IMPORTANT QUESTIONS CH-161

Q1) Define safe system.
(Answer not from slides)

Q2) What is occupational health and safety and why is it necessary?
Occupational health and safety (OH&S) is the discipline concerned with protecting the physical, mental, and social well-being of workers by preventing work-related injury and illness. It is necessary to protect individuals from harm, ensure legal compliance, reduce financial losses, and promote a healthy, productive work environment.

Q3) List different types of workplace hazards.
The slides list the following types of hazards:
• Physical Hazards
• Ergonomic Hazards
• Chemical Hazards
• Biological Hazards
• Environmental Hazards
• Organizational Hazards

Q4) Define the above types of workplace hazards and give examples of each category.
• **Physical Hazards:** Arise from the work environment (e.g. slips, trips, falls, noise, vibrations, falling objects, unguarded machinery).
• **Ergonomic Hazards:** Related to work methods and repetitive tasks (e.g. manual handling, lifting loads, prolonged repetitive activities causing musculoskeletal disorders).
• **Chemical Hazards:** From exposure to chemicals (e.g. cleaning solutions, solvents, dust, vapors).
• **Biological Hazards:** Involve exposure to infectious agents (e.g. blood, bodily fluids, contaminated animals or plant material).
• **Environmental Hazards:** Due to extreme conditions (e.g. excessive heat leading to heat exhaustion, extreme cold causing hypothermia).
• **Organizational Hazards:** Arise from workplace culture or management issues (e.g. high job

demands, poor job satisfaction, workplace violence).

Q5) Define PPE and enumerate its examples.

Personal Protective Equipment (PPE) consists of specialized clothing or equipment worn to protect individuals from hazards. Examples include:

- Face shields
- Safety glasses/goggles
- Hard hats
- Safety shoes
- Coveralls
- Gloves
- Vests
- Earplugs/respirators
- Safety harnesses

Q6) What safety precautions need to be taken when providing personal protective equipment?

Precautions include:

- Ensuring the equipment is appropriate for the specific hazard and meets recognized standards.
- Verifying that the PPE is of good quality and fits properly (in size, weight, and design).
- Providing training on when PPE is necessary, how to correctly put it on, remove it, adjust it, and its limitations.
- Educating on proper care, maintenance, and disposal of the equipment.

Q7) Name different types of eye/face hazards.

Eye/face hazards mentioned in the slides include:

- Impact hazards (from flying particles, dust, powder, fumes, and mists)
- Chemical hazards (from toxic gases, vapors, and liquids)
- Thermal and radiation hazards (from heat sources such as welding or metal cutting)
- Hazards from swinging objects (e.g. chains, ropes)

Q8) Comment on the following:

• **Potential Incidents of Eye/Face Hazards:** These include exposure to airborne particles (dust, powders, fumes), direct contact with toxic chemicals, impact from falling or swinging objects, and exposure to excessive heat or radiation.

• **Head Protection:** Hard hats are used to protect against impact and electrical hazards. The slides note that hard hats are classified as:

– *Class G (General):* Rated for 2,200 volts

– *Class E (Electrical):* Rated for 20,000 volts

– *Class C (Conductive):* Do not provide electrical protection; additionally, lightweight bump caps are available for low-risk environments.

• **Hand, Arm and Finger Protection:** Protection is provided through various types of gloves (padded cloth, heat resistant, latex disposable, lead-lined), forearm cuffs, thumb guards, finger cots, mittens, and hand pads—all designed to safeguard against cuts, abrasions, heat, and chemical exposure.

• **Foot Protection:** Safety footwear (e.g. steel-toe, metatarsal, reinforced sole) protects against falling objects, impacts, chemical spills, and extreme temperatures, with design features such as proper grip and shock absorption.

Q9) What is fire?

Fire is defined as an exothermic combustion reaction that liberates large amounts of heat, smoke, and light as the main products of combustion.

Q10) What are some common causes of fire?

Common causes include:

• Carelessness (e.g. improper disposal of cigarette butts, smoking in bed)

• Accidents (e.g. electrical short circuits, faulty appliances)

• Ignorance (lack of proper fire prevention knowledge)

• Sabotage (deliberate acts of destruction)

Q11) List the consequences of fire.

Consequences of fire include:

• Death and personal injury
• Loss of business and jobs
• Property damage (loss of land, infrastructure)
• Environmental pollution and water contamination
• Loss of biodiversity and transport disruption
• Global warming effects

Q12) Write a short note on the fire diamond.
The fire diamond is a pictorial label used to convey critical hazard information about a chemical. It typically provides ratings for flammability, reactivity, health hazards, and special hazards (such as water reactivity). For example, the fire diamond for sulfuric acid would indicate its potential for causing severe burns and its reactive nature.

Q13) Define flash point.
Flash point is the lowest temperature at which a liquid emits enough vapor to form a combustible mixture with air near its surface.

Q14) Does a low flash point correspond to a greater hazard?
Yes – a lower flash point means that a liquid can ignite at a lower temperature, thereby posing a greater hazard.

Q15) Name the components of the fire triangle.
The fire triangle consists of three essential elements:
• Fuel
• Ignition Source
• Oxygen

Q16) Discuss four main methods of extinguishing fires.
The four main methods are:

1. **Cooling:** Removing heat (typically with water or substances that absorb heat).
2. **Smothering:** Reducing oxygen (using agents like carbon dioxide or fire blankets).
3. **Starvation:** Removing the fuel source.
4. **Cutting off the Chain Reaction:** Interrupting the chemical chain reaction that sustains combustion.

Q17) By means of a graph, illustrate various stages of fire development.
The stages of fire development are depicted as follows:
• **Incipient Stage:** Initial, low-intensity phase when the fire is just starting.
• **Growth Stage:** Rapid increase in fire intensity as the fuel load burns.
• **Flashover Stage:** A critical point where nearly all combustible materials ignite almost simultaneously.
• **Fully Developed Stage:** The fire reaches its maximum intensity, limited only by oxygen availability.
• **Decay Stage:** A decline in intensity as the fuel and oxygen become depleted.

Imagine a graph with time on the horizontal axis and fire intensity on the vertical axis showing a slow start, a steep rise at flashover, a plateau at full development, and a gradual decline in the decay stage.

Q18) What are the main hazards and risks of fire?
The main hazards and risks include:
• Oxygen depletion (leading to asphyxiation)
• Burns from intense flames and heat
• Inhalation of toxic smoke and gases
• Structural failures or collapse due to high temperatures
• Impact injuries from falling debris during evacuation

Q19) Define the following:

• **Direct Burning/Ignition:** The process by which combustible materials catch fire through direct contact with flames, leading to self-sustained combustion.

• **Ignition Temperature:** The minimum temperature to which a material must be heated in order to ignite.

.**Flash point:**The lowest temperature at which a substance gives off enough vapor to ignite in the presence of an external ignition source (e.g., spark or flame).

• **Convection:** The transfer of heat by the physical movement of hot air or fluid.

• **Conduction:** The transfer of heat through a material by direct contact.

• **Radiation:** The emission of heat in the form of electromagnetic waves.

Q20) Define Active Fire Protection and list its categories along with examples of each category.

Active Fire Protection (AFP) refers to systems that require some form of action or motion to operate in order to detect or suppress a fire. Its categories include:

• **Fire Suppression:** Devices such as fire extinguishers, fire hydrants, fire blankets, and standpipes.

• **Sprinkler Systems:** Quick response and standard response systems that release water to cool and extinguish fires.

• **Fire Detection:** Systems like smoke detectors, heat detectors, and fire alarm systems.

• **Hypoxic Air Fire Prevention:** Systems that use nitrogen or carbon dioxide to lower oxygen levels and prevent combustion.

Q21) Name different systems that come under the heading of Passive Fire Protection.

Passive Fire Protection (PFP) systems are designed to contain fires and slow their spread. They include:

• Fire-resistance rated walls and doors

• Fire-resistant glass

• Fire-resistance rated floors

• Occupancy separations

Q22) Classify different types of fires based on their source.

Fires are generally classified according to the type of fuel involved:

- **Class A:** Ordinary combustibles (e.g. wood, paper, cloth)
- **Class B:** Flammable liquids and gases
- **Class C:** Electrical fires
- **Class D:** Combustible metals
- **Class K:** Cooking oils and fats

Q23) Highlight the evacuation procedure in case of fire.

The evacuation procedure includes:

- Exiting the building promptly and reporting to a designated assembly point.
- Ensuring that exit routes are kept clear and not blocked.
- Reporting any missing colleagues to the fire warden.
- Assisting persons with disabilities as needed.
- Remaining at the assembly point until further instructions are given.

Q24) Discuss firefighting decision criteria.

Key decision criteria for firefighting are:

- Knowing the department's emergency procedures and evacuation routes.
- Being aware of the locations and proper use of fire extinguishers.
- Ensuring there is a safe egress route before attempting to fight a fire.
- Only attempting to extinguish a fire if it is small, contained, and if you are trained; otherwise, evacuate immediately.

Q25) Draw and label different components of a fire extinguisher.

A fire extinguisher typically includes:

- **Cylinder:** The container holding the extinguishing agent.
- **Pressure Gauge:** Indicates the internal pressure and charge level.
- **Discharge Nozzle/Hose:** Directs the extinguishing agent onto the fire.
- **Operating Lever/Trigger:** Activates the discharge mechanism.
- **Safety Pin:** Prevents accidental discharge until removed.

(A detailed diagram was not provided in the slides.)

Q26) Analyse different types of fire extinguishers and comment on the correlation between the number on the fire extinguisher and the fuel load of the test fire.

- **Pressurized Water:**
  – Used for Class A fires.
  – Contains about 2.5 gallons of water; discharge time up to 1 minute; works by cooling.
- **Carbon Dioxide (CO_2):**
  – Suitable for Class B or C fires.
  – Contains between 2.5–100 lb of CO_2; discharge time of 8–30 seconds; works by smothering the fire.
- **Multipurpose Dry Chemical:**
  – Effective on Class A, B, and C fires.
  – Contains 2.5–20 lb of dry chemical; discharge time of 8–25 seconds; leaves a residue that may require clean-up.
- **Halon:**
  – Used for Class B-C fires, particularly in areas with sensitive equipment; very short range and quick discharge (5–10 seconds).

The number rating (e.g., 1A, 2A, etc.) on an extinguisher indicates the fuel load of the test fire it was rated against; a higher number means the extinguisher has been tested against a larger fuel load.

Q27) What is a fire door?

A fire door is designed to withstand fire, heat, and smoke for a specified period (typically 20 minutes to 3 hours). It is usually self-closing and equipped with a positive latching mechanism to ensure it remains closed during a fire, helping to contain its spread.

Q28) Identify safe work practices when it comes to fire protection and prevention.

Safe work practices include:

- Keeping fire exits and routes clear at all times.
- Knowing the location of fire extinguishers, alarms, and emergency call points.
- Reporting any fire incidents immediately.

• Regularly inspecting and maintaining fire protection equipment.
• Ensuring work areas are kept free of excess combustible materials and debris.

Q29) What are chemical substances?
Chemical substances are materials defined by a specific chemical composition that remain the same regardless of their physical state (solid, liquid, or gas). Examples include water, cleaning products, cosmetics, plastics, paints, dyes, and solvents.

Q30) Define chemical hazard.
A chemical hazard is any chemical that has the potential to cause illness, injury, or an emergency.

Q31) Analyse various types of chemical hazards along with giving illustrations of each category.
The slides describe several categories:
• **Corrosive:** Chemicals (e.g. sulfuric acid, caustic soda) that destroy living tissue or materials.
• **Explosive:** Reactive substances (e.g. nitroglycerine, gas cylinders) that can detonate under certain conditions.
• **Toxic:** Substances (e.g. ammonia, chlorine, hydrochloric acid, hydrazine) that can harm health and the environment.
• **Oxidizing:** Agents (e.g. oxygen, hypochlorite) that facilitate combustion even if they are not combustible themselves.
• **Harmful:** Materials (e.g. dust, fumes, gases) that may cause adverse health effects on exposure.
• **Extremely Flammable:** Liquids with a flash point below 32°C (e.g. ethanol, toluene, acetone, diethyl ether) that pose a high fire risk.

Q32) Discuss various health effects of exposure to chemicals.
Exposure to chemicals can lead to:
• Effects on the brain and nervous system (e.g. from pesticides, mercury, lead, solvents).

• Irritation of the eyes, nose, and throat (e.g. from acid mists, vapors, welding fumes).
• Respiratory issues and lung damage (e.g. asbestos exposure linked to lung cancer).
• Allergic reactions such as asthma (e.g. from flour or wood dust).
• Liver damage (e.g. exposure to vinyl chloride).
• Skin conditions including allergic and irritant contact dermatitis (e.g. from nickel, latex, or solvents).

Q33) Identify health risks of chemical exposure.
Health risks include neurological damage, respiratory problems, skin and eye irritation, liver and kidney damage, allergic reactions, and other systemic toxic effects resulting from chemical exposure.

Q34) List various routes of chemical exposure.
The routes include:
• **Absorption:** Through the skin or eyes.
• **Inhalation:** Breathing in vapors, fumes, or dust.
• **Ingestion:** Accidental swallowing.
• **Injection:** Through punctures or cuts (e.g. via needles).

Q35) How can an individual assess chemical exposure?
An individual can assess chemical exposure by:
• Determining the hazard level of the chemical.
• Identifying the exposure route (skin, inhalation, ingestion, injection).
• Evaluating the duration and frequency of exposure.
• Noting sensory clues (smell, taste) and physical symptoms.
• Using measurement methods such as air sampling and consulting the MSDS for guidance.

Q36) Draw hierarchy of controls diagram and label it along with giving relevant examples.
Hierarchy of controls (typically shown as a pyramid) usually includes:

1. Elimination

2. Substitution
3. Engineering Controls
4. Administrative Controls
5. Personal Protective Equipment (PPE)
   (Diagram and detailed examples are not provided in the slides.)
   (Answer not from slides)

Q37) What methodology must be followed when dealing with a chemical spill and/or a chemical fire?

The slides advise the following steps:

• **Identify the Chemical:** Determine which substance is involved and consult the MSDS.

• **Assess the Hazard:** Evaluate the concentration, duration, and route of exposure.

• **Contain the Spill:** If it is safe, remove contaminated clothing, use appropriate PPE, and contain the spill.

• **Notify Others:** Alert nearby workers and supervisors, and if necessary, call emergency services.

• **Response Action:** For a chemical fire, if safe to do so, extinguish open flames and shut off energy sources; otherwise, evacuate immediately.

Q38) Write a short note on handling hazardous waste.

Hazardous waste should be minimized from the start. It is critical to never pour chemical waste down the drain, to understand the chemical's classification, and to use appropriately labeled, flame-resistant containers. After use, remove any funnels from the container and follow proper disposal procedures, including arranging for waste pick-up if necessary.

Q39) Define MSDS.

MSDS stands for Material Safety Data Sheet. It is a document that provides comprehensive information on a chemical's properties, hazards, safe handling, storage, and emergency measures.

Q40) Define chemical label.

A chemical label is the information provided on the container by the manufacturer that includes the chemical's name, manufacturer details, hazard information, precautionary measures, first-aid instructions, and proper handling/storage guidelines.

Q41) Mention some safe chemical handling and storage best practices.

Best practices include:

- Always add acid or base to a solvent (never the reverse).
- Keep chemicals in their designated storage areas and never remove them from the lab.
- Use proper PPE when handling chemicals and work in well-ventilated areas or fume hoods.
- Ensure containers are tightly closed and stored away from ignition sources.
- Dispose of chemical waste according to regulatory guidelines.

Q42) What are the objectives of machine safety?

Machine safety aims to:

- Safeguard workers from hazards associated with machinery and equipment.
- Prevent accidents and injuries through proper design, maintenance, and use of machines.
- Ensure that machines are designed and manufactured to minimize or eliminate risks.
- Provide reliable safety information and control measures for employers.

Q43) What are the benefits of safe design.

Safe design helps to:

- Reduce the risk of injuries and accidents by incorporating protective features into machinery.
- Ensure that machines are inherently safer through thoughtful engineering and design choices.
- Lower long-term costs associated with accidents, downtime, and liability.

Q44) List safe machine operations.

Safe machine operations include:

- Identifying and assessing hazards associated with each machine or piece of equipment.
- Eliminating or reducing risks through proper engineering controls and administrative

procedures.
• Following manufacturer guidelines and performing regular maintenance.
• Using appropriate PPE and safety devices (e.g. guards, emergency stops).

Q45) Identify five root causes of unpleasant incidents especially when it comes to machine safety.
(Answer not from slides)

Q46) With examples, differentiate between mechanical and non-mechanical hazards.
• **Mechanical Hazards:** Arise from moving parts of machinery (e.g. unguarded rotating parts that can cause crushing, shearing, or cutting injuries).
• **Non-Mechanical Hazards:** Do not directly involve moving parts but include risks such as electrical shock, noise, vibrations, extreme temperatures, or harmful emissions.

Q47) Define PUWER regulation and mention three control methods which fit in this category.
PUWER (Provision and Use of Work Equipment Regulations) is a UK regulation that ensures the safe use of work equipment. It requires that access to dangerous parts of machinery be controlled. Three control methods mentioned are:
• **Physical Barrier (Fixed Guards):** Permanently block access to hazardous areas.
• **Interlocked Guards:** Prevent machine operation when the guard is open.
• **Detection Devices:** Sensors or pressure-sensitive mats that stop the machine if a person enters a danger zone.

Q48) Suggest some control measures when it comes to machine safety.
Control measures include:
• Installing appropriate machine guarding (fixed, adjustable, or interlocked).
• Implementing lockout/tagout (LOTO) procedures during maintenance.
• Ensuring regular maintenance and inspections of machinery.
• Providing comprehensive training and proper PPE for machine operation.
• Utilizing emergency stop devices and safety switches.

Q49) Describe various types of machine guarding.

Machine guarding types include:

• **Fixed Guards:** Permanent barriers that enclose dangerous parts without any moving parts.

• **Adjustable Guards:** Can be repositioned (either by the user or automatically) to allow partial access when necessary.

  – *User Adjusted Guard:* Manually set by the operator.

  – *Self-Adjusting Guard:* Automatically adjusts to the size of the workpiece or operation.

• **Interlocked Guards:** Integrated with machine controls so that the machine stops if the guard is opened.

Q50) What are the basic safety rules that must be adhered to when dealing with non-powered hand tools?

The slides list five basic rules:

1. Keep all tools in good condition with regular maintenance.
2. Choose the right tool for the job.
3. Inspect tools for damage before use and do not use damaged tools.
4. Follow the manufacturer's instructions for proper tool usage.
5. Wear and use the correct Personal Protective Equipment (PPE).

Q51) List different types of hand-held power tools and mention the general hazards that are affiliated with their usage.

Hand-held power tools include those powered by:

• Electricity

• Pneumatics (compressed air)

• Liquid fuel

• Hydraulics

General hazards associated with these tools include:

• Tripping hazards due to cables or hoses.

• Contact hazards from cutting blades or bits.

• Projectile hazards from flying debris during operation.

Q52) What are the various types of hazardous energy?
The slides identify several types of hazardous energy, including:
• **Mechanical Energy:** From moving parts like springs or rotating components.
• **Magnetic Energy:** Found in devices such as capacitors.
• **Gravity:** Energy from parts that may descend or fall.
• **Electrical Energy:** AC or DC energy from machinery.
• **Hydraulic Energy:** Energy from fluid under pressure.
• **Pneumatic Energy:** Energy stored in compressed air.
• **Thermal Energy:** Energy due to extreme temperatures (hot or cold).
• **Chemical Energy:** Energy released during a chemical reaction.

Q53) Discuss the six-step procedure of Lock Out Tag Out and identify various LOTO devices.
The LOTO procedure typically involves:

1. **Preparation:** Understand the machine and its energy sources before shutdown.
2. **Shutdown:** Turn off the machine using the proper shutdown procedures.
3. **Isolation:** Disconnect or isolate the machine from its energy sources.
4. **Application:** Apply lockout or tagout devices to the energy-isolating components.
5. **Release of Stored Energy:** Ensure all residual or stored energy (mechanical, hydraulic, etc.) is released or restrained.
6. **Verification:** Verify that the machine is isolated and de-energized before starting maintenance.

LOTO devices include physical locks, tags, individual LOTO locks, supervisor locks, and energy-isolating devices.

Q54) What are the limitations for tag out devices?
Tagout devices serve as a prominent warning but do not provide the physical restraint that

lockout devices do. They may also give a false sense of security, making them less effective than lockout devices in preventing the accidental release of hazardous energy.