

Philosophy of Science Area Comprehensive Exam

Reading List

Revised September 2011

Exam Format: Students will have four hours to write answers to four questions, chosen from a list of approximately 20-30 questions organized according to topic:

- I. General Philosophy of Science
- II. History of Philosophy of Science
- III. Special Topics
 - a. Philosophy of Physics
 - b. Philosophy of Biology
 - c. Philosophy of Mind / Cognitive Science
 - d. Logic and Foundations of Mathematics

Students are required to answer a total of three questions from sections I and II (at least one from each section), and one question from section III.

For each section, we have provided a list of core readings—mostly journal articles and book chapters—that are representative of the material with which we expect you to be familiar. Many of these readings will already be familiar to you from your coursework and other reading. Use this as a guide to filling in areas in which you are less well-prepared. Please note, however, that these readings do not constitute necessary or sufficient background to pass the comp. The Philosophy of Science area committee assumes that anyone who plans to write this exam has a good general background in the area acquired through previous coursework and independent reading.

Some anthologies

There are several good anthologies of Philosophy of Science that will be useful for further background (many of the articles listed below are anthologized; references included in the list below).

- Richard Boyd, Philip Gasper, and J.D. Trout, eds., *The Philosophy of Science* (MIT Press, 1991).
- Martin Curd and J. A. Cover (eds.), *Philosophy of Science: The Central Issues* (Norton, 1998).
- James H. Fetzer, ed., *Foundations of Philosophy of Science* (Paragon House, 1993).
- Lange, Marc, ed., *Philosophy of Science: An Anthology* (Blackwell Publishing, 2007).
- David Papineau, ed., *The Philosophy of Science* (Oxford University Press, 1996).

I. General Problems in the Philosophy of Science

Core Readings.

Theory Assessment and Confirmation

Earman, John, and Wesley C. Salmon, "The Confirmation of Scientific Hypotheses" in Salmon, *et al.*, *Introduction to the Philosophy of Science* (Hackett Publishing Company, 1992).

Feyerabend, Paul, *Science in a Free Society* (New Left Books, 1978), "Part One: Reason and Practice," pp. 13–70.

Glymour, Clark, "Why I am not a Bayesian," Ch. III of *Theory and Evidence* (University of Chicago Press, 1981). Reprinted in Curd and Cover, pp. 584–606, and in Papineau, pp. 290–313.

Goodman, Nelson (1955) "The New Riddle of Induction" and "Prospects for a Theory of Projection", in *Fact, Fiction, and Forecast*, chapters III and IV, pp. 59–124.

Hempel, Carl G., "Studies in the Logic of Confirmation" in *Aspects of Scientific Explanation and other Essays in the Philosophy of Science* (The Free Press, 1965), pp. 3–51.

Kelly, Kevin, and Clark Glymour, "Why Probability does not Capture the Logic of Scientific Justification" in Christopher Hitchcock, ed., *Contemporary Debates in the Philosophy of Science* (Blackwell, 2004), pp. 94-114.

Maher, Patrick, "Does Probability Capture the Logic of Scientific Confirmation or Justification?" in Christopher Hitchcock, ed., *Contemporary Debates in the Philosophy of Science* (Blackwell, 2004), pp. 69-93.

Norton, John "Must Evidence Underdetermine Theory?" in Carrier, Howard, and Kourany, eds. *The Challenge of the Social and the Pressure of Practice: Science and Values Revisited* (University of Pittsburgh Press, 2008), pp. 17–44.

Rationality and Theory Change

Kuhn, Thomas S., "Objectivity, Value Judgment, and Theory Choice" in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (University of Chicago Press, 1977), pp. 320–339.

Kuhn, Thomas S., "What Are Scientific Revolutions?" in Kruger, *et al.*, eds., *The Probabilistic Revolution* (MIT Press, 1987). Reprinted in *The Road Since Structure* (University of Chicago Press, 2000), pp. 13–32.

Popper, Karl “Science: Conjectures and Refutations” in *Conjectures and Refutations: The Growth of Scientific Knowledge*, (Harper & Row, 1965) pp. 33-58.

van Fraassen, Bas, “Scientific Revolution/Conversion as a Philosophical Problem,” Lecture 3 in *The Empirical Stance* (Yale University Press, 2002).

Realism and Empiricism

Boyd, Richard, “Realism, Approximate Truth, and Philosophical Method” in C. Wade Savage, ed., *Scientific Theories: Minnesota Studies in the Philosophy of Science* Vol. 14 (199), pp. 355–91. Reprinted in Papineau, pp. 215–255.:

Carnap, Rudolf, “Empiricism, Semantics, and Ontology,” in *Meaning and Necessity*, 2nd edition. (University of Chicago Press, 1956), pp. 205–221. Reprinted in Boyd, Gasper, and Trout, eds., *The Philosophy of Science* (MIT Press, 1991), pp. 85–97.

Hacking, Ian. *Representing and Intervening*, (Cambridge University Press, 1983). Introduction, Chs. 1, 2, pp. 1–40.

Hempel, Carl G., “Empiricist Criteria of Cognitive Significance: Problems and Changes,” in *Aspects of Scientific Explanation and other Essays in the Philosophy of Science* (The Free Press, 1965), pp. 101–122.

Quine, Willard V.O., “Two Dogmas of Empiricism,” *Philosophical Review* **60** (1951), pp. 20–43. Reprinted in *From a Logical Point of View* (Harvard University Press, 1953), pp. 20–49, in Curd and Cover, pp. 280–301.

Laudan, Larry, “A Confutation of Convergent Realism,” *Philosophy of Science* **48** (1981), 19–49. Reprinted in Boyd, Gasper, and Trout, pp. 223–245.

Stein, Howard, “Yes, but... Some Skeptical Remarks on Realism and Anti-Realism“ *Dialectica* **43** (1989), 47–65.

van Fraassen, Bas (1980) “Arguments concerning Scientific Realism” in *The Scientific Image* (Oxford University Press, 1980), Ch. 2, pp. 6–40.

Worrall, John, “Structural Realism: the Best of Both Worlds?” *Dialectica* **43**(1989), 99–124. Reprinted in Boyd, Gasper, and Trout, pp. 223–245, and in Papineau, pp. 139–165.

Nature of Theories, Laws, and Intertheory relations

- Carnap, Rudolf “Theoretical Laws and Theoretical Concepts,” Part V of Martin Gardner (ed.) *Philosophical Foundations of Physics: An Introduction to the Philosophy of Science* (Basic Books, 1966), pp. 225–274.
- Cartwright, Nancy, *How the Laws of Physics Lie* (Clarendon Press, 1983) , Essays 2, 3, 4, pp. 44–86.
- Earman, John, “Determinism and Laws of Nature,” Ch. V of *A Primer of Determinism* (D. Reidel, 1986), pp. 80–110.
- Fodor, Jerry (1974). “Special Sciences, or the Disunity of Science as a Working Hypothesis.” *Synthese* **28** (1974), pp. 77–115. Reprinted in Boyd, Gasper, and Trout, pp. 429–441.
- Lewis, David K. “Introduction,” *Philosophical Papers, Vol. II* (Oxford University Press, 1986).
- McMullin, Ernan, “Galilean Idealization,” *Studies in History and Philosophy of Modern Science* **16** (1985), pp. 247–273.
- Nagel, Ernst., "Issues in the Logic of Reductive Explanation", in Curd and Cover, pp. 905–921.
- Oppenheim, Paul and Hilary Putnam (1958) “Unity of Science as a Working Hypothesis” in *H. Feigl, M. Scriven, and G. Maxwell (eds.) Concepts, Theories, and the Mind-Body Problem, Minnesota Studies in the Philosophy of Science, Volume II*, pp. 3–36. Reprinted in Boyd, Gasper, and Trout, pp. 405–427.
- van Fraassen, Bas C. “Structure: its Shadow and Substance,” *British Journal for the Philosophy of Science* **57** (2006), pp.275–307.
- van Fraassen, Bas C., *Laws and Symmetry* (Clarendon Press, 1989), Ch. 2, “What Are Laws of Nature?” and Ch. 8, “What If There Are No Laws? A Manifesto” pp. 17–39, 183–214.

Explanation and Causation

- Hempel, Carl. “Aspects of Scientific Explanation” *Aspects of Scientific Explanation and other Essays in the Philosophy of Science* (Free Press, 1965) pp. 376–386.
- Lipton, Peter, *Inference to the Best Explanation*, 2nd ed. (Routledge, 2004) Chs. 4, 8.
- Salmon, Wesley, “Scientific Explanation,” in Salmon, *et al.*, eds. *Introduction to the Philosophy of Science* (Hackett, 1992), pp. 7–41.

van Fraassen, Bas, "The Pragmatics of Explanation," Ch. V of *The Scientific Image* (Oxford University Press, 1980), pp. 97–157.

Woodward, James "Introduction and Preview" in *Making Things Happen: A Theory of Causal Explanation* (Oxford University Press, 2003), pp. 3–24.

Values in Science

*Articles with an asterisk are reprinted in Janet A. Kourany, ed., *The Gender of Science*, (Prentice Hall, 2002). Note that some of these "reprints" are slightly abridged

Anderson, Elizabeth. "Uses of Value Judgments in Science: A General Argument with Lessons from a Case Study of Feminist Research on Divorce", *Hypatia* vol. 19, no.1 (Winter 2004), pp. 1-24.

Douglas, Heather. "Inductive Risk and Values in Science. *Philosophy of Science* **67** (2000), pp. 559–579.

Dupré, John. "Fact and Value" in *Value-Free Science? Ideals and Illusions*, edited by Kincaid, Dupré, and Wylie. Oxford, 2007. pp. 27-41.

Haraway, D. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies*, 14.3 (1988): pp. 575-599.*

Harding, S. "'Strong Objectivity'. A Response to the New Objectivity Question," *Synthese* vol. 104, no.3 (1995), pp. 332-349.*

Harding, Sandra. "A World of Sciences" in Sandra Harding and Robert Figueroa (eds), *Science and other cultures: Issues in philosophies of science and technology*, Routledge, 2003.

Hempel, Carl. "'Science and Human Values,'" in *Aspects of Scientific Explanation and other Essays in the Philosophy of Science* (Free Press, 1965), pp. 81–96.

Lacey, Hugh. *Is Science Value Free?* (Routledge, 1999), Introduction and Ch. 4. pp. 1-22, 4-87.

Longino, H. "Subjects, Power, and Knowledge: Description and Prescription in Feminist Philosophies of Science". In *Feminist Epistemologies*, Linda Alcoff and Elizabeth Potter (eds.), pp. 101-120.*

Longino, H. and R. Doell. "Body, Bias, and Behavior: A Comparative Analysis of Reasoning in Two Areas of Biological Science," *Signs* vol. 9, no.2 (Winter 1983), pp. 206-227.

Okruhlik, K. "Gender and the Biological Sciences" in *Biology and Society, Canadian Journal of Philosophy*, Supplementary volume 20 (1984), pp. 21- 42. Reprinted in Curd and Cover, pp. 192–208.

Background

The following readings provide useful background to discussion of the issues raised in the articles listed above. Most of these are works that a philosopher of science should become familiar with at some point.

Cartwright, Nancy, *Nature's Capacities and Their Measurement*

Coffa, J. Alberto, *The Semantic Tradition from Kant to Carnap: To the Vienna Station*

Earman, *Bayes or Bust?: A Critical Examination of Bayesian Confirmation Theory*

Feyerabend, Paul, *Against Method*

Friedman, Michael, *The Dynamics of Reason*

Friedman, Michael, *Reconsidering Logical Positivism*

Howson and Urbach, *Scientific Reasoning: The Bayesian Approach* (2nd ed.)

Kuhn, Thomas S. *The Structure of Scientific Revolutions*

Lakatos, Imre, and Alan Musgrave, eds., *Criticism and the Growth of Knowledge*

Popper, Karl R., *The Logic of Scientific Discovery*

Psillos, Stathis, *Scientific Realism: How Science Tracks Truth*

Suppe, Frederick, ed., *The Structure of Scientific Theories*. See, in particular, Suppe's Introduction, "The Search for Philosophic Understanding of Scientific Theories," and "Afterword—1977.

II. History of Philosophy of Science

There are two anthologies that you will find particularly useful:

T. McGrew, M. Alspector-Kelly, and F. Allhoff, eds., *Philosophy of Science: An Historical Anthology* (Wiley-Blackell, 2009).

See in particular selections from Bacon, Mill, Whewell, Peirce, Poincaré.

J.J. Kockelmans, ed., *Philosophy of Science: The Historical Background* (Transaction Publishers, 1999)

See in particular selections from Herschel, Whewell, Mill, Poincaré, and Peirce.

III. Philosophy of Particular Sciences

a. Philosophy of Physics

Quantum Theory

Bell, John S. “Bertlmann’s socks and the Nature of Reality” in *Speakable and Unspeakable in Quantum Mechanics*. (Cambridge University Press, 1987, 2004), pp. 139–158.

Howard, Don “Einstein on Locality and Separability,” *Studies in History and Philosophy of Modern Science* **16** (1985), pp. 171–201.

Lewis, Peter J. “GRW: A Case Study in Quantum Ontology.” *Philosophy Compass* **1/2** (2006): 224–244.

Shimony, Abner “An Exposition of Bell’s Theorem”, and “Controllable and Uncontrollable Non-Locality,” in *Search for a Naturalistic World View*, Vol. II (Cambridge University Press, 1993).

van Fraassen, Bas, “The Charybdis of Realism: Epistemological Implications of Bell’s Inequality,” in J.T. Cushing and E. McMullin, eds., *Philosophical Consequences of Quantum Theory* (University of Notre Dame Press, 1989), pp. 97–109.

Wallace, David “Everett and Structure”, *Studies in the History and Philosophy of Modern Physics* **34** (2003)., pp. 87-105

Space and Time

DiSalle, Robert “Spacetime as Physical Geometry,” *Erkenntnis* **42** (1995), pp. 317–337.

Earman, John and John Norton, “What Price Spacetime Substantivalism?” *The British Journal for the Philosophy of Science* **38** (1987), pp. 515–525.

Stein, Howard “Newtonian Spacetime,” *Texas Quarterly* **10** (1967), pp. 174–200.
Reprinted in Robert Palter (ed.), *The Annus Mirabilis of Sir Isaac Newton 1666-1966*. (MIT Press, 1970), pp. 258-284.

Stein, Howard “Some Philosophical Prehistory of General Relativity,” in Earman, Glymour, and Stachel, eds., *Foundations of Space-Time Theories: Minnesota Studies in the Philosophy of Science*, VIII (University of Minnesota Press, 1977), pp. 3-49.

Statistical Mechanics and Thermodynamics

Albert, David *Time and Chance*, Chs 2-4.

Callender, Craig “Taking Thermodynamics too Seriously” *Studies in History and Philosophy of Modern Physics* **32** (2001), pp. 539–553.

Uffink, Jos “Compendium of the Foundations of Classical Statistical Physics,” in Earman and Butterfield, eds., *Philosophy of Physics* (North-Holland, 2007). Also available at <http://philsci-archive.pitt.edu/2691/>.

b. Philosophy of Biology

Several of these are found in Elliott Sober, ed., *Conceptual Issues in Evolutionary Biology* (MIT Press: 2nd ed., 1994; 3rd ed., 2006).

Beatty, John “The Evolutionary Contingency Thesis,” Sober, 3rd edition, pp. 217–248.

Cummins, Robert “Functional Analysis,” *Journal of Philosophy* **72** (1975), 741-765,
Reprinted in Sober, 2nd ed., pp. 49–69.

Gould, Steven Jay and Richard Lewontin, “The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme,” in Sober, 2nd ed, pp. 73-90; 3rd ed., pp. 79–98.

Hrdy, Sarah Blaffer “Empathy, Polyandry, and the Myth of the Coy Female,” in Ruth Bleier, ed., *Feminist Approaches to Science* (Teachers College Press, Columbia University, 1986), pp. 119-146. Reprinted in Janet A. Kourany, ed., *The Gender of Science*, (Prentice Hall, 2002), and in Sober, 3rd ed., pp. 131–160.

- Laland, Kevin, John Odling-Smee, and Marcus W. Feldman, "Niche construction, Biological Evolution and Cultural Change." *Behavioral And Brain Sciences* **23** (2000), pp. 131–175.
- Lewontin, Richard C. "Gene, Organism and Environment" S. Oyama, P. Griffiths, and R. D. Gray, eds., *Cycles of Contingency* (MIT Press, 2001), pp. 55–66.
- Mayr, Ernst "Typological versus Population Thinking," in Sober, 2nd ed., 157–160; 3rd ed., pp.325–328.
- Mills, Susan K. and John H. Beatty, "The Propensity Interpretation of Fitness," in Sober, 2nd ed., pp. 3–24; 3rd ed., pp. 3–24.
- Rosenberg, Alexander : *Instrumental Biology or the Disunity of Science*, (The University of Chicago Press, 1994), Chs. 1–2.
- Sober, Elliott *The Nature of Selection* (The University of Chicago Press, 1984), Ch. 3,
- Sterelny, Kim and Philip Kitcher: "The Return of the Gene," *Journal of Philosophy* **85** (1988), pp. 339-361.
- Williams, George C. *Adaptation and Natural Selection* (Princeton University Press, 1966), Introduction, Ch.2.. pp. 3–19, 20–55.
- Wilson, David Sloan "Levels of Selection," in Sober, 2nd ed., pp. 143–154; 3rd ed., 63–78.
- Wright, Larry "Functions," *Philosophical Review* **82** (1973), pp. 139–168. Reprinted in Sober, 2nd ed., pp. 27–48.

c. Philosophy of Cognitive Science

- Dennett, Daniel . "Three Kinds of Intentional Psychology" in R. Healy (ed.) *Reduction Time and Reality* (Cambridge University Press, 1981).
- Fodor, Jerry and Zenon Pylyshyn. "Connectionism and Cognitive Architecture" *Cognition* 28 (1988), pp. 3-71.
- Fodor, Jerry. "Précis of *The Modularity of Mind*" in *A Theory of Content and Other Essays* (Cambridge, MA: MIT Press), pp. 195-206.
- Kosslyn, Steven. "Mental Images and the Brain" *Cognitive Neuropsychology* 22:3/4 (2005), pp. 333–347.

Newell, Allen and Herbert Simon. "Computer Science as Empirical Inquiry: Symbols and Search" *Communications of the ACM* **19** (1976), pp. 113–126.

Pylyshyn, Zenon. "Return of the Mental Image: Are there really pictures in the head?" *Trends in Cognitive Science*, 2003, 7(3): 113-118.

Searle, John. "Minds, Brains, and Programs" *Behavioral and Brain Sciences* 3:3 (1980), pp. 417-424.

Turing, Alan. "Computing Machinery and Intelligence" *Mind* 59 (1950), pp. 433-460.

d. Logic and Foundations of Mathematics

The philosophical literature presupposes a certain amount of background in formal logic and set theory. There are several good textbooks; the following, in particular, are recommended.

Boolos and Jeffrey, *Computability and Logic*
Enderton, *Mathematical Introduction to Logic*.
Machover, *Set Theory, Logic, and Their Limitations*

Demopoulos' notes on Enderton, available from the Graduate Programme Assistant, are a valuable supplement.

See also Bell's notes on set theory, also available from the Graduate Programme Assistant.

Philosophical works:

Dummett, "The Philosophy of Mathematics," in A.C. Grayling, ed., *Philosophy 2: Further Through the Subject*. (available from the Graduate Programme Assistant)

Benacerraf and Putnam, *Philosophy of Mathematics: Selected Readings*.

See, in particular:

Carnap, Heyting, and von Neumann, Symposium on the foundations of mathematics.

Brouwer, "Intuitionism and Formalism"

Hilbert, "On the Infinite"

Benacerraf, "What numbers could not be"

Putnam, "Models and Reality"

Boolos, "The iterative concept of set"

Parsons, "What is the iterative concept of set?"

Wang, "The concept of set"