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EXPLORING THE WORLD OF PHYSICS
Chapter 1 Supplemental Questions

1. Explain Galileo's principle of the pendulum. Include what happens to the period (the complete cycle—the time it takes the pendulum to get back to where it was released, when the angle of the pendulum arc is changed). Also, what happens to the period if the length of the pendulum is shortened? Increased?

   Experiments done by Galileo show that the period is constant for a given length, regardless of the angle of the arc. If the length is shortened, the period decreases; if lengthened, the period increases.

2. What use was this discovery to science?

   This discovery allowed clocks to measure time to the second.

3. How did Aristotle's and Galileo's methods of explaining observation differ?

   Aristotle believed that testing an observation only required common sense and clear thinking. Galileo believed that only by physically testing an observation could a conclusion be drawn.

4. What conclusions did each reach for "falling bodies," and whose method do we use today?

   Aristotle believed that heavier objects fell faster than light objects. A 10-lb. sphere would fall 10 times faster than a 1-lb. sphere. Galileo took Aristotle's accepted fact and dropped different sized spheres from the Leaning Tower of Pisa and observed that all hit the ground at the same time; thus, all objects, regardless of weight, fall at the same rate. Galileo's method was correct, and all the scientific community uses Galileo's method of testing.

5. Astronaut David Scott proved Galileo's observation that all objects fall at the same rate disregarding air resistance. Explain why this worked on the moon but wouldn't work on the earth.

   When David Scott walked on the moon, he had a feather and a hammer. He held both up and dropped them at the same time. They both hit the surface of the moon at exactly the same time. This would not have worked on the earth because air resistance would have slowed the feather down.

6. Suppose you drop a hammer from the rim of a tall crater on the moon. It takes 10 seconds before it hits the bottom (dust flies up).

   a. How fast is the hammer traveling when it hits the floor of the crater?

      $v_f = g \times t$ v_f (final velocity) t (time in seconds) $g = 1.67\ m/s^2$ (gravitational acceleration on the moon)

      $v_f = 1.67\ m/s^2 \times 10\ sec$

      $v_f = 16.7\ m/s$

   b. Calculate the average speed.

      $v_{ave} = ½\ v_f$

      $v_{ave} = ½\ 16.7\ m/s$

      $v_{ave} = 8.35\ m/s$

   c. Calculate the height of the crater.

      $d = v_{ave} \times t$

      $d = 8.35\ m/s \times 10\ sec$

      $d = 83.5\ m$

   d. Find the height of the crater by using a different equation. Does the answer agree with Question 6c?

      $d = ½\ g \times t^2$ $g = 1.67\ m/s^2$ $t = 10\ s$

      $d = ½\ (1.67\ m/s^2)\ (10\ s)^2$

      $d = 83.5\ m$

      yes