

Academic Reading Paper 21

Nitrogen, Colour and Libraries

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.

Bread from the air

Every protein in every living thing contains nitrogen, and the atmosphere is seventy-eight per cent nitrogen, and almost nothing can use it. The gas exists as two atoms held together by one of the strongest bonds in ordinary chemistry, and prising them apart takes more energy than a plant has. Until the twentieth century the reactive nitrogen that agriculture depended on came from three places: the droppings of seabirds on rainless Pacific islands, a nitrate-bearing rock quarried in the Atacama desert, and ammonia recovered as a by-product from making coal gas. All three were finite and two of them were controlled by a small number of countries. The guano islands had already been worked out in places within a single lifetime, which is what turned a question of agricultural chemistry into a question of national supply.

In 1898 the president of the British Association, William Crookes, put the arithmetic to his audience. Wheat yields depended on nitrogen, the accessible supply of it was being consumed faster than it was being found, and unless the nitrogen of the air could be brought into use the bread supply of the wheat-eating nations would fail within a generation. He was wrong about the date and right about the problem, and he named the solution before anybody could perform it: the fixation of atmospheric nitrogen was, he said, a matter that would decide whether people ate.

Fritz Haber, working at Karlsruhe, showed in 1909 that it could be done. His apparatus stood on a bench and combined nitrogen with hydrogen over a catalyst of osmium at about one hundred and seventy-five atmospheres of pressure and a temperature between five hundred and six hundred degrees. Only a small percentage of the gas converted on each pass, which sounds like failure and is not: the unconverted gas was cooled, the ammonia removed as a liquid, and the remainder pumped back round to try again. Continuous recycling turns a poor single-pass yield into a good process.

Between a bench and a factory lay two obstacles that were not chemistry. The first was that no pressure vessel existed which could hold two hundred atmospheres at that temperature for any length of time. Worse, hydrogen under those conditions attacks steel from the inside, stripping the carbon out of it, so the tubes did not merely wear out; they lost the property that made them steel, and they burst.

Carl Bosch, the engineer BASF assigned to the problem, solved it by giving up on a single material. He built the vessel as two layers: an inner liner of soft, almost carbon-free iron, which the hydrogen could not damage because there was nothing in it to remove, inside an outer jacket of strong steel that carried the pressure and never met the gas. Hydrogen still worked its way slowly through the liner, so Bosch drilled small holes through the outer jacket to let it escape rather than accumulate. A vessel deliberately full of holes is what made the process possible, and it was arrived at by accepting that the leak could not be prevented and asking instead where it should go.

The second obstacle was the catalyst. Osmium is one of the rarest elements on earth, and Haber's method had used a substantial fraction of the world's supply. Alwin Mittasch, given the job of finding a substitute, ran something in the order of twenty thousand experiments on around two and a half thousand different formulations. What emerged was iron, the cheapest metal available, with small quantities of alumina and potash added, which are useless as catalysts themselves and make the iron work far better than iron alone. The first factory opened at Oppau in September 1913.

The scale of what followed is difficult to hold in the mind. The process now fixes more than a hundred million tonnes of nitrogen every year, which is more than all the bacteria in all the world's soils together manage. Roughly half of the nitrogen atoms in the body of a person reading this passed through a steel vessel on their way. It also consumes between one and two per cent of the world's energy, and takes its hydrogen mostly from natural gas, which is why a technology invented to feed people is now also an argument about carbon.

Haber himself makes an uncomfortable subject for a story about feeding the world. During the war that began the year after Oppau opened he directed the German chemical weapons programme and was present at Ypres in 1915 when chlorine was released against the French line. He received a Nobel Prize for the ammonia synthesis in the year the war ended, and the award was protested at the time. The two facts are not related by any logic except that the same man did both, which is a poor reason to leave either of them out.

Questions 1–5

Complete the table below.

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

Two problems between the bench and the factory		
Problem	Why it defeated the obvious approach	What was done instead
Containing the pressure	hydrogen at that temperature strips the 1 out of steel, so the tubes burst	an inner liner of soft, almost carbon-free 2 inside an outer steel jacket
Hydrogen still leaking through	it could not be stopped	small 3 were drilled through the outer jacket to let it escape
Finding a catalyst	osmium is one of the rarest elements, and Haber's method had used much of the world's 4	iron, with small quantities of alumina and 5 added

Questions 6–9

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.

- 6 Crookes named the solution to the problem he described.
- 7 Crookes was correct about when the shortage would arrive.
- 8 Crookes's warning led Haber to begin work on the problem.
- 9 The alumina and potash act as catalysts in their own right.

Questions 10–13

Complete the sentences below.

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

- 10 Mittasch tested around two and a half thousand different before settling on iron.
- 11 The first factory opened at Oppau in September
- 12 The process now fixes more nitrogen each year than all the world's soil together.
- 13 The hydrogen for the process comes mostly from natural

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

Where a language puts its boundaries

- A** Colour is a continuum and every language cuts it up. English uses eleven basic terms, Russian twelve, and some languages manage with two. For most of the twentieth century the assumption among anthropologists was that these divisions were arbitrary, that a language could carve the spectrum wherever it liked, and that speakers of different languages therefore lived in perceptually different worlds. The assumption was rarely tested, because testing it requires taking the same physical stimuli to speakers of very different languages, which is expensive and uncomfortable and was nobody's priority. It also had the quality that makes a claim durable rather than true: everyone could supply an example of a language that divided things oddly, and nobody had to supply a counter-example.
- B** Brent Berlin and Paul Kay tested it in 1969, using a standard array of coloured chips and data from nearly a hundred languages. What they reported was not arbitrariness but a sequence. If a language has only two basic colour terms they divide dark from light. If it has three, the third is red. The fourth and fifth are green and yellow in either order, the sixth is blue, the seventh brown, and the remainder are purple, pink, orange and grey. No language in their sample had a term for brown without having one for blue. The cut was not arbitrary; it was constrained. A language could be anywhere along that sequence, but it could not be at the seventh position without having passed through the sixth, which is a claim strong enough to be destroyed by a single well-documented exception.
- C** The finding needed a perceptual explanation, and Eleanor Rosch went to look for one. She worked with the Dani of New Guinea, who have two basic colour terms covering roughly the dark and cool colours and the light and warm ones. If the language made the perception, the Dani should treat all reds alike. They did not. Taught arbitrary new names for colour chips, they learned the names for the best examples of red, blue and green faster than names for chips at the edges of those categories, exactly as English speakers do. The anchors appeared to be in the eye rather than in the vocabulary. It was a clean result, it fitted Berlin and Kay, and it was taken as closing the question.
- D** For nearly thirty years that was the settled position, and then it stopped being settled. Debi Roberson, with Ian Davies and Jules Davidoff, worked with the Berinmo, another people of Papua New Guinea, who have five basic terms. The Berinmo boundary between the terms *nol* and *wor* falls in a place that English does not mark at all, and English marks a boundary between green and blue that Berinmo does not. Each group discriminated better across its own boundary than across the other group's, which is the pattern you would expect if the categories were learned rather than given. The Rosch result did not reproduce, and the failure was not marginal.

- E** A more precise measurement came from a language with an ordinary boundary in an unexpected place. Russian has no single word for blue: goluboy and siniy are separate basic terms for the lighter and darker ranges, and a Russian speaker must choose between them as an English speaker must choose between blue and green. Jonathan Winawer and colleagues showed Russian and English speakers pairs of blues and asked which of two matched a third. Russian speakers were faster when the pair straddled their boundary than when both fell inside one category. English speakers, looking at identical chips, showed no such difference.
- F** Two details of that experiment matter more than the headline. The Russian advantage vanished when the subjects were made to hold a string of digits in mind while judging, and survived when they were given a demanding spatial task instead. Whatever language is doing here, it is doing it during the judgement rather than having reshaped the eye in childhood. And the effect is largely confined to stimuli in the right half of the visual field, which is the half that reports first to the language areas in the left hemisphere.
- G** So both of the original positions were wrong, and the useful description is narrower than either. Human colour vision is the same everywhere and the ordering of the terms reflects it, which is Berlin and Kay's contribution and it stands. Where a language places its boundaries measurably changes how quickly a speaker tells two nearby colours apart, which is Roberson's contribution and it also stands. The effect is real, it is small, it is measured in tens of milliseconds, and it depends on the language being active at the moment of looking. Nobody lives in a different world. Some people are slightly faster at one particular judgement than others.

Questions 14–20

Reading Passage 2 has seven sections, A–G.

Choose the correct heading for each section from the list of headings below.

Write the correct number, I–X.

List of Headings

- i A belief that survived because nobody looked for a counter-example
- ii A belief that survived because the counter-examples were ignored
- iii Order found where arbitrariness was expected
- iv Arbitrariness found where order was expected
- v A result that appeared to close the question
- vi A result that reopened a closed question
- vii Two details that matter more than the headline
- viii A boundary in an unexpected place
- ix Both original positions replaced by a narrower one
- x The original position confirmed in full

14 Section A

15 Section B

16 Section C

17 Section D

18 Section E

19 Section F

20 Section G

Questions 21–24

Complete the summary below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

What the Russian experiment measured

Russian speakers were asked which of two blues matched a third, and were faster when the pair crossed the boundary between goluboy and **21** English speakers looking at the same chips showed no such difference. The advantage disappeared when subjects had to keep a string of **22** in mind, which suggests that language is involved during the

23 itself. The effect is also confined largely to the right half of the visual field, which reports first to the left **24**

Questions 25–26

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

- 25** What did Rosch's work with the Dani show?
- A The Dani could not distinguish red from blue.
 - B The Dani learned names for the best examples of colours faster than for edge cases.
 - C The Dani had more colour terms than had been believed.
 - D The Dani sorted chips in the same order as Berlin and Kay's sequence.
- 26** Which statement about the size of the effect does the passage make?
- A It is large enough to give speakers different perceptual worlds.
 - B It cannot be measured reliably.
 - C It is real but amounts to tens of milliseconds.
 - D It appears only in children.

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

What a library is for now

The argument about public libraries is conducted almost entirely by people who are wrong. On one side the institution is obsolete: the information is free, the catalogue is a search box, and a building full of paper is a monument to a solved problem. On the other it is sacred, beyond examination, and any question about what it costs is an attack on literacy itself. Both positions have the same defect, which is that neither of them has looked at who is in the building.

Start with the awkward number. In most countries with reliable statistics, book lending has fallen substantially over the past two decades. It is the measure the sector reports, the measure funders look at, and the measure the obsolescence argument is built on. Over much of the same period, visits to library buildings have held up or risen. People are going and not borrowing, which means either that a large number of people are wasting their afternoons or that the loan figure has stopped describing what the place is for. Only one of those two readings is worth taking seriously, and it is not the one the funding formula assumes.

What they are doing there is not mysterious to anybody who works in one. They are using a warm room that does not require them to buy a coffee, which in most towns is now the only such room. They are using the internet connection, because a substantial minority of households does not have one that works for filling in a government form. They are bringing small children somewhere safe. They are asking a member of staff for help with something that has nothing to do with books, and increasingly that something is an application for housing, benefits or immigration status. None of those activities produces a loan, and so none of them appears anywhere in the figures on which the building's future is decided.

That last item is where the sentimental defence of libraries starts to do damage, because it is not a success story. Library staff are performing frontline social work for which they are not trained, not funded and not accountable, and they are doing it because the services that were supposed to do it were closed and the library was the door that stayed open. Describing this as libraries reinventing themselves is a way of congratulating an institution for absorbing a failure elsewhere. The correct response is not applause. It is either to fund it properly or to put the other services back.

The obsolescence argument has its own blind spot, and it is a category error about what was ever being provided. A library was never primarily a store of information; it was a mechanism for giving people access to things they could not individually afford, and to a professional whose job is to help with the question behind the question. Search engines are extraordinarily good at answering the query you typed. They are useless at the far commoner situation in which you do not know what you should be asking, and that gap has widened rather than closed as the quantity of available material has grown.

None of which means everything currently defended is worth defending. A good deal of what is said about libraries is nostalgia wearing an argument's clothes, and some of the estate is in the wrong place, open at the wrong hours, and organised around a lending operation that a minority of visitors uses. The sector's own attachment to the loan figure is part of this: it is a measure that flatters the past, and it is defended most strongly by people who would be embarrassed by an honest count of what the building is actually used for.

The practical problem is therefore a measurement problem, and it is the ordinary one. What gets counted is what was easy to count when the counting began, and everything the institution has since become is invisible to it. A place can be busier than ever and appear, in every document that decides its future, to be in decline. Its funders can cut it for failing at the one thing it has stopped doing, while the thing it now does has no line in any budget and no advocate, because nobody has a number for it.

So the question is not whether libraries should survive. It is what they are being asked to do, whether anybody has said so out loud, and whether the thing being measured is the thing being used. Those are answerable questions, they would cost very little to answer, and they are being avoided by both sides of an argument that is, in its present form, about a building rather than about the people inside it.

Questions 27–32

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 libraries should be beyond examination.
- 28 The writer accepts that some library buildings are open at the wrong times.
- 29 Library visits have risen faster in cities than in rural areas.
- 30 The writer regards libraries taking on social work as evidence of successful reinvention.
- 31 The writer believes search engines answer a typed query well.
- 32 The writer thinks the loan figure should be abolished entirely.

Questions 33–36

Complete the sentences below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

- 33 The writer says a library is in most towns now the only warm room that does not require a visitor to buy a
- 34 A library was never mainly a store of information but a way of reaching things people could not individually
- 35 A librarian's job includes helping with the question behind the

- 36** Staff are doing frontline social work for which they are not trained, not funded and not

Questions 37–40

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

- 37** Why does the writer describe the fall in book lending?
- A To show that libraries are declining.
 - B Because it is the measure on which the obsolescence argument rests.
 - C To argue that people read less than they used to.
 - D To explain why library staff have changed roles.
- 38** Which position does the writer reject?
- A That some of what is defended about libraries is nostalgia.
 - B That library staff are doing work they were not funded for.
 - C That a library was principally a store of information.
 - D That what gets counted shapes what gets funded.
- 39** According to the passage, what is the correct response to libraries absorbing social work?
- A To praise the institution for adapting.
 - B To fund it properly or restore the other services.
 - C To train library staff in social work at their own expense.
 - D To close the services that failed.
- 40** Which of the following best expresses the writer's conclusion?
- A Ask what libraries are being asked to do, and whether the thing measured is the thing used.
 - B Libraries should be closed where lending has fallen.
 - C Libraries should be protected from any examination of their cost.
 - D Search engines have made professional help unnecessary.