



PART 1

Read the text below and answer questions 1–13.

UNEARTHING THE PAST: NEW TOOLS FOR ARCHAEOLOGY

A

Archaeology has always been a technology-driven discipline. From the humble trowel and sieve to radiocarbon dating, each methodological shift has changed what counts as evidence and how confidently the past can be reconstructed. In recent decades, however, the most dramatic advances have come from digital and scientific tools that allow archaeologists to detect, sample, and model ancient activity with far less disturbance to a site than traditional excavation requires. Remote sensing can locate structures before a trench is opened; laboratory chemistry can infer diet and movement from microscopic traces; and high-resolution mapping can connect scattered finds into coherent landscapes. These approaches do not eliminate the need to dig, but they can reduce destructive excavation by turning “where to dig” into a targeted decision rather than a guess.

B

Survey work has been transformed by remote sensing, particularly satellite imagery and LiDAR (Light Detection and Ranging). Satellite photographs can reveal soil marks and crop patterns that hint at buried walls, roads, or ditches, especially when drought or seasonal growth exaggerates subtle differences in vegetation. LiDAR goes further by sending laser pulses from aircraft and measuring the time they take to return, producing a dense three-dimensional point cloud. By digitally stripping away vegetation, LiDAR can reveal micro-topography—terraces, causeways, low mounds, and ancient field systems—even under dense canopy. This method has reshaped understanding of the Maya lowlands, where forest cover once concealed extensive settlement and infrastructure, and it has also been used to trace Roman roads whose straight alignments become visible when terrain is modelled at fine scale.

C

Closer to the ground, geophysical methods help archaeologists “see” beneath the surface before excavating. Ground-penetrating radar (GPR) transmits electromagnetic pulses into soil and records reflections, creating slice-like images that can suggest buried foundations, voids, or graves. Magnetometry detects tiny variations in the Earth’s magnetic field caused by features such as pits, ditches, and fired materials like hearths or kilns. In practice, these instruments can rapidly survey large areas, allowing teams to plan trenches that test specific anomalies rather than disturbing entire fields. Yet these



methods require careful calibration and expert interpretation. Soil moisture, mineral content, and modern interference can distort signals, meaning that the same reading may imply different structures in different environments. The most reliable surveys combine multiple techniques and verify interpretations through limited excavation.

D

At the artefact level, portable spectroscopy and micro-analysis have brought laboratory power into the field. X-ray fluorescence (XRF) can estimate elemental composition in metals, pigments, ceramics, and glass, helping archaeologists distinguish local production from imports by comparing trace-element “fingerprints”. For example, variations in copper and tin composition can suggest different ore sources, while distinctive signatures in glass can reveal trade links across regions. Residue analysis adds another layer. Under a microscope, researchers can identify traces of fats, starches, or proteins absorbed into pottery or preserved on tools, offering evidence of cooking practices, storage, and craft activities. In some projects, mass spectrometry is used to separate and identify molecular compounds with high precision, allowing archaeologists to infer what a vessel once contained even when no visible residue remains.

E

Biomolecular archaeology has opened a powerful window on past lives, especially through ancient DNA (aDNA) and isotope analysis. Recovering aDNA from teeth or petrous bone can reveal genetic relationships, population histories, and episodes of migration, sometimes overturning narratives based only on artefacts or language. Stable isotope analysis provides a different kind of evidence: isotopic signatures in bone and enamel can indicate diet and mobility by reflecting the chemistry of local water and food webs. Neolithic sites, for instance, have used isotopes to identify individuals who grew up elsewhere, while dietary isotopes can distinguish broad patterns such as marine versus terrestrial consumption. These techniques, however, raise ethical issues about consent, repatriation, and the respectful handling of human remains, especially when descendant communities contest sampling or interpretation. Responsible projects therefore increasingly include governance agreements that specify access, analysis, and data ownership.

F

The next frontier is integration. Instead of treating discoveries as isolated, researchers increasingly combine spatial mapping, laboratory results, and historical sources into shared digital databases and Geographic Information Systems (GIS). This makes it possible to model settlement patterns, route networks, and resource use across whole regions, rather than only within a single trench. Machine learning can assist by classifying



fragments, recognising patterns in aerial imagery, or predicting likely site locations based on terrain and known distributions. Yet these tools can reproduce bias if training data reflect where archaeologists have historically chosen to search—often near roads, in politically stable regions, or on land that is easy to access. A model trained on such data may “learn” those past preferences and under-predict sites in areas that are simply less surveyed, reinforcing inequality in what gets discovered and protected.

G

Despite their power, new tools do not remove uncertainty; they relocate it. LiDAR may reveal a mound, but not its function. aDNA can indicate genetic relationships, but not personal identity or social role. Isotopes can show movement, but not motive—whether migration was voluntary, forced, seasonal, or ritual. Even the most advanced survey remains a form of inference, and responsible interpretation requires triangulating methods, testing competing explanations, and reporting uncertainty rather than presenting a single reconstruction as inevitable. The most productive future for archaeology is therefore likely to blend careful excavation with non-invasive survey, transparent data practices, and ethical decision-making that recognises both scientific ambition and the cultural stakes of studying the past.

Questions 1–4

Select the correct answer.

1 The passage suggests that many modern archaeological methods can reduce destructive digging because they

- A** provide complete explanations of past behaviour without further analysis
- B** allow information to be obtained while leaving much of the site intact
- C** make excavation unnecessary for dating and artefact recovery in all cases
- D** produce conclusions that are unaffected by the skill of the researcher

2 What does the passage imply is a key advantage of LiDAR?

- A** It can digitally remove vegetation to reveal subtle surface features
- B** It identifies the chemical composition of artefacts directly in the field
- C** It measures dietary signatures by analysing human bone and teeth
- D** It detects changes in the Earth’s magnetic field produced by buried features

3 Why does the passage say geophysical methods require careful calibration?

- A** Because satellite images cannot detect crop marks reliably without it
- B** Because calibration prevents vegetation from obscuring surface evidence



- C** Because excavation decisions can be made accurately without expertise
- D** Because the equipment and readings must be set up and interpreted precisely

4 Which ethical concern is associated with biomolecular techniques?

- A** the risk that remote-sensing surveys will damage fragile landscapes
- B** the possibility that open databases will encourage looting
- C** questions of consent and the treatment of human remains
- D** disagreement over how to price software licences fairly

Questions 5–8

Which paragraph contains the following information? Choose the correct letter, **A–G**. **NB** You may use any letter more than once.

- 5** The warning that computational models can inherit past survey patterns and therefore mislead future searches.
- 6** A method for inferring whether artefacts were made locally or obtained through exchange networks.
- 7** The point that scientific indicators may reveal movement or kinship without explaining intentions or meanings.
- 8** An example of a remote method that has reshaped reconstructions of large ancient landscapes, including hidden infrastructure.

Questions 9–13

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

- 9** Satellite imagery can reveal crop patterns and that suggest buried features.
- 10** GPR creates subsurface images by transmitting electromagnetic into the ground.
- 11** Magnetometry detects small variations in the Earth's caused by buried features.
- 12** Residue analysis can identify traces of fats, starches, or on pottery and tools.
- 13** Stable isotope analysis can provide evidence about diet and from chemical signatures.

Answer Key



1. B
2. A
3. D
4. C
5. F
6. D
7. G
8. B
9. soil marks
10. pulses
11. magnetic field
12. proteins
13. mobility