**Scientific Theories**

**Importance of Testing**

*True or false:* **Heavier objects fall faster than lighter objects.**

Explain why you think this.

Read the following story:

*Aristotle was a famous ancient Greek scholar. He was so well known,*

*and his thoughts so highly respected, that often his ideas were accepted without question. One such idea was that the mass of an object would determine how fast it fell. Aristotle never tested his hypothesis and for many years it seemed quite logical. Approximately 350 years ago, Galileo, an Italian physicist, questioned Aristotle’s hypothesis and decided to test its*

*validity.*

**Examining the Findings**

Four groups of students tested Aristotle’s hypothesis (that the mass of an object determines how fast it falls).

1. In **group A,** two students of different heights each dropped an identical object from their respective shoulder heights.
2. In **group B**, students dropped objects with different masses and different shapes (a ball and a rectangular shaped box) from the same height.
3. In **group C**, students used a stopwatch to time how long it took objects of identical shapes, but different masses, to travel a set distance. They performed their test once.
4. In **group D**, students used the same apparatus and method as group C, but repeated the test several times.

Based on the statements above, are the groups’ results **reliable**? Why or why not?

|  |  |  |
| --- | --- | --- |
| Group: | Reliable or not: | Explain why: |
| A |  |  |
| B |  |  |
| C |  |  |
| D |  |  |

**Scientific Theory Questions**

Work in groups to answer the following questions:

1. What would have to be done before a person could consider a statement to be accurate?

2. Someone develops a new cream for acne. What would have to happen before you would feel confident enough to use it on your skin?

3. Why would a product need to be tested many times?

4. What is a theory – in your own words?

**Assignment: Plan and conduct your own experiment to test Aristotle’s hypothesis. Ensure that you design experiments that test one variable at a time.**

***Scientific Theories and the Particle Theory***

**Scientific theory** – an idea that has been tested many many times and has not been proven\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It helps to explain an observation, and is widely accepted as true.

**Scientific Theories: Yesterday/Today/Tomorrow**

Fill in the following blanks after discussing with your group:

1. Christopher Columbus helped to disprove one theory that was held during his time. What was it? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. At one time people believed that all things were made of earth, fire, and water, but the current scientific theory is that all living things are made of cells. What type of technology may have enabled (helped) people to discover this theory? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Presently there is a scientific theory that all things are made of tiny particles that vibrate (the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of matter).

Will this theory still be considered true in the year 3000? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Particle Theory of Matter p. 84-85 & p. 18**

* AKA the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Four main ideas:
  + All matter is made of tiny \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Particles are always \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + The more \_\_\_\_\_\_\_\_\_\_\_\_\_ particles have, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ they move and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ they spread out.
  + There are forces of attraction between particles.
* Heat affects particles because **heat adds energy**.

3 states of matter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Compare the states of matter in the chart below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Solid | Liquid | Gas |
| Picture |  |  |  |
| Volume |  |  |  |
| Flow |  |  |  |
| Particle movement |  |  |  |
| Forces of attraction |  |  |  |

P. 88 – 89 q’s # 1-4 (5 as enrichment if finished)

**Effect of Heat on Particles:**

* Heating causes matter to expand in volume. (increase the energy)
* Cooling causes a decrease in volume. (decrease the energy)

\***Note:** Water is an exception. It expands when it freezes.

Everyday applications include:

• putting a jar lid under hot water to cause it to expand away from the glass jar and to open more easily

• filling the joints between sidewalk blocks with tar to prevent the blocks from buckling in the summer heat

• leaving enough slack in hydro lines so that they sag a little in summer but do not snap when they contract in the winter cold

• building bridges with jagged metal grid gaps at either end of the span

• designing thermostats from bimetallic strips so that they can turn a furnace on/off depending on temperature

• using liquid in glass thermometers

• leaving air space or a small air hole at the top of filled plastic gas containers

**Case Studies: Effects of Heating and cooling**

**Manitoba Winters**

In Manitoba would it be advisable (a good idea) to leave water in a car’s radiator all year round? *Why or why not?*

**Bars of Gold?**

A chest is located at the bottom of the Gulf of Mexico and some metal bars are found inside. Legend has it that ships that travelled in the area carried gold bars and jewels. Often captains of the ships would substitute fake bars in the chests so that if the ships were boarded by pirates, the real gold would not be stolen as it would be hidden elsewhere on the ships.

A lab heats up the bars to 955°C before they begin to melt. The scientist working in the lab consults the information below to determine whether the bars are gold.

**Gold Information: Melting Point (°C)** 1063°, **Boiling Point (°C)** 2600°

*Are the bars gold? How do you know?*