

Academic Reading Paper 04

Shells, Witnesses and Maps

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 colour that came from a shell

For something like two thousand years the most expensive substance in the Mediterranean world was a colour. Tyrian purple was extracted from sea snails, chiefly two species of murex found along the Levantine coast, and it was expensive because of an arithmetic that no amount of organisation could improve. The German chemist Paul Friedländer, who in 1909 finally established what the dye actually was, needed twelve thousand snails to obtain 1.4 grams of it. A single robe consumed a small reef.

The snail does not contain the colour. What it contains, in a gland behind its head, is a clear precursor that turns purple only after it has been broken open and left to the light and the air; the change is chemical and takes hours. Somebody, at some point before 1500 BC, noticed this happening on a beach and worked out what to do about it, and the sequence they arrived at was still being followed when Pliny described it in the first century AD.

The description is unappetising. Large snails had the gland cut out; small ones were crushed shell and all. The material was salted and left for three days, then simmered for another nine or ten in vats of lead, kept below boiling and skimmed of flesh, until a tenth of the original volume remained. Cloth was steeped in the reduced liquor and then hung in the sun, where it turned from yellow through green to a red-purple that darkened as it dried. The smell of the vats was famous. Dyeworks stood outside the city walls, downwind, and the industry is one of the few whose location archaeologists can predict.

What justified the labour was permanence. Almost every other ancient dye faded — in sunlight, in salt water, in a wash — and purple did not. Pliny records the belief that it improved with weathering, and modern testing on surviving fragments has not contradicted him. A garment dyed with murex outlived the person who commissioned it, which for a Roman senator was rather the point. How expensive that made it can be stated exactly, because Diocletian tried to fix prices. His edict of AD 301 set a ceiling of fifty thousand denarii for a pound of purple-dyed wool, and in the same document set a farm labourer's wage at twenty-five denarii a day with food. A pound of the cloth was therefore worth something over five years of a working man's earnings, and that was the price the edict was trying to hold down.

Because it was scarce and permanent it became a marker, and because it became a marker it was legislated. Roman sumptuary law restricted the wearing of purple to certain ranks, with the width of the stripe on a toga indicating the wearer's standing; it did not confine the colour to one man. That came later. Under the Byzantine emperors the deepest grade was reserved to the imperial household alone, dyeworks were state monopolies, and a child born to a reigning emperor was described as born in the purple — a phrase that has outlived every fact behind it.

The industry left physical traces of an unusual kind. At Tyre and at Sidon there are mounds of crushed murex shells, discarded over centuries, large enough to be visible landscape features. They are the waste heap of the process, and they are the reason we can be confident about its scale. The heaps were still be-

ing quarried for lime in the nineteenth century, which is how they came to be described at all, and the shells in them are broken in a consistent way, struck at the shoulder to reach the gland behind it.

It ended in a single decade and not by exhaustion. In 1856 an eighteen-year-old chemistry student in London named William Perkin was attempting to synthesise quinine, the anti-malarial, from coal-tar derivatives. He failed, and the black sludge his failure produced turned out to dye silk a brilliant purple. Mauveine was cheap, it could be made in any quantity, and within twenty years the trade that had taken twelve thousand snails to fill a thimble was of interest only to historians. The Levantine coast still has the shell mounds. Nobody has any commercial reason to add to them.

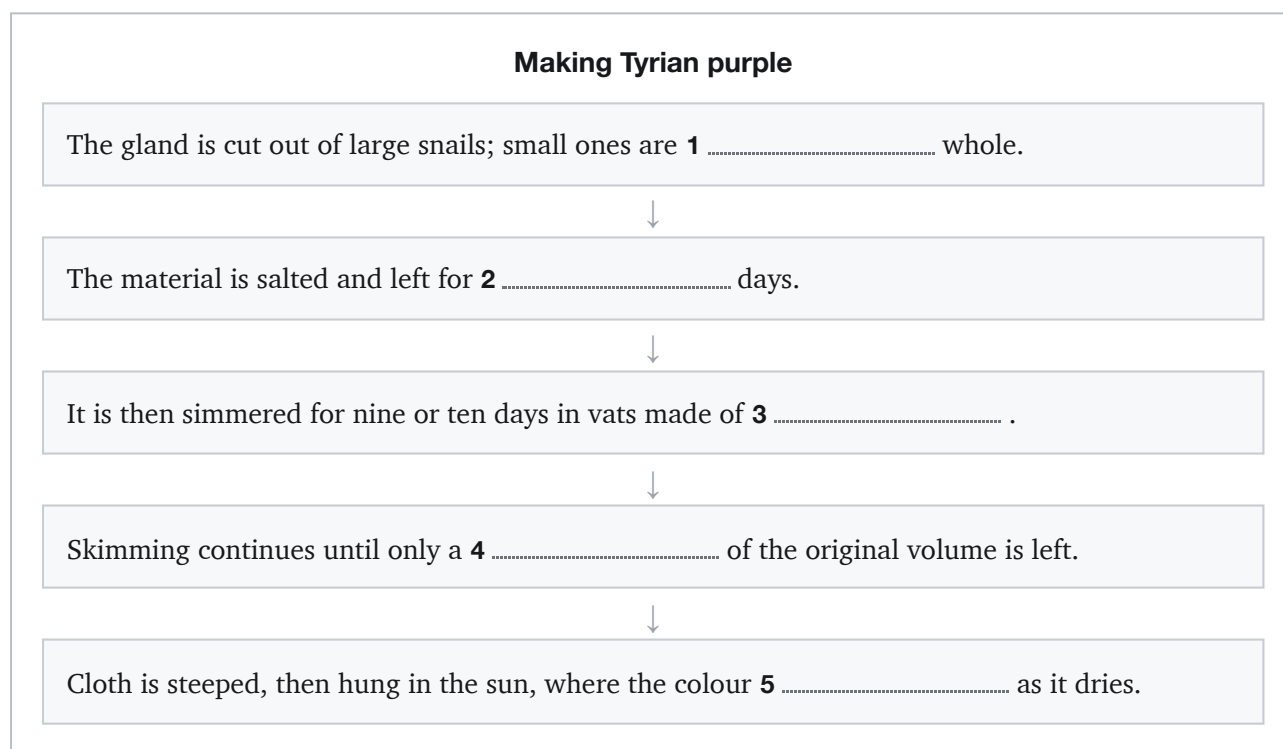
murex: a group of predatory sea snails with spined shells

sumptuary law: a law restricting what people of particular ranks may wear or own

Questions 1–5

Complete the flow-chart below.

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



Questions 6–9

Answer the questions below.

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

6 How many snails did Friedländer need to obtain 1.4 grams of dye?

7 Because of the smell, dyeworks stood outside

- 8 What quality made the dye worth the labour?
- 9 What was the name of the synthetic dye that replaced it?

Questions 10–13

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.

- 10 Purple-dyed cloth kept its colour better than cloth dyed by other ancient methods.
- 11 Roman law reserved the colour purple for the emperor alone.
- 12 The shell mounds at Tyre are larger than those at Sidon.
- 13 Perkin was trying to produce a purple dye when he made his discovery.

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

The unreliable witness

- A** When American courts began admitting DNA evidence in the late 1980s, it became possible for the first time to check convictions against a physical fact rather than against a jury's opinion. The result was a natural experiment nobody had planned. Of the first several hundred prisoners exonerated by DNA testing in the United States, around seven in ten had been convicted at least partly on the word of an eyewitness who was sure and who was wrong. Not lying: wrong. Almost none of these cases involved an identification made in bad faith. Before DNA there had been almost nothing an appeal court could weigh a confident identification against. A witness's certainty was treated as evidence of its own reliability, on the reasonable-sounding ground that people know their own minds.
- B** The reason is that memory does not work in the way that everybody, including most witnesses, assumes it does. In 1932 the Cambridge psychologist Frederic Bartlett had English students read a Native American folk tale and retell it at intervals over months. The tale did not simply fade. It changed in a direction — details that made no sense to an English reader were dropped, others were altered until they did make sense, and the story shortened towards something the tellers found plausible. Bartlett's conclusion was that remembering is reconstruction, an act of rebuilding performed fresh each time and shaped by what the rememberer expects.
- C** If memory is rebuilt on each retrieval, then anything supplied between the event and the retelling can be built in. Elizabeth Loftus demonstrated this in a form that made the point unavoidable. Volunteers watched a film of a traffic accident and were asked how fast the cars were going when they contacted, hit, bumped, collided or smashed into one another. The single verb moved the average speed estimate substantially, and a week later those who had been given the strongest verb were the more likely to report having seen broken glass. There had been no broken glass in the film. Loftus went on to show that a whole episode can be installed the same way: a substantial minority of volunteers, told by an older relative that they had once been lost in a shopping centre as a small child, came to remember the experience, several of them in circumstantial detail.
- D** For a long time the professional conclusion drawn from this work was that a witness's confidence tells you nothing about their accuracy, and that conclusion is now regarded as too strong. John Wixted has argued that confidence recorded at the moment of the first identification, under clean conditions, is in fact a reasonably good guide — and that the weak relationship found in the courtroom is an artefact of everything that happens in between. What happens in between is feedback. A witness who is told, however casually, that they picked the suspect becomes markedly more confident, and also remembers having had a better view, having been more certain at the time, and having identified the person more quickly.

- E** Most of the practical reform of the last thirty years follows from that observation, and Gary Wells is the name attached to most of it. The officer running an identification should not know which person is the suspect, so that nothing can be signalled. The witness should be told in as many words that the person may or may not be present, because a witness who assumes the culprit is in the room will pick whoever looks most like their memory. A statement of confidence should be taken immediately, in the witness's own words, before anybody says anything. The fillers should resemble the description the witness gave, not the suspect.
- F** The courtroom is where the reforms meet their limit. Jurors weight a confident witness heavily, and there is no reliable way to instruct them not to; mock-jury studies find that a witness's certainty predicts conviction better than almost anything else about the testimony. Expert evidence about the properties of memory is admitted in some jurisdictions and excluded in others, sometimes on the ground that the subject is a matter of common sense. It is precisely not a matter of common sense, which is the whole of the difficulty. Nor does the problem stop with juries. Prosecutors, defence lawyers and judges have all been found, in survey after survey, to hold beliefs about how memory works that the research contradicts, so a case can pass through every stage of a court without anybody in the room knowing what is wrong with it.
- G** None of this shows that eyewitnesses are useless, and it would be a poor reading of the evidence to conclude that. An identification taken under clean procedure, with confidence recorded at once, is useful evidence. The trouble is that the procedure is cheap to get right and cheap to get wrong, and that the difference is invisible afterwards: the confident witness in the courtroom looks the same either way.

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 list of the specific things a witness misremembers after being praised
- 15** an experiment in which a single word changed what people reported seeing
- 16** a reason why a court might refuse to hear an expert on memory
- 17** a proportion of overturned convictions that rested on identification
- 18** an instruction that must be given to a witness before they look

Questions 19–23

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

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

NB You may use any letter more than once.

List of Researchers

- A** Frederic Bartlett
- B** Elizabeth Loftus
- C** John Wixted
- D** Gary Wells

- 19** He showed that a remembered story drifts towards what the teller finds plausible.
- 20** She showed that information supplied after an event can be absorbed into the memory of it.
- 21** He argued that an earlier professional conclusion had been drawn too strongly.
- 22** His name is attached to most of the procedural reforms.
- 23** He proposed that the person conducting an identification should not know who the suspect is.

Questions 24–26

Complete the sentences below.

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

- 24** Bartlett concluded that remembering is an act of , performed afresh each time.
- 25** What inflates a witness's confidence between the identification and the trial is
- 26** The people used alongside the suspect should match the witness's , not the suspect.

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

Every map is an argument

In 1827 Carl Friedrich Gauss proved a result about curved surfaces which has the incidental consequence that the argument people have about world maps can never be won. His theorem establishes that the curvature of a surface is intrinsic to it, and it follows that a sphere cannot be laid flat without stretching. Every flat map of the earth is therefore wrong in some way that cannot be repaired by drawing it better. What a cartographer chooses is not whether to distort but which distortion to accept, and that choice is the map's argument.

The best-known defendant in this dispute is Gerardus Mercator, whose projection of 1569 enlarges everything as it moves away from the equator, so that Greenland appears comparable in size to Africa when it is about a fourteenth of it. The charge is that this is a colonial map which inflates the north and diminishes the tropics. The charge misdescribes what the map is for. Mercator's projection has one property, and he built it to have that property: a line of constant compass bearing is a straight line on the paper. For a navigator with a compass and a ruler this is not a convenience but the whole problem solved, and no equal-area projection can do it. The distortion of area is the price of that property, and it was paid knowingly.

The best-known prosecutor is Arno Peters, who in 1973 presented an equal-area world map as a corrective to Mercator and made the case in explicitly moral terms. Cartographers reacted with an irritation that surprised the public and needs explaining, because it was not simply professional territory. The projection Peters presented had been published by the Scottish clergyman James Gall in 1855, and Peters appears not to have known it. Several of the claims made for it — that it was uniquely faithful, that it alone showed true areas — were false; dozens of equal-area projections existed, most of them kinder to the shapes of continents than this one, which stretches the tropics into vertical smears. What Peters had was not a better map but a better campaign.

It is worth being clear that the campaign was answering something real. A single map repeated everywhere does teach a shape of the world, and Mercator was for a long time the default in classrooms, atlases and, more recently, in web mapping, where it survives for the same reason it was invented: it preserves local angles, so a street corner looks like a street corner at every zoom level. That a tool designed for navigation ended up as the world's mental image is a genuine problem. It is not, however, one that is solved by making a different rectangle compulsory.

In 1989 seven North American geographic organisations, including the National Geographic Society and the American Cartographic Association, passed a joint resolution urging publishers and the media to abandon rectangular world maps altogether — Mercator and Peters together, and everything like them. Their reasoning was that any projection which forces the round earth into a rectangle must place the

greatest distortion where readers are least equipped to notice it, at the poles and the edges, and that a map with curved meridians at least announces that it is a projection. The resolution had modest effect, which tells you something about how arguments of this kind are settled.

There is a technique for showing a map's distortion instead of debating it. Nicolas Tissot's indicatrix places small circles at intervals across the map; on the sphere they are all identical, so whatever the projection does to them — swelling them, flattening them into ellipses, tilting them — is the distortion, drawn. A Mercator map covered in Tissot circles shows Greenland's swelling honestly and immediately, and so does a Peters map show its vertical smearing. A reader who has once seen a map with the indicatrix on it does not afterwards need to be told that maps distort.

The useful conclusion is narrower than either side wanted. Ask what the map is for. If the question is how much land a country has, use an equal-area projection and accept the shapes. If the question is a bearing, use Mercator and accept the areas. If the map is going on a classroom wall to be looked at for eleven years, then it is not answering a question at all, it is forming an impression, and the honest choice there is not a better rectangle but several maps and an explanation of why they disagree.

What should be given up is the idea that somewhere there exists a neutral map that a fair-minded person would use. There does not, and there cannot, and Gauss proved it before the argument started.

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 equal-area projection Peters promoted was of his own devising.
- 28** The writer thinks the complaint against Mercator was answering nothing real.
- 29** The writer believes web mapping should stop using the Mercator projection.
- 30** The writer thinks the 1989 resolution changed publishing practice substantially.
- 31** Tissot devised the indicatrix in response to the dispute over the Peters map.
- 32** The writer holds that no map can be politically neutral.

Questions 33–36

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

List of Words

- A bearing
- B area
- C curvature
- D impression
- E accuracy
- F shape
- G campaign
- H distance

Choosing a projection

Because the **33** of a sphere belongs to the sphere itself, no flat map can avoid distortion, and a cartographer chooses which kind to accept. A navigator needs a constant **34** to be a straight line and pays for it in **35** A map hung on a classroom wall answers no question at all; what it does instead is form an **36**

Questions 37–40

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

- 37** On a Mercator map, Greenland appears
- A about a fourteenth the size of Africa.
 - B roughly the same size as Africa.
 - C fourteen times the size of Africa.
 - D smaller than it really is.
- 38** Why does the writer say cartographers were irritated by Peters?
- A Because an equal-area map was unnecessary.
 - B Because he was not a professional cartographer.
 - C Because the claims made for his map were untrue.
 - D Because his map distorted the shapes of the tropics.

- 39** The 1989 resolution called for the abandonment of
- A** the Mercator projection only.
 - B** the Peters projection only.
 - C** all rectangular world maps.
 - D** all maps with curved meridians.
- 40** Which of the following best describes the writer's position?
- A** Equal-area projections should replace Mercator in all uses.
 - B** The choice of projection should follow from what the map is for.
 - C** The dispute about projections is not worth having.
 - D** A neutral projection will eventually be found.