



PART 2

Read the text below and answer questions 14–26.

THE ENGINEERING MARVEL OF ROMAN AQUEDUCTS

A

Roman aqueducts are remembered for their dramatic arcades striding across valleys, yet this postcard image conceals the system's typical form. In many regions, the great majority of an aqueduct's length was built as a covered channel cut into rock or laid in trench and then buried. Such routing was not merely cheaper than an endless succession of arches; it also protected water quality and safeguarded supply. Subterranean channels reduced evaporation in hot climates, prevented sunlight from encouraging algal growth, and shielded the flow from wind-blown debris. They also reduced theft and damage, because an exposed channel invited puncturing, illegal diversion, and deliberate sabotage. Arches were therefore selective solutions for visible obstacles, while the everyday logic of Roman water engineering lay in concealment, protection, and steady hydraulic control.

B

Because aqueducts relied on gravity, the central engineering challenge was maintaining an appropriate gradient over long distances. Too steep a slope accelerated water, increasing erosive force and scouring mortar linings; too gentle a slope risked stagnation, sedimentation, and intermittent flow. Roman surveyors had to read topography with remarkable precision, especially where routes crossed uneven ground. One instrument associated with this work was the chorobates, a long wooden bench equipped with a straightedge and either plumb lines or a water channel used to detect minute deviations from level. By combining such tools with repeated checks and a disciplined route plan, engineers could keep a canal descending only slightly over many kilometres while still arriving at the required elevation to feed urban distribution tanks.

C

Topography rarely offered a smooth corridor. Hills required tunnels or cuttings; ridges might be pierced to avoid long detours. Valleys posed the most conspicuous test, and although arcades are the most visible response, they were not always the most practical. In certain cases Romans used inverted siphons: water was forced down into pipes, across the valley floor, and up the opposite side under pressure created by the height difference. This method demanded robust pipework and careful jointing, because the lowest point could experience substantial hydraulic stress. Engineers could use stone blocks drilled as conduits, ceramic pipes in sections, and—where weight and sealing mattered—metal pipes including lead. Siphons were thus an application of hydraulic principles rather than a



rejection of gravity: the driving force still came from elevation, but the route momentarily exchanged open channel flow for pressurised transport.

D

Even with perfect surveying, aqueducts faced an unavoidable chemical and physical problem: the water itself altered the system. Many sources carried dissolved minerals that precipitated as calcium carbonate, gradually forming a hard crust known as sinter on channel walls. Over time this calcification narrowed passages, reduced discharge, and roughened surfaces, changing flow patterns. Roman engineers anticipated these effects. They built settling tanks where the current slowed and suspended material could drop out, and they included inspection shafts and accessible points so maintenance crews could enter to scrape deposits. Waterproof mortar linings helped resist leakage, but they also had to withstand repeated cleaning. The system's long-term performance therefore depended on design features that made upkeep possible, not merely on initial construction.

E

Within cities, the aqueduct's most politically sensitive work began. Water typically entered a main distribution reservoir—often described as a *castellum divisorium*—where pressure could be regulated and grit allowed to settle. From there, supply was divided among conduits serving fountains, baths, workshops, and sometimes private households. This was not a neutral allocation. Public uses were usually prioritised to sustain fountains, sanitation, and the civic prestige of bathing complexes. Private connections could be restricted by legal privilege, taxed, or granted as favours, making water access a visible marker of status. In this way, hydraulics intersected with hierarchy: the same infrastructure that improved urban life for many could also reinforce social distinctions through controlled distribution.

F

Maintenance and administration were therefore integral, not incidental. Aqueduct routes required continuous inspection for leaks, storm damage, and illegal tapping. Rome developed a bureaucratic apparatus to manage these tasks, including officials responsible for oversight and teams of workers assigned to repair and cleaning. One of the most cited sources is Frontinus, a water commissioner who wrote about the management of Rome's supply and the persistent problem of puncturing and unauthorised diversions. His accounts suggest that technical success depended on governance: records, enforcement, and periodic audits of distribution rights. Aqueduct failure could be politically embarrassing precisely because the structures were symbols of munificence and order. A



dry fountain or reduced bath supply did not merely inconvenience citizens; it signalled administrative weakness and undermined civic reputation.

G

Modern debates complicate the triumphal narrative, especially regarding materials. Lead pipes are often invoked as evidence that Roman engineering carried hidden risks, since lead can leach into water. Yet the issue is contested. In many aqueduct systems, mineral-rich water deposited sinter inside pipes, potentially forming a protective layer that reduced direct contact between water and metal. This does not prove that exposure was impossible, but it suggests that toxicity varied by local water chemistry, pipe usage, and maintenance. More broadly, research indicates that not all cities depended equally on aqueducts; some relied substantially on cisterns, wells, and local adaptation. The legacy of Roman aqueducts, then, lies not only in monumental arches but in an integrated approach—surveying precision, hydraulic problem-solving, and administrative control—that shows infrastructure is as much a social system as a technical one.

Questions 14–17

Select the correct answer.

14 What advantages of subterranean channels does the passage identify?

- A** They increased water speed and made the channels easier to clean.
- B** They reduced evaporation and contamination while protecting the supply from illegal diversion.
- C** They eliminated the need for waterproof mortar in Roman aqueducts.
- D** They allowed repairs to be carried out only from within the city.

15 Why was the calculation of the channel's gradient considered a delicate engineering balance?

- A** Because a steep slope reduced erosion but increased stagnation
- B** Because any slope prevented mineral deposits from forming entirely
- C** Because the gradient was chosen mainly to match the height of arcades
- D** Because too steep a slope caused erosion while too gentle a slope encouraged sedimentation

16 What alternative to arcades is described for crossing valleys when they were not the most practical solution?

- A** By abandoning gravity flow and pumping water manually uphill
- B** By diverting the entire route around the valley, even if it added many kilometres



- C** By using inverted siphons that carried water through pressurised pipes
- D** By allowing channels to drop sharply and then rebuilding them at a higher level

17 What does the passage indicate about the distribution of water within the city?

- A** Private access could be restricted or treated as a privilege, while public supply was prioritised
- B** All neighbourhoods received equal water allocations regardless of status
- C** Baths were supplied only after private households had received their full share
- D** Water was distributed mainly for agriculture rather than urban facilities

Questions 18–22

Complete the summary below. Choose **NO MORE THAN TWO WORDS** from the text for each answer.

Technical challenges and maintenance

The aqueduct system relied on **18** to move water over vast distances. However, dissolved minerals could form a hard crust known as **19** on channel walls. To manage this, engineers installed **20** where suspended material could drop out. Administration was also crucial; records left by officials such as **21** reveal the struggle against illegal theft. Modern debates often focus on the use of **22** pipes, though historical evidence suggests mineral deposits may have reduced their toxicity.

Questions 23–26

Choose **TRUE** if the statement agrees with the information given in the text, choose **FALSE** if the statement contradicts the information, or choose **NOT GIVEN** if there is no information on this.

23 The passage suggests that illegal tapping of water channels was a significant problem for Roman administrators.

24 The passage states that the Aqua Appia carried twice as much water as the Aqua Marcia.

25 The passage states that the use of lead pipes resulted in widespread poisoning across the Roman population.

26 The passage indicates that cities differed in how heavily they depended on aqueducts.

Answer Key

14. B



15. D

16. C

17. A

18. gravity

19. sinter

20. settling tanks

21. Frontinus

22. lead

23. TRUE

24. NOT GIVEN

25. NOT GIVEN

26. TRUE