The Internet Infidels Test of Scientific Literacy

Scientists usually expect an experiment to turn out a certain way.

TRUE

Science only produces tentative conclusions that can change.

TRUE

Science has one uniform way of conducting research called "the scientific method."

FALSE

Scientific theories are explanations and not facts.

TRUE

When being scientific one must have faith only in what is justified by empirical evidence.

TRUE

Science is just about the facts, not human interpretations of them.

FALSE

To be scientific one must conduct experiments.

FALSE

Scientific theories only change when new information becomes available.

FALSE

Scientists manipulate their experiments to produce particular results.

TRUE

Science proves facts true in a way that is definitive and final.

FALSE

An experiment can prove a theory true.

FALSE

Science is partly based on beliefs, assumptions, and the non-observable.

TRUE

Imagination and creativity are used in all stages of scientific investigations.

TRUE

Scientific theories are just ideas about how something works.

FALSE

A scientific law is a theory that has been extensively and thoroughly confirmed.

FALSE

Scientists' education, background, opinions, disciplinary focus, and basic guiding assumptions and philosophies influence their perception and interpretation of the available data.

TRUE

A scientific law will not change because it has been proven true.

FALSE

An accepted scientific theory is an hypothesis that has been confirmed by considerable evidence and has endured all attempts to disprove it.

TRUE

A scientific law describes relationships among observable phenomena but does not explain them.

TRUE

Science relies on deduction (x entails y) more than induction (x implies y).

FALSE

Scientists invent explanations, models or theoretical entities.

TRUE

Scientists construct theories to guide further research.

TRUE

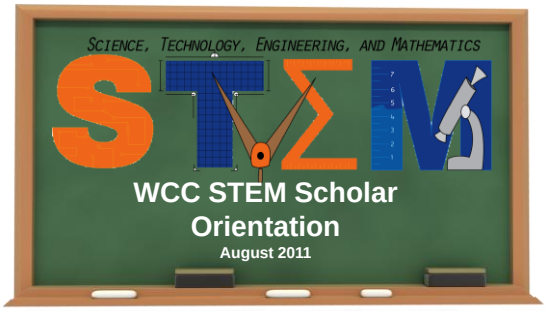
Scientists accept the existence of theoretical entities that have never been directly observed.

TRUE

Scientific laws are absolute or certain.

FALSE

0 wrong = A+
1 wrong = A
2 wrong = A-
3 wrong = B+
4 wrong = B
5 wrong = B-
6 wrong = C
7 wrong = D
8 or more wrong = F



Scientific Inquiry

Technology

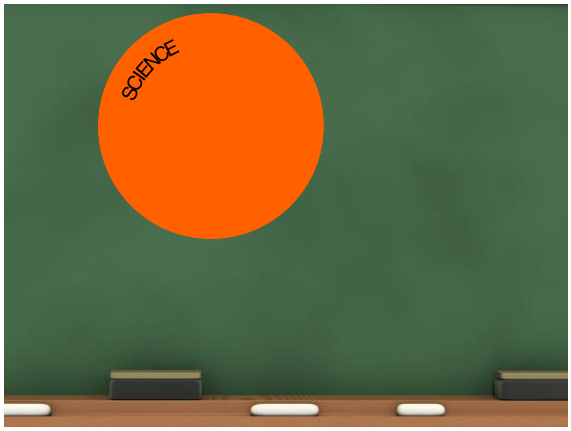
The application of scientific knowledge for practical purposes, esp. in industry (i.e. computer **technology**; recycling **technologies**).

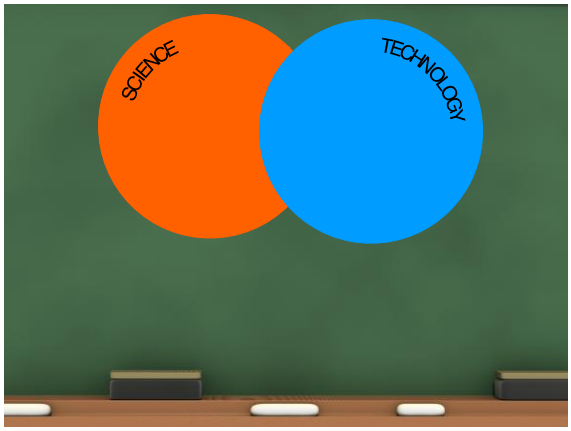
Engineering

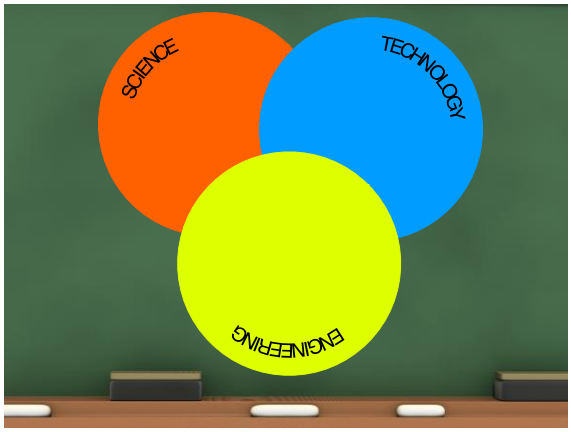
The branch of science and technology concerned with the design, building, and use of engines, machines, and structures.

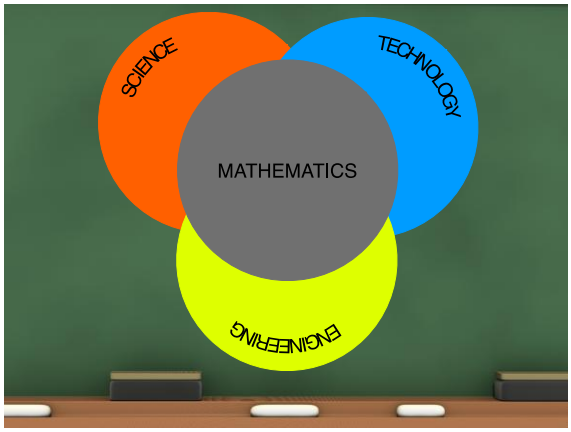
Mathematics

The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations.

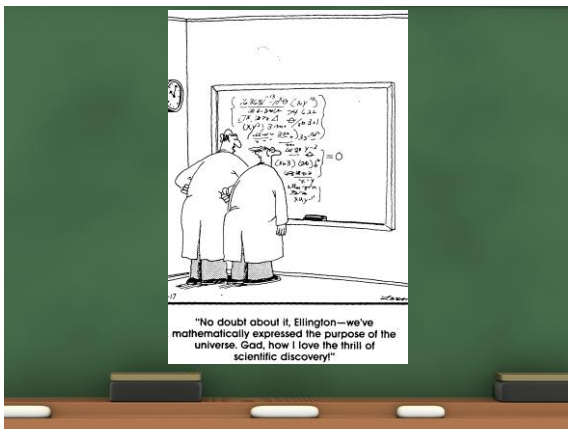








science



Definitions according to Merriam-Webster (online)

- The state of knowing **:** knowledge as distinguished from ignorance or misunderstanding.
- Department of systematized knowledge as an object of study (i.e the *science* of theology).
- Knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through the scientific method.
- Such knowledge or such a system of knowledge concerned with the physical world and its phenomena (i.e. Natural Science).
- A system or method reconciling practical ends with scientific laws (i.e. culinary *science*).
- Christian Science.

Science is different from many other ways of learning because of the way it is done.

Science relies on testing ideas with evidence gathered from the natural world.

Science is complex and multi-faceted.

Science is a process!

Characteristics of Science

Characteristics of Science

Science focuses exclusively on the natural world, and does not deal with supernatural explanations.

Within science, the term natural refers to any element of the physical universe — whether made by humans or not.

This includes matter, the forces that act on matter, energy, the constituents of the biological world, humans, human society, and the products of that society.

Characteristics of Science

Science is not simply a collection of facts; rather it is a path to understanding.

Science is a way of learning about what is in the natural world, how the natural world works, and how the natural world got to be the way it is.

The ultimate objective of science is predictability.

Predictability

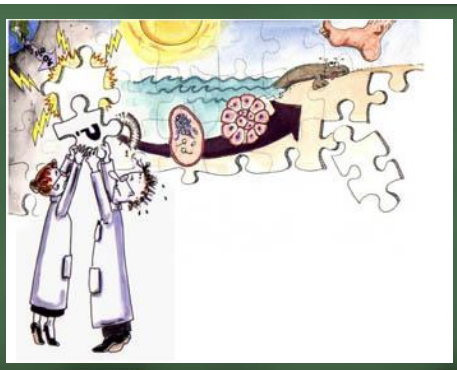
To be able to predict certain things will happen given the same operating conditions.

The end result of science is to make valid generalizations about the items and events being investigated or analyzed.

These generalizations develop further support each time they are tested, and are given several different names.

Scientific Hierarchy

- Hypothesis
  - A testable idea.
- Theory
  - An explanation or model based on observation, experimentation, and reasoning, especially one that has been tested and confirmed to explain and predict natural phenomena.
- Principle
  - A rule concerning a natural phenomenon or the function of a complex system.
- Law
  - A formal statement describing a natural phenomenon that has been proven to occur invariably whenever certain conditions are.



Is the Scientific Hierarchy outdated?

There is no 'proof' or absolute 'truth' in science!

Note, however, if you define proof as arriving at a logical conclusion, based on the evidence, then there is 'proof' in science.

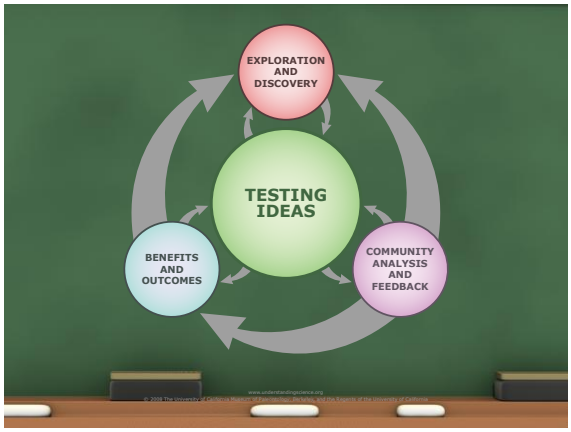
The closest we get are facts, which are indisputable observations.

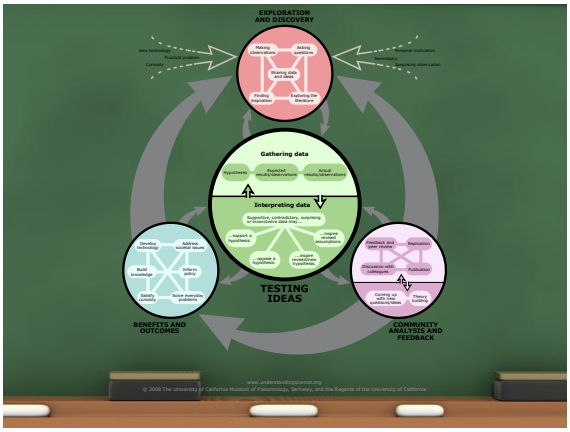
Paradigm

The predominant worldview in the realm of human thought.

Characteristics of Science

Scientists work in many different ways, but all science relies on testing ideas by figuring out what expectations are generated by an idea and making observations to find out whether those expectations hold true.





Characteristics of Science

Accepted scientific ideas are reliable because they have been subjected to rigorous testing, but as new evidence is acquired and new perspectives emerge these ideas can be revised.

Occam's Razor

Named after the 14th century English logician and Franciscan friar William of Ockham.

Occam did not create the concept - the work of Thomas Aquinas and even Aristotle referred to some form of it.

The name was first attributed to him in the 1800s, indicating that he must have espoused the philosophy enough that his name became associated with it.

entia non sunt multiplicanda praeter necessitatem

entities should not be multiplied beyond necessity

"Everything should be made as simple as possible, but not simpler."

Albert Einstein

Science is always a work in progress, and its conclusions are always tentative.

Science's conclusions **ARE NOT** tentative in the sense that they are temporary until the real answer comes along.

Scientific conclusions are well founded in their factual content and thinking and are tentative only in the sense that all ideas are open to scrutiny.

Scientists are willing to modify their ideas as new evidence appears.

Science is not democratic!

Scientific ideas are accepted or rejected instead on the basis of evidence.

Paradigm Shift

- A change from one way of thinking to another.
- A revolution, a transformation, a sort of metamorphosis.
- It just does not happen, but rather it is driven by agents of change.

The best that scientists can do is to fail to disprove things while pointing out how hard they tired.

Characteristics of Science

Science is a community endeavor.

- Science relies on a system of checks and balances, which helps ensure that science moves in the direction of greater accuracy and understanding.
- This system is facilitated by diversity within the scientific community, which offers a broad range of perspectives on scientific ideas.

Limits of Science

Limits of Science

Science doesn't make moral judgments.

Science helps us describe how the world *is*, but it cannot make any judgments about whether that state of affairs is right, wrong, good, or bad.

Science can help us learn about terminal illnesses and the history of human and animal rights — and that knowledge can inform our opinions and decisions. But ultimately, individual people must make moral judgments.

Limits of Science

Science doesn't make aesthetic judgments.

Science can reveal the frequency of a G-flat and how our eyes relay information about color to our brains, but science cannot tell us whether a Beethoven symphony, a Kabuki performance, or a Jackson Pollock painting is beautiful or dreadful.

Individuals make those decisions for themselves based on their own aesthetic criteria.

Limits of Science

Science doesn't tell you how to use scientific knowledge.

Science itself doesn't indicate what should be done with scientific knowledge.

Science can tell you how to recombine DNA in new ways, but it doesn't specify whether you should use that knowledge to correct a genetic disease, develop a bruise-resistant apple, or construct a new bacterium.

Limits of Science

Science doesn't draw conclusions about supernatural explanations.

Questions that deal with supernatural explanations are, by definition, beyond the realm of nature — and hence, also beyond the realm of what can be studied by science.

For many, such questions are matters of personal faith and spirituality.

Moral judgments, aesthetic judgments, decisions about applications of science, and conclusions about the supernatural are outside the realm of science, but that doesn't mean that these realms are unimportant.

In fact, domains such as ethics, aesthetics, and religion fundamentally influence human societies and how those societies interact with science.

In fact, topics like aesthetics, morality, and theology are actively studied by philosophers, historians, and other scholars.

However, questions that arise within these domains generally cannot be resolved by science.