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| 1. Glass is a hard, amorphous material made by melting silicon dioxide, calcium oxide, and sodium oxide at very high temperatures.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-01 - LO: 15-01FSFI.BERT.2.LO: 15-02 - LO: 15-02 |

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| 2. The primary ingredient of glass is carbon dioxide.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | False |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-01 - LO: 15-01 |

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| 3. Glass is called an amorphous solid because its atoms are arranged in a random fashion.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Easy |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-01 - LO: 15-01FSFI.BERT.2.LO: 15-02 - LO: 15-02 |

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| 4. Fine glassware and decorative art glass, called crystal or leaded glass, contain lead oxide rather than calcium oxide.

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|   | a.  | True |
|   | b.  | False |

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| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-02 - LO: 15-02FSFI.BERT.2.LO: 15-08 - LO: 15-08 |

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| 5. Each type of glass has a density that is specific to that glass.  One method of matching glass fragments is by a density comparison.

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| --- | --- | --- |
|   | a.  | True |
|   | b.  | False |

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| --- | --- |
| *ANSWER:* | True |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-04 - LO: 15-04 |

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| 6. Density of glass is calculated by dividing the:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | a.  | substance of a mass by its volume. | b.  | mass of a substance by its volume. |
|   | c.  | volume of a mass by its substance. | d.  | volume of a substance by its mass. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-04 - LO: 15-04 |

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| 7. The refractive index is a measure of how light bends as it passes through:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | a.  | three or more substances. | b.  | one substance and into another. |
|   | c.  | four or more substances. | d.  | None of these choices. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 8. Refractive index comparisons result in circumstantial class evidence and:

|  |  |  |
| --- | --- | --- |
|   | a.  | can confirm guilt. |
|   | b.  | cannot to confirm guilt. |
|   | c.  | only provides meaningful results for window glass or television glass. |
|   | d.  | only provides meaningful results for quartz glass or leaded glass. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 9. Light travels:

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| --- | --- | --- |
|   | a.  | nearly as fast through air as it does through a vacuum. |
|   | b.  | nearly as fast through a vacuum as it does through air. |
|   | c.  | at the same speed in both air and water. |
|   | d.  | at the same speed in methanol and clove oil. |
|   | e.  | ​in a way that varies on a case-by-case basis based on environmental factors. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 10. The speed of an object when it hits a piece of glass influences the number and location of concentric circles in the fracture pattern. An object moving at high speed upon impact, such as the bullet, produces:

|  |  |  |
| --- | --- | --- |
|   | a.  | concentric circles with wide margins. |
|   | b.  | concentric circles with narrow margins. |
|   | c.  | tighter concentric circles. |
|   | d.  | widely spaced concentric circles. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-06 - LO: 15-06 |

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| 11. One method of determining if the evidence glass matches the glass from the crime scene is to compare the:

|  |  |  |
| --- | --- | --- |
|   | a.  | index of the evidence glass to the index of the glass from the crime scene. |
|   | b.  | refractive index of the evidence glass to the refractive index of the glass from the crime scene. |
|   | c.  | reflective index of the evidence glass to the reflective index of the glass from the crime scene. |
|   | d.  | None of these choices. |

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| *ANSWER:* | b |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 12. The submersion method involves placing the glass fragment into different liquids of known refractive indexes.  If a piece of glass and a liquid have the same refractive index, the glass fragment will seem:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | a.  | larger when placed in the liquid. | b.  | smaller when placed in the liquid. |
|   | c.  | to disappear when placed in the liquid. | d.  | to reappear when placed in the liquid. |

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| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 13. If the refractive indexes of several different liquids are known, the:

|  |  |  |
| --- | --- | --- |
|   | a.  | submersion method can be used to estimate the refractive index of the glass. |
|   | b.  | submersion method can be used to estimate the reflective index of the glass. |
|   | c.  | reflective method can be used to estimate the refractive index of the glass. |
|   | d.  | reflective method can be used to estimate the submersion index of the glass. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 14. If the refractive index of the liquid medium is different than the refractive index of the piece of glass, a halo-like ring appears around the edge of the glass.  This halo-like effect is called a:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | a.  | Becke line. | b.  | Becke edge. |
|   | c.  | Beck line. | d.  | Beck edge. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-05 - LO: 15-05 |

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| 15. When certain types of sand are exposed to extremely high temperatures, such as lightning strikes or volcanic eruptions, which type of glass can be formed?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | a.  | obsidian glass | b.  | leaded glass |
|   | c.  | decorative glass | d.  | carnival glass |
|   | e.  | ​colored glass | f.  | ​volcanic glass |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-01 - LO: 15-01FSFI.BERT.2.LO: 15-02 - LO: 15-02 |

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| 16. When glass is hit:

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| --- | --- | --- | --- | --- |
|   | a.  | it cannot stretch. | b.  | it can stretch a great deal. |
|   | c.  | it can stretch slightly. | d.  | it cannot stretch unless it is heated. |

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| --- | --- |
| *ANSWER:* | c |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-06 - LO: 15-06 |

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| 17. There is sophisticated technology that enables nondestructive analysis of glass. Which of these technologies can help determine the cause of an automotive collision by determining whether the headlights were on at the time of the collision?

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| --- | --- | --- |
|   | a.  | scanning electron microscopy (SEM) |
|   | b.  | X-ray fluorescence (XRF) |
|   | c.  | inductively coupled plasma-mass spectrometry (ICP-MS) |
|   | d.  | None of these choices. |
|   | e.  | ​All of these choices.  |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-09 - LO: 15-09 |

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| 18. Silicon dioxide is:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | a.  | the chemical name for silica. | b.  | the chemical name for glass. |
|   | c.  | the chemical name for obsidian. | d.  | None of these choices. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-01 - LO: 15-01FSFI.BERT.2.LO: 15-03 - LO: 15-03 |

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| 19. Glass will break first on the weaker side, the side:

|  |  |  |
| --- | --- | --- |
|   | a.  | opposite the strike.  Radial fractures will result. |
|   | b.  | of the strike.  Radial fractures will result. |
|   | c.  | opposite the strike.  Tertiary fractures will result. |
|   | d.  | of the strike.  Tertiary fractures will result. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-06 - LO: 15-06 |

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| 20. As a bullet passes through glass, it pushes some glass ahead of it, causing a cone-shaped piece of glass to exit along with the bullet.  The cone of glass makes the exit hole:

|  |  |  |
| --- | --- | --- |
|   | a.  | larger than the entrance hole of the bullet. |
|   | b.  | smaller than the entrance hole of the bullet. |
|   | c.  | the same size as the entrance hole of the bullet. |
|   | d.  | None of these choices. |

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| *ANSWER:* | a |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-07 - LO: 15-07 |

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| 21. If several shots are fired through glass, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in which the shots were fired can be determined if enough of the glass is available or can be reconstructed.

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| *ANSWER:* | order |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-07 - LO: 15-07 |

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| 22. The angle at which a bullet enters a piece of window glass can help locate the position of the shooter.  If the bullet was fired perpendicular to the windowpane, the entry hole of the bullet will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| *ANSWER:* | round. |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-07 - LO: 15-07 |

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| 23. A high-velocity bullet fired from a great distance will often exhibit characteristics of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fired from a closer range.

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| --- | --- |
| *ANSWER:* | lower-velocity bullet |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Challenging |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-07 - LO: 15-07 |

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| 24. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a combination of two or more types of glass, one hard and one soft.  The softer layer makes the glass more elastic so it can flex instead of shatter.

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| *ANSWER:* | Bulletproof glass |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-08 - LO: 15-08 |

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| 25. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is also known as tempered glass.  It is used in car windows, shower doors, and glass tables. As it has been subjected to extreme temperatures or chemical treatments, it has improved strength.

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| *ANSWER:* | Safety glass |
| *POINTS:* | 1 |
| *DIFFICULTY:* | Average |
| *LEARNING OBJECTIVES:* | FSFI.BERT.2.LO: 15-02 - LO: 15-02FSFI.BERT.2.LO: 15-08 - LO: 15-08 |

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