

Scientific Foundations of Art History

Art History · Answer Key · 20 Questions

1. What chemical compound is responsible for the distinct blue pigment known as 'Egyptian Blue', the first synthetic pigment produced by humans?

- A) Copper calcium silicate**
- B) Ultramarine sulfur compound
- C) Cobalt aluminate
- D) Prussian blue ferric ferrocyanide

2. Which non-destructive analytical technique is primarily used to identify the elemental composition of pigments without requiring a physical sample?

- A) Gas chromatography-mass spectrometry
- B) X-ray fluorescence (XRF) spectroscopy**
- C) Scanning electron microscopy
- D) High-performance liquid chromatography

3. In dendrochronological analysis of wooden panels, what specific data point serves as the basis for calculating the 'terminus post quem' of a painting?

- A) The heartwood density
- B) The outermost tree ring present**
- C) The bark resin consistency
- D) The pith-to-cambium ratio

4. Which organic binding medium, historically used in oil painting, undergoes a process of polymerization and oxidation that causes it to form a solid film?

- A) Gum arabic
- B) Linseed oil**
- C) Egg yolk
- D) Rabbit skin glue

5. The presence of lead-tin yellow (Type I) in a painting is a diagnostic marker used to rule out works produced before which century?

- A) 12th century
- B) 13th century**
- C) 14th century
- D) 15th century

6. What is the primary physical reason that frescoes painted using the 'buon fresco' technique are more durable than those painted 'a secco'?

A) Calcium carbonate carbonation process

- B) Adhesion of synthetic resins
- C) Molecular bonding of hydrophobic waxes
- D) Crystallization of gypsum binders

7. Which isotope analysis is commonly employed to determine the geological provenance of marble sculptures found in classical antiquity?

- A) Carbon-14 dating
- B) Strontium-87/86 ratios

C) Oxygen and Carbon stable isotope ratios

- D) Potassium-Argon dating

8. The degradation of 'Verdigris' (copper acetate) in oil paintings is chemically linked to which process that damages surrounding layers?

- A) Dehydration of the lead white base
- B) Solvolysis of the varnish

C) Oxidative cleavage of the fatty acid chains

- D) Sublimation of the copper ions

9. What spectroscopic technique is utilized to detect pentimenti--hidden underdrawings or previous compositions--by imaging materials with different absorption spectra?

A) Infrared reflectography

- B) Raman spectroscopy
- C) Mass spectrometry
- D) Atomic absorption

10. Which biological factor is most significant in the chemical deterioration of paper-based art stored in environments with relative humidity exceeding 65%?

- A) Oxidative photo-bleaching

B) Microbial induced cellulolysis

- C) Volatile organic compound sublimation
- D) Hydrolysis of calcium lignin

11. What is the chemical composition of 'Lapis Lazuli', the raw mineral used to produce natural ultramarine?

- A) Basic copper carbonate

B) Sodium aluminum silicate with sulfur

- C) Hydrated iron oxide
- D) Calcium sulfate dihydrate

12. Which term describes the specific aging process in oil paintings where the refractive index of the oil binder increases, causing the paint layer to become more transparent?

- A) Blanching
- B) Pentimento manifestation**
- C) Mojo formation
- D) Lead soap formation

13. In the analysis of bronze statuary, what does the presence of high concentrations of zinc suggest about the alloy's production date?

- A) It was created before the 1st century BCE
- B) It was produced using brass-cementation post-Roman era**
- C) It originated from volcanic smelting sites
- D) It contains high levels of arsenic impurities

14. What scientific phenomenon allows for the cleaning of soot from marble using laser ablation?

- A) Photo-thermal decomposition**
- B) Molecular resonance ionization
- C) Electrolytic surface stripping
- D) Cation exchange extraction

15. Which chemical compound is the primary constituent of 'bone black', a pigment created through the calcination of animal bones?

- A) Carbon and calcium phosphate**
- B) Ferric oxide
- C) Manganese dioxide
- D) Titanium dioxide

16. What property of 'lead white' makes it chemically distinct from 'zinc white' when analyzed via X-ray imaging?

- A) Higher atomic number causing greater X-ray attenuation**
- B) Lower density causing less radiopacity
- C) Faster oxidation rate
- D) Lack of crystalline structure

17. The 'craquelure' pattern on a painting's surface is physically influenced by which property of the ground layer?

- A) Thermal expansion coefficient**
- B) Refractive index
- C) Hydrophilicity
- D) Specific heat capacity

18. Which analytical method is best suited for identifying organic binders like protein-based tempera or animal glue by analyzing their amino acid profiles?

A) X-ray diffraction

B) Gas chromatography-mass spectrometry

C) Polarized light microscopy

D) Inductively coupled plasma mass spectrometry

19. In the context of pigment stability, what is the chemical result of exposing cinnabar (mercuric sulfide) to prolonged direct light?

A) Oxidation to white mercury sulfate

B) Phase transition to metacinnabar

C) Decomposition into pure sulfur

D) Reduction to metallic mercury

20. What specific chemical process is responsible for the 'bloom' or 'clouding' effect seen on the surface of some historical oil varnishes?

A) Migration of moisture into the varnish layer

B) Sublimation of dammar resins

C) Crystallization of paraffin waxes

D) Polymerization of terpene oils