



Part 1

Read the text below and answer questions 1–13.

THE HIDDEN JOURNEY OF A SMARTPHONE

A modern smartphone is designed to appear effortless: a thin “glass-and-metal” object that wakes instantly, streams video, and navigates cities. Yet the apparent simplicity is the endpoint of a supply chain that is neither short nor local. Long before a phone reaches a shop shelf, its key ingredients have already travelled through mines, refineries, chemical plants, clean rooms, and ports. The first stage is raw materials, many of which are invisible to consumers but essential to function. Lithium and cobalt support rechargeable batteries; copper carries electrical signals; and silicon forms the basis of the chips that coordinate every operation. Other materials are less familiar but equally significant. Coltan (a source of tantalum) helps stabilise tiny capacitors that manage power in compact circuits. Rare earth elements, used in speakers, vibration motors, and camera stabilisation, may be sourced from a different continent altogether. The geography of extraction is therefore complex: lithium may be associated with South American brine deposits or hard-rock mining elsewhere, cobalt with Central Africa, and coltan with regions where governance and traceability can be contested. Even before engineering begins, the phone’s “route” is shaped by geology, trade, and political risk.

Mining, however, is only the beginning. Most ores are unusable in their raw state and must be refined into materials with tightly controlled composition. This refining stage is energy-intensive and chemically demanding: metals are concentrated, separated, and purified; unwanted elements are removed; and outputs are produced to strict industrial specifications. The logic is unforgiving because modern electronics are sensitive to minute impurities. In semiconductors, for example, contamination that would be irrelevant in construction-grade metal can be catastrophic. For certain steps in chip production, chemical inputs and silicon itself are often required at “five nines” purity—around 99.999%—because even trace levels of the wrong element can change electrical behaviour, shorten battery life, reduce conductivity, or introduce defects that later multiply in manufacturing. As a result, the supply chain tends to rely on a limited number of highly capable refineries and chemical suppliers. That concentration can create bottlenecks: when demand spikes or a major plant is disrupted, downstream manufacturers cannot simply substitute any alternative source without risking performance failures.

The most technically intricate part of the journey is the chip. Unlike the intuitive idea of “cutting” silicon into smaller pieces, chipmaking is essentially microscopic construction. Silicon is formed into wafers—thin, near-perfect discs—then repeatedly processed so that



billions of transistors can be patterned onto the surface. In photolithography, light is used to “print” circuit patterns onto a wafer coated with photosensitive materials. Modern facilities rely on highly controlled clean rooms because particles that are harmless on a tabletop can destroy microscopic features on a chip. Layers are built through cycles of deposition and etching, with measurements after each stage to ensure alignment and fidelity. Ultraviolet light is central to this printing process, and the combination of optical precision, chemical stability, and vibration control makes advanced fabrication geographically concentrated. A small number of regions host the most capable plants, meaning that a power shortage, a shipping delay for critical chemicals, or a natural disaster can ripple through global electronics markets. Companies may hold inventories, but rapid product cycles and fast-moving chip designs limit the protection that stockpiling can provide.

After chips and other components are produced, assembly becomes the next hidden challenge. The public often imagines assembly as simple “putting parts together”, but modern assembly requires controlled adhesives, heat-sensitive batteries, and display modules that demand microscopic alignment. A phone’s components can originate from dozens of places—sometimes described as supply inputs spanning forty or more countries—before being brought together in a small number of assembly hubs. The logistics model is commonly “just-in-time”: parts arrive in carefully timed sequences to reduce storage costs and allow quick switches between product variants. This efficiency has a trade-off. If a single component is delayed—an image sensor, a power-management chip, a specialised connector—final output can slow dramatically. Quality control is also iterative rather than final: cameras, microphones, antennas, and radios are tested repeatedly, with automated inspection and human checks ensuring performance tolerances are met before devices are sealed, packaged, and shipped.

Once the phone enters daily life, its journey continues through maintenance, repair, reuse, and eventual disposal. Here, a different debate becomes central: planned obsolescence versus the right to repair. Critics argue that devices are sometimes designed in ways that make upgrading or repairing uneconomical, nudging consumers toward replacement. Sealed “glass sandwich” constructions, strong adhesives, proprietary screws, and paired components can make opening a device difficult without specialised tools, and replacing a part may require calibration software or manufacturer-authorised procedures. Supporters of repair reform respond that longer lifespans reduce the demand for new production, lowering the device’s environmental footprint—especially when the most carbon- and resource-intensive stages occur upstream in mining, refining, and chip fabrication. In response, some manufacturers have expanded official repair programmes or modular



elements, while some jurisdictions have debated or introduced right-to-repair measures aimed at improving access to parts, manuals, and independent servicing.

Recycling is often presented as the final remedy, but smartphone recycling is constrained by physics and economics. Phones are compact mixtures of metals, plastics, ceramics, and adhesives—materials fused together for durability and thinness, but difficult to separate later. In thermodynamic terms, recovering concentrated, high-purity materials from a mixed, miniaturised object requires energy and careful processing; it is not the reverse of manufacturing. Some facilities treat discarded electronics as a form of “urban mining”, using specialised shredding and separation to recover valuable fractions such as gold, copper, and cobalt. However, yields vary, and high-value recovery often depends on proper collection and processing infrastructure. Where devices are exported to informal operations, workers may face hazardous exposures and valuable materials may be lost through inefficient methods. The hidden journey of a smartphone, then, does not end at purchase: it continues into debates about durability, repairability, and the responsibilities of producers and consumers in managing e-waste.

Questions 1–7

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.

- 1 Coltan is described as weakening components that help control power in compact circuits.
- 2 The passage states that a smartphone’s raw materials may be sourced from multiple continents.
- 3 The passage indicates that some semiconductor-related inputs may require around 99.999% purity.
- 4 The passage suggests that the number of highly capable refineries is limited, which can create supply bottlenecks.
- 5 The passage claims that chip fabrication is evenly distributed across many regions to reduce disruption risk.
- 6 The passage suggests that “just-in-time” logistics can make assembly vulnerable to delays in a single component.
- 7 The passage argues that right-to-repair laws have already eliminated the need for manufacturer-authorised servicing worldwide.



Questions 8–13

Complete the notes below. Choose **ONE WORD ONLY** from the text for each answer.

A simplified route of a smartphone

- Rechargeable batteries depend on lithium together with **8**
- Certain materials used in semiconductor production must reach about 99.999% **9**
- Before microscopic circuitry is constructed, silicon is shaped into thin discs known as **10**
- During photolithography, circuit patterns are transferred onto the wafer using ultraviolet **11**
- Assembly uses a **12** logistics model to reduce storage costs and switch rapidly between product variants.
- Recovering valuable resources from discarded electronics is sometimes described as urban **13**

Answer Key

1. TRUE
2. FALSE
3. TRUE
4. TRUE
5. FALSE
6. TRUE
7. FALSE
8. cobalt
9. purity
10. wafers
11. light
12. just-in-time



13. mining