

Academic Reading Paper 14

Matches, Deep Time and Novels

Time allowed: 1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until you are told to do so.
- Write your name and the date at the top of the answer sheet.
- Answer **all** the questions.
- Write your answers **on the answer sheet**, not in this booklet.
- You must transfer your answers within the hour. **No extra time is given for transferring answers in the Reading test.**
- Do not remove this booklet from the examination room.

INFORMATION FOR CANDIDATES

- There are 40 questions in this paper.
- Each question carries one mark.
- There are three passages, with 13, 13 and 14 questions.

These passages were written for this library. They are **not** reproduced from any published past paper. The format, timing and task types follow the published specification for the Academic Reading test so that sitting this on paper feels like the real thing.

You should spend about 20 minutes on Questions 1–13, which are based on Reading Passage 1 below.

The match that would not strike anywhere

The friction match is one of those objects whose difficulty is invisible because the problem was solved. Making fire on demand requires a substance that ignites from the heat of a scrape and then burns long enough to light something else, and the earliest commercial attempts, sold in England from 1826, used a mixture that ignited unpredictably, sometimes explosively, and often not at all. What made the match reliable was white phosphorus, introduced into the head in the early eighteen-thirties, and white phosphorus is one of the more poisonous things a nineteenth-century worker could have been asked to handle.

The damage it did had a name. Phosphorus necrosis of the jaw began as toothache in somebody who worked over the mixing pans or the drying racks, breathing the fumes. An abscess formed, the bone of the jaw died, and the dead bone was said to glow a faint greenish-white in a dark room. Treatment, where there was any, meant surgical removal of the jaw. Untreated, the infection frequently reached the brain. The condition was recognised within a decade of the material coming into use, was reported on repeatedly, and went on being produced for another sixty years. The reports were not obscure. Medical journals carried series of cases, factory inspectors described what they had seen, and the condition acquired a nickname in the trade long before it acquired a regulation.

It went on because the alternatives were not obviously better as products. In 1844 Anton Schrötter showed that phosphorus has another form, produced by heating it out of contact with air, which is red rather than white, far less reactive and not poisonous in the same way. Eleven years later Johan Edvard Lundström in Sweden patented a match that used it, and the design solved the safety problem by separating the ingredients. The oxidising agent and the fuel stayed in the head; the red phosphorus went onto a strip on the side of the box. A match of this kind cannot be lit on a wall, a boot or a table, which was precisely the property customers had been buying.

So the safety match was more expensive, less convenient, and for decades a minority product, while the factories making the cheap kind employed mostly women and girls at piece rates. In London in 1888 about fourteen hundred of them walked out of one such factory. The dispute was formally about fines — for talking, for dropping matches, for going to the lavatory without permission — and about the deductions taken from wages for the brushes and paint they worked with. Piece rates meant that a slow day produced a poor wage, and the fines came out of the same sum, so a worker could reach the end of a week owing the company money. The strike lasted around three weeks, it was won, and it is usually treated as one of the founding episodes of British trade unionism, partly because the strikers were the group everybody assumed had the least power.

The regulation took another twenty years and arrived internationally. In 1906 a convention signed at Berne prohibited the manufacture, import and sale of matches containing white phosphorus, and the signatory states legislated over the following years. The United States did not sign, because the federal gov-

ernment of the period did not believe it had the constitutional authority to ban a product outright. It achieved the same end in 1912 by imposing a tax on white-phosphorus matches high enough to end their manufacture, which is a solution of some elegance.

One detail of the American story is worth recording. A company holding the patent on a non-toxic substitute, a compound of phosphorus and sulphur that struck anywhere and did not cause necrosis, released the patent for anybody to use, at the request of the President. The commercial advantage of holding it was real; the argument for giving it up was that a competitor unable to make a safe match would go on making an unsafe one.

What the episode is usually used to illustrate is the power of regulation, and it does illustrate that. It illustrates something else at least as clearly. The chemistry that made the safe match possible had been available since 1844, and the safe match itself since 1855, and neither of those facts ended the disease. What ended it was a tax and a treaty, sixty years after the first medical reports, in an industry where the people bearing the cost were not the people choosing. A single firm that gave up white phosphorus while its competitors kept it would have been undercut and would have closed, which is the shape of most problems that regulation exists to solve.

The matchbox in a modern kitchen still has the striking strip on the side, and the reason is the one Lundström designed for: the ingredients that make a flame are kept in two places so that they only meet when somebody intends them to.

Questions 1–6

Complete the notes below.

Choose **NO MORE THAN TWO WORDS AND/OR A NUMBER** from the passage for each answer.

From dangerous to safe

The problem

- Matches sold from 1826 ignited unpredictably.
- Reliability came from putting **1** into the head, from the early 1830s.
- Workers breathing the fumes developed an abscess, after which the bone of the **2** died.

The chemistry

- 1844 — Schrötter produces red phosphorus by heating it out of contact with **3**
- 1855 — Lundström separates the ingredients: the red phosphorus goes onto a strip on the **4** of the box.

The response

- 1888 — about **5** women and girls strike at a London factory.

- 1906 — a convention at 6 prohibits white-phosphorus matches.

Questions 7–13

Do the following statements agree with the information given in Reading Passage 1?

Write **TRUE** if the statement agrees with the information, **FALSE** if the statement contradicts the information, or **NOT GIVEN** if there is no information on this.

- 7 The disease caused by white phosphorus was identified long before its use in matches ended.
- 8 Red phosphorus was discovered eleven years before the 1888 strike.
- 9 The safety match was popular with customers as soon as it appeared.
- 10 The London strikers were paid more than workers in other match factories.
- 11 The United States banned white-phosphorus matches outright in 1912.
- 12 The company that gave up its patent did so because the substitute was unprofitable.
- 13 Similar prohibitions were later applied to other industrial poisons.

You should spend about 20 minutes on Questions 14–26, which are based on Reading Passage 2 below.

The discovery of deep time

- A** For most educated Europeans in the seventeenth and eighteenth centuries, the earth was a few thousand years old. The figure was not arrived at carelessly: it was calculated from the genealogies in scripture by scholars working with the best texts they had, and the most famous of those calculations put the creation in 4004 BC. It was a number produced by a method, and the method was the one available.
- B** What displaced it was not an argument but an outcrop. In 1788 James Hutton took a boat along the coast of southern Scotland to a place called Siccar Point, where two kinds of rock meet. Underneath are beds of grey stone standing almost vertically. Above them, lying nearly flat, are beds of red sandstone. To produce that arrangement, the lower beds must have been laid down horizontally under water, hardened, tilted through ninety degrees, raised above the sea, worn down flat by erosion, submerged again, buried under a new set of sediments, and raised once more. Each of those stages is slow. John Playfair, who was in the boat, wrote afterwards that the mind seemed to grow giddy looking so far into the abyss of time. At the junction itself the rock is a rubble of broken fragments, worn off the lower beds before the upper ones were laid down on them, and that rubble is the part of the outcrop Hutton pointed at.
- C** Hutton's own formulation was more austere and more provocative: in the earth's record he found no vestige of a beginning and no prospect of an end. He was not claiming the earth was eternal. He was saying that the processes he could see, running at the rates he could measure, would need spans of time that the rocks did not record the start of.
- D** The argument was made usable by Charles Lyell, whose textbook of the eighteen-thirties set out the principle that the past should be explained by causes now in operation, acting at the intensities now observed. That principle is a demand for time: if valleys are cut by the rivers running in them and mountains are worn down by weather, then the durations involved are enormous. Darwin took the first volume with him on the Beagle, and the argument of the Origin depends on it, because natural selection acting in small steps requires spans of time that a young earth does not provide.
- E** Then physics arrived and said no. From the eighteen-sixties William Thomson, later Lord Kelvin, calculated the age of the earth from its rate of cooling: a body that began molten and has been losing heat ever since can be dated from its present temperature gradient. His figures moved over the years and settled in the range of twenty to forty million years, which is not remotely enough for either Lyell's erosion or Darwin's selection. Kelvin was the most eminent physicist in Britain, his method was quantitative where geology's was descriptive, and the disagreement was widely read as a defeat for the geologists. The calculation was also elegant, which mattered. It needed only a temperature gradient measured down a mine, a figure for the conductivity of rock, and arithmetic, and geology had nothing to set against it in the same form.

- F** Darwin felt it. The first edition of the Origin contains an estimate of the time required to erode a particular English valley, arrived at from observed rates and running to three hundred million years. He was mocked for it, and the passage was removed from later editions. The geologists were right and could not say why they were right.
- G** The resolution came from something neither side had known existed. Radioactivity was identified at the end of the century, and radioactive decay releases heat continuously from within the rock. Kelvin's calculation assumed a body cooling from an initial store with nothing adding to it, and that assumption was simply false; the earth has an internal furnace. The same discovery supplied a clock. A radioactive element decays into another at a fixed rate, so the proportion of the two in a mineral gives the time since it formed, and from about 1905 the first mineral ages were being reported in hundreds of millions and then in billions of years.
- H** Arthur Holmes spent the next forty years turning that into a usable timescale against professional resistance and very little funding, and the modern figure of about four and a half thousand million years was established in the nineteen-fifties from the composition of meteorites. It has hardly moved since, which is unusual for a number arrived at that recently. What is worth noticing is the shape of the episode. A discipline reading rocks reached a conclusion it could not defend numerically; a discipline with numbers refuted it using an assumption nobody could test; and the argument was settled by a phenomenon that was invisible to both.

Questions 14–18

Reading Passage 2 has eight sections, A–H.

Which section contains the following information?

Write the correct letter, A–H.

NB You may use any letter more than once.

- 14** a sequence of events needed to produce one rock formation
- 15** a statement that a widely quoted phrase did not mean what it seems to
- 16** an estimate that its author later withdrew
- 17** an explanation of why one discipline's method carried more authority
- 18** a description of how a mineral can be dated

Questions 19–22

Look at the following statements and the list of people below.

Match each statement with the correct person, A–D.

NB You may use any letter more than once.

List of People

- A** James Hutton
- B** Charles Lyell
- C** William Thomson
- D** Arthur Holmes

- 19** He set out the principle that the past must be explained by causes now in operation.
- 20** He dated the earth from the rate at which it was losing heat.
- 21** He worked for decades to build a timescale with little support.
- 22** He said the rocks recorded no sign of a beginning.

Questions 23–26

Complete the summary using the list of words, A–H, below.

List of Words

- A** genealogies
- B** observations
- C** erosion
- D** cooling
- E** assumption
- F** measurement
- G** heat
- H** pressure

How the argument was settled

The traditional figure for the age of the earth was calculated from scriptural **23**

Geology replaced it with an argument from the rates of processes such as **24**

Thomson's rival figure rested on an **25** that could not be tested at the time: that nothing inside the earth was producing **26**

You should spend about 20 minutes on Questions 27–40, which are based on Reading Passage 3 below.

What reading is supposed to do

Defences of literature have a habit of arriving at the same destination. Reading fiction, it is said, makes a person better at imagining other people's minds, and therefore kinder, more tolerant and more useful to a society. The claim is old, it is agreeable, and for a while it appeared to have been demonstrated experimentally, which is a more precarious position for an idea than it sounds. Two things are being claimed at once and they are worth separating. One is that reading changes a reader, which is hard to doubt. The other is that it changes them in a particular direction, by an amount detectable in a laboratory, which is a different proposition entirely.

The demonstration came in 2013. A pair of psychologists reported that people asked to read a short extract of literary fiction, as opposed to popular fiction or non-fiction or nothing, went on to do better on a standard test of the ability to read emotion from photographs of faces. The result was published in a leading journal, reported everywhere, and taken up immediately by everybody with an interest in defending the humanities. It appeared to convert an article of faith into a finding.

The finding did not hold. A large replication involving several laboratories and around eight hundred participants, published three years later, found no effect of the reading condition on the same test. The original effect, examined again, turned out to rest on a small sample and a difference that was statistically marginal. This is not a scandal and nobody behaved badly; it is the ordinary process by which a result is checked. But it left the instrumental defence of literature in a worse position than it had occupied before the study was run.

There is separate evidence that is more robust and says less. People who have read a great deal of fiction over their lives do tend to score better on measures of social understanding, and that correlation has been found repeatedly. What it cannot establish is the direction. People interested in other people's inner lives may read more novels, in which case the reading is a symptom rather than a cause, and no amount of additional correlational data will separate the two. The measure itself is indirect as well. Lifetime reading is usually estimated by asking people to pick real authors out of a list seeded with invented ones, which discourages exaggeration but records familiarity rather than reading.

The deeper problem with the whole line of argument is not evidential. It is that the argument makes a bargain, and the bargain is bad. If literature is to be valued because it produces a measurable improvement in a social skill, then the value of literature becomes contingent on the measurement, and a failed replication is no longer a fact about an experiment; it is an argument against reading. Anyone who cited the 2013 study is obliged to take the 2016 one on the same terms, and very few of them have.

There is also an awkward historical record to account for. Extremely literate societies have organised atrocities, and highly cultivated individuals have taken part in them. That does not show that reading makes people worse, and the anecdote is not evidence in either direction. What it shows is that whatever

reading does, it does not reliably do the thing the instrumental claim asserts, because if it did, the record would look different.

None of this requires the conclusion that nothing happens. Something plainly does. Spending several hours inside a sustained account of how the world looks to somebody who is not you is an unusual thing for a person to do, and it is reasonable to think it leaves something behind. But that is a description of an experience, not a claim about an effect size, and the honest position is that the experience is the point rather than the evidence for something else.

The practical consequence is a change of register rather than of policy. Literature does not need to be shown to work. It needs to be defended in the way that other things people value are defended: as something worth having, whose absence would be a loss, which people who have it are reluctant to give up. That is a weaker claim in the sense that it cannot be tested. It is a considerably stronger one in the sense that it cannot be refuted by a replication. It is also the defence people actually give in private, when nobody is asking them to justify a budget.

Questions 27–31

Do the following statements agree with the claims of the writer in Reading Passage 3?

Write **YES** if the statement agrees with the claims of the writer, **NO** if the statement contradicts the claims of the writer, or **NOT GIVEN** if it is impossible to say what the writer thinks about this.

- 27** The writer thinks the researchers behind the 2013 study behaved improperly.
- 28** The writer concludes that reading fiction has no effect on a reader at all.
- 29** The replication study used the same reading extracts as the original.
- 30** The writer accepts that the correlational evidence cannot show which way the causation runs.
- 31** The writer believes the humanities receive too little public funding.

Questions 32–36

Complete each sentence with the correct ending, A–H, below.

Endings

- A was taken up at once by people defending the humanities.
- B found no effect of what the participants had read.
- C cannot show whether reading causes the ability or follows from it.
- D makes the value of literature depend on a measurement.
- E cannot be refuted by a further experiment.
- F proves that reading fiction damages social understanding.
- G was withdrawn by its authors after the replication.
- H established the direction of the relationship for the first time.

- 32 The 2013 result
- 33 The multi-laboratory replication
- 34 The lifetime-reading correlation
- 35 Defending literature by its measurable effects
- 36 Defending literature as something worth having

Questions 37–40

Choose the correct letter, A, B, C or D.

- 37 The replication study involved
 - A around eight hundred participants across several laboratories.
 - B a single laboratory and eight participants.
 - C three years of continuous testing.
 - D the same participants as the original.
- 38 Why does the writer mention literate societies that organised atrocities?
 - A To argue that reading makes people worse.
 - B To show that reading does not reliably do what the claim asserts.
 - C To explain why the 2013 study failed to replicate.
 - D To criticise the teaching of literature.

- 39** The writer describes the defence based on measurable benefit as
- A** a bargain that costs more than it gains.
 - B** the only defence available.
 - C** impossible to state clearly.
 - D** recently invented.
- 40** Which of the following best states the writer's conclusion?
- A** Experiments on reading should not be conducted.
 - B** Literature should be defended as worth having rather than as effective.
 - C** The correlational evidence settles the question.
 - D** Reading fiction is more valuable than reading non-fiction.