



PART 2

Read the text below and answer questions 14–26.

APPLICATIONS IN ARCHAEOLOGY AND RESTORATION

Digital heritage becomes most tangible when it leaves the archive and enters the field. In archaeology and conservation, digital tools are used not only to display the past but also to record fragile sites, test hypotheses, and guide restoration decisions. This practical turn can increase safety and precision, yet it also introduces a new kind of uncertainty: reconstructions may look more definitive than the evidence allows. A smooth 3D surface, a complete arch, or a “restored” pattern can persuade the eye even when the underlying data are partial, noisy, or open to competing interpretations. For that reason, responsible projects treat digital outputs as arguments, not as neutral mirrors of reality.

One widely used technique is photogrammetry, which builds 3D models by combining overlapping photographs taken from multiple angles. At its core is photogrammetric triangulation: the software identifies matching features across images and estimates camera positions, then computes the geometry of the surface. Compared with older survey methods, photogrammetry is relatively low-cost and portable, making it attractive for excavations in remote locations and for short seasons when time is limited. When properly calibrated—using scale bars, control points, and consistent capture settings—models can preserve fine surface detail so researchers can examine tool marks, erosion patterns, or masonry alignment long after a trench has been refilled.

However, photogrammetry is not simply “take photos, get truth.” Lighting, lens distortion, motion blur, and reflective materials can produce distortions that look like genuine features. Shadows may be interpreted as depth, and repetitive textures can confuse feature matching. The most reliable workflows therefore include careful documentation of capture conditions, explicit metadata about camera settings, and checks against independent measurements. Metadata standards matter here: without consistent records of when, where, and how a model was created, later users cannot judge whether a difference between two models reflects real change or merely a different workflow.

Laser scanning is often used for larger structures or complex interiors where consistent geometric accuracy is required. LiDAR instruments can create dense point clouds that represent geometry with high precision, often capturing millions of points in minutes. This density is valuable for recording irregular stonework, deformed walls, or carved interiors that are difficult to measure by hand. Yet the data volume can be enormous, demanding specialist software, robust storage, and long-term planning for file migration as formats



and platforms evolve. A project that scans a cathedral or a large ruin may generate datasets that are expensive to curate even if the scanning itself is quick.

A key limitation of laser scanning is occlusion, or “line of sight” loss. Cavities, narrow recesses, behind-column surfaces, and hidden joints may be missed unless scans are planned from multiple positions. If occluded areas are later filled by interpolation or by a generic surface, the model can quietly acquire features that were never measured. The risk is not only missing data but misinterpretation: users may treat gaps as absence rather than as unobserved space, or assume that a completed mesh implies complete coverage. Good practice therefore separates measured points from derived surfaces, and it records scan positions and coverage maps so viewers can see where uncertainty is highest.

Digital recording also supports preventive conservation. High-resolution scans and repeated imaging can detect cracks or deformation early, enabling interventions before damage becomes visible to the naked eye. In museums, periodic scanning can help track deterioration linked to humidity cycles, light exposure, vibration, or handling. Yet scanning itself does not prevent decay; it improves monitoring and decision-making. Conservation still depends on environmental control and skilled physical treatment, and a digital record can create complacency if institutions treat documentation as a substitute for care. The strength of preventive scanning is therefore diagnostic: it provides earlier warning and better baselines, not automatic preservation.

Restoration is where digital heritage raises the sharpest debates. When fragments are missing, software can propose heuristic reconstruction by mirroring surviving parts, matching patterns, or referencing comparable objects. These methods can be useful for visualisation and planning, but they embed assumptions about symmetry, typicality, and what “should” be there. A reconstructed arch or painted surface may look convincing even when multiple interpretations are possible, especially if the final rendering hides joins and uncertainty. Many conservators therefore argue that reconstructions should be shown with uncertainty markers or with alternative versions, so users understand where evidence ends and interpretation begins.

Archaeologists also use digital models to test hypotheses about how structures were built or used. Virtual reconstructions can simulate sightlines in theatres, water flow in irrigation channels, or the stability of collapsed walls. Such simulations can eliminate implausible theories and reveal inconsistencies, but they are only as good as the inputs. Small measurement errors, uncertain dating, or unexamined modelling assumptions can produce outputs that appear scientifically precise because they are numerical and visually clean. Responsible work therefore reports sensitivity: how much results change when key parameters are varied, and which conclusions remain robust under uncertainty.



In post-disaster contexts, digitisation can help prioritise recovery. After earthquakes or conflict, rapid documentation creates an inventory of damage and supports planning for stabilisation. Drones can map unsafe areas and reduce risk to personnel, but emergency digitisation raises ethical questions about control, consent, and exposure. Detailed models can unintentionally aid looting by revealing access routes or high-value targets, and data sharing may exclude local communities from decisions about how their heritage is recorded. These risks intersect with practical limits as well: many organisations lack trained staff to process point clouds, manage metadata, or maintain software licences. Projects can stall when expertise leaves or when funding ends, so long-term value depends on open formats, clear documentation, and realistic maintenance plans.

Questions 14–18

Select the correct answer.

14 The passage suggests that digital methods can increase uncertainty because reconstructions may

- A** become unusable when software licences expire
- B** appear more conclusive than the supporting evidence justifies
- C** remove the need to document how models were created
- D** prevent further deterioration once a scan has been made

15 Photogrammetry is described as suitable for remote excavations mainly because it

- A** is relatively low-cost and portable
- B** produces 3D results without requiring overlapping images
- C** guarantees complete coverage of cavities and hidden surfaces
- D** depends on large, permanently installed equipment

16 A limitation of laser scanning mentioned in the passage is that it can

- A** reduce accuracy if lighting is not calibrated
- B** eliminate the need for specialist software
- C** generate too little data to be useful long term
- D** miss areas that are not visible to the scanner unless scans are planned carefully

17 High-resolution scanning supports preventive conservation chiefly by

- A** stopping decay before it begins
- B** replacing environmental control in museums
- C** revealing early cracks or deformation so action can be taken sooner
- D** removing the need for skilled physical treatment



18 The passage suggests simulations based on digital models may be misleading because

- A** they cannot be used to test hypotheses about ancient structures
- B** small errors in inputs can produce outputs that look scientifically precise
- C** they inevitably confirm the initial interpretation
- D** they avoid assumptions by relying only on raw data

Questions 19–22

Match each statement with the correct application, **A–D**, below. **NB** You may use any letter more than once.

List of Applications

- A** Photogrammetry
- B** Laser scanning (LiDAR)
- C** Preventive conservation
- D** Post-disaster digitisation

19 Repeated recording is used to spot deterioration before damage is obvious, supporting earlier intervention decisions.

20 Overlapping images from multiple angles are combined through triangulation to generate a 3D surface model.

21 Rapid mapping after earthquakes or conflict can document damage while reducing risk, but it may also increase exposure to theft.

22 Dense geometric datasets can suffer from occlusion, so hidden surfaces may be missed without careful scan planning.

Questions 23–26

Answer the questions below. Choose **NO MORE THAN TWO WORDS** from the text for each answer.

23 What can calibrated photogrammetry models preserve at a very detailed level?

24 What term is used for the dense geometric datasets produced by laser scanning?

25 Besides uncertainty markers, what may conservators provide to show that more than one reconstruction is possible?

26 Emergency digitisation may expose sites to what criminal risk?



Answer Key

14. B

15. A

16. D

17. C

18. B

19. C

20. A

21. D

22. B

23. surface detail

24. point clouds

25. alternative versions

26. looting