**SCI 1003 – Assignment due on October 10 (2022)**

Read *Scientific epistemology: How scientists know what they know* (warning! Long read; **ignore the technical physics and math stuff)** this reading is a chapter from a textbook for students who will be Physics teachers; we will focus on the ‘how we know’ discussions.

1. **What is ‘scientific epistemology’? Why is it important to understand scientific epistemology?**

What is knowledge, and what do we mean when we say that we know something? What is the source of knowledge, and how do we know if it is reliable? What is the scope of knowledge, and what are its limitations?

Its important to question knowledge as science is a process of always questioning Nature and its processes.

**2) According to Wenning, does learning scientific content (facts, principles, laws and theories) teach the process of science? Explain.**

No because he believes that teaching just the facts does not teach the philosophy of science underneath.

**3) Is knowing in science the same as knowing in sociology, history and religion? Explain**

No, as in those fields of study you have faith that what you are being taught is true and especially true in religion you are not allowed to question those beliefs because they are more dogmatic in nature.

**4) How does Wenning define ‘knowledge’?**

justified belief

**5) What is the Uniformity of Nature principle? Why is it important?**

The laws of nature are forever constant and apply the same way to all matter across both time and space. Its important because it shows that the same physical principles in operation over the entire universe and throughout the distant past have remained the same.

**6) Wenning describes scientific knowledge as ‘tentative, while at the same time, durable’. How is scientific knowledge tentative? How is it durable?**

Scientific knowledge is tentative as since we cannot know everything there could be a scenario where a theory is wrong and will have to be changed but at the same time many concepts are so well supported, they are probably not wrong i.e. durable.

**7) a) How does knowledge differ from ‘truth’?**

Knowledge is what we know based on experience, or other information. It doesn’t necessary mean it is correct. While truth could be considered fact or belief that is accepted as true.

**b) Do scientists claim that scientific knowledge is the ‘truth’? Why or why not?**

No because that would consist of knowing something to be correct now and forever, which isn’t possible

**8) What are ‘induction’, ‘deduction’ and ‘abduction’? Give an example of each that was not in any of our readings.**

Induction: making an inference based on an observation.

All of my friends are eating the food, therefore the food must be tasty.

Deduction: Inference about general or universal premises.

Robins are birds, All birds have feathers. Therefore Robins have feathers.

Abduction: making a probable conclusion from what you know.

Discovering the identity of a criminal based on evidence at a crime scene

**9) What is empiricism? Why is it important in science?**

Logic, connected to verification though observation or experimentation, leads to knowledge and is constrained by physical evidence. Its important as most science is done through experimentation as well as the gathering of evidence.

**10) Do all scientists perform experiments? If not, how do scientists who don’t do experiments discover new knowledge about nature?**

Not all scientists do experiments but they can use methods such as the hypothetico-deductive method to test hypothesis but usually experiments are usually better if possible.

**11) Briefly explain the ‘hypothetico-deductive method’.**

A way of testing a hypothesis based on empirical evidence available.

**12) What are the characteristics of a scientific theory? (What should a scientific theory be able to do? Wennings gives a list).**

They are consistent with established knowledge, they unify data and account for hitherto unexplained data, they sometimes point to relationships that previously have gone unnoticed, they explain and often predict.

**13) a) Can a theory ever be proven to be correct? b) Is absolute certainty required in science?**

No as theories must be correct for all scenarios. Its not required though as a theories require constant scrutiny and experimentation so the best possible theory is crafted.

**14) According to Wenning, is science teaching usually based on knowledge and inquiry or on faith and authority?**

On faith and authority, as facts and processes are taught rather than doing experimentation.

**15) a) What do you think Wenning means when he writes that ‘knowledge has to be ‘constructed’?**

Knowledge must be built through experimentation, experience, and factual knowledge.

**b) Do we construct scientific knowledge when we memorize content? If not, what, besides memorization, does a learner need to do in order to ‘construct knowledge’?**

No, it plays a part in building knowledge but to truly construct knowledge you must do a mix of experimentation and memorizing as the more you generally know the more ideas you can come up to test for an experiment.