

The Trench in the Hill

PASSAGE · NON-FICTION

SKILLS TRAINED

Working memory

Delayed recall

Critical analysis

HOW TO USE THIS SHEET

About 22 minutes

- 1 Read the passage twice, slowly. Take about seven minutes.
- 2 Turn to the next page and cover this one. No looking back.
- 3 Write what you remember, then mark it on the last page.

In 1908 an archaeologist named Vassily Vyatkin was digging on a low hill outside Samarkand, looking for a building that everybody agreed had once existed and nobody could find. What he uncovered was not a wall or a floor. It was a curved stone trench, cut into the bedrock, marked along its length with careful graduations, and running away from him up the slope like a railway for something that had never been a train.

The trench was the surviving part of an observatory built in the 1420s by Ulugh Beg, a ruler of Samarkand and a grandson of the conqueror Timur. Ulugh Beg governed the city, but his real interest was the sky, and what he spent his money on was not a palace but an instrument.

To understand why the instrument had to be so large, it helps to know what astronomers of that century were actually doing. They had no telescopes. Every measurement was made with the naked eye, by lining up a sight along a scale, and the accuracy of the result depended almost entirely on how finely the scale could be divided. On a small brass quadrant the gap between one degree and the next is a few millimetres wide, and a reading can only ever be approximate. Make the same arc a hundred times bigger and each degree becomes a comfortable hand's span, so a careful observer can split it into minutes. Precision, before optics, was mostly a question of size.

Ulugh Beg's main instrument was therefore enormous: a sextant arc of about forty metres' radius, laid in the north-south plane so that the sun, moon and stars crossed it as they reached their highest point each day. Building something that big and that steady above ground would have been close to impossible, so the lower part of the arc was sunk into a trench cut in the rock of the hill. The hill itself held the instrument rigid, which is also why a trench is the one part of the observatory that has survived.

The results were remarkable. Working with a team of mathematicians and astronomers, Ulugh Beg produced a star catalogue, the *Zij-i Sultani*, which fixed the positions of more than a thousand stars — the first substantial new catalogue compiled from fresh observation, rather than copied and corrected, in some seventeen hundred years. His

team also measured the length of the year. Their figure was out by only a few seconds, which for an instrument of stone and brass, read by eye, is an astonishing thing.

The observatory did not last. Ulugh Beg's reign ended badly in 1449, his school of astronomers dispersed, and over the following centuries the building was dismantled for its materials until nothing stood above the ground. By the nineteenth century its very location was disputed, which is how a man with a spade came to be looking for it in 1908.

Something else escaped. Copies of the *Zij-i Sultani* travelled, and in 1665 the catalogue was printed at Oxford. Astronomers in Europe, by then beginning to use telescopes, read the star positions of a Samarkand prince and found them good. The arc that produced them had already been quarried away for building stone.

Today you can walk down into the trench. It is short, the stone is worn smooth, and the graduations are still legible under your hand. Standing in it is a peculiar experience, because the thing you are standing inside is not really a building. It is a measuring device, and you are at the bottom of its scale.

- 6 The observatory was destroyed, yet its catalogue survived and was still useful centuries later. Weigh up which of the two was the greater achievement.

PART C Mark your own work

Now go back to the passage. Tick every answer you got right. You do not need the same words as the answer below — if you wrote the same idea in your own words, it counts.

- ☐ 1 · An archaeologist named Vassily Vyatkin rediscovered it, in 1908.
- ☐ 2 · Because every reading was taken by eye along a scale, so accuracy depended on how finely the scale could be divided. On a small arc a whole degree is only a few millimetres wide and cannot be split, while on a huge arc a degree becomes a hand's span and can be read down to minutes.
- ☐ 3 · Because it is not made of anything worth taking away. The hill itself formed the structure, so there were no blocks or bricks to be carried off for other buildings, and a shaped hole in the bedrock stayed where it was even after everything above ground had been dismantled.
- ☐ 4 · Graduations are the marked divisions of a measuring scale, like the lines on a ruler. They were the most important feature because the whole purpose of the arc was to measure angles: without the markings it would be a curved ditch, and the fineness of those markings decided how precise every observation could be.
- ☐ 5 · The writer wants admiration mixed with a sense of loss. Admiration comes from the numbers — a forty-metre arc, over a thousand stars, a year measured to within a few seconds by eye — while the loss comes from flat statements about the building being quarried away and its site forgotten. Setting the Oxford printing of 1665 directly against the destroyed arc makes the contrast sharpest.
- ☐ 6 · The instrument was the harder thing to make: it demanded money, engineering and the insight that size could replace optics, and without it no accurate figures could have been produced at all. But it was fixed in one place, needed a trained team to use, and was gone within a few generations. The catalogue was lighter than the arc in every sense — it could be copied, carried, printed at Oxford in 1665 and checked by astronomers who had never seen Samarkand. Since the point of the arc was to produce measurements, the catalogue is arguably the greater achievement, because it is the part that did the work the arc was built for and the part that still does it.

FACTS RECALLED IN PART A

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QUESTIONS CORRECT

— / 6

DATE

THE STRATEGY Retrieval under pressure

Give yourself a short, fixed time and write down everything you can recall before you check anything — three minutes, pen moving, no looking. The time limit matters: it stops you drifting into comfortable rereading and forces the fast, effortful recall you will need in an exam. Expect it to feel bad. Pulling hard on a memory strengthens it far more than finding the fact again on the page.

WHERE YOU ALREADY DO THIS

Where do you already have to produce something from memory at speed — a sport, a performance, answering questions in a lesson? What do you do in the seconds before it starts?

FOR THE PARENT OR TEACHER · This sheet trains delayed recall, not reading speed. Let your teenager read the passage once, then cover it completely before Part A — no glancing back and no prompting, because the effort of hauling a half-remembered fact out of memory is what fixes it there. At this level mark the thinking rather than the wording: the answers given for the inference, tone and analysis questions are one good response each, not the only one.