

**NST Part IB History and Philosophy of Science
Senior Examiner's Report**

17 June 2019

1. The examination process

As in previous years, the Part IB HPS examination consisted of two papers: History of Science (HPS/1), and Philosophy of Science (HPS/2). The examiners were Dr Matt Farr (senior examiner), Dr Salim Al-Gailani, Dr Emma Perkins, Dr Nick Hopwood, Dr Riana Betzler, and Dr Andrew Buskell. There was no external examiner.

The History of Science (HPS/1) exam took place on Monday 3 June 2019, and Philosophy of Science (HPS/2) on Tuesday 4 June 2019. There were no notable incidents during the examinations, to the examiners' best knowledge. All candidates with registered disabilities were accommodated appropriately, also to the examiners' best knowledge.

Drs Al-Gailani, Perkins, and Hopwood read the History of Science scripts, and Drs Farr, Betzler, and Buskell read the Philosophy of Science scripts. Each script was blind double-marked. On each paper, any given examiner read 2/3 of the scripts, the rota being arranged so that each pairing of examiners was assigned 1/3 of the whole set. A numerical mark out of 100 was given by each examiner to each script as a whole, and that mark was agreed between the two examiners in each case; in very few cases, agreement was reached with the help of the remaining examiner. Marks were not agreed question-by-question, though each examiner did make assessments of each answer and those assessments were discussed in some detail in some cases.

The HPS Part IB examiners' meeting was held on Tuesday 11 June, to agree all marks and discuss any issues. In preparation for this meeting, the two groups of three markers of each paper met independently on Monday 10 June to discuss each script in detail. The examiners are to be commended for working to this tight timetable. Scripts from examinations that were taken at special locations were generally delivered quickly, helping to facilitate this turnaround, though it is to be remarked that some of these scripts were not received by examiners until Thursday 6 June, which was not ideal given the short timeframe in which to mark the scripts.

As in previous years, there was some difficulty in deciphering the handwriting of a few candidates, requiring much time and effort on the part of the examiners. In one case, a candidate's handwriting was determined to be indecipherable and was sent for transcription. The script was thus marked and agreed separately from the rest of the candidates, as the transcribed script was only received after the examiners' meeting had taken place. It was able to be included, however, in the final electronic markbook delivered to NST IB.

2. The subject examiners' meeting, and recommendations arising from it

The HPS subject examiners' meeting on 11 June was attended by all examiners. Marks on the individual papers, HPS/1 and HPS/2, had all been agreed at the meetings on 10 June, and were combined to provide an overall mark. Since our agreed final grades met the

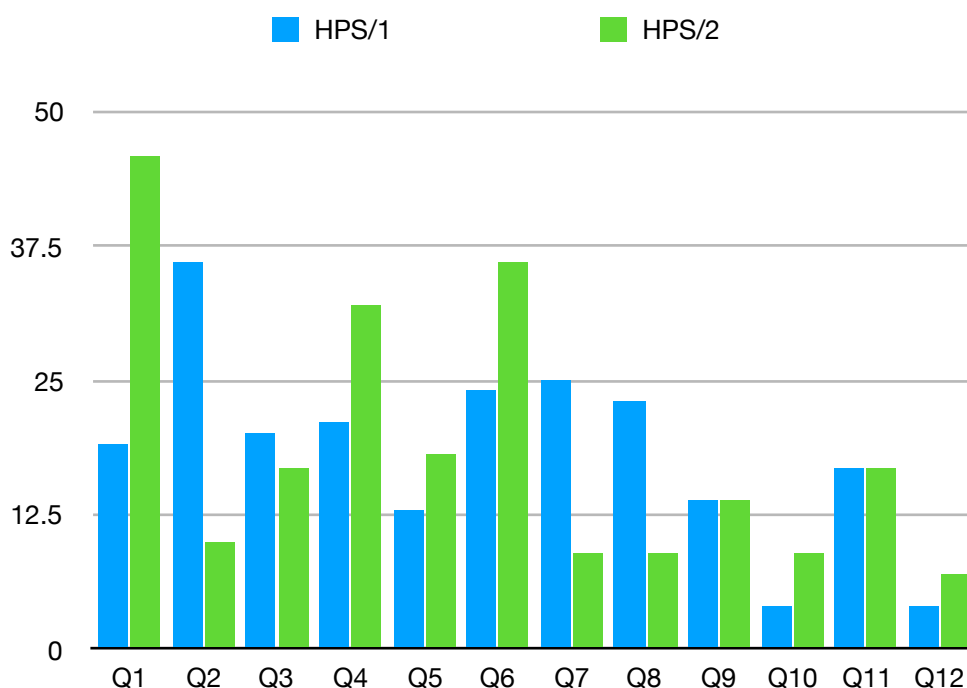
distribution requirements of NST (whereby 18-22% of candidates in each subject are to receive firsts in that subject, and 58-62% to receive 2.1 or above), no scaling was required.

3. Summary of results

A total of 66 candidates were entered for the examinations, of whom 3 withdrew from both exams, leaving 63. Of these, there were 12 PBS students, each of whom sat one exam only (6 History of Science, 6 Philosophy of Science). 2 HSPS students sat the Philosophy of Science paper. 2 NST Part II Physical Sciences students sat both papers. 1 Social Anthropology student sat the History of Science paper. The remainder (46 students) were NST IB candidates. In the latter group, the distribution of classes was as follows: 69.95 or above (1st) 10 candidates (21.74%); 59.95 to 69.9 (2.1) 18 candidates (39.13%) 49.5 to 59.9 (2.2) 17 candidates (36.96%); 39.95 to 49.9 (3rd) 0 (0%); and 0 to 39.9 (fail) 0 (0.00%). The average mark was 63.75%, with a standard deviation of 7.21.

Distribution of questions answered

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
HPS/1	19	36	20	21	13	24	25	23	14	4	17	4
HPS/2	46	10	17	32	18	36	9	9	14	9	17	7



4. Comments on performance on individual questions

As in previous years, there was some unevenness in the distribution of candidates tackling different questions. For Section A, there was unevenness on both exams: on the History paper, there was a strong preference for Q2 (36 out of 55); and on the Philosophy paper there was an even stronger preference for Q1 (46 out of 56). For Section B, there was a pleasingly even distribution of candidates' essay choices across the exam questions (though questions 10 and 12 were each answered by only four candidates). For the Philosophy exam, there was a more noted clustering on specific questions, notably those pertaining to Kuhn (Q4 — 32 out of 56; 57%) and Popper (Q6 - 36 out of 56; 64.3%).

History of Science (HPS/1)

Answers were more evenly distributed among questions than usual and there was none of the excessive signposting to which the examiners objected in 2018.

Section A

Q1. "The history of the sciences is a great fugue, [a musical composition] in which the voices of the nations come one after the other to the fore." (J. W. v. Goethe) Do you agree?

Q1 provoked some thoughtful answers. The strongest considered nationalism, internationalism and colonialism; highlighted competition and conflict between and within nations; and thus also explored limitations of the nation state as a unit of analysis. The weakest answers picked a few country-specific episodes from the history of science and wrote about those.

Q2. How has government patronage affected the historical development of natural sciences?

The more popular Q2 elicited some fine, analytically driven answers that considered various and changing ways in which government patronage has shaped science; they discussed not just funding, but also kinds of utility and prestige as well as effects on access, training and regulation. Less successful answers worked through a small number of cases to make one basic point.

Section B

Q3. How did instruments shape the development of early modern science?

The best answers to Q3 addressed questions of persuasion and trust for different kinds of practitioners, with some strong sections on relations between natural philosophers and artisans. More limited responses treated instruments as unproblematic extensions of the senses and their use as obviously progressive.

Q4. What was the role of empirical observation in early modern science?

While Q3 and Q4 were analytically distinct, there was overlap in the material used to answer them, especially in the less focused attempts. The best answers to Q4 contrasted Aristotelian and Baconian notions of experience and recognised that empirical observation is not the same as experiment.

Q5. Was there a revolution in eighteenth-century chemistry?

Q5 produced a wide range of answers. The very best engaged with the historiographical issues, considering what should count as a revolution and exploring multiple dimensions, the interpretations of different groups of actors and longer-term change, while keeping the focus on the eighteenth century.

Q6. Did modern science begin around 1800?

The few strong answers to Q6, which was potentially large for Section B, focused on changes around 1800 and considered these in a longer-term view. Too many responses sacrificed detailed consideration of the decades of most interest to extended discussions of other periods, or devoted too many paragraphs to matters of definition.

Q7. Why was Charles Darwin's *On the Origin of Species* an important book in the nineteenth century?

Q7 proved an effective discriminator, because it asked candidates to focus on one book and on the nineteenth century. Several responses made valiant attempts to explore readings of Darwin beyond Europe, but found it difficult to knit these into a coherent answer.

Q8. What were the relationships, if any, between tropical medicine and European imperial expansion in the nineteenth century?

The best responses to Q8 discussed the key term, tropical medicine, whether in a broad or the narrow (Mansonian) sense it gained at the very end of the period; the many less strong answers took it for granted and sometimes let expressions of outrage overwhelm the analysis. Ideally, candidates might also have made some distinctions between kinds of imperial expansion.

Q9. What did Robert Oppenheimer mean when he told the atomic scientists at Los Alamos in 1945 that "there is nothing in atomic weapons – there is certainly nothing that we have done here or in the physics or chemistry that immediately preceded our work here – in which any revolutionary ideas were involved"?

The challenging Q9 produced some creative attempts to divine Oppenheimer's intentions without knowing the rest of the speech. The most successful used secure knowledge of the larger context to make plausible and informative arguments that, crucially, had to consider physical and chemical ideas before and during the Manhattan Project.

Q10. Has the increasing dominance of commercial considerations fundamentally changed the practice of science since the 1970s?

The few candidates who tackled Q10 struggled with a question to answer which they had few resources beyond some history of recombinant-DNA-based biotechnology.

Q11. Using specific examples, discuss how molecules became involved in the twentieth-century politics of gender and of race.

It was obvious to candidates that they would write about sickle-cell disease and the oral contraceptive pill in response to Q11, less obvious to many that this demanded a tight focus

on molecules and politics. Yet the best answers achieved this as they explored molecules as variously depoliticising and politicised; a few recognised that they could discuss race also in the history of the pill.

Q12. *What does the history of climate change tell us about how the scientific community has changed?*

Passion for decolonisation was admirable in the few answers to Q12; candidates should be aware that this does not substitute for analysis.

Philosophy of Science (HPS/2)

Section A

Q1. *Should we trust scientific results?*

Answers to this problem were variable, with authors focusing on different terms of the question. Many focused on investigating the nature of scientific results, and linked their answers to debates around scientific realism. This often led students to evaluate whether scientists themselves should believe in the truth of contemporary theories. Others interrogated the nature of trust. These tended to focus on social and organisational features of science, particularly how science might be better organised to deal with systematic biases or shortcomings. Successful essays offered a balanced view of considerations as to why scientific trustworthiness might be (or is) undermined and how science might be (or is) structured to deal with such epistemic difficulties. Pessimistic and optimistic responses answered this question equally well.

Q2. *What, if anything, unifies the sciences?*

Answers to this question tended to be less successful than those given to Q1. The dominant strategy linked the question to the putative existence of a ‘scientific method’ and brought in considerations from Kuhn, Popper, Lakatos, and Feyerabend. How essays developed then relied on the extent to which authors found these thinkers’ arguments convincing.

Section B

Q3. *Should scientists reason via a process of inference to the best explanation?*

This question was most often approached by looking at what Lipton’s objections attributed to Hungerford and Voltaire—though there were some sophisticated articulations of the ‘best of the bad lot’ argument. Competent answers described these problems and either diagnosed them as insuperable or insufficient without much further analysis. Many essays failed to take a stance on whether scientists should or should not use IBE. More successful essays used the above objections as a means to diagnose what was distinctive about IBE as an epistemological strategy, and to evaluate whether, and in what instances, scientists should deploy this strategy.

Q4. *What, if anything, does Kuhn’s incommensurability thesis threaten?*

This was a very popular and, in general, a well-answered question. More successful answers narrowed down the question to talk about a specific aspect of incommensurability—for

instance, the incommensurability of meaning and reference of terms across paradigms—and identified a particular aspect of scientific practice or theory-building that was problematised. Less successful answers tended to give a gloss of Kuhn's machinery and give only general remarks on incommensurability and Kuhn-loss.

**Q5. “Scientists always make inductive leaps, therefore science must be value-laden”
Discuss.**

Answers here were well-distributed across the grade spectrum. Satisfactory answers tended to focus on Douglas's arguments around epistemic risk, and articulated some difficulties this posed for a value-free ideal, though these were often distracted by concerns around objectivity, progress, or a distinction between 'pure' and 'applied' science. Better answers tended to distinguish epistemic from non-epistemic values and to be more specific about the problems associated with inductive risks. Finally, sophisticated answers not only distinguished different kinds of values, but different domains of scientific research, and noted that these values played different roles and required different regulatory mechanisms to enforce good scientific practice.

Q6. What is the single biggest problem affecting Popper's falsificationism? Can it be solved?

This was the most popular question, though not because it was an easy question to properly address. The answers identified various problems: Popper's rejection of induction, his need to include 'corroboration', and, most popular, the difficulties for falsificationism in the face of Duhem-Quine thesis concerning the holistic nature of theory testing. Answers at the lower end of the spectrum tended to identify a problem for Popper then show how other individuals attempted to solve this problem. Many of these tended to represent Popper's position as unduly weak in face of the specified problem. The stronger answers stayed with Popper to look at his proposed solutions, and provide rigorous evaluations as to whether they succeeded or failed, thus giving a more balanced appraisal of Popper's position.

Q7. Should there be limits to scientific research?

This was not a frequently answered question. Poor and satisfactory essays tended to list scenarios where individuals may be harmed, without offering much analysis or principled reasons for determining where scientific research should be limited. Better responses did this hard work of offering and analysing principles, and attempted to say—often in response to a specific kind of research—when and where research should be curtailed.

Q8. Are Species the right sort of thing to have natures?

This proved to be a tricky question, one which few authors succeeded at answering. There was often little discussion of what one should take 'nature' to consist in, and in several cases, there was little to no discussion of species and their key features. Another common pitfall was an undue focus on human nature without reflection on the broader question of species as a category. In general, essays here tended to run through a list of different approaches to kindhood or species concepts, without much argumentative focus.

Q9. “Only biological organisms are capable of thought.” Do you agree?

This was a challenging question, and individual responses were variable. Many answers looked to functionalism as offering a promising method for attributing thought to non-biological entities—though different arguments were mobilised to support the position. Some successful essays considered Searle’s Chinese Room argument, though others also attempted this and failed to articulate what was at stake. Lastly, a number of students stipulated a definition of the term ‘thought’ and investigated the implications of this definition—a strategy that did not often meet with success.

Q10. *Is science a special pursuit in virtue of its distinctive method or in virtue of its social norms?*

In general, answers to this question rejected the idea that science has a distinctive method and looked towards social organisation as a promising means for demarcating science. Less successful answers attempted to catalogue positions on both sides—articulating ideas of a distinctive scientific method or a distinctive kind of social organisation—before saying which of the two catalogues seemed to offer more promise. Sometimes this strategy got the better of students, with authors doing a good job articulating Popperian and Lakatosian attempts at articulating a distinctive scientific method, only to assert at the last moment (and often without much argumentation) that these failed and social organisation could do the hard work.

Q11. *Is there a distinction to be made between the natural and social sciences? Is it justified?*

Many attempts at this question focused on Hacking’s ‘looping kinds’ argument, though were not always clear as to how precisely this served to demarcate something like social science from natural science. The most successful essays made clear substantive differences between the natural and social sciences, either by pointing to differences in methodology or difference in subject matter—often, but not always, by focusing on the arguments and ideas of interpretivists. Less successful attempts usually attempted to define both the natural and social sciences first, before moving on to consider a wide range of possible demarcating criteria.

Q12. “The idea of time as passing is a relic from the age of classical physics.” Discuss.

There were several strong answers to this question, the majority of which accurately covered the implications for the concept of time in the transition from classical to relativistic physics. The stronger essays went into detail about the significance of absolute simultaneity in the classical picture of time, and how this is threatened in relativity theory. Many answers also brought in the issue of the tenability of time travel in general relativity, and its implications for time; the weaker of these tended to wander from the main topic of the question on to the logical coherence of time travel. Several answers suggested that instrumentalists and antirealists can resist the conceptual implications of relativity theory, but none went into detail as to how exactly this would work.