Week 1

1. Which of the following are general categories of process safety management as defined by the Center for Chemical Process Safety? (Select all that apply).
   * **Understanding hazards and risk**
   * **Learning from experience**
   * **Making a commitment to process safety**
   * **Managing risk**
2. Which of the following are important hazards associated with the chemical process industry? (Select all that apply).
   * Slips, trips, and falls
   * Requirement of specialized training
   * **Operations running at high temperature and pressure**
   * **Toxic and reactive chemicals**
3. Which of the following best describes the need of a process safety and risk management program in the chemical or manufacturing industry?
   * A process safety and risk management program is essential, but the costs associated must be managed as they can severely impact profitability.
   * A process safety and risk management program always result in greater profitability and therefore should be implemented.
   * A process safety and risk management program is important when there are serious hazards present, but the cost needs to be weighed against the potential benefits.
   * **A process safety and risk management program is an essential part of doing business in order to hold paramount the safety, health, and welfare of the public as well as to protect the environment.**
4. What are important questions that must be asked for every process in a chemical plant? (Select all that apply).
   * **What could go wrong and how bad could it be?**
   * **What is the risk, and how do we control and manage this risk?**
   * **How often could it happen?**
   * **What are the hazards?**
5. Which of the following is a general chemical process safety task? (Select all that apply).
   * **Hazard Evaluation**
   * **Hazard Identification**
   * Risk Assessment
   * **Risk-Cost Analysis**
6. Which of the following are essential elements of a positive safety culture? (Select all that apply).
   * **Confidence in processes**
   * **Sense of vulnerability**
   * Deferring to expertise
   * **Effective communication**
7. What deficiencies were the major cause of the tragic release of methyl isocyanate in Bhopal, India, 1984? (Select all that apply).

* **No process hazards analysis**
* Not enough methyl isocyanate stored in the tanks
* **Poorly maintained equipment**
* **Lack of emergency response planning**

1. What change to the design of the Union Carbide process at Bhopal could have greatly reduced the impact of the methyl isocyanate release?
   * More methyl isocyanate could have been stored in the intermediate storage tank such as to fill the tank to a greater capacity.
   * Since methyl isocyanate was an intermediate product, it could have been used as it was made, and much less could have been held in the intermediate storage tank.
   * The reaction could have been run at lower temperature and pressure.
   * **The methyl isocyanate could have been stored under pressure.**