Free pendulum charts printable pdf worksheets printable worksheets

Most science classes, including biology, start with an introductory lesson on the nature of science. The scientific method is an integral part of all science classes. Students should be encouraged to problem-solve and not just perform step by step experiments. Stories and Scenarios Lab Safety – illustration, identify good and bad procedures Lab Safety Guidelines – contract for students to sign that lists basic rules for the lab Controls and Variables – read experiment scenarios, identify controls Scientific Method in Action – reading passage shows how the scientific method was used to solve real world problems (beriberi and penicillin discovery) Manipulated and Responding Variables – science fair project stories, identify key parts of the experiment The Elephant Poem – contemplate the nature of observations The Martian and the Car – identify what makes something "alive" The Language of Science – prefixes and suffixes Debunking the Paranormal – investigate a "claim" from a scientific standpoint, critical thinking skills How Many Hands on a Horse – article with questions about measuring horses and the importance of standard units Scientific Method Scenarios – take a question and design an experiment to test the question, each group receives a different question and shares their design with the class Scientific Method and Causal Questions – examine a flow chart on variables that affect water evaporation Significant Figures – An activity that looks at uncertainty in measurements, comparing rulers with different values. Scientific Method Experiments – a collection of short inquiry labs the focus on consumer science. Students design and test their hypotheses Investigation: What Are the Processes of Science – students design an experiment about lung capacity; requires spirometers, AP Biology Sponge Capsules – quick lab using capsules and water (toys) to collect data on how fast the "animals" grow Sponge Animals: Growing Insects – this lab grows sponge animals, graphs and calculates the growth rate (slope of line) Plop Plop Fiz Fiz – measure the rate of dissolving in alka-seltzer tablets in both hot and cold water (a basic experiment for introducing the scientific method) Water in Living Things – investigate how much water is stored in grass clippings Gummi Bear Experiment – inquiry lab investigating the dissolving properties of gummi bears Mystery Eggs – students use the scientific method to guess how many nails are hidden inside plastic eggs Saving Sam – using paperclips rescue Sam, the gummy worm by putting a life preserver on him Observation – opener lab, using the senses to investigate hardware items, then describe items Pendulum Project – Inquiry based, experimental design and data analysis (physical science) Penny Lab – conduct an experiment on surface tension, water drops are added to a penny and compared with soapy water Carbon Dioxide Production – determine how activity changes the amount of CO2 expelled Making Slime – instructions for creating a polymer Measuring Lung Capacity – graphing and data gathering Measure a Bean – basic lab where students work with volume and mass, as well as common lab equipment Scientific Processes – Tools and Measurements – work with graduated cylinders and other tools to practice measuring (metric system) What is the Effect of Exercise on Heart Rate – aligned to NGSS, feedback mechanisms and homeostasis. Students design and conduct an experiment. Investigation: What Factors Effect the Heart Rate of Daphnia – expose a tiny crustacean to ethanol and gather data on its heart rate Virtual Labs Using the Scientific Method – Plant Experiment – change variable such as soil type and addition of soap Can Crickets Tell the Temperature? – change the temperature and count the number of chirps Virtual Lab – Independent and Dependent Variables List of Virtual Labs by Glencoe – some of these are inquiry labs where you can manipulate variables Analyzing and Graphing Data Analyzing Data – make and interpret graphs, summarize data trends Graphing Data – Flow Rates – graph the flow rate of liquids in a pipe, simple plot and draw two lines Graphing Practice – given data sets, such as video games scores and shirt colors, students create line and bar graphs, activity paired with growing sponge animals while students wait on results Interpreting Graphs and English Usage – simple graph showing tadpoles, this is more of a vocabulary lesson on words used to interpret graphs, such as fluctuate, decline, stabilize… Interpreting Graphs – shows a pie chart with grades, a scatter plot, and a few line graphs with questions to answer about each. Data Collection is Fun(gi) – use notes gathered in a field journal to create a data table to organize information about fungi and graph the relationship between fruiting body size and number. Microscope Use How to Use a Microscope – basic guidelines, tips and troubleshooting for the classroom light microscope | Presentation Microscope Labeling – image, no labels Microscope Coloring – learn the parts of the microscope by coloring Microscope "E" Lab – use a microscope to examine the letter "e" Microscope "E" Lab – online version, for students who miss the lab in class Microscope Virtual Lab – uses an online virtual microscope, students can actually focus and adjust light using the simulator Microscope Lab (advanced) – for AP Biology Lab Reports Lab Report Template & Rubric Scientific Method Flowchart– this flow chart can be used for any experimental design. Students organize their experiment, identify the controls and variables, collect data and draw conclusions. Guides, Notes, and Information Notes on the Scientific Method – a guide for understanding the processes of science Lecture Powerpoints (you do not need to download to view) By Tammy Croft i Jupiterimages/Goodshoot/Getty Images Charts and graphs provide an ideal visual explanation for business plans, marketing strategies and other reporting activities. These aids may seem difficult to make, but technology has made it easier to create professional and elaborate charts. Most software programs provide many options regarding the number of columns, rows, sizes and other creative graphics from which to choose. Charts can be made with word processing software, such as Microsoft Word. Open Microsoft Word. Click on the start button in the lower left corner of your screen. Click on "All Programs," Microsoft Word and Microsoft Works Word processor. This process will display a blank and editable screen. Choose the chart symbol from the toolbar. This symbol resembles a small white chart and reads "insert table" when highlighted. When clicked, a menu will appear with many options of styles from which to choose. Options include basic, simple, creative, modern, professional and basic charts. Select the number of rows and columns needed for your chart. Enter the number into the spaces provided beside rows and columns. Choose the number of rows and columns needed in your chart. The number of rows and columns can be anywhere from one row to 100 rows. Choose the row height and column width. Both attributes can range from one centimeter up to 22 centimeters. You also have the option of letting the program determine these two options for you by selecting "auto," which is also listed in the drop-down menus of each. Press "OK" when you are satisfied with your selections. The chart wil appear in printable form. Set your font styles and colors. Styles, font and color can all be customized by selecting the appropriate symbols from the tool bar. After you've finished your customization, you're ready to print. Choose one of two printing options. You can print the chart immediately by selecting the print symbol form the toolbar or selecting "print" from the file drop-down menu. If you're not ready to print, you can save the document by selecting "save" or "save as" from the drop-down menu and giving it a file name. You have now created a printable chart. Grade Level: 8 (7-9) Time Required: 45 minutes Expendable Cost/Group: US $1.00 Group Size: 3 Activity Dependency: None Subject Areas: Algebra, Physical Science, Physics After this activity, students should be able to: Describe the motion of pendulums. Collect data while experimenting with pendulums, and use that data to predict future behavior. Use collected data to explain the relationship between pendulum length and frequency. Give examples of situations in which engineers use pendulums. (activity extension) Use knowledge acquired from data analysis to create a pendulum that solves a design challenge. Patterns can be used to identify cause and effect relationships. (Grades 6 - 8) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Graphs, charts, and images can be used to identify patterns in data. (Grades 6 - 8) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. (Grade 6) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Represent data with plots on the real number line (dot plots, histograms, and box plots). (Grades 9 - 12) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Explain how knowledge gained from other content areas affects the development of technological products and systems. (Grades 6 - 8) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Solve real-world and mathematical problems involving the four operations with rational numbers. (Grade 7) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Represent data with plots on the real number line (dot plots, histograms, and box plots). (Grades 9 - 12) More Details View aligned curriculum Do you agree with this alignment? Thanks for your feedback! Suggest an alignment not listed above Each group needs: 110 cm of string fishing weights (1 oz. and 2 oz.) tape metric ruler or tape measure colored markers protractor stopwatch Swing in Time Worksheet (pdf) Visit [www.teachengineering.org/activities/view/cub_mechanics_lesson09_activity1] to print or download. Basic understanding of forces such as lift, weight, thrust and drag, plus rotational motion and angular momentum. Waves in water go up and down, cars bounce up and down when they hit a bump, and people go back and forth when they are playing on a swing. Can you think of other things that have a regular back and forth motion? Items that move back and forth regularly move in similar ways. If scientists and engineers can understand one kind of back and forth motion, such as a swing, then they can apply that understanding to other items that move in a back and forth motion. In this activity, you will examine the motion of a pendulum. If you have ever played on a swing set, you are already familiar with some of the ways that a pendulum can move. In this lab, you will examine specific factors that might affect the way a pendulum swings. You will time a pendulum swinging back and forth, and see what factors make it speed up and what conditions make it slow down. The motion of a pendulum was first mathematically described by a man named Galileo Galilei in the late 1500s. Galileo also investigated how things fall, how planets move, and many other scientific phenomena. Many of his discoveries grew out of his observations of how pendulums swing. Just think—maybe you can figure out how something works by understanding pendulums! Pendulums were not only used in the 1500s, though. Engineers use the motion of pendulums today. In fact, some of the most advanced building designs incorporate large pendulums to dissipate the energy if the building is shaken by an earthquake. Engineers use pendulums in robots and in clocks. Can you think of useful ways to use a pendulum? Before the Activity Cut string pieces to 110 cm. Attach either the 1 oz. or the 2 oz. weight to all pendulums. Label fishing weights 1 oz. and 2 oz. Make copies of the Swing in Time Worksheet, one per student. With the Students Introduce the activity: Ask students if they know what a pendulum is. Ask them if they know how pendulums are used. Tell them they will learn more about pendulums and their movements in this activity. See the associated lesson for more background information and motivation. Hand out the worksheets. Direct students to use the worksheets to follow along with the activity. Working in groups of three, have students measure and mark their string at 10-cm intervals, starting measurement at the middle of the weight and marking up to 100 cm. Have students tape the pendulum to their desks at the 10-cm mark. Pull the weight back at a 45-degree angle for consistency in the swing. Predict and test: First have students predict the number of times the pendulum will swing back to its original starting point (a swing or oscillation) during a 30-second timing, for the pendulum length and weight being tested, and record this in the worksheet table. Next, have one student time the swing for 30 seconds and two other students count the number of complete swings (oscillations), and record this in the worksheet table. Repeat the "predict and test" process, taping at the next 10-cm increment (20 cm). Repeat again, up to a 50-cm length. Have students create bar graphs with the number of swings (oscillations) on the vertical axis and the pendulum length on the horizontal axis. Expect students to observe a pattern. Repeat the procedure using the second weight. Ask students to observe any differences between the two weights (there should be no difference). Expect their bar graphs to look similar to the example below. (Note: The weight has a negligible effect on the number of swings, but due to experimental error, there may be a slight discrepancy.) Following the pattern, students should be able to make predictions for the results at the 60-cm to 100-cm lengthsn. Have students continue to record their predictions, test and record their results on the worksheet. Conclude with a class discussion to review and share results, worksheet answers and conclusions. bob: The swinging weight at the end of a pendulum. gravity: The force that attracts bodies toward the center of the Earth. oscillation: The back and forth swinging motion of the bob of a pendulum. One oscillation is complete when the bob returns to its starting position. pendulum : A string with a weight at one end suspended from a fixed support, so that it swings freely back and forth, under the influence of gravity. period: The amount of time it takes the bob of a pendulum to return to its initial position. Pre-Activity Assessment Discussion Question: Solicit, integrate and summarize student responses. Ask students: What is a pendulum? Then brainstorm examples of pendulums. (Possible answers: Playground swings, rope or tire swings hanging from trees, grandfather clocks, circus trapeze swings and ropes, balancing mechanisms for some robots, etc.) Activity Embedded Assessment Worksheet: Have students follow along with the activity using the Swing in Time Worksheet and use it to record their lab observations and measurements.Review their data, answers and graph to gauge their depth of engagement and comprehension. Pairs Check: After student groups finish working on worksheets, have them compare answers with another completed group, giving all students time to finish the worksheet. Post-Activity Assessment Worksheet Discussion: Review and discuss worksheet answers with the entire class. Students' answers indicate their mastery of the subject. Small weights can be a choking hazard. It may be helpful to model this activity for the students. Make sure that students keep an accurate count of the pendulum's oscillations. Have two students count and agree on the number of swings. Sand Pendulum: Make a cone-shaped cup and fill it with sand or salt. Swing the cone like a pendulum, letting the sand pour out from a hole in the bottom of the cone. Observe the pattern it makes. Experiment with two or more pendulums at one time: Swing the pendulums in the same direction, in the opposite directions, two one-way and one another, criss-cross, etc. Predict the amount of time it will take the pendulum to come to a complete stop. Ask students to find a string length that makes the pendulum swing exactly 60 times per minute. How would this be useful? (Answer: A pendulum could be used as a clock if each swing took one second.) Design Challenge: Challenge students to design a pendulum that swings back and forth 10 times in 1 minute. Encourage students to "fail quickly," so they can test many different designs within the allotted time. Also encourage students to use what they learned about pendulums from this activity to make the necessary adjustments to their designs. For younger students, have them draw pictures of something that swings, such as a tire swing or a clock pendulum. After they have finished drawing, have them show the class what they drew. Ask students what they think controls how fast the pendulum swings—the mass or the length of the pendulum? For older students, have them create line graphs rather then bar graphs. Sabre Duren; Ben Heavner; Malinda Schaefer Zarske; Denise W. Carlson Integrated Teaching and Learning Program, College of Engineering, University of Colorado Boulder The contents of this digital library curriculum were developed under grants from the Fund for the Improvement of Postsecondary Education (FIPSE), U.S. Department of Education, and National Science Foundation (GK-12 grant no 0338326). 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