

Academic Reading Paper 24

Smallpox, Tree Rings and Experts

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 disease that ran out of people

Smallpox killed roughly three hundred million people in the twentieth century, which is more than every war of that century combined. In 1967, the year a serious attempt was made to end it, there were still something between ten and fifteen million cases a year across thirty-one countries and about two million deaths. The severe form killed around three in ten of the people it infected, and a large proportion of the survivors were left scarred or blind. It is the only human disease that has ever been eliminated deliberately, and it was eliminated on a budget of about three hundred million dollars spread over eleven years.

The reason it could be done has less to do with medicine than with the particular habits of the virus, and four of those habits mattered. It infects human beings and nothing else, so there is no animal population quietly holding a reserve. Everyone who can pass it on is visibly ill, because there are no healthy carriers and no long silent period of infectiousness. The rash it produces is distinctive enough that a person with no medical training can recognise it from a photograph. And a single successful vaccination gives protection for years, from a freeze-dried preparation that survives heat, which matters in places where a refrigerated chain cannot be maintained across the last hundred kilometres.

Take any one of those away and the campaign fails. A disease with an animal reservoir cannot be eradicated by treating people, which is why the same approach has never worked for yellow fever. A disease spread by people who look perfectly well cannot be chased by finding the sick ones. Polio has both of those difficulties in mild form: most infections produce no symptoms at all, so the people spreading it cannot be found by looking for the sick. That is why a programme begun in 1988 is still running nearly forty years later.

An instrument helped more than it should have. In 1965 Benjamin Rubin designed a needle with two prongs and a gap between them, which holds one dose of vaccine by surface tension in the way a small loop of wire holds a soap film. It used about a quarter of the vaccine of the methods it replaced, it needed no syringe, and a person could be taught to use it correctly in a few minutes. The company that owned the patent waived its royalties for the eradication programme.

The strategy that finally worked was not the one the programme began with, and it arrived by accident. The plan had been mass vaccination, on the principle that if enough of a population is immune the chain of transmission breaks, with eighty per cent named as the target. In December 1966 a medical officer in eastern Nigeria named William Foege found himself with an outbreak and not enough vaccine to do anything of the kind. The shortage was the ordinary sort, a delivery that had not arrived, and it forced a decision that nobody with a full store would have taken.

What he did instead was to use radios and runners to find out exactly where cases were, and to vaccinate the households and villages immediately around each one. The outbreak stopped, at a level of coverage far below anything the models called sufficient. The reason is that smallpox does not spread the

way a respiratory infection does: it needs prolonged face-to-face contact, it moves slowly, and it therefore travels in identifiable clusters rather than diffusing through a population. A ring drawn around each cluster is enough, and it is enormously cheaper than vaccinating everybody.

Surveillance and containment became the method from 1967 onwards, and the campaign changed character. The work was no longer chiefly medical; it was a search. India's programme in the mid-1970s put something like a hundred and twenty thousand people into house-to-house searches, carrying recognition cards, in a country of six hundred million. Rewards were offered for reporting a case. What the programme needed was not more vaccine but faster information, and most of the difficulty in the last years was administrative rather than biological: persuading people to report, reaching places without roads, and keeping a search going after the number of cases had fallen far enough for everyone to lose interest.

The last person to catch the disease naturally was Ali Maow Maalin, a hospital cook in Merca, in Somalia, in October 1977. He recovered, and spent much of his later life working on the polio campaign in the same country. One further person died the following year, a photographer at a medical school in Birmingham, infected from a laboratory below her darkroom. The World Health Assembly declared the disease eradicated in May 1980, and the two remaining stocks of the virus, one in the United States and one in Russia, have been the subject of an unresolved argument ever since.

Questions 1–6

Complete the notes below.

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

Why this disease and not another

Four habits of the virus

- It infects human beings and nothing else, so there is no animal **1** holding a reserve.
- Everyone who can pass it on is visibly ill: there are no healthy **2**
- The rash can be identified by an untrained person from a **3**
- The vaccine is freeze-dried and survives **4** , so no cold chain is needed at the end of the journey.

The instrument

- 1965 — Rubin's two-pronged needle holds one dose by surface **5**
- It used about a **6** of the vaccine that earlier methods needed.

Questions 7–10

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 containment method was adopted because of a shortage.
- 8 Foege's outbreak was stopped by reaching the coverage level the plan required.
- 9 Foege had worked on smallpox before the outbreak of December 1966.
- 10 Ali Maow Maalin died of the disease he caught in 1977.

Questions 11–13

Complete the sentences below.

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

- 11 In 1967 the disease still caused about deaths a year.
- 12 The polio programme referred to in the passage began in
- 13 India's programme put about 120,000 people, carrying recognition cards, into house-to-house
..... •

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

The clock that had to be corrected

- A** Radiocarbon dating rests on a supply and a decay. Cosmic rays striking the upper atmosphere produce neutrons, those neutrons hit nitrogen and turn some of it into carbon-14, and the carbon-14 combines with oxygen and joins the ordinary carbon dioxide of the air. Plants take it up, animals eat the plants, and every living thing therefore holds the same proportion of carbon-14 as the atmosphere around it. At death the intake stops, the carbon-14 begins to disappear at a fixed rate, and the proportion remaining is a measure of how long ago that happened. Half of any quantity of it is gone in about five and a half thousand years, which sets both the usefulness of the method and its limit: after ten or so half-lives there is too little left to measure against the background.
- B** Willard Libby put this into practice in the late 1940s at Chicago, and did the obvious and necessary thing: he tested the method on material whose age was already known. Wood from Egyptian tombs of established dynastic date came out close to the historical figures. The result was published in 1949 and the technique spread through archaeology faster than any method before or since, because for the first time a date could be obtained from a scrap of charcoal rather than argued from the style of a pot. Libby received a Nobel Prize in 1960. The speed of the adoption is worth noting, because it meant that a great many results were published before anybody had established how far the method could be trusted.
- C** There was an assumption underneath all of it, and it was wrong. The method requires that the amount of carbon-14 in the atmosphere has been constant, so that a sample formed five thousand years ago started with the same proportion as one formed last year. Hessel de Vries showed in 1958 that it has not been constant. Cosmic ray intensity varies with the sun's activity and with the Earth's magnetic field, and the atmospheric level wanders up and down by a few per cent over centuries. A few per cent does not sound serious until it is converted, at which point it becomes several hundred years in the wrong place.
- D** The correction required a second clock that was already right. Tree rings supply one: a ring is a year, the sequence of thick and thin rings in a region is a signature that can be matched between overlapping timbers, and a continuous series can be built backwards from living trees through old beams and buried logs. Bristlecone pines and European oaks have between them produced an unbroken record more than twelve thousand years long, in which every ring has a calendar date that owes nothing to radiocarbon. That independence is the whole point; a correction derived from the thing being corrected would establish nothing.
- E** Measuring the carbon-14 in rings of known age gives a curve, and the curve is what converts a laboratory measurement into a date. Hans Suess published an influential version of it in the 1960s. The consequence for archaeology was larger than a technical adjustment: calibrated dates made

the megalithic tombs of western Europe older than the eastern monuments they had been assumed to imitate, and the model in which civilisation spread outwards from the Near East lost the chronology it had been resting on.

F The curve is not a smooth line and this matters more than it sounds. Where it runs steeply, a measurement converts to a narrow band of calendar years. Where it flattens, a single measurement can be consistent with three or four centuries, and no improvement in laboratory precision will help, because the ambiguity is in the atmosphere rather than in the instrument. Certain periods are notorious for this, and an archaeologist working in one of them knows in advance that radiocarbon will not settle the question. It follows that a radiocarbon result is not a date at all but a range of calendar years with probabilities attached, and reporting it as a single year is a courtesy to the reader that occasionally misleads them.

G Two human interferences have since been written into the record. Burning coal and oil released carbon that is far too old to contain any carbon-14, diluting the atmosphere and making twentieth-century samples appear older than they are. Then atmospheric nuclear testing roughly doubled the amount of carbon-14 by the early 1960s, and the level has been falling since the tests stopped. That falling curve is now used in reverse: material formed after the mid-1950s can be dated to within a year or two, which is useful in forensic work and useless for everything the method was invented to do. A technique built to reach back forty thousand years now has a second life measuring whether a thing is as old as its seller claims.

Questions 14–18

Reading Passage 2 has seven sections, A–G.

Which section contains the following information?

Write the correct letter, A–G.

NB You may use any letter more than once.

- 14** a reason why a small proportional error becomes a serious one
- 15** an unwelcome consequence of how quickly the method was taken up
- 16** a statement that a result is not really a single date at all
- 17** an explanation of why the second method had to be independent of the first
- 18** a use of the method that has nothing to do with its original purpose

Questions 19–23

Complete the table below.

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

Three things that disturb the record

Disturbance	What it does to the atmosphere	Effect on a measurement
Changes in 19 ray intensity, with the sun and the Earth's magnetic field	the level wanders by a few per cent over centuries	a date can land several hundred years in the wrong 20
Burning coal and oil	releases carbon too 21 to contain any carbon-14, diluting the air	twentieth-century samples appear 22 than they are
Atmospheric nuclear testing	roughly 23 the amount of carbon-14 by the early 1960s	

Questions 24–26

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

- 24** How did Libby check that the method worked?
- A By comparing it with tree rings of known age.
 - B By testing wood from Egyptian tombs whose dates were already established.
 - C By repeating the measurement in several laboratories.
 - D By calculating the half-life more precisely.
- 25** What did calibrated dates do to the accepted account of European prehistory?
- A They confirmed that monuments spread outward from the Near East.
 - B They showed western European tombs to be older than the monuments they supposedly imitated.
 - C They showed that tree-ring dating was unreliable.
 - D They proved that the megalith builders had contact with Egypt.
- 26** Why does better laboratory precision not help in certain periods?
- A The samples from those periods are usually contaminated.
 - B Too little carbon-14 remains to measure.
 - C The ambiguity lies in the atmosphere rather than in the instrument.
 - D Tree-ring records do not reach those periods.

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

What an expert is for

Two positions are available about experts and both are held with enthusiasm. The first is that they should be deferred to, because they have spent decades on a subject and you have not. The second is that they are a professional group like any other, with interests, fashions and a record of confident error, and that their pronouncements deserve no more weight than anyone else's. The argument between these two has been running for years without moving, and it cannot move, because the question as posed has no answer. Both sides can produce cases, and each side's cases are real, which ought to have been a clue some time ago.

It has no answer because expertise is not one thing. The evidence on this is unusually clear and it has been available for a long time. Paul Meehl, in 1954, collected studies comparing the predictions of trained clinicians with those of a simple statistical rule using the same information. The rule won or drew almost everywhere. Philip Tetlock later spent two decades collecting specific, checkable forecasts from several hundred people paid to analyse politics, and found their accuracy close to chance, with the better-known among them doing slightly worse than the others.

Set against that is a body of evidence just as strong pointing the other way. An experienced anaesthetist reads a patient more reliably than any rule available. Chess masters see positions that a strong amateur cannot. Firefighters and nurses report a sense that something is wrong minutes before they can say what, and they are frequently right. Weather forecasters, over a few days, are extremely well calibrated. These are not anecdotes; they are measured, and the people involved are doing something that cannot be replaced by a formula.

The reconciliation was worked out by two researchers who had spent years disagreeing about it. Daniel Kahneman, whose work had documented the failures, and Gary Klein, who had documented the successes, wrote a joint paper in which they agreed on the conditions under which intuitive expertise develops. There are two. The environment must be regular enough that there are genuine patterns to learn, and the person must have had an opportunity to learn them, which means many repetitions with prompt and unambiguous feedback.

Both conditions are met in an operating theatre and in a chess tournament. Neither is met in long-range political forecasting, where the situations are not repetitions of each other, the feedback arrives years later if at all, and it is nearly always possible to argue that one was almost right. The clinician in Meehl's studies was in the same position: outcomes came slowly, arrived mixed with everything else that had happened to the patient, and could be reinterpreted after the fact. The failure is not of intelligence or of effort, and it is not corrected by trying harder.

This gives a usable test, and it does not require knowing anything about the subject. Ask what feedback the expert receives, how quickly it arrives, and whether it can be argued with. A radiologist who is told within a week whether the tumour was there is in a learning environment. An economist forecasting five years out is not, and neither is a manager predicting which of two candidates will do better, since only one of them is hired and the other outcome is never observed. The question is not how clever or how honest the person is.

None of this licenses the dismissal that the second position wants. The same analysis that says to discount a long-range political forecast says to accept the anaesthetist's judgement without argument, and it says something stronger about the parts of expertise that are not prediction at all. Knowing what has already been tried, what the terms mean, which sources are reliable and which question is the useful one is not forecasting, and it does not depend on a regular environment. Most of what an expert is for is this, and it is the part that non-experts consistently underrate because it is invisible from outside.

So the honest version is narrower than either slogan and more use than both. Expertise is real, it is specific to a domain and to a kind of task within that domain, and its reliability can be estimated in advance by looking at the feedback rather than at the credentials. Someone who says trust the experts and someone who says do not are both making a claim about a category that does not behave as a category, and the argument will continue for exactly as long as it is conducted in those terms. The useful conversation begins one question later, with what the person in front of you is actually being asked to do.

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 believes expert judgement should generally be discounted.
- 28** The writer accepts that some professionals detect a problem before they can describe it.
- 29** Tetlock's forecasters were paid more than the clinicians in Meehl's studies.
- 30** The writer thinks poor forecasters could improve by working harder at it.
- 31** The writer holds that non-experts undervalue the non-predictive part of expertise.

Questions 32–36

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

Endings

- A the situations are not repetitions of one another and the feedback arrives years later.
- B a simple statistical rule using the same information.
- C the environment is regular and the feedback is prompt and unambiguous.
- D only one candidate is hired, so the other outcome is never observed.
- E what has been tried, what the terms mean and which question is the useful one.
- F the experts involved were less intelligent than the rule's designers.
- G credentials rather than the feedback the person receives.
- H political forecasters are more accurate when they are well known.

- 32 Meehl compared clinicians' predictions with
- 33 Intuitive expertise develops when
- 34 Long-range political forecasting fails because
- 35 A manager predicting which candidate will do better gets no feedback because
- 36 The undervalued part of expertise is knowing

Questions 37–40

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

- 37 Why does the writer mention weather forecasters?
- A To show that forecasting is impossible over any period.
 - B As a measured case of expertise that works.
 - C To argue that models outperform people.
 - D To explain why long-range prediction fails.
- 38 Which position does the writer reject?
- A That expertise is specific to a domain and to a kind of task.
 - B That expert reliability can be estimated from the feedback available.
 - C That experts as a category should be deferred to or dismissed.
 - D That knowing which question is useful is a form of expertise.

- 39** What is notable about the paper by Kahneman and Klein?
- A** It was written by two people who had disagreed for years.
 - B** It was the first study of expert intuition.
 - C** It contradicted both authors' earlier work.
 - D** It was based on a survey of forecasters.
- 40** Which of the following best expresses the writer's test?
- A** Ask what feedback the expert gets, how fast it arrives, and whether it can be argued with.
 - B** Ask how long the expert has worked in the field.
 - C** Ask whether other experts agree with the judgement.
 - D** Ask whether the expert has published on the subject.