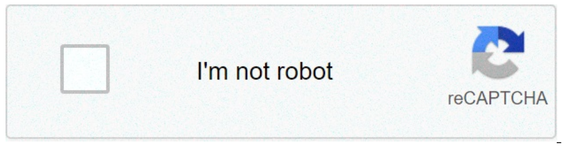

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Inference definition chemistry

Distinguish between strong and weak arguments or inferences. Outline the general scientific method. Identify the critical elements of strong inference as a way of knowing. Identify and describe the roles of basic elements of experimental design: dependent and independent variables, positive and negative controls. What is the difference between strong and weak arguments or inferences? Is that the same as valid or invalid arguments? See this video for a good explanation: The first example in the video, that begins with all humans have DNA, and concludes that Pat has DNA, is an exercise in deductive reasoning. Logically correct deductive reasoning leads to valid arguments or conclusions. However, much of science is dedicated to constructing generalities or models from specific examples, and dealing with uncertainties. This takes inductive reasoning, reaching conclusions based on evidence, and distinguishing between strong and weak arguments. Scientific investigations use both deductive and inductive reasoning. Scientific Method and Strong Inference Why are some scientists more successful than others? Is it just luck, or that some problems are just more difficult than others, or that some scientists are smarter or know more or work harder? Platt, who coined the term “strong inference,” thinks it’s a method of systematic scientific thinking (Platt, 1964). This Platt paper is required reading for students enrolled in Biol 1510! In its separate elements, strong inference is just the simple and old-fashioned method of inductive inference that goes back to Francis Bacon. The steps are familiar to every college student and are practiced, off and on, by every scientist. The difference comes in their systematic application. Strong inference consists of applying the following steps to every problem in science, formally and explicitly and regularly: Devising alternative hypotheses; Devising a crucial experiment (or several of them), with alternative possible outcomes, each of which will, as nearly as possible, exclude one or more of the hypotheses; Carrying out the experiment so as to get a clean result; Recycling the procedure, making subhypotheses or sequential hypotheses to refine the possibilities that remain, and so on. Platt expounds on two critical points in this method: Chamberlin’s idea of multiple working hypotheses, to avoid attachment to a favored hypothesis and confirmation bias; experiments designed to eliminate (falsify) one or more alternative hypotheses. These two essays by Platt (1964) and Chamberlin (1890, 1897, reprinted 1995) are not just classic, but timeless in that they remain relevant and stimulate much discussion today and will do so into the future. They are well worth reading and re-reading every few years. Here’s a fun video to illustrate the value of attempting to disprove your hypothesis: Experimental Design Well-designed experiments test hypotheses; they attempt to falsify (disprove or eliminate) as many hypotheses as possible. Typical experiments have one or more independent variables, some factor in the experiment that is set in varying amounts by the experimenter. Examples of independent variables include time or the amounts of a particular substance added to reactions or to cell cultures. Dependent variables are the outcomes that depend on the independent variables. Typically, the independent variables are plotted on the x-axis of a graph, and the dependent variables are plotted on the y-axis. The valid interpretation of experiments requires proper controls. Positive controls are experiments with known outcomes. Their purpose is to make sure that the instruments and reagents are all working properly. If an experiment with an unknown produces negative results, but the positive control produces the expected results, then we can be confident that the negative results were not due to faulty instruments or reagents. Conversely, negative controls are experiments that should produce negative or null results. They also guard against faulty instruments or contaminated reagents. An experiment with an unknown that produces a positive result is valid only if the negative control shows the expected negative result. Questions for thought and discussion Given that science is a way of knowing about the world around us (epistemology), what are the applications of strong inference outside the science laboratory? What are the similarities and differences between strong inference and clinical diagnostics (see any episode of House, M.D.), or criminal investigation? What are the limitations of strong inference and the scientific method? Is it possible for the scientific method to definitively prove a hypothesis? These days, when we have a question, we turn to the internet. Internet search engines like Google can link you to almost any content, and they even filter content based on your past searches, location, and preference settings. However, search engines do not vet content. Determination of whether content is credible is up to the end-user. We are also living in an era where misinformation can be mistaken for fact. How do we know what information to trust? The process of scientific peer-review is one assurance that scientists place on the reporting of scientific results in scientific journals like Science, Nature, the Proceedings of the National Academy of Science (PNAS), and many hundreds of other journals. In peer review, research is read by anonymous reviewers who are experts in the subject. The reviewers provide feedback and commentary and ultimately provide the journal editor a recommendation to accept, accept with revisions, or decline for this journal. While this process is not flawless, it has a fairly high success rate in catching major issues and problems and improving the quality of the evidence. In the rare situation when a study has passed through the sieve of peer review and is later found to be deeply flawed, the journal or the authors can choose to take the unusual action to retract the work. Retraction is infrequent but does happen in science, and it is reassuring to know that there are ways to flag problematic work that has slipped through the peer review process. A prominent example of a retracted study in biology was one linking the MMR vaccine to autism (. Some sectors of the public still have misconceptions about supposed linkages between autism and vaccination. The putative autism-vaccination connection is a classic case of how correlation does not imply causation, meaning that just because two events co-occur—the recommended childhood vaccination schedule and the onset of autism symptoms—does not mean that one caused the other. With the rapid spread of SARS-CoV-2 and the Covid-19 pandemic, the demand for scientific information about the novel coronavirus SARS-CoV-2 outpaced the rate that journals can peer-review and publish scientific research. Many research articles for SARS-CoV-2 have therefore been released as preprints, meaning they have been submitted to a journal for peer-review and eventual publication, but the authors wanted to release the information for immediate use. In the media, journalists use published and preprint articles, press releases, interviews, and public records requests, and other sources to find source information. They cite their sources when possible and are responsible to their editors for the quality and authenticity of their reporting. Some media sources have better track records than others for unbiased reporting. Websites and social media posts are places where anyone can post anything and make claims that are or are not supported by evidence. As the end-users, our job is to find sources supported by evidence, cited ethically, and otherwise credibly presented. We have the responsibility to notice whether an organization is funded or motivated in ways that might generate bias in their content. We have the obligation to cross reference ideas from unvetted sources to help us establish how believable or how credible the source of information is. Science is based in evidence, and we will work this semester to identify and interpret scientific evidence. References: Platt, John R. “Strong Inference.” In Science, New Series, Vol. 146, No. 3642 (Oct. 16, 1964), pp. 347-353 (html reprint) Raup, David C. and Thomas C. Chamberlin. “The Method of Multiple Working Hypotheses.” In The Journal of Geology, Vol. 103, No. 3 (May, 1995), pp. 349-354 (pdf) – originally published in 1897 In statistics, you have come across the terms, observation and inference, several times. Observation means an act of monitoring, something, i.e. objects, units, persons or anything else, by using senses. In this process, the observer stays at the place of the survey and observes the objects under consideration and notes down the observations himself. Conversely, Inference refers to the conclusion drawn based on the facts and evidence available, i.e. deductions are made as per the research made. The two terms are so closely intertwined that for a layman these two terms are synonymous, but the truth is that these two words are different. So, if you are looking for the differences between observation and inference, you are at the right place. Have a look. Content: Observation Vs Inference Comparison Chart Definition Key Differences Conclusion Comparison Chart Basis for ComparisonObservationInference MeaningObservation means the act of carefully watching or examining a person or object when something is happening.Inference is termed as an act of deriving rational conclusion from known facts or circumstances. NatureObjectiveSubjective What is it?It is what one perceives.It is an explanation or assumption of what one has perceived. Based onHands-on experienceSecond hand information InvolvesCollection of information without questioning respondentsTaking decision about the collected information. ImpliesAttentively monitoring of the subject under study.Logically deducing a conclusion by reasoning. Definition of Observation Observation is defined as the primary source of data collection used in descriptive research. It is the most widely used method of acquiring information, in the field of behavioural sciences. We human beings use our senses to observe things that surround us this is also observation, but not scientific. Observation is said to be scientific when it serves the formulated purpose of research. It involves the collection and recording of data, events and objects in a systematic manner. Further, the data is subjected to checks and controls to ensure validity and reliability of data. Under this method, the investigator does not rely on the respondent for information, i.e. he does not question the people being observed, rather he observes directly, so as to ensure accurate observation and to eliminate subjective bias. Moreover, the information gathered is based on the current events, i.e. it is not influenced by past or future intentions or attitudes. Observation can be structured or unstructured, disguised or undisguised. It can be conducted in a natural or contrived environment. Definition of Inference In simple terms, inference means assumption or conclusion drawn rationally on the basis of facts and observations. It is a calculated guess, which relies on the evidence and circumstances. It is an element of reasoning and thinking, which can be accurate or inaccurate, justified or unjustified, logical or illogical. When the population size is large, it is impractical to study each and every item of the population, and that is why a sample is selected at random, which represents the entire population. On the basis of the sample so selected, generalisation is made about unknown characteristics of the population. In statistics, inference involves two things i.e. hypothesis testing and estimation. The difference between observation and inference can be drawn clearly on the following grounds: The act of carefully watching or examining a person or object when something is happening is known as an observation. An act of deriving rational conclusion from known facts or circumstances is called inference. Observation is objective while inference is subjective. Observation is what one perceives or notices. On the other hand, the inference is an explanation or assumption of what one has perceived or seen. Observation is based on hands-on experience. Unlike inference, which relies on the facts that are already known. Observation implies attentive monitoring of the subject under study. As opposed to inference, logically deducing a conclusion by reasoning. Observation is an act of obtaining information without questioning respondents. As against this inference involves taking decisions about the collected information. Conclusion Besides the differences mentioned above, observation and inferences are interrelated to each other in the sense that observation is what we notice when something takes place while inference is what we deduce on the basis of observations. In this way, the inference is often understood as an interpretation of what is being observed. In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. Read with purpose and meaning. Drawing conclusions refers to information that is implied or inferred. This means that the information is never clearly stated. Writers often tell you more than they say directly. They give you hints or clues that help you "read between the lines." Using these clues to give you a deeper understanding of your reading is called inferring. When you infer, you go beyond the surface details to see other meanings that the details suggest or imply (not stated). When the meanings of words are not stated clearly in the context of the text, they may be implied – that is, suggested or hinted at. When meanings are implied, you may infer them. Inference is just a big word that means a conclusion or judgement. If you infer that something has happened, you do not see, hear, feel, smell, or taste the actual event. But from what you know, it makes sense to think that it has happened. You make inferences everyday. Most of the time you do so without thinking about it. Suppose you are sitting in your car stopped at a red signal light. You hear screeching tires, then a loud crash and breaking glass. You see nothing, but you infer that there has been a car accident. We all know the sounds of screeching tires and a crash. We know that these sounds almost always mean a car accident. But there could be some other reason, and therefore another explanation, for the sounds. Perhaps it was not an accident involving two moving vehicles. Maybe an angry driver rammed a parked car. Or maybe someone played the sound of a car crash from a recording. Making inferences means choosing the most likely explanation from the facts at hand. There are several ways to help you draw conclusions from what an author may be implying. The following are descriptions of the various ways to aid you in reaching a conclusion. General Sense The meaning of a word may be implied by the general sense of its context, as the meaning of the word incarcerated is implied in the following sentence: Murderers are usually incarcerated for longer periods of time than robbers. You may infer the meaning of incarcerated by answering the question "What usually happens to those found guilty of murder or robbery?" What have you inferred as the meaning of the word incarcerated? If you answered that they are locked up in jail, prison, or a penitentiary, you correctly inferred the meaning of incarcerated. Examples When the meaning of the word is not implied by the general sense of its context, it may be implied by examples. For instance, Those who enjoy belonging to clubs, going to parties, and inviting friends often to their homes for dinner are gregarious. You may infer the meaning of gregarious by answering the question, "What word or words describe people who belong to clubs, go to parties a lot, and often invite friends over to their homes for dinner?" What have you inferred as the meaning of the word gregarious? If you answered social or something like: "people who enjoy the company of others", you correctly inferred the meaning of gregarious. Antonyms and Contrasts When the meaning of a word is not implied by the general sense of its context or by examples, it may be implied by an antonym or by a contrasting thought in a context. Antonyms are words that have opposite meanings, such as happy and sad. For instance, Ben is fearless, but his brother is timorous. You may infer the meaning of timorous by answering the question, "If Ben is fearless and Jim is very different from Ben with regard to fear, then what word describes Jim?" If you answered a word such as timid, or afraid, or fearful, you inferred the meaning of timorous. A contrast in the following sentence implies the meaning of credence: Dad gave credence to my story, but Mom's reaction was one of total disbelief. You may infer the meaning of credence by answering the question, "If Mom's reaction was disbelief and Dad's reaction was very different from Mom's, what was Dad's reaction?" If you answered that Dad believed the story, you correctly inferred the meaning of credence; it means belief. Be Careful of the Meaning You Infer! When a sentence contains an unfamiliar word, it is sometimes possible to infer the general meaning of the sentence without inferring the exact meaning of the unknown word. For instance, When we invite the Paulsons for dinner, they never invite us to their home for a meal; however, when we have the Browns to dinner, they always reciprocate. In reading this sentence, some students infer that the Browns are more desirable dinner guests than the Paulsons without inferring the exact meaning of reciprocate. Other students conclude that the Browns differ from the Paulsons in that they do something in return when they are invited for dinner; these students conclude correctly that reciprocate means "to do something in return." In drawing conclusions (making inferences), you are really getting at the ultimate meaning of things – what is important, why it is important, how one event influences another, how one happening leads to another. Simply getting the facts in reading is not enough. You must think about what those facts mean to you.