

1. Characteristics of Scientific Knowledge

	SD	D	U	A	SA	Response Count
A. Scientific knowledge is a product of the scientific method alone.	21.4% (6)	42.9% (12)	3.6% (1)	32.1% (9)	0.0% (0)	28
B. Scientific knowledge is affected by social and cultural traditions.	7.1% (2)	7.1% (2)	3.6% (1)	67.9% (19)	14.3% (4)	28
C. Scientific knowledge is durable, that is, substantially the same over time.	17.9% (5)	42.9% (12)	10.7% (3)	25.0% (7)	3.6% (1)	28
D. Scientific knowledge is certain or exact.	17.9% (5)	53.6% (15)	7.1% (2)	21.4% (6)	0.0% (0)	28
E. Scientific knowledge is subject to review by other scientists.	0.0% (0)	0.0% (0)	0.0% (0)	28.6% (8)	71.4% (20)	28
F. Scientific knowledge is heavily dependent on logical arguments.	0.0% (0)	3.6% (1)	3.6% (1)	42.9% (12)	50.0% (14)	28
answered question						28
skipped question						0

2. Comments on Characteristics of Scientific Knowledge

	Response Count
	7
answered question	7
skipped question	21

3. Acceptance of Theories in Scientific Community

	SD	D	U	A	SA	Response Count
A. Scientists will accept two different theories at the same time, when both theories explain the same event/phenomenon equally well because if scientists cannot tell which theory is better, they may consider both useful for the time being.	0.0% (0)	14.8% (4)	3.7% (1)	48.1% (13)	33.3% (9)	27
B. Scientists will accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well because scientists interpret evidence differently based on their theories.	0.0% (0)	25.9% (7)	7.4% (2)	59.3% (16)	7.4% (2)	27
C. Scientists will not accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well because scientists tend to favor one theory over another.	7.4% (2)	33.3% (9)	18.5% (5)	37.0% (10)	3.7% (1)	27
D. Scientists will not accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well, because scientists tend to accept the simpler theory.	7.4% (2)	37.0% (10)	11.1% (3)	37.0% (10)	7.4% (2)	27
E. Scientists will not accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well, because scientists tend to accept the theory that is favored by more expert scientists.	11.1% (3)	44.4% (12)	7.4% (2)	25.9% (7)	11.1% (3)	27
F. Scientists will not accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well, because scientists tend to reject the theory	7.4% (2)	18.5% (5)	7.4% (2)	55.6% (15)	11.1% (3)	27

inconsistent with the presently accepted scientific theories and laws.							
G. Scientists will not accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well because scientists will accept the true theory only.	55.6% (15)	33.3% (9)	7.4% (2)	3.7% (1)	0.0% (0)		27
						answered question	27
						skipped question	1

4. Comments on Acceptance of Theories in Scientific Community	
	Response Count
	5
	answered question 5
	skipped question 23

5. Social and Cultural Influence on Science

	SD	D	U	A	SA	Response Count
A. Scientists who conduct scientific research are influenced by their culture and society.	0.0% (0)	10.7% (3)	3.6% (1)	71.4% (20)	14.3% (4)	28
B. The values and expectations of the culture determine what science is conducted, interpreted, and accepted.	3.6% (1)	7.1% (2)	7.1% (2)	64.3% (18)	17.9% (5)	28
C. The values and expectations of the culture determine how science is conducted, interpreted, and accepted.	3.7% (1)	7.4% (2)	11.1% (3)	63.0% (17)	14.8% (4)	27
D. All cultures conduct scientific research the same way because science is universal and independent of culture and society.	7.1% (2)	75.0% (21)	0.0% (0)	17.9% (5)	0.0% (0)	28
E. Scientists are trained to conduct "pure," unbiased research, therefore their work is not affected by culture and society.	21.4% (6)	60.7% (17)	0.0% (0)	14.3% (4)	3.6% (1)	28
F. The purpose of scientific research is to find the absolute truth without the influence of the society and culture.	3.6% (1)	32.1% (9)	0.0% (0)	46.4% (13)	17.9% (5)	28
answered question						28
skipped question						0

6. Comments on Social and Cultural Influence on Science.

	Response Count
	3
answered question	3
skipped question	25

7. Imagination and Creativity in Scientific Investigations

	SD	D	U	A	SA	Response Count
A. Scientists use their imagination and creativity during planning and hypothesizing.	0.0% (0)	0.0% (0)	3.6% (1)	21.4% (6)	75.0% (21)	28
B. Scientists use their imagination and creativity during data collection phase.	0.0% (0)	10.7% (3)	10.7% (3)	57.1% (16)	21.4% (6)	28
C. Scientists use their imagination and creativity during data analysis.	0.0% (0)	7.1% (2)	0.0% (0)	57.1% (16)	35.7% (10)	28
D. Scientists use their imagination and creativity during interpretation and reporting.	0.0% (0)	7.1% (2)	0.0% (0)	46.4% (13)	46.4% (13)	28
E. Scientists do not use their imagination and creativity because imagination and creativity is in conflict with logical reasoning in science.	64.3% (18)	32.1% (9)	0.0% (0)	3.6% (1)	0.0% (0)	28
F. Scientists do not use their imagination and creativity because imagination and creativity can interfere with the true facts to be discovered.	60.7% (17)	35.7% (10)	0.0% (0)	3.6% (1)	0.0% (0)	28
answered question						28
skipped question						0

8. Comments on Imagination and Creativity in Scientific Investigations

	Response Count
	4
answered question	4
skipped question	24

9. Nature of Scientific Theories

	SD	D	U	A	SA	Response Count
A. Scientific theories will be gradually refined or modified as experimental techniques/instruments improve.	0.0% (0)	0.0% (0)	0.0% (0)	32.1% (9)	67.9% (19)	28
B. Old scientific theories may be abandoned and be replaced with new theories in light of new evidence.	0.0% (0)	0.0% (0)	0.0% (0)	35.7% (10)	64.3% (18)	28
C. Scientific theories change because new scientists may reinterpret or reconceptualize existing observations.	0.0% (0)	7.1% (2)	0.0% (0)	57.1% (16)	35.7% (10)	28
D. Scientific theories that are built on correctly done experiments will not change.	39.3% (11)	57.1% (16)	3.6% (1)	0.0% (0)	0.0% (0)	28
answered question						28
skipped question						0

10. Comments on Nature of Scientific Theories

	Response Count
	4
answered question	4
skipped question	24

11. Scientific Laws vs. Theories

	SD	D	U	A	SA	Response Count
A. Scientists discover (or find) theories that have been existing in the natural world.	14.8% (4)	33.3% (9)	11.1% (3)	37.0% (10)	3.7% (1)	27
B. Scientists discover (or find) laws that have been existing in the natural world.	3.7% (1)	3.7% (1)	7.4% (2)	70.4% (19)	14.8% (4)	27
C. Scientists discover (or find) information to create scientific laws.	3.7% (1)	18.5% (5)	3.7% (1)	59.3% (16)	14.8% (4)	27
D. Scientific laws are certain but theories are uncertain.	14.8% (4)	51.9% (14)	14.8% (4)	14.8% (4)	3.7% (1)	27
E. Scientific laws are theories that have been proven.	7.4% (2)	40.7% (11)	7.4% (2)	40.7% (11)	3.7% (1)	27
F. Scientific theories explain scientific laws.	14.8% (4)	33.3% (9)	14.8% (4)	33.3% (9)	3.7% (1)	27
G. Scientific theories do not become scientific laws because theories and laws are two different categories of scientific knowledge.	25.9% (7)	44.4% (12)	7.4% (2)	14.8% (4)	7.4% (2)	27
answered question						27
skipped question						1

12. Comments on Scientific Laws vs. Theories

	Response Count
	4
answered question	4
skipped question	24

13. Nature of Observations

	SD	D	U	A	SA	Response Count
A. Scientists' observations of the same events may be different because the scientists' prior knowledge may affect their observations.	3.6% (1)	17.9% (5)	7.1% (2)	60.7% (17)	10.7% (3)	28
B. Scientists with similar background knowledge are trained to make similar observations of the same events.	0.0% (0)	14.3% (4)	17.9% (5)	67.9% (19)	0.0% (0)	28
C. All scientists' observations of the same events must be the same because scientists are objective.	3.6% (1)	78.6% (22)	0.0% (0)	17.9% (5)	0.0% (0)	28
D. All scientists' observations of the same events are the same because observations are true facts.	21.4% (6)	64.3% (18)	3.6% (1)	7.1% (2)	3.6% (1)	28
E. All scientists' observations of the same events are similar because scientists use a variety of methods to verify results.	10.7% (3)	50.0% (14)	10.7% (3)	25.0% (7)	3.6% (1)	28
answered question						28
skipped question						0

14. Comments on Nature of Observations

	Response Count
	3
answered question	3
skipped question	25

15. Processes of Science

	SD	D	U	A	SA	Response Count
A. In order to generate and validate theories, scientists must use the universal step-by-step scientific method.	10.7% (3)	53.6% (15)	7.1% (2)	25.0% (7)	3.6% (1)	28
B. When scientists use the scientific method correctly, their results are true and accurate.	14.8% (4)	63.0% (17)	3.7% (1)	18.5% (5)	0.0% (0)	27
C. There is no single, universal step-by-step scientific method.	7.4% (2)	11.1% (3)	0.0% (0)	59.3% (16)	22.2% (6)	27
D. Scientific findings may be accidental.	0.0% (0)	3.6% (1)	3.6% (1)	46.4% (13)	46.4% (13)	28
E. Scientists use a variety of methods that can produce fruitful results.	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (14)	50.0% (14)	28
F. Scientists may use different methods to investigate, but all results will eventually be verified or confirmed by using the scientific method.	3.6% (1)	14.3% (4)	17.9% (5)	46.4% (13)	17.9% (5)	28
answered question						28
skipped question						0

16. Comments about Processes of Science

	Response Count
	2
answered question	2
skipped question	26

Page 1, Q2. Comments on Characteristics of Scientific Knowledge

1	Of course I assumed that you were asking what I think of scientific knowledge as it is, not as it should be.	Mar 25, 2011 6:39 AM
2	The answer to many of these questions depend on context and your point of view (perhaps that was the intention). In question C, for example, scientific knowledge does grow and evolve as we uncover new evidence, disprove old theories, and catalog new phenomenon. However, none of this evolution invalidates the results of previous experiments (unless indeed they were faulty) or diminishes the power of long-standing theories to predict the behavior of the natural world. For example, General Relativity may appear to "invalidate" the results of Isaac Newton, but Newton's model of the world is still very widely used, even more so than Einstein's Relativity, for one good reason: it is still extremely accurate at predicting the behavior of the natural world, and it has been well-tested over a much wider range of conditions than even relativity has. In a similar way, scientific knowledge is certain, in the sense that its theories are constantly tested and proven, and exact in the sense that most theories provide unambiguous, quantitative results. But it is also uncertain in that there is always the possibility of new evidence changing our way of thinking (like relativity did with Newtonian physics) and it is inexact in that many theories are approximations that remain accurate over a certain quantifiable range of conditions.	Feb 22, 2011 8:40 AM
3	As posed the questions confuse "knowledge" with "truth" as opposed to a viable model of reality.	Feb 21, 2011 5:05 AM
4	Scientific knowledge is our best guess of how to interpret a specific observation given our current understanding. It is uncertain, plagued by our social and cultural assumptions, and thus, it changes as we change.	Feb 19, 2011 1:02 AM
5	Science involves way more "people" issues that most scientists are willing to admit. But that doesn't mean that science still won't get things "right" in the end. It will.	Feb 18, 2011 6:08 PM
6	There is often a broad range in the level of certainty of what is considered to be scientific knowledge.	Feb 18, 2011 2:20 PM
7	There are true things that can not be proven true (Godel)	Feb 18, 2011 1:05 PM

Page 1, Q4. Comments on Acceptance of Theories in Scientific Community

1	Here is my actual perception (difficult to fit in the above): Scientists (as a community) will often accept two different theories at the same time, even though or because both theories explain the same event/phenomenon equally well, unless one of the two is in obvious conflict with established, demonstrated evidence (and sometimes not even in that case). In many cases however it's not that both theories are accepted by the whole community, but that one of the two theories is accepted by one part of "the community" while the other theory by the remaining part (with a few exceptions of neutral scientists). And therefore: scientists (as individual scientists) will rarely accept two different theories at the same time, even though both theories explain the same event/phenomenon equally well, because scientists will accept the true (their) theory only, possibly the one favoured by more expert scientists of their same faction.	Mar 25, 2011 6:39 AM
2	These statements were long and complicated, so I may not have understood exactly what was being said.	Feb 21, 2011 10:56 AM
3	Questions are ill posed. Scientists are humans with a wide range of personal perspectives and biases.	Feb 21, 2011 5:05 AM
4	Scientists are not perfect. Most of these statements are true for some people and not for others. The only thing I'm really certain of is that scientists will accept only the true theory - because no one knows what is actually "true."	Feb 19, 2011 1:02 AM
5	It is kind of sad that I agreed with almost all of those. Unfortunately they all happen sometimes. Science fixes that in the end, though, too...	Feb 18, 2011 6:08 PM

Page 1, Q6. Comments on Social and Cultural Influence on Science.

1	I think most scientists would agree that science SHOULD pursue the truth without the bias of culture or society, but this is difficult to realize in practice. To be blunt, scientific research just isn't funded unless there is some expectation of getting the result that society "wants."	Feb 22, 2011 8:40 AM
2	F is true -- unfortunately there is a 'human bias' or 'cultural bias' (unconscious bias), that is almost impossible to quantify or take into account. Therefore everything a scientist does or thinks is almost indistinguishable from his culture. This does not mean that it cannot be rational or that the conclusions are not purely objective or not scientific. True advancement comes from such unbiased people ahead of their culture and time, not necessarily mainstream (and I think someone like Newton).	Feb 22, 2011 8:38 AM
3	Although we are taught that scientific research should be unbiased and we are taught the principles that could, in principle, make scientific research unbiased, we are human. We have human expectations and prejudice and limitations based on the society and culture in which we are raised. Thus, science is always influenced by the presence of humanity.	Feb 19, 2011 1:02 AM

Page 1, Q8. Comments on Imagination and Creativity in Scientific Investigations

1	Of course, as above, this refers to how I often see things going, not to how they should go.	Mar 25, 2011 6:39 AM
2	Imagination and creativity are crucial to devising insightful experiments and making the conceptual leaps that advance our scientific knowledge. Further, as a scientist who practices engineering, imagination and creativity are absolutely necessary to devise ways of using our scientific knowledge to create technology, and this technology through instrumentation in turn is the key to unlocking new scientific frontiers.	Feb 22, 2011 8:40 AM
3	Creativity and scientific research are just different aspects of the same thing, curiosity.	Feb 19, 2011 1:02 AM
4	Imagination and creativity can be used hand-in-hand with logic to _great_ effect.	Feb 18, 2011 6:08 PM

Page 2, Q2. Comments on Nature of Scientific Theories

1	concerning question D: I guess it *might* have been true if it was "Scientific theories that are CORRECTLY built on correctly done experiments will not change", but even in that case the "correctly" may be questionable.	Mar 25, 2011 6:51 AM
2	can look at the correct data and experiments in different ways.	Feb 22, 2011 8:43 AM
3	Theories are models of reality that can be used to make useful predictions. As such, theories are affected by the ability to make measurements and the accuracy of such.	Feb 21, 2011 5:24 AM
4	These are some of the key tenants of the scientific method!	Feb 18, 2011 6:13 PM

Page 2, Q4. Comments on Scientific Laws vs. Theories

1	I would have said that scientists create (invent) theories to explain (or in some cases more "model") how things work in the natural world.	Mar 25, 2011 6:51 AM
2	Semantics.	Feb 22, 2011 8:44 AM
3	Scientific theories explain --> describe natural laws.	Feb 22, 2011 8:43 AM
4	The distinction between "theory" and "law" is largely semantic. Newton's "laws" are valid for a certain range of physical conditions whereas Einstein's "theories" of relativity give a better match to reality under more extreme conditions of speed and gravity.	Feb 21, 2011 5:24 AM

Page 2, Q6. Comments on Nature of Observations

1	pure observations should be unbiased. the interpretaion is biased. verifying results and making observations are two different things.	Feb 22, 2011 8:43 AM
2	No observation is perfect; all data are affected by uncertainty and systematic biases and evaluating data is largely a matter of taking these uncertainties and biases into account. Different researchers can arrive at incompatible conclusions even from analysing the same data.	Feb 21, 2011 5:24 AM
3	Scientists must constantly work to avoid biases.	Feb 18, 2011 6:13 PM

Page 2, Q8. Comments about Processes of Science

1	No theory, law or conjecture can be "proven" to be true by current criteria. This would require that all alternative hypothesis as false. A theory can be falsified by making clearly incorrect predictions. Theories become widely accepted only after serious efforts to disprove them have failed.	Feb 21, 2011 5:24 AM
2	The scientific method isn't required for progress, but using the scientific method correctly almost always helps.	Feb 18, 2011 6:13 PM