

Benchmarks for Science Literacy

1. The Nature of Science

1.1 When a science investigation is done the way it was done before, we expect to get a very similar result.

1.2 Science investigation generally work the same way in different places.

1.3 People can often learn about things around them just by observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens.

1.4 Tools such a thermometers, magnifiers, rulers, or balances often give more information about things than can be obtained by just observing things without their help.

1.5 Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.

1.6 When people give different description of the same thing, it usually is a good idea to make some fresh observations instead of just arguing about who is right.

1.7 Scientists' explanations about what happens in the world come partly from what they observe, partly from what they think. Sometimes scientists have different explanations for the same set of observations. That usually leads to their making more observations to resolve the differences.

1.8 Everybody can do science and invent things and ideas.

1.9 In doing science, it is always helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.

1.10. A lot can be learned about plants and animals by observing them closely, but care must be taken to know the needs of living things and how to provide for them on the classroom.

1.11. Science is an adventure that people everywhere can take part in, as they have for many centuries.

1.12. Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world.

1.13. Doing science involves many different kinds of work and engages men and women of all ages and backgrounds.

2. The Nature of Mathematics

2.1. Numbers and shapes can be used to tell about things.

2.2. Numbers and shapes -- and operations on them -- help to describe and predict things about the world around us.

3. The Nature of Technology

3.1. Tools are used to do things better and more easily and to do some things that otherwise could not be done at all. In technology, tools are used to observe, measure, and make things.

3.2. When trying to build something or get something to work better, it usually helps to follow directions if there are any or to ask someone who has done it before for directions.

3.3. People can use objects and ways of doing things to solve problems.

3.4. People, alone or in groups, are always inventing new ways to solve problems and get work done. The tools and ways of doing things that people have invented affect all aspects of life.

4. The Physical Setting

4.1. Some events in nature have a repeating pattern. The weather changes from day to day, but things such as temperature and rain (or snow) tend to be high, low, or medium in the same months of every year.

4.2. Water can be a liquid or a solid and can go back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing.

4.3. Water left in an open container disappears, but water in a closed container does not disappear.

4.4. Air is a substance that surrounds us, takes up space, and whose movement we feel as wind.

4.5. When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets of water.

4.6. Objects can be described in terms of the materials they are made of (clay, cloth, paper, etc.) and their physical properties (color, size, shape, weight, texture, flexibility, etc.).

4.7. Things can be done to materials to change some of their properties, but not all materials respond the same way to what is done to them.

4.8. Materials may be composed of parts that are too small to be seen without magnification.

4.9. The sun warms the land, air, and water.

4.10. When warmer things are put with cooler ones, the warm ones lose heat and the cool ones gain it until they are all the same temperature. A warmer object can warm a cooler object by contact or at a distance.

4.11. Some materials conduct heat much better than others. Poor conductors can reduce heat loss.

4.12. Things that make sound vibrate.

5. The Living Environment

5.1. Some animals and plants are alike in the way they look and in the things they do, and others are very different from one another.

5.2. Plants and animals have features that help them live in different environments.

5.3. For any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

5.4. Different plants and animals have external features that help them thrive in different kinds of places.

6. The Human Organism

6.1. People use their sense to find out about their surroundings and themselves. Different senses give different information. Sometimes a person can get different information about the same thing by moving closer to it, or farther away from it.

6.2. People can learn from each other by telling and listening, showing and watching, and imitating what others do.

6.3. Learning means using what one already knows to make sense out of new experiences or information, not just storing the new information in one's head.

8. The Designed World

8.1. Naturally occurring materials such as wood, clay, cotton, and animal skins may be processed or combined with other materials to change their properties. ,

8.2. Through science and technology, a wide variety of materials that do not appear in nature at all have become available, ranging from steel to nylon to liquid crystals.

8.3. The sun is the main source of energy for people and they use it in various ways.

8.4. People try to conserve energy in order to slow down the depletion of energy resources and/or to save money.

9. The Mathematical World

9.1. Numbers can be used to count things, place them in order, or to name them.

9.2. Simple graphs can tell about observations.

9.3. Similar patterns may show up in many places in nature and in the things people make.

9.4. Tables and graphs can show how values of one quantity are related to values of another.

9.5. Some things are more likely to happen than others. Some events can be predicted well and some cannot. Sometimes people aren't sure what will happen because they don't know everything that might be having an effect.

9.6. Often a person can find out about a group of things by studying just a few of them.

9.7. Some predictions can be based on what is known about the past, assuming that conditions are pretty much the same as now.

9.8. People are more likely to believe your ideas if you can give a good reason for them.

9.9. One way to make sense of something is to think how it is like something more familiar.

11. Common Themes

11.1. Most things are made of parts.

11.2. A model of something is different from the real thing but can be used to learn something about the real thing.

11.3. One way to describe something is to say how it is like something else.

11.4. Things can change in different ways, such as in size, weight, color, and movement. Some small changes can be detected by taking measurements.

12. Habits of Mind

12.1. Students should be able to raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out.

12.2. Students should be able to keep records of their investigations and observations and not change the records later.

12.3. Students should be able to offer reasons for their findings and consider reasons suggested by others.

12.4. Students should be able to use whole numbers and simple everyday fractions in ordering, counting, identifying, measuring, and describing things and experiences.

12.5. Students should be able to make something out of paper, cardboard, wood plastic, metal, or existing objects that can actually be used to perform a task.

12.6. Students should be able to measure and mix dry and liquid materials (in the kitchen, garage, or laboratory) in prescribed amounts, exercising reasonable safety.

12.7. Students should be able to keep a notebook that describes observations made, carefully distinguishes actual observations from ideas and speculations about what was observed, and is understandable weeks or months later.

12.8. Students should be able to describe and compare things in terms of number, shape, texture, size, weight, color, and motion.

12.9. Students should be able to draw pictures that correctly portray at least some of the features of the thing being described.

12.10. Students should be able to write instructions that others can follow in carrying out a procedure.

12.11. Students should be able to make sketches to aid in explaining procedures or ideas.

12.12. Students should be able to use numerical data in describing and comparing objects and events.

12.13. Students should be able to ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question.

12.14. Students should be able to recognize when comparisons might not be fair because some conditions are not kept the same.

12.15. Students should be able to seek better reasons for believing something than "Everybody knows that" or "I just know" and discount such reasons when given by others.