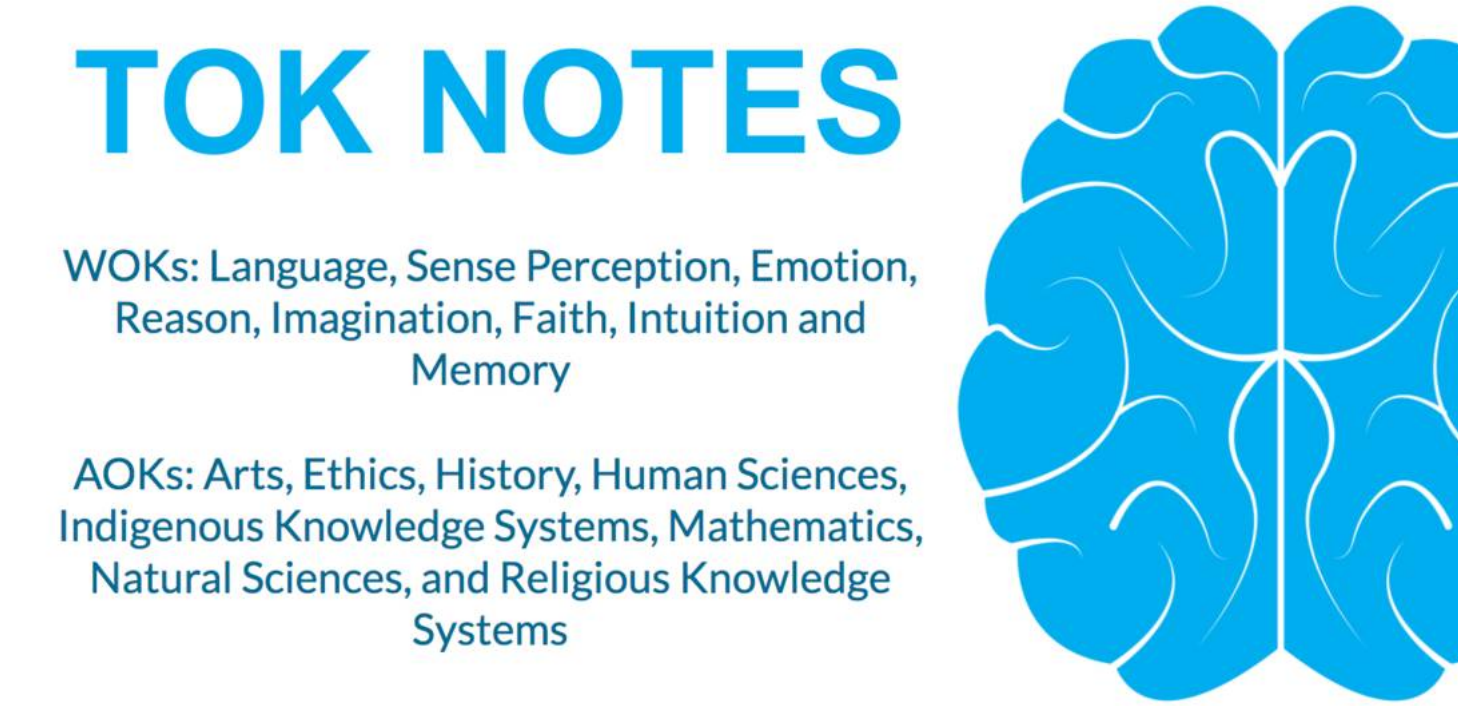
Natural Science Notes

Post 16/17



ToK Notes

Mark as Complete

Natural Science Quotes

- "It has been said that man is a rational animal. All my life I have been searching for evidence which could support this." (Bertrand Russell)
- "I do not feel obliged to believe that the same God who has endowed us with sense, reason, and intellect has intended us to forgo their use." (Galileo Galilei)
- "He that will not reason is a bigot; he that cannot reason is a fool; and he that dares not reason is a slave." (William Drummond)
- “As a matter of historical fact, the history of science is, by and large, a history of progress.” (Karl Popper)
- "Critical reason is the only alternative to violence so far discovered." (Karl Popper)
- "Reason itself is a matter of faith. It is an act of faith to assert that our thoughts have any relation to reality at all." (G K Chesterton)
- "You do not reason a man out of something he was not reasoned into." (Jonathan Swift)

Definitions of Natural Science

- A science or knowledge of objects or processes observable in nature,as biology or physics, as distinguished from the abstract or theoretical sciences, as mathematics or philosophy. *(Dictionary.com)*
- any of the sciences (as physics, chemistry, or biology) that deal with matter, energy, and their interrelations and transformations or with objectively measurable phenomena. *(Merriam-Webster Dictionary)*

Insights from Natural Science

The insights of science allow us to understand the processes of our world. People applying the methods of science have given us insights into things, from **the more abstract (pure science) areas**, such as the theory of relativity, big bang theory or evolution, to **more practical areas (applied science)** such as the research which have brought us antibiotics, electricity and all of our advanced technologies.

- Often insights which seem very abstract and unsuited to practical application end up having dramatic practical uses. For example, when the structure of DNA was first discovered, genetic engineering wasn't considered a practical possibility. Today, genetically modified crops have already reduced chemical pesticide use by 37% and increased crop yields by 22% (Klümper, W).
- The essense of the power of science is it's predictive power. Science allows us to make predictions about what will and won't work in terms of technologies.
- Science is great at overcoming personal biases or wrong beliefs. Scientists aren't able to test every potentially wrong belief, but in the areas where scientific testing is possible (i.e. natural processes) the scientific method does a great job at uncovering false beliefs.
- Specific instances of scientific insight can be generalised, using inductive reasoning, to derive general principles of how the world works.
- Scientists are expected to record and share both their results and their methodologies. This means that new findings are shared widely and mistakes can be caught.

Weaknesses of Natural Science

- The majority of data in science is obtained through observation, and thus observations in science are sometimes limited by our 5 senses. However, technologies continue to expand the range of our senses to include things like infared radiation, radio waves, and sounds at low and high frequencies.

- Science is limited by the the ability of humanity to ask questions. In some areas, our ability to ask clear, testable questions comes up against the limits of available facts, language and clear thinking. As a result aspects such as infinity, the future, or the nature of god can seem beyond what science can explore. Two interesting examples to explore are the Schrödinger's cat paradox and Heisenberg's uncertainty principle.

- Scientists are encouraged to do experiments they expect with result in new, interesting findings, rather than confirm previous findings.
- Science is unable to provide compete certainty. It can only be proven wrong, never completely right (See "falsifiability"). This is shown in the climate change debate. Despite the overwhelming majority of experts agreeing on the scientific processes involved, some scientists continue to question this and explore, which suggests to some that there is still "scientific uncertainty" about humans' role. This inability to achieve complete certainty could be seen as a weakness of science.
- Science probably can't answer moral questions. The Milgram experiment (on obedience to authority) was a very famous human science experiment. But it always reminds me of how people often trust scientists proclamations without understanding the science behind them. The work of scientists requires so much specialist knowledge that it is hard for them to make their findings fully understood. As a result, we have come to trust science without understanding it in many cases.
- The resources of the scientific community are limited. They confront a huge volume of data, on all natural phenomena. It is expensive to collect, verify, process, and store this information. And then much more expensive to anaylse it using scientific study. As a result, priorities are decided and much information goes unstudied.

The Scientific Method

The scientific method is a process in which many scientists construct and test scientific hypotheses. Scientists use the scientific method because it is evidence-based, standardized and objective. This helps scientists avoid the influence of preconceived notions and personal biases in their research processes, which also improves the credibility of research findings (The Scientific Method). observation, testing, formulation, experimentation and measurement. In general though it has roughly four steps:

1. Observation and description of a phenomenon.

2. Formulation of an hypothesis to explain the phenomenon.

3. Use of the hypothesis to predict the existence of other phenomena, or to predict quantitatively the results of new observations.

4. Performance of experimental tests of the predictions by several independent experimenters and properly performed experiments.

Scientific theories are created to support the obtained data.

Popper's Principle of Falsifiability

Falsifiability is the logical possibility that a particular assertion could be shown false by an observation or experiment. Falsifiability means that if statement was false, it's 'falseness' could be demonstrated. Scientists try to always test falsifiable statements. Let's look at an example.

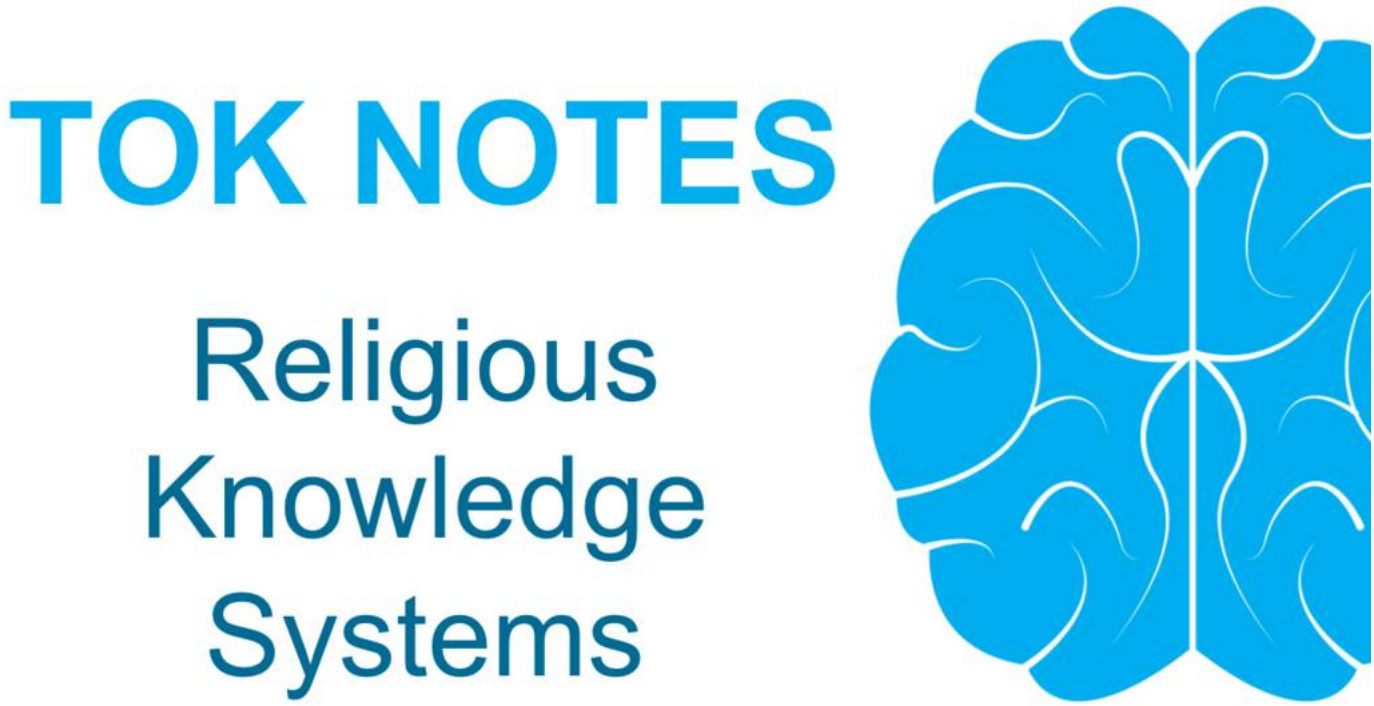
If someone said, **"No humans live forever"** that would not be easily falsifiable because it is almost impossible to prove this statement wrong. It would require that every human be observed forever to make sure none of them lives forever. No one has time for that. Whereas the statement, **"All humans live forever"** is falsifiable because it is the kind of statement that could be proven wrong fairly easily. Finding a single dead human would show that the satement is wrong.

Falsifiability basically means "testability". Scientists are concerned with making hypotheses that they can test, so they can determine new facts. For this reason Popper says that unfalsifiable statements are unscientific because they can't be tested to determine whether they are true or not.

Sources

Klümper, W; Qaim, M (2014). "A Meta-Analysis of the Impacts of Genetically Modified Crops". PLoS ONE. 9 (11): e111629.

The Scientific Method. Reference.com https://www.reference.com/science/scientists-use-scientific-method-887b9796714e7261#



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