

The following questions pertain to various topics discussed in the first several chapters of Salmon's *Four Decades of Scientific Explanation*. Topics include various issues surrounding scientific explanation.

1. Are there any inductive or statistical explanations of particular facts? In their classic 1948 paper, Hempel and Oppenheim say that there are such explanations, but do not offer any explication of their nature. Later attempts to work out the details ran into many difficulties. Discuss these problems and say whether you think they are insuperable.
2. According to the explanation-prediction symmetry thesis, every satisfactory scientific explanation could (in some suitable context) serve as a scientific prediction, and every scientific prediction could (in some suitable context) serve as a scientific explanation. Critically discuss both directions of this symmetry thesis. Give your reasons for accepting or rejecting each direction.
3. Are there any fundamental differences between explanations in the natural sciences and explanations in the social sciences? Are there basic differences between human behavior and the behavior of other kinds of physical objects that make one kind more amenable to explanation than the other? Is explanation of human behavior that involves conscious deliberation and free choice possible? Explain critically.
4. In the text, it was suggested that “No gold sphere has a mass greater than 100,000 Kg” is not a lawlike statement, whereas “No enriched uranium sphere has a mass greater than 1000,000 Kg” is a lawlike statement. Discuss the distinction between lawlike and accidental generalizations. Explain as clearly as possible why one is lawlike and the other is not.
5. Discuss the role of causality in scientific explanation. Do all legitimate scientific explanations make reference to causal relations? Is causality essentially irrelevant to scientific explanation? Are some good explanations causal and other good explanations non-causal? Discuss critically.
6. Choose an actual example of a scientific explanation from a magazine such as *Scientific American*, *Science*, *Nature*, *American Scientist*, etc. or from a textbook you have used in a science course. Give a concise summary of this explanation, and analyze it in terms of the modes (such as D–N, I–S, D–S, S–R) and concepts (such as covering law, causal-mechanical, unification) introduced in the text/course. Evaluate the explanation in terms of these models and/or concepts.
7. In the text, Salmon claims that:
  - (i) All gases, kept in closed containers of fixed size, exert greater pressure when heated.

is a general statement, whereas:

- (ii) All apache basketry is made by women.

is not completely (or, to use the language of Hempel & Oppenheim, “purely”) general, because it refers specifically to a particular group of people. But, it might be objected that (i) refers to physical objects of a specific type, namely, gases in closed containers, so it is not completely general either. Moreover, (ii) is a general statement about the Apache. Discuss this objection. **Hint:** Statement (i) can be reformulated as follows; “If anything is a gas in a closed container that is heated, it will expand.” But: Statement (ii) can likewise be formulated as follows: “If anything is an Apache basket, it was made by a woman.” Is there a fundamental logical difference between the two statements as reformulated? Also, is there a fundamental *nomological* difference between the properties “Apache basket” and “gas in a closed container”? Is one “natural” (or “qualitative”) and the other not?

8. Must every scientific explanation contain a law of nature? According to philosophers who support the “received view” (e.g., Hempel & Oppenheim’s “covering law” model), the answer is affirmative. Other philosophers (e.g., Van Fraassen, Salmon, *et al.*) have answered in the negative. Discuss critically the arguments pro and con. Give your own answer, supported by reasons.