|  |  |
| --- | --- |
| Science is open-ended, but scientists operate with expectations based on the predictions of theory.  1 | A theory is what scientists strive for:  a large body of continually refined observations, inferences, and testable hypotheses.  2 |
| Theories help scientists  interpret their observations:  facts do not speak for themselves.  3 | In general, scientists plan  investigations by working  along the lines suggested by theories, which in turn are based on previous knowledge. Theories serve to give direction to observations,  i.e., they tell one where to look.  4 |
| A theory is a logical construct  of facts and hypotheses  that attempts to explain  a range of natural phenomena  and that can be tested  in the natural world.  5 | Good science cannot be done  without good theories.  6 |
| Observation is central to all of science, i.e., seeing is believing.  7 | A scientist should not allow  preconceived theoretical ideas to influence observation  and experimentation.  8 |
| Unless an idea is testable  it is of little or no use;  thus, scientists attempt to convert  possible explanations into  testable predictions.  9 | Careful, repeatable observation  and experiment give the facts  about the world around us.  10 |
| Good science always begins with observations.  11 | Science is never authoritative;  it is always subject to adjustment  in the light of new observations.  12 |

|  |  |
| --- | --- |
| A phrase such as  "Many scientists believe..."  misrepresents scientific inquiry  because scientists deal in evidence.  13 | Science is always changing and therefore is not very reliable.  14 |
| Scientists should be held  Responsible for harm their  discoveries have caused,  e.g., pollution, nuclear weapons.  15 | Earning recognition from other  scientists is really the main  motivation of most scientists.  16 |
| Most of what scientists do  will never be of much practical value.  17 | Money spent on projects such as  NASA space flights would be  better spent elsewhere.  18 |

|  |  |
| --- | --- |
| Science destroys values and morality  by disparaging the unique nature  of men and women.  19 | Science and religion  are fundamentally at odds.  20 |
| The scientific method should be  followed in all fields of study.  21 | Scientists and engineers should  make the decisions about things like types of energy to use because  they know the facts best.  22 |
| Science is the most important  way of gaining knowledge  open to humanity.  23 | Science knowledge is of  much greater value than  any other type of knowledge.  24 |

|  |  |
| --- | --- |
| Only science can tell us  what is really true about the world.  25 | Science knowledge is always  objective and self-correcting.  26 |
| Credit for our advanced way  of life must go to science  and scientific progress.  27 | Funding decisions influence  the direction of scientific inquiry  28 |
| Scientific questions, methods,  and results vary according  to historical, political, cultural  and social settings  29 | The predominance of men  in the sciences has led to bias  in the choice and definition  of the problems scientists  have addressed  30 |

|  |  |
| --- | --- |
| Scientific facts are manufactured  through social negotiations  between scientists. Nature  has nothing to say  on its own behalf.  31 | Scientists tend to see things alike,  so even groups of scientists  may have trouble being  entirely objective.  32 |
| The Early Egyptians, Greeks,  Chinese, Hindu and Arabic  cultures are responsible  for many scientific  and mathematical ideas  and technological inventions.  33 | The predominance of men  in the sciences has led to bias  which is a factor in the  under representation of  women in science  34 |
| Science is one of several powerful  ways of knowing and understanding  the natural world, however,  some matters cannot be examined usefully in a scientific way.  35 | Science leads to generalizations  based on observations or theories.  Science always aims to be testable, objective and consistent.  36 |

|  |  |
| --- | --- |
| As with all human endeavors  science is subject to many influences  both good and bad.  37 | Science builds on what has gone on before and refines its conclusions,  but scientific work does not result  in infallible propositions,  such as the word “proof”  implies to a nonscientist.  38 |
| Scientific progress has made possible some of the best things in life  and some of the worst.  39 | Theory and observation interact.  Each contributes to the other:  If theory without observation  is empty, then observation  without theory is blind.  40 |
| **What is Science all about?**  CARD GAME  Require 5 sets of 40 cards = 200 total  for use with groups of 20-32 students  **STEP 1**  Shuffle cards, deal 6 per student  **STEP2** (10 min)   1. Students mingle B) show cards/discuss C) Trade duplicates, trade for cards you agree with, trade away cards you disagree with   **STEP 3** Find a pair (see RULES) | **RULES**: A) Each pair must hold 8 cards  where both relatively agree with statements  B) Each member must contribute at least 3 cards C) Discard remaining cards  **STEP 4** Find a foursome  Same RULES as above, ASK groups to rank order their statements  **STEP 5** BASED ON YOUR CARDS, WRITE a statement of paragraph length  on the nature of science (as a group)  **WRAP-UP**, share paragraphs  Discuss why reject/accept some cards |