Forensic Astro-Science & Celestial Evidence

Forensic Science In Space · Answer Key · 20 Questions

1. What analytical technique is used by the Curiosity rover's Sample Analysis at Mars (SAM) instrument suite to identify organic molecules in Martian soil?

A) Gas Chromatography-Mass Spectrometry
B) Polarized Light Microscopy
C) Gel Electrophoresis
D) Atomic Force Microscopy

2. In forensic planetary science, what specific isotope ratio is commonly measured in lunar rocks to determine the provenance of water signatures?

A) Carbon-13 to Carbon-12
B) Deuterium to Hydrogen
C) Oxygen-18 to Oxygen-16
D) Nitrogen-15 to Nitrogen-14

3. Which cosmic-ray-induced phenomenon poses a significant forensic challenge for determining the surface exposure age of meteorites via noble gas mass spectrometry?

A) Spallation
B) Nuclear Fission
C) Beta Decay
D) Electron Capture

4. What forensic protocol was utilized during the Apollo missions to ensure the containment of potential lunar microorganisms within the Lunar Receiving Laboratory?

A) Triple-Stage HEPA Filtration
B) Negative Pressure Biosafety Level 4
C) Gamma Irradiation Sterilization
D) Vacuum-sealed Plasma Torch

5. When analyzing asteroid samples, which chemical marker is considered the 'gold standard' for identifying non-terrestrial amino acid chirality?

A) L-isomers dominance
B) Racemic mixtures
C) D-isomers dominance
D) Total absence of Carbon

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6. What is the primary forensic application of the 'Stardust' mission's aerogel collector in analyzing cometary debris?

A) Capturing hypervelocity particles intact
B) Measuring electromagnetic radiation
C) Detecting localized magnetic fields
D) Filtering solar wind particulates

7. In the forensic identification of interstellar dust particles, which mineral is most commonly identified as the primary host of extraterrestrial magnesium-rich silicates?

A) Olivine
B) Calcite
C) Quartz
D) Halite

8. Which spectroscopic method is used to determine the chemical composition of planetary atmospheres from a distance by measuring light absorption?

A) Differential Absorption Lidar
B) Transmission Spectroscopy
C) X-ray Fluorescence
D) Raman Spectroscopy

9. What is the forensic significance of 'Widmanstätten patterns' observed in cross-sections of iron meteorites?

A) Determining the cooling rate of a planetary core
B) Identifying the meteorite's solar orbit
C) Measuring the age of the local star system
D) Calculating the impact velocity on Earth

10. The use of X-ray Fluorescence (XRF) on the Viking lander was designed to detect which elemental category in the Martian surface regolith?

A) Noble Gases
B) Major and minor rock-forming elements
C) Radioactive isotopes
D) Biological lipids

11. In forensic space archaeology, what is the 'Mars Sample Return' mission planning to use to prevent cross-contamination of planetary bodies?

A) Break-the-Chain of Contact (BCC) protocol
B) UV-C surface bathing
C) Plasma sterilization
D) Chemical etching

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12. Which element is detected in lunar samples to provide a forensic 'chronometer' for dating impact events via Argon-Argon (Ar-Ar) dating?

A) Potassium
B) Helium
C) Neon
D) Radon

13. What forensic evidence does the presence of 'shocked quartz' provide when investigating a planetary impact crater?

A) High-pressure mineral transformation
B) Recent volcanic activity
C) Meteorite biological contamination
D) Atmospheric composition at impact

14. To verify a meteorite's origin from the Martian crust, scientists forensically analyze trapped gases within what specific mineral inclusions?

A) Glass melt pockets
B) Clay minerals
C) Sedimentary layers
D) Carbonate nodules

15. What is the forensic utility of 'Cosmogenic Nuclides' in determining the duration a meteorite spent in space before reaching Earth?

A) Measuring accumulated surface exposure time
B) Calculating the meteorite's density
C) Determining the orbital inclination
D) Assessing the impact angle on the atmosphere

16. In the study of cosmic forensics, what does a 'chondrule' indicate about the formation history of a meteorite?

A) Rapid thermal processing in the early solar nebula
B) Planetary core differentiation
C) Impact-induced melting on a planetary surface
D) Aqueous alteration in a water-rich asteroid

17. The 'Hayabusa' mission returned samples from asteroid Itokawa; forensic analysis focused on which specific feature to prove its relation to LL chondrites?

A) Mineralogical and oxygen isotope composition
B) Carbon content
C) Organic volatility
D) Magnetic permeability

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18. What specific forensic marker in meteorites suggests that the early solar system was injected with short-lived radionuclides from a nearby supernova?

A) Aluminum-26 excess
B) Carbon-14 depletion
C) Uranium-238 spikes
D) Helium-3 enrichment

19. In planetary science, the forensic analysis of 'crater counting' relies on which mathematical relationship to estimate surface age?

A) Size-frequency distribution
B) The Inverse Square Law
C) Boltzmann constant
D) The Doppler Shift

20. What is the forensic purpose of studying 'refractory inclusions' (CAIs) in carbonaceous chondrites?

A) Determining the absolute age of the solar system
B) Measuring current solar wind speed
C) Identifying the origin of Earth's oceans
D) Calculating the mass of Jupiter

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