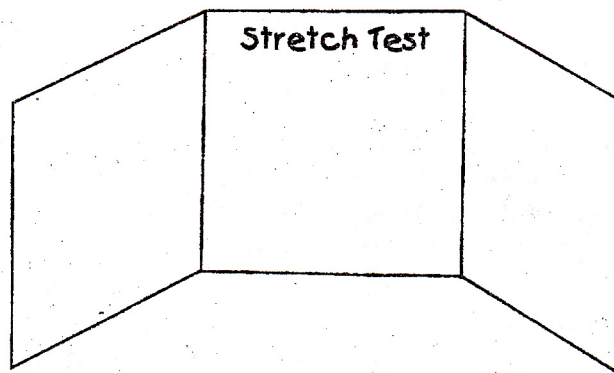
8. Graph of My Data



9. My Conclusions

Based on my results, I conclude that my hypothesis was correct. The longer a person works out before stretching, the farther the person will be able to stretch. I would like to see how other forms of workout affect the distance a person can stretch. For instance, would doing jumping jacks help a person stretch farther?

10. A Sketch of My Display



200 Science-Project Ideas That Will Wow Judges!

Name: _____

Date: _____

Read this list of 200 science-fair project ideas.
Circle all of the ones that sound interesting to you.

1. How does the temperature of a tennis ball affect the height of its bounce?
2. How does the air pressure of a soccer ball affect how far it travels when kicked?
3. Does a metal baseball bat vibrate more than a wooden one?
4. How does the weight of a bowling ball affect how many pins the ball knocks down?
5. Which increases your heart rate more: walking up and down real stairs or using a stair-master?
6. How does yoga affect your flexibility?
7. How does fast dancing affect your heart rate?
8. How does humidity affect the curliness of hair?
9. How does a shampoo's brand affect the strength of hair?
10. How does the type of material affect how long a shirt takes to dry?
11. Which nail polish best resists chipping?
12. How does the fat content of cheese affect its stretchiness?
13. How does the length of time that a soda bottle is open affect its fizziness?
14. How does the temperature of water affect the time it takes to freeze into ice cubes?
15. How will the time spent chewing bubble gum affect its bubbles' maximum size?
16. How will adding different flavors of Kool-Aid® to water affect the water's boiling point?
17. Which brand of popcorn leaves the fewest unpopped kernels?
18. Does the flavor of gelatin affect the amount of time it takes to set?
19. How does playing video games affect hand-eye coordination?
20. What is the effect of toothpaste brand on teeth-cleaning power?
21. What brand of paper towel is most absorbent?
22. What brand of trash bag can withstand the most weight before ripping?
23. How does a light bulb's wattage affect the amount of heat detected above a light?
24. Under what color light do plants grow best?
25. Which brand of mouthwash kills the most bacteria?
26. Which brand of breath mint lasts longest?
27. How does the amount of sugar in homemade ice cream affect how fast it freezes?
28. In a blind taste test, can you tell the difference between nonfat, low-fat, and whole milk?
29. When you pour soda out of a newly opened soda bottle, which produces more fizz: regular or diet soda?
30. How does brand affect ketchup's flow?
31. Given the same amount of water, how does pot size affect the amount of time it takes to boil water?
32. Where is the best place to store home-baked cookies to keep them fresh longest?
33. How does the amount of yeast affect how high bread rises?
34. Which cereal brand stays crunchy in milk the longest?
35. Which brand of chocolate bar melts fastest in the sun?
36. Which type of bread turns moldy first: store-bought or bakery bread?

200

Science-Project Ideas That
Will Wow Judges!

37. How does the type of container affect ice cream's melting time?
38. Which can support more weight: paper or plastic grocery bags?
39. Does the type of animal in a pet-store window affect the number of people who are attracted to the window?
40. Does the color of a terrarium affect a lizard's skin color?
41. Does the brand of kitty litter affect clumping?
42. Does listening to one type of music lower heart rate more than another type?
43. How old does chewed gum have to be before it stops sticking to shoes?
44. Which frozen dessert melts slowest: ice cream, frozen yogurt, or sorbet?
45. How does the tension in a violin's strings affect its pitch?
46. How does the size of a drum affect its pitch?
47. How does a person's age affect his or her flexibility?
48. How does a person's age affect his or her ability to see at night?
49. How does the amount of air in a bicycle's tires affect how long it takes the bike to brake?
50. How does the size of a bicycle's tires affect how far it travels given a specific amount of pedaling?
51. How does hair's curliness affect its strength?
52. How does color affect a person's mood?
53. How does the time of day affect your body's temperature?
54. How does the type of music that a person listens to while exercising affect how hard he or she works out?
55. Does one type of food fill you up faster than another?
56. Which grows faster: fingernails or toenails?
57. Does gender affect lung capacity?
58. If you are right-handed or left-handed, do you also prefer a certain foot?
59. Does the surface of a tennis court affect the height that a tennis ball bounces?
60. Does the time of day affect your flexibility?
61. How does air temperature affect your flexibility?
62. Does a no-name stain remover work just as well as a brand name?
63. Which is a better insulator: wool, cotton, or down feathers?
64. How do various ski waxes affect the amount of friction between the ski and the snow?
65. Does playing Sudoku puzzles improve your performance on other types of puzzles?
66. How does shutter speed affect the color of a photograph?
67. How can you speed up the ripening of tomatoes?
68. What effect does watering have on how fast a plant grows from a seed?
69. How does gravity affect the direction of a plant's growth?
70. Do all plants seek out light?
71. How does the weight of a paper airplane affect its ability to fly?
72. How does a parachute's material affect the speed at which it falls?
73. How does the anticipation of a tickle affect you?
74. How does the weather affect your mood?
75. Which type of soap removes more grease: dish soap, hand soap, or shampoo?
76. Which type of fruit is more acidic: lemons, oranges, or watermelon?
77. What type of ground layers limit erosion most: sand, gravel, or soil?
78. How does the speed of a river's current affect the size of the grains on the riverbed?
79. How does the type of music played in a store affect the number of purchases made by customers?
80. In what type of lighting does a plant grow best?
81. What difference do low-phosphorous fertilizers have on a lake's pollution levels compared with standard fertilizers?

200 Science-Project Ideas That Will Wow Judges!

82. How does the type of seed in a birdfeeder affect the types of birds that the feeder attracts?
83. What types of flowers attract the highest number of butterflies?
84. Which brand of potato chips has the least grease?
85. How does the material of a bandage affect its ability to stick after getting wet?
86. How does the time of day affect levels of algae in a lake?
87. How does tire pressure affect a car's fuel efficiency?
88. How does the amount of air in a balloon rocket affect how far it flies?
89. How does the type of string used in a "can and string" phone affect the phone's ability to transmit sound?
90. Does one cell-phone carrier get better reception than other carriers?
91. Do "triple roll" toilet paper rolls really last three times as long as regular rolls?
92. Are rooms with carpeted floors noisier or quieter than rooms with wooden floors?
93. How does humidity affect how often a plant needs to be watered?
94. Can people tell the difference between music played on an MP3 player, CD player, tape player, and turntable?
95. How does temperature affect the growth of mold?
96. How does meditation affect your heart rate?
97. Which has a longer life: an LED or an incandescent light bulb?
98. Is the incidence of asthma in a region related to the area's level of air pollution?
99. How does the color of a shirt affect the amount of heat it absorbs?
100. How does the amount of daylight that enters your room affect how late you sleep?
101. How does the type of stuffing in a pillow affect its fluffiness?
102. How does the time of year affect the number of hours of daylight in a 24-hour period?
103. How does the magnification of binoculars affect how far you can see?
104. Do all chocolate candles have the same melting point?
105. Do different types of onions make your eyes tear up more than others?
106. Which is better at cleaning mold and mildew: vinegar or commercial cleaning agents?
107. Does maple syrup's "grade" affect its flow?
108. Do different brands of batteries last longer than others?
109. Which uses more water: a shower or a bath?
110. Which type of cup will keep a hot drink warm longer: paper, plastic, Styrofoam, or glass?
111. Do natural mosquito repellants keep more mosquitoes away than artificial repellants?
112. How do gas stations affect the soil around them?
113. Which cleans teeth more effectively: baking soda or toothpaste?
114. Does the length of a clock's pendulum affect its period?
115. Which holds hair in place for a longer period of time: gel or hairspray?
116. Does listening to music while studying affect your performance on a memory test?
117. Does a person's height affect his or her ability to successfully make a jump shot in basketball?
118. How much trash do you keep out of a landfill by recycling paper and plastics?
119. Which type of photos do people hold on to longer before making prints: digital or film?
120. Do mood rings accurately predict a person's emotions?
121. Is a person's favorite subject in school influenced by gender?

200 Science-Project Ideas That Will Wow Judges!

122. Does the weight of a baseball bat affect how far the ball goes when it is hit?
123. Does the temperature of a hockey puck affect how far it will travel when struck by the stick?
124. Do girls spend more time talking on the phone with friends than boys?
125. How does the type of food dispensed in school vending machines affect the eating choices that kids make throughout the day?
126. Which type of fertilizer helps plants grow taller?
127. Which has a better chance of survival: grass that was planted as seed or sod?
128. Is there a correlation between gender and the number of push-ups that a person can do?
129. Do best friends have the same favorite color?
130. Who buys from the "sale" rack more often: kids or adults?
131. Are kids more likely to be influenced by ads that feature other kids or by ads that feature adults?
132. Does the amount of time a student spends watching TV affect his or her grades?
133. Does the length of a surfboard affect its stability?
134. Which stays fresher longer: organic or nonorganic fruit?
135. Does a person's age affect whether he or she goes to the Internet, radio, TV, or newspaper for news?
136. Which stains dentures more: coffee, soda, or grape juice?
137. How does the temperature of a pool's water affect the speed at which a swimmer swims?
138. Does the use of flippers help a person swim faster?
139. Do you wake up feeling more alert when you awaken to an alarm clock that buzzes, plays music, or plays nature sounds?
140. Does the size of a dog determine how high or low-pitched its bark is?
141. Does your cat prefer one brand of food over another?
142. Can blindfolded people tell the difference between bottled water and tap water?
143. Is there a relationship between people's age and the amount of time they can hula hoop?
144. Do objects float better in freshwater or in salt water?
145. How does a person's age affect reaction time?
146. How does caffeine affect people's heart rate?
147. Do some materials conduct heat more than others?
148. How does the roughness of sandpaper affect its ability to smooth various surfaces?
149. How does increasing the height of a ramp affect how far a ball rolls down the ramp?
150. How does the strength of a magnetic field vary with the magnet?
151. Can people identify their pet dog by the sound of its bark alone?
152. Do people who exercise regularly have a greater lung capacity?
153. Can people use their sense of hearing alone to tell apart a penny, nickel, dime, and quarter?
154. Do left-handed people prefer the same school subjects as right-handed people?
155. Does the type of liquid in a glass affect the pitch of the note that results when a person rubs the rim of the glass?
156. Does the length of a wind chime affect its pitch?
157. Do people who live in rural areas name constellations correctly more often than people who live in cities?
158. Does weather affect satellite-TV reception?
159. Do girls and boys talk about the same topics as each other when they hang out with their friends?
160. Does the length of a bat affect how far a baseball will travel?

200

Science-Project Ideas That
Will Wow Judges!

161. Does your dog prefer water directly from the faucet or tap water that's been refrigerated?
162. How often can people accurately tell if someone is happy, sad, or mad just by looking at the person's eyes?
163. How often can people correctly determine if a person is left-handed or right-handed just by looking at the person's handwriting?
164. What melts ice the fastest: sand, cat litter, or mineral rock salt?
165. Does temperature affect the growth rate of shoots on a potato?
166. Which type of container traps the most heat: a shoebox covered in aluminum foil, plastic wrap, or wax paper?
167. How does the shape of a boat's hull affect its speed?
168. How does water pressure vary with depth?
169. Which best helps prevent soil erosion on a slope: plants, rocks, or mulch?
170. Does one brand of antacid neutralize acids faster than another?
171. Do gym shoes have more bacteria than sandals?
172. Does sunlight fade the paper more in books or in magazines?
173. In which room of the house do plants grow the highest?
174. Which toothbrushes last longest: ones with natural or nylon bristles?
175. Which air freshener lasts longest?
176. Do mildew-resistant shower curtains really keep mildew away longer than regular shower curtains?
177. Does a person's weight vary throughout the day?
178. Do certain bicycle helmets hold up better after an impact than others?
179. Can you skate faster with in-line skates or roller skates?
180. Do thunderstorms happen more often in the afternoon than in the morning?
181. Does bread stay fresher longer when it is kept in the refrigerator or on the counter?
182. Which kind of gum keeps its flavor longer: sugar-free or regular?
183. Which lightens stains better: vinegar or lemon juice?
184. Which type of bread toasts fastest?
185. Do bigger lemons have more seeds than smaller ones?
186. Does squinting improve your vision?
187. Do fans really make you cooler or do they just make you feel like you're cooler?
188. Do taller people take longer strides than shorter people?
189. Can you judge depth as well using just one eye than using two?
190. Does your "handedness" have any relation to which eye is stronger?
191. Does exercise increase or decrease your energy level?
192. How does your sight affect your balance?
193. Which do people prefer: a booth or a table toward the middle of a restaurant?
194. Do plants inside a mall grow faster under artificial light or under a skylight?
195. Does listening to rock music make you eat faster than listening to classical music?
196. Does eye color affect how well a person sees?
197. Does toothpaste with whitener whiten teeth more than regular toothpaste?
198. Does washing your hands reduce the amount of bacteria on them more than not washing?
199. Does using conditioner leave your hair with fewer knots than not using conditioner?
200. Does hair take longer to dry when using a hair drier or when it dries naturally?

Now, reread all of the questions that you circled. Do these questions have anything in common? If so, what?

Look at your answer above. If the questions you circled have anything in common, you probably have a strong interest in that topic. You might want to think about doing a science-fair project on that topic.