



PART 1

Read the text below and answer questions 1–13.

THE RISE OF THE UNDERGROUND: A HISTORY OF METRO SYSTEMS

A

Metro systems did not appear because cities admired subterranean engineering; they emerged because the surface stopped working. By the mid-nineteenth century, industrial capitals were swelling with migrants and factories, and the street became a bottleneck of carts, omnibuses, and later trams competing for space. London's response was radical: in 1863 it opened what is widely regarded as the first modern underground railway, arguing that only by separating mass transit from road traffic could the city maintain economic momentum. Yet building beneath crowded neighbourhoods meant tearing up the very streets that commerce depended upon. The early approach—*cut-and-cover*—required trenches to be excavated along existing roads, with temporary bridges for pedestrians and a patched-up cityscape after the track was laid. Dust, noise, blocked access, and collapsing shop revenues created political resistance, so the success of the project depended not only on engineers but also on leaders willing to absorb public anger and keep construction moving.

B

The limitations of shallow tunnels soon pushed metro builders toward depth. Steam locomotives could drag carriages through early tunnels, but the smoke and heat made stations unpleasant and ventilation difficult, especially as lines grew longer. The breakthrough was a combination of new tunnelling tools and cleaner traction. In London, the Greathead Shield—an advance in mechanical excavation that stabilised soft ground—made circular, deep-bore tunnels feasible where open trenches were impossible. At roughly the same time, *electrification* replaced steam on key routes, reducing fumes and allowing trains to operate efficiently in enclosed spaces. Together, these shifts transformed the underground from a shallow trench system into a deeper network threading beneath existing foundations, rivers, and utilities. Deep tunnelling, however, demanded meticulous surveying, stronger linings, and careful management of groundwater, turning metro construction into a high-stakes contest between geology and human ambition.

C

As lines went deeper, operating them safely and comfortably became a second engineering frontier. Stations were no longer simple staircases down from the pavement;



they became vertical transport machines. Escalators enabled rapid circulation between street level and deep platforms, while improved passenger flow design reduced congestion at peak times. Inside the tunnels, the objective was to move more trains without expanding the track footprint, and this depended on *signalling systems*. With better block control and later more advanced train detection, operators could shorten the distance between trains, raising *capacity* by reducing headways and smoothing traffic through the network. These changes were not cosmetic upgrades: they redefined what an underground railway could do, turning metros into high-frequency arteries capable of absorbing commuting demand that surface transport could not handle.

D

Yet metros have never been purely technical artefacts; they are political and financial bargains set in concrete and steel. Different cities adopted different governance strategies. Some relied on private companies expecting fares to cover costs, while others treated underground rail as a public utility financed through taxation, municipal borrowing, or government bonds. The choice of funding model shaped everything from fare levels to expansion speed, and it influenced which neighbourhoods received stations first. Political leaders justified expensive lines by promising productivity gains, fewer traffic jams, and a more orderly city, but they also faced the recurring problem of overruns and delays. Once excavation begins, unforeseen ground conditions, utility relocations, and contract disputes can inflate budgets, and a metro that was sold as an efficient solution can become a symbol of waste. In this sense, every kilometre of tunnel is also a test of public trust.

E

Historical shocks left distinct layers in metro history. During the Second World War, underground stations and tunnels served as shelters during air raids in several cities, turning transport infrastructure into emergency refuge. At the same time, construction often slowed or stopped as labour and materials were diverted to the war effort, and wartime damage forced planners to rethink urban form. In the post-war decades, reconstruction and modernisation programs revived underground expansion, presenting metros as symbols of a rebuilt future. Later, however, eras of cheap fuel and car-oriented planning weakened the political case for large-scale subterranean projects. Suburban sprawl made fixed-rail investments harder to justify in some regions, while periodic economic crises tightened budgets and postponed ambitious schemes. Metro development, therefore, did not follow a smooth upward curve; it advanced in bursts, shaped by conflict, recovery, and shifting ideologies about how a city should move.



F

In the late twentieth and early twenty-first centuries, the metro's relationship with the city became even more visibly socioeconomic. New stations can raise surrounding property values, attract investment, and accelerate redevelopment, but this can also trigger gentrification, pushing lower-income residents away from the very accessibility that public transport provides. Meanwhile, network maps often reveal inequality: lines and interchanges may prioritise districts with political influence, while other communities remain underserved or forced into long, indirect journeys. These routing debates expose questions of power—who benefits, who pays, and whose time matters. Alongside these social tensions, automation has become a defining trend. Some systems now use *driverless trains* to increase frequency, standardise operations, and reduce labour costs, but automation requires sophisticated control centres, rigorous safety design, and substantial capital investment. The technology can enhance reliability, yet it also concentrates risk: a single failure in software or oversight can ripple through the entire network.

G

Environmental pressures now dominate the strategic argument for underground rail, but they also introduce new vulnerabilities. Electrified metros can cut per-passenger emissions compared with private cars, especially as electricity grids decarbonise, making rail a cornerstone of climate policy. However, the environmental ledger is complicated by the carbon footprint of excavation, concrete, and steel, and by the growing threat of extreme weather. Flooding, in particular, can overwhelm entrances, shafts, and low-lying tunnel sections, damaging equipment and forcing closures. As a result, contemporary projects increasingly include *resilience planning*—pumps, barriers, drainage redesign, and protective upgrades to critical systems—so that underground infrastructure can survive climate volatility. Looking forward, the future of metros may depend less on grand standalone lines and more on integration: coordinated timetables, unified ticketing, and seamless links with buses, suburban rail, cycling, and walking. Metros persist because they solve a fundamental urban problem, but they endure only by adapting to new technologies, political realities, and environmental constraints.

Questions 1–4

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

1 Early London lines were built using the shallow-tunnel method.

2 Later replaced steam on key routes, reducing fumes in enclosed spaces.



3 Moving more trains without expanding the existing track footprint depended on

4 Some systems now use to increase frequency, standardise operations and reduce labour costs.

Questions 5–9

The text has seven paragraphs, **A–G**. Which paragraph contains the following information? Choose the correct letter, **A–G**.

5 the need for political acceptance of disruptive construction in order to build underground lines.

6 the effects of war and economic crises on both the use of tunnels and the pace of construction.

7 the idea that different governance and funding arrangements shaped metro development.

8 the claim that metro routes can mirror unequal access and power within a city.

9 the risks posed by climate impacts such as flooding, and measures taken to improve resilience.

Questions 10–13

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

Stages in the development of metro systems

Development stage	Problem or pressure	Engineering response	Result or consequence
Early underground construction	Surface streets were congested, but construction beneath them disrupted commerce	The 10 method used trenches excavated along existing roads	Mass transport was separated from road traffic
Move to deeper tunnels	Smoke and heat from steam trains made 11 difficult	Shield tunnelling and electrification enabled	Lines could pass beneath buildings, rivers and utilities



Development stage	Problem or pressure	Engineering response	Result or consequence
		deep-bore construction	
Expansion of operations	More trains had to use the existing track space	Improved signalling shortened the distance between trains	Reduced headways raised network 12
Automation	Operators sought higher frequency and more standardised services	Driverless trains and sophisticated control centres	Lower labour costs, but greater dependence on software
Climate adaptation	Flooding threatened entrances, shafts and low-lying tunnels	13 introduced pumps, barriers and redesigned drainage	Critical systems became better protected from extreme weather

Answer Key

1. cut-and-cover
2. electrification
3. signalling systems
4. driverless trains
5. A
6. E
7. D
8. F
9. G
10. cut-and-cover
11. ventilation



12. capacity

13. resilience planning