Q1. What are the types of accident in industrial safety?

Industrial accidents are unplanned, unexpected events that result in injury to workers, damage to property, or loss of productivity. They generally occur due to unsafe acts, unsafe conditions, or negligence in following safety regulations. Understanding the different types of industrial accidents helps industries to take preventive measures effectively.

Types of Industrial Accidents:
1. **Mechanical Accidents** – Caused by machines such as gears, shafts, presses, and conveyors. They occur due to entanglement, crushing, cutting, or improper handling of equipment.
2. **Chemical Accidents** – Exposure to toxic, flammable, or corrosive chemicals leading to poisoning, burns, or explosions.
3. **Electrical Accidents** – Shocks, burns, or electrocution due to faulty wiring, improper grounding, or unsafe contact with live parts.
4. **Fire Accidents** – Fires caused by inflammable materials, electrical faults, or negligence in fire handling systems.
5. **Explosion Accidents** – Caused by high-pressure vessels, gas leaks, or chemical reactions, leading to severe damage and fatalities.
6. **Fall Accidents** – Workers falling from heights such as scaffolding, ladders, or platforms due to lack of protective equipment.
7. **Ergonomic Accidents** – Injuries caused by repetitive strain, poor posture, or improper workplace design.
8. **Environmental Accidents** – Accidents due to dust, noise, radiation, or poor ventilation affecting worker health.

Conclusion:
Industrial accidents can be minimized by strict adherence to safety standards, regular training, use of protective equipment, and proper maintenance of machinery. Identifying accident types helps in framing specific safety protocols.

Q2. Describe Fault Tree Analysis (FTA).

Fault Tree Analysis (FTA) is a systematic and logical method used to analyze the probability of accidents or system failures in industries. It identifies the root causes of accidents by using a top-down approach where the undesired event is placed at the top, and all possible causes are traced downwards.

Steps in Fault Tree Analysis:
1. **Define the Problem** – The top event (like fire, explosion, or machine failure) is clearly defined.
2. **Construct the Fault Tree** – Logical diagrams using AND and OR gates are created to represent combinations of faults that lead to the top event.
3. **Identify Basic Events** – Primary causes like human error, equipment failure, or environmental conditions are listed.
4. **Qualitative Analysis** – Determines possible ways the top event can occur and helps in prioritizing preventive measures.
5. **Quantitative Analysis** – Probabilities of failure are calculated to estimate the likelihood of the top event.
6. **Evaluation & Mitigation** – Risk-reducing actions like maintenance schedules, safety devices, and training are recommended.

Advantages of FTA:
- Provides a clear visual representation of failures.
- Helps in identifying critical weak points in a system.
- Assists in decision-making for risk reduction.
- Improves safety by predicting and preventing accidents.

Conclusion:
Fault Tree Analysis is an effective tool in industrial safety management. It systematically identifies potential faults, their causes, and their probability, thereby enabling industries to take proactive safety measures.

Q3. Organize the classification of pressure vessels.

Pressure vessels are containers designed to hold gases or liquids at a pressure different from the ambient pressure. They are widely used in industries like chemical plants, refineries, power plants, and manufacturing industries. Proper classification of pressure vessels is necessary for safety, design, and regulatory compliance.

Classification of Pressure Vessels:
1. **Based on Shape:**
- **Horizontal Pressure Vessels** – Placed horizontally; used in oil storage, fuel tanks, etc.
- **Vertical Pressure Vessels** – Stand vertically; used in distillation towers and reactors.
- **Spherical Pressure Vessels** – Provide maximum strength; used for gas storage.

2. **Based on Operating Pressure:**
- **Low-Pressure Vessels** – Operate up to 15 psi; used in storage tanks.
- **Medium-Pressure Vessels** – Operate between 15–300 psi; used in boilers and reactors.
- **High-Pressure Vessels** – Operate above 300 psi; used in nuclear reactors and gas cylinders.

3. **Based on End Construction:**
- **Hemispherical Ends** – Strongest and commonly used.
- **Ellipsoidal Ends** – Economical and efficient for medium pressures.
- **Flat Ends** – Used in small vessels with low pressure.

4. **Based on Material:**
- **Steel Vessels** – Most common due to strength and durability.
- **Composite Vessels** – Made of fiberglass or carbon fiber for lightweight applications.
- **Non-metallic Vessels** – Used in chemical industries for corrosion resistance.

Conclusion:
The classification of pressure vessels based on shape, pressure, end type, and material helps engineers design safe and efficient vessels for specific industrial applications. Following proper codes and standards (ASME, ISO) ensures safety and reliability.