Name: _____ **Date:** _____

Complex Lab Risk Assessment for Undergraduates

Evaluate high-stakes chemical interactions and justify emergency mitigation strategies through rigorous scenario-based analysis of non-routine laboratory failures.

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1. When scaling up a Grignard reaction from 10 mmol to 500 mmol, which thermodynamic factor represents the most significant safety risk enhancement?

A. Linear increase in byproduct formation
B. Surface area-to-volume ratio decrease affecting heat dissipation
C. Proportional increase in solvent vapor pressure
D. Enhanced purity requirements for the magnesium turnings

2. A standard nitrile glove (approx. 4-5 mil thickness) provides a sufficient permeation barrier for handling dichloromethane (DCM) for extended periods exceeding 30 minutes.

A. True
B. False

3. In the event of a significant alkali metal fire (e.g., bulk Sodium), which extinguishing agent must be used to avoid a violent explosive reaction?

A. Carbon Dioxide (CO_2)
B. Water Mist
C. Class D Dry Powder
D. Halon 1301

4. You discover an old bottle of Diethyl Ether that has developed visible crystalline solids around the cap. What is the most appropriate first action?

A. Carefully open the bottle in a fume hood to add a stabilizer
B. Immediately move the bottle to the hazardous waste collection area
C. Place the bottle in a secondary container and contact EHS/Bomb Squad
D. Run a peroxide test strip on the liquid content

5. Perchloric acid digestions are permissible in any standard laboratory fume hood provided the sash is kept at the appropriate working height.

A. True
B. False

6. When working with Pyrophoric reagents like tert-Butyllitium (t-BuLi), the primary engineering control utilized to maintain an inert atmosphere in the reaction vessel is the _____.

A. Recirculating Chiller
B. Schlenk Line
C. Rotary Evaporator

D. Centrifugal Separator

7. Which specific physiological effect makes Hydrofluoric Acid (HF) uniquely dangerous compared to stronger acids like HCl?

A. Instantaneous protein coagulation on the skin surface
B. Rapid exothermic reaction with dermal moisture
C. Decalcification of bone and induction of hypocalcemia
D. Activation of nociceptors leading to immediate extreme pain

8. In the Hierarchy of Controls, the use of Personal Protective Equipment (PPE) is considered the most effective method for mitigating laboratory hazards.

A. True
B. False

9. To satisfy the 'Prudent Practices' standard for chemical storage, incompatible materials like concentrated Nitric Acid and _____ must be physically separated.

A. Sulfuric Acid
B. Hydrochloric Acid
C. Glacial Acetic Acid
D. Phosphoric Acid

10. Under the OSHA Laboratory Standard, which document must be present and detail specific work practices for particularly hazardous substances (PHS)?

A. Material Safety Data Sheet (MSDS)
B. Chemical Hygiene Plan (CHP)
C. Globally Harmonized System (GHS) Poster
D. Laboratory Inventory Log