

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - 5 SEMESTER – MID TERM – W26 – ANSWER BANK

Subject Name & Code:

OCCUPATIONAL HEALTH & SAFETY MANAGEMENT - 3141310/BE05000451



Answer Bank Summary

- **Total Questions Covered:** 41
- **3-Mark Questions:** 14
- **4-Mark Questions:** 12
- **7-Mark Questions:** 15

CHAPTER A1 – OCCUPATIONAL HEALTH

Repeated Questions

Q1) Explain the various routes of entry of toxicants into the human body. (7 Marks)

Routes of entry of toxicants:

- **Inhalation** – Most common route; toxicants enter through respiratory tract as gases, vapors, dusts, or fumes. Absorbed through lungs into bloodstream.
- **Ingestion** – Toxicants enter through digestive tract via contaminated food, water, or hand-to-mouth transfer. Absorbed through stomach and intestines.
- **Skin (Dermal) Absorption** – Toxicants penetrate through intact or damaged skin directly into bloodstream. Common for organic solvents and pesticides.
- **Injection** – Toxicants enter through puncture wounds, needle sticks, or sharp objects; bypass natural barriers.
- **Mucous Membrane Absorption** – Toxicants enter through eyes, nose, or other mucous membranes; rapid absorption into bloodstream.

Note: Once absorbed, toxicants distribute through bloodstream to target organs and may cause systemic effects.

Q2) Define permissible exposure limit, threshold limit value, lethal dose and lethal concentration. (4 Marks)

Term	Definition
Permissible Exposure Limit (PEL)	Legal regulatory limit set by OSHA; maximum concentration of a substance in workplace air averaged over 8-hour shift.
Threshold Limit Value (TLV)	Recommended guideline by ACGIH; airborne concentration of a substance that most workers can tolerate without adverse effects over a working lifetime.
Lethal Dose (LD₅₀)	Dose of a substance that kills 50% of test animal population; expressed as mg of substance per kg of body weight (mg/kg).
Lethal Concentration (LC₅₀)	Airborne concentration of a substance that kills 50% of test animals after specified exposure period; expressed as ppm or mg/m ³ .

Key: PEL = legal; TLV = advisory; LD₅₀ = oral/contact toxicity; LC₅₀ = inhalation toxicity.

Q3) What do you mean by the term ergonomics? Explain its Application. (7 Marks)

Ergonomics: Scientific study of relationship between humans and their working environment; aims to optimize worker comfort, safety, and efficiency.

Applications of ergonomics:

- **Workstation Design** – Adjusting chair height, desk layout, monitor positioning to prevent musculoskeletal disorders.
- **Tool Design** – Designing tools with comfortable grips, proper weight, and reduced vibration to minimize strain.
- **Work Methods** – Reducing repetitive movements, awkward postures, and excessive force requirements.
- **Environmental Factors** – Controlling noise, lighting, temperature, and ventilation for worker comfort.
- **Task Analysis** – Matching job demands with worker capabilities to reduce fatigue and errors.
- **Injury Prevention** – Reducing work-related musculoskeletal disorders (WMSDs), back injuries, and carpal tunnel syndrome.
- **Productivity Enhancement** – Improving efficiency through better worker-environment fit.

Conclusion: Ergonomics creates safer, healthier, and more productive workplaces.

Q4) Give the classification of various occupational health hazards. (7 Marks)**Occupational Health Hazards Classification:**

Type	Examples
Physical Hazards	Noise, vibration, radiation (ionizing/non-ionizing), temperature extremes (heat/cold), pressure, illumination
Chemical Hazards	Toxic gases (CO, H ₂ S), vapors (solvents), dusts (silica, asbestos), fumes (metal), mists, liquids (acids)
Biological Hazards	Bacteria (TB), viruses (Hepatitis, HIV), fungi, parasites, insect bites, animal products
Ergonomic Hazards	Repetitive motions, awkward postures, heavy lifting, vibration, improper workstation design
Psychosocial Hazards	Work stress, shift work, burnout, workplace violence, harassment, poor work organization
Mechanical Hazards	Unguarded machinery, pinch points, crushing, cutting, shearing hazards
Electrical Hazards	Shock, burns, arc flash, explosion from faulty equipment

Conclusion: Hazards are classified into 7 major categories for systematic identification and control.

Q5) Define Pneumoconiosis. List out the types of Pneumoconiosis. (3/4 Marks)

Pneumoconiosis: A group of occupational lung diseases caused by inhalation and deposition of mineral dust in the lungs, leading to fibrosis (scarring) and respiratory impairment.

Types of Pneumoconiosis:

- **Silicosis** – Caused by silica dust exposure (mining, quarrying, sandblasting)
- **Asbestosis** – Caused by asbestos fiber inhalation (construction, shipbuilding)
- **Coal Worker's Pneumoconiosis (CWP)** – Also called "Black Lung"; caused by coal dust (mining)
- **Byssinosis** – Caused by cotton, flax, or hemp dust (textile industry)

- **Bagassosis** – Caused by bagasse (sugarcane fiber) dust (sugar mills)
- **Siderosis** – Caused by iron oxide dust (welding, iron/steel industry)
- **Anthraxis** – Form of CWP; black pigmentation of lungs from coal dust

Conclusion: Pneumoconiosis is preventable through dust control measures and respiratory protection.

Q6) Describe symptoms, diagnosis, treatment and prevention of Silicosis. (4/7 Marks)

Silicosis – Occupational Lung Disease

Aspect	Details
Symptoms	• Progressive shortness of breath (dyspnea) • Chronic cough (initially dry, later productive) • Chest pain • Fatigue and weakness • Weight loss • Cyanosis (blue skin) in advanced stages
Diagnosis	• Occupational history (silica exposure) • Chest X-ray (shows nodular or honeycomb pattern) • Pulmonary function tests (restrictive pattern) • CT scan for detailed imaging • Bronchoscopy with biopsy (in severe cases)
Treatment	• No specific cure; primarily supportive • Supplemental oxygen for hypoxia • Bronchodilators to relieve airways • Corticosteroids for inflammation • Pulmonary rehabilitation • Lung transplant in end-stage disease
Prevention	• Dust control measures (wet drilling, ventilation) • Respiratory protective equipment (N95, RPE) • Regular medical surveillance • Medical monitoring (chest X-ray, lung function tests) • Training on silica hazards and safe work practices

Conclusion: Silicosis is preventable through effective dust control and PPE; once developed, management focuses on symptom control.

Q7) Describe symptoms, treatment and prevention of Byssinosis. (3/7 Marks)

Byssinosis – Occupational Lung Disease (Cotton Dust)

Aspect	Details
Symptoms	• Chest tightness (especially on first day back to work – "Monday morning chest tightness") • Shortness of breath • Cough • Wheezing • Reduced lung function (develops over time) • Symptoms often improve during the week and worsen on return
Diagnosis	• Occupational history (cotton/textile exposure) • Pulmonary function tests (shows decline) • Chest X-ray (may be normal initially)
Treatment	• Avoidance of cotton dust exposure • Bronchodilators (relieve airway constriction) • Corticosteroids (for severe cases) • Supplemental oxygen • Removal from exposure in advanced cases
Prevention	• Dust control (ventilation, wet processing) • Respiratory protection • Pre-placement and periodic medical surveillance • Health education and training • Engineering controls to reduce airborne dust

Conclusion: Byssinosis is an occupational respiratory disease; prevention through dust control and medical monitoring is key.

Q8) Explain the constituents of Ergonomics. (4/7 Marks)

Constituents of Ergonomics:

- **Anthropometry** – Study of human body measurements; ensures equipment and workspaces fit diverse body sizes (height, reach, weight).
- **Biomechanics** – Study of forces on human body; analyzes postures, movements, and lifting techniques to prevent strain.
- **Work Physiology** – Study of human energy expenditure; examines metabolic workload, fatigue, and fitness requirements for tasks.
- **Environmental Psychology** – Study of human response to work environment factors like lighting, noise, temperature, and spatial arrangements.
- **Cognitive Ergonomics** – Study of mental workload; addresses decision-making, attention, memory, information processing, and human error.
- **Organizational Ergonomics** – Study of work systems; addresses work schedules, shift design, teamwork, communication, and job satisfaction.
- **Physical Ergonomics** – Study of physical demands; focuses on posture, manual handling, repetitive motions, and workplace layout.
- **Macroergonomics** – Study of overall work system design; considers technology, organizational structure, and human-machine interaction.

Conclusion: Ergonomics integrates multiple disciplines to optimize human performance and well-being.

Q9) Discuss application of Ergonomics for safety and health. (4/7 Marks)

Applications of Ergonomics for Safety and Health:

- **Injury Prevention** – Reduces work-related musculoskeletal disorders (WMSDs), back injuries, carpal tunnel syndrome, and repetitive strain injuries.
- **Productivity Improvement** – Optimizes workflow, reduces unnecessary movements, and increases operational efficiency.
- **Job Design** – Matches job demands to physical capabilities; reduces overexertion and fatigue.
- **Environmental Control** – Improves lighting, noise, temperature, and ventilation for worker comfort.
- **Tool Redesign** – Reduces vibration, improves grips, minimizes force requirements.
- **Human Error Reduction** – Minimizes cognitive errors through better interface design and workload management.
- **Quality Improvement** – Reduces errors and defects through better human-machine interaction.
- **Absenteeism Reduction** – Prevents injuries and promotes health, reducing sick leave.
- **Employee Morale** – Increases job satisfaction and worker engagement.

Conclusion: Ergonomics creates safer, healthier workplaces and enhances productivity.

Q10) Define: (i) LD₅₀ (ii) STEL (iii) risk (3 Marks)

Term	Definition
LD₅₀ (Lethal Dose 50)	Dose of a toxic substance that causes death in 50% of a test animal population; expressed in mg/kg body weight; standard measure of acute toxicity.
STEL (Short-Term Exposure Limit)	Maximum airborne concentration of a substance permitted over a short period (typically 15 minutes); should not be exceeded at any time during work shift; designed to protect against acute effects.
Risk	Probability or likelihood that a hazard will cause harm under specific conditions; often expressed as: $\text{Risk} = \text{Severity} \times \text{Probability}$; represents potential for adverse health or safety outcomes.

Q11) Describe the significance of Threshold Limit Value (TLV). (3/4 Marks)

Significance of Threshold Limit Value (TLV):

- **Occupational Exposure Guideline** – Represents safe airborne concentration levels that most workers can tolerate without adverse health effects over a working lifetime.
- **Risk Assessment Tool** – Used to evaluate workplace exposure levels and identify potential overexposure risks.
- **Control Strategy Basis** – Used to design engineering controls, ventilation systems, and respiratory protection programs.
- **Medical Surveillance Trigger** – Exposures exceeding TLV require employee medical monitoring and additional protective measures.
- **Emergency Response Reference** – Used to determine evacuation criteria and emergency actions during chemical spills/releases.
- **Hazard Communication** – Helps in Material Safety Data Sheet (MSDS) development and employee training.

Key: TLV is advisory (ACGIH); PEL is legal regulatory (OSHA) standard. TLV represents best workplace practice.

Q12) Enlist the dangerous properties of chemicals. (3/4 Marks)

Dangerous Properties of Chemicals:

- **Toxicity** – Capacity to cause adverse health effects through ingestion, inhalation, or skin contact.
- **Flammability** – Ability to catch fire easily; determined by flash point and auto-ignition temperature.
- **Explosivity** – Capacity to undergo rapid exothermic reaction producing pressure and shock waves.
- **Reactivity** – Ability to undergo chemical reactions with other substances (e.g., water-reactive, oxygen-reactive).
- **Corrosivity** – Ability to cause tissue damage upon contact; includes acids and alkalis.
- **Carcinogenicity** – Capacity to cause cancer; includes substances like asbestos and benzene.
- **Mutagenicity** – Ability to cause genetic mutations; e.g., ethylene oxide, certain solvents.
- **Teratogenicity** – Ability to cause fetal abnormalities; e.g., lead, mercury.
- **Sensitization** – Ability to cause allergic reactions on repeated exposure; e.g., isocyanates, formaldehyde.
- **Environmental Persistence** – Ability to remain in environment for extended periods; bioaccumulation potential.

Conclusion: Understanding dangerous properties helps in storage, handling, and emergency planning.

Q13) What is meant by occupational diseases? Explain any one in detail. (3 Marks)

Occupational Disease: Health condition caused or aggravated by exposure to physical, chemical, biological, or ergonomic hazards in the workplace; develops over prolonged exposure period.

Example – Silicosis (Detailed):

- **Cause:** Inhalation of respirable crystalline silica dust (mining, quarrying, sandblasting, foundry work).
- **Pathology:** Silica particles cause fibrosis (scarring) in lungs; reduces lung compliance and gas exchange capacity.
- **Symptoms:** Cough, breathlessness, chest pain; progressive and irreversible.
- **Diagnosis:** Occupational history + chest X-ray (nodular shadows).
- **Prevention:** Wet drilling, exhaust ventilation, PPE (N95 mask).
- **Treatment:** No cure; management focuses on symptom relief and preventing complications.

Conclusion: Occupational diseases are preventable through hazard control and medical monitoring.

Q14) Describe symptoms, treatment and prevention of Asbestosis. (3/4 Marks)

Asbestosis – Occupational Lung Disease

Aspect	Details

Aspect	Details
Symptoms	• Progressive shortness of breath • Dry cough • Chest pain • Finger clubbing (advanced disease) • Crackles (inspiratory) on lung auscultation • Reduced exercise tolerance
Diagnosis	• Occupational history (asbestos exposure) • Chest X-ray (ground-glass opacities, pleural plaques) • CT scan (interstitial fibrosis) • Pulmonary function tests (restrictive pattern)
Treatment	• No specific cure • Supplemental oxygen for hypoxemia • Bronchodilators and corticosteroids for symptom relief • Pulmonary rehabilitation • Treatment for secondary infections • Lung transplant (advanced cases)
Prevention	• Substitution with safer materials • Engineering controls (dust suppression, ventilation) • Personal protective equipment (respirators) • Regular medical surveillance • Worker training and health education

Key: Asbestosis is associated with mesothelioma and lung cancer risk; prevention through elimination of asbestos exposure is critical.

Other Important Questions

Q15) Discuss the objectives of Occupation health and safety. (3/4 Marks)

Objectives of Occupational Health and Safety:

- **Protect Workers** – Prevent injuries, diseases, and fatalities through hazard identification and control.
- **Promote Worker Health** – Maintain physical, mental, and social well-being of workers.
- **Ensure Safe Work Environment** – Create safe working conditions through engineering controls and safe work procedures.
- **Prevent Occupational Diseases** – Identify and control exposure to chemical, biological, and physical hazards.
- **Comply with Regulations** – Meet legal requirements (Factories Act, OSHA, ISO 45001) and international standards.
- **Reduce Costs** – Minimize accident-related costs (medical, compensation, lost production) through proactive safety management.
- **Improve Productivity** – Healthy, safe workers = higher morale and efficiency.
- **Education and Training** – Increase safety awareness and develop competencies for hazard recognition and control.
- **Emergency Preparedness** – Prepare for and respond effectively to emergencies and accidents.

Conclusion: OHS objectives aim to create safe, healthy, and productive workplaces while ensuring legal compliance.

Q16) Define: (i) MSDS (ii) TWA (iii) LD₅₀ (3 Marks)

Term	Definition
MSDS (Material Safety Data Sheet)	Comprehensive document providing information on chemical composition, hazards, safe handling, emergency response, disposal, and PPE requirements for a chemical substance; now called SDS (Safety Data Sheet).
TWA (Time-Weighted Average)	Average airborne concentration of a substance over a specified period (usually 8-hour shift); used to assess compliance with occupational exposure limits (PEL, TLV).

Term	Definition
LD₅₀ (Lethal Dose 50)	Dose of a toxic substance that causes death in 50% of test animal population within a specified period; expressed in mg/kg body weight; primary measure of acute oral toxicity.

Q17) Define: (i) LC₅₀ (ii) TLV (iii) hazard (3 Marks)

Term	Definition
LC₅₀ (Lethal Concentration 50)	Airborne concentration of a substance that causes death in 50% of test animals after specified exposure (usually 4 hours); expressed in ppm or mg/m ³ ; measure of inhalation toxicity.
TLV (Threshold Limit Value)	Recommended guideline by ACGIH; airborne concentration of a substance below which most workers can be repeatedly exposed without adverse health effects over a working lifetime.
Hazard	Inherent capability or property of a substance or situation to cause harm, injury, or damage to health, property, or environment; e.g., toxicity, flammability, corrosivity.

Q18) Discuss the various agents responsible for occupational diseases. (3/4 Marks)

Agents Responsible for Occupational Diseases:

Agent Category	Examples	Diseases
Physical Agents	Noise, vibration, radiation, heat/cold, pressure	Hearing loss, Raynaud's disease, heat stroke, hypothermia, decompression sickness
Chemical Agents	Toxic gases, dusts, fumes, vapors, liquids	Silicosis, asbestosis, poisoning (lead, mercury), dermatitis, cancer
Biological Agents	Bacteria, viruses, fungi, parasites, animal products	Tuberculosis, hepatitis B, anthrax, fungal infections, zoonotic diseases
Ergonomic Factors	Repetitive motions, awkward postures, heavy lifting, vibration	Carpal tunnel syndrome, back pain, musculoskeletal disorders
Psychosocial Factors	Work stress, shift work, violence, bullying	Mental health issues, burnout, cardiovascular stress

Conclusion: Occupational diseases arise from multiple workplace agents; control through hazard identification and management is essential.

Q19) Describe symptoms, diagnosis, treatment and prevention of Anthracosis. (4 Marks)

Anthracosis – Black Lung Disease (Coal Worker's Pneumoconiosis)

Aspect	Details
Symptoms	• Chronic cough (productive with black sputum) • Shortness of breath • Chest tightness •

Aspect	Details
	Generalized fatigue • Respiratory infections • Progressive loss of pulmonary function
Diagnosis	• Occupational history (coal mining exposure) • Chest X-ray (shows nodular opacities) • CT scan (detailed imaging of lung fibrosis) • Pulmonary function tests (restrictive pattern)
Treatment	• No specific cure • Bronchodilators and corticosteroids for symptom relief • Oxygen supplementation for hypoxia • Pulmonary rehabilitation • Management of secondary infections
Prevention	• Dust suppression (water sprays, ventilation) • Respiratory protective equipment (dust masks) • Regular medical surveillance (chest X-ray) • Coal dust concentration monitoring • Health education and training

Conclusion: Anthracosis is preventable through dust control and respiratory protection; management focuses on symptom control.

Q20) Define ergonomics and explain the constituents of ergonomics in detail. (7 Marks)

Ergonomics: Scientific study of human capabilities, limitations, and interactions with work systems; aims to design workplaces, tasks, and tools for safe and efficient human performance.

Constituents of Ergonomics (Detailed):

Constituent	Description
Anthropometry	Measures human body dimensions (stature, reach, strength); used to design workstations and equipment that fit 5th–95th percentile populations.
Biomechanics	Studies forces, torques, and stresses on muscles, joints, and bones during physical work; analyzes postures, lifting techniques, and material handling to prevent overexertion.
Work Physiology	Examines metabolic energy expenditure, cardiovascular and respiratory responses to work loads; determines physical work capacity and fatigue thresholds.
Environmental Psychology	Investigates human response to physical environment (thermal comfort, acoustics, lighting, air quality, spatial layout) and their effects on performance and well-being.
Cognitive Ergonomics	Addresses mental workload, decision-making processes, attention allocation, memory, and information processing; designs interfaces to match mental capacities and reduce errors.
Organizational Ergonomics	Optimizes work systems including schedules, shift patterns, team structures, communication flows, and job design to improve performance and reduce stress.
Physical Ergonomics	Focuses on specific physical demands of work: posture assessment, manual handling, repetitive motion analysis, and vibration exposure.

Constituent	Description
Macroergonomics	Considers overall system design involving technology, organizational structure, and human factors; uses sociotechnical systems approach for comprehensive optimization.

Conclusion: Understanding these constituents enables holistic design of safe, efficient, and human-centered work environments.

Q21) Write a short note on pneumoconiosis. (7 Marks)

Pneumoconiosis – Occupational Lung Diseases from Dust Exposure

Definition: A group of fibrotic lung diseases caused by inhalation of mineral or organic dusts at workplaces, leading to permanent lung damage.

Types and Causes:

- **Silicosis** – Crystalline silica dust (quartz, cristobalite) from mining, quarrying, sandblasting, glass/ceramics industry.
- **Asbestosis** – Asbestos fibers from mining, milling, construction, shipbuilding (also causes mesothelioma).
- **Coal Worker's Pneumoconiosis** – Coal dust from mining and processing (black lung).
- **Byssinosis** – Cotton, flax, hemp dust from textile processing.
- **Bagassosis** – Bagasse dust from sugar cane processing.
- **Siderosis** – Iron oxide dust from welding, iron/steel industry.
- **Anthracosis** – Variant of CWP.

Pathology: Dust particles lodge in alveoli → immune response → chronic inflammation → fibrosis (scarring) → reduced lung compliance → respiratory insufficiency.

Symptoms: Cough, breathlessness, chest pain, fatigue, cyanosis, increased susceptibility to infections.

Prevention: Dust control (wet methods, ventilation), PPE (respirators), medical surveillance, worker training, dust monitoring.

Treatment: No cure; symptom management (oxygen, bronchodilators); early detection through periodic medical check-ups.

Conclusion: Pneumoconiosis is a serious, preventable occupational disease requiring comprehensive dust control and health monitoring programs.

Q22) Define TLV. Also explain the significance of TLV. (4 Marks)

TLV (Threshold Limit Value): Recommended airborne concentration of a chemical substance adopted by ACGIH (American Conference of Governmental Industrial Hygienists) below which nearly all workers can be repeatedly exposed without adverse health effects.

Significance of TLV:

- **Exposure Assessment** – Used as benchmark to evaluate workplace air samples against safe levels.
- **Hazard Communication** – Helps in MSDS preparation and worker training on chemical hazards.
- **Control Strategy** – Guides selection of engineering controls (ventilation) and PPE requirements when exposures exceed TLV.
- **Compliance Reference** – Often adopted in company policies and international standards.
- **Medical Surveillance** – Exposures exceeding TLV trigger health monitoring requirements.
- **Emergency Response** – Used to establish Safe Exposure Limits during chemical spills or accidents.
- **Occupational Health Programs** – Provides basis for health surveillance and work restriction decisions.

Key Distinction: TLV is **advisory** (ACGIH), not legally binding like PEL (OSHA). Represents professional judgment of safe exposure levels.

Q23) Discuss any three properties of hazardous material. (3 Marks)**Three Properties of Hazardous Material:**

- **Toxicity** – Ability to cause adverse health effects through ingestion, inhalation, or skin absorption. Examples: cyanide, arsenic. Measured by LD₅₀ and LC₅₀.
- **Flammability** – Ability to ignite and burn easily. Determined by flash point (< 23°C = highly flammable), auto-ignition temperature, and vapor pressure. Examples: gasoline, acetone.
- **Reactivity** – Ability to undergo rapid chemical reactions such as polymerization, decomposition, or explosion. Includes water-reactive materials (sodium), peroxide formers, and materials that generate toxic gases when mixed with water or acids.

Q24) Define: (i) TLV (ii) Ceiling Limit (iii) MSDS (3 Marks)

Term	Definition
TLV (Threshold Limit Value)	Recommended ACGIH guideline for maximum airborne concentration of a substance that workers can safely be exposed to over a working lifetime (8-hour TWA basis).
Ceiling Limit	Maximum permissible airborne concentration of a substance that should never be exceeded during any part of the work shift (not even momentarily); also called "TLV-C".
MSDS (Material Safety Data Sheet)	Document containing information on chemical hazards, handling, storage, PPE, emergency response, and disposal procedures for a substance; required under OSHA Hazard Communication Standard.

Q25) Group occupational diseases under physical agent, chemical agent & biological agent. (7 Marks)

Physical Agents	Chemical Agents	Biological Agents
• Noise → Hearing loss, tinnitus	• Silica dust → Silicosis	• Bacteria (TB) → Tuberculosis
• Vibration → Raynaud's disease, Hand-arm vibration syndrome	• Asbestos → Asbestosis, mesothelioma	• Viruses (Hepatitis B) → Hepatitis
• Radiation (Ionizing) → Radiation sickness, cancers	• Coal dust → Coal worker's pneumoconiosis	• Fungi (Aspergillus) → Aspergillosis
• Radiation (Non-ionizing) → Skin cancer, cataracts	• Cotton dust → Byssinosis	• Animal products (Feathers) → Pigeon breeder's disease
• Heat → Heat stroke, heat exhaustion	• Lead → Lead poisoning, anemia	• Plant products (Pollen) → Allergic rhinitis, asthma
• Cold → Hypothermia, frostbite	• Mercury → Mercurialism	• Parasites → Malaria, amoebiasis
• Pressure → Decompression sickness, caisson disease	• Solvents → Dermatitis, neurological effects	• Bacteria (Leptospira) → Leptospirosis

Physical Agents	Chemical Agents	Biological Agents
	• Pesticides → Poisoning, neurological effects	• Viruses (HIV) → HIV/AIDS (needle stick)

Conclusion: Occupational diseases can be categorized by causative agent type; helps identify workplace control measures.

CHAPTER B1 – CONCEPT, PHILOSOPHY & PSYCHOLOGY OF SAFETY

Repeated Questions

Q26) Explain the Concept of Safety & Philosophy of Safety. (4/7 Marks)

Concept of Safety: State of being protected from harm, injury, or loss. In occupational context: freedom from unacceptable risk of physical, mental, or environmental harm.

Philosophy of Safety:

- **Humanistic Philosophy** – Worker life and health have intrinsic value; safety is a moral obligation.
- **Economic Philosophy** – Safety reduces costs (compensation, downtime, production loss) and increases productivity.
- **Legal Philosophy** – Safety is mandated by law; regulations enforce safe practices (Factories Act, OSHA).
- **Total Safety Concept** – Safety is integrated into all organizational activities (design, production, maintenance, management).
- **Elimination Philosophy** – Primary aim is to eliminate hazards through design and engineering.
- **Preventive Philosophy** – Proactive identification and control of hazards before incidents occur.
- **Safety Culture Philosophy** – Shared values, beliefs, and attitudes within organization regarding safety importance.

Conclusion: Safety philosophy guides organizational approach to safety management and commitment.

Q27) Define: (i) Safety (ii) LD₅₀ (iii) MSDS (iv) EHS (4 Marks)

Term	Definition
Safety	State of being protected from unacceptable risk of harm or injury; in occupational terms: freedom from risk or exposure to hazards.
LD ₅₀	Dose of a substance required to kill 50% of test animal population; measure of acute oral toxicity; expressed in mg/kg body weight.
MSDS	Document providing comprehensive information on chemical composition, hazards, safe handling, and emergency procedures for a substance.
EHS	Environment, Health, and Safety; integrated approach to managing environmental protection, worker health, and workplace safety programs.

Other Important Questions

Q28) Explain safety terminology. (4 Marks)

Safety Terminology:

- **Accident** – Unplanned, undesirable event causing harm or damage.
- **Incident** – Unplanned event that could or did cause harm; includes "near misses" (no harm).
- **Hazard** – Potential or inherent ability to cause harm (e.g., chemicals, heights).
- **Risk** – Probability × Severity of harm; likelihood of hazard causing harm.
- **Danger** – Immediate threat or high-risk situation.
- **Safety** – Freedom from unacceptable risk.
- **Control** – Measures to eliminate or reduce hazards and risk.
- **Exposure** – Contact with a hazard (time/concentration dependent).
- **Permissible Exposure Limit (PEL)** – Legal exposure limit (OSHA standard).
- **TLV** – Threshold Limit Value (ACGIH recommended exposure guideline).
- **MSDS** – Material Safety Data Sheet (chemical information).

Conclusion: Safety terminology standardizes communication about workplace hazards and controls.

Q29) Discuss the philosophy of safety. (3 Marks)

Philosophy of Safety:

- **Humanistic/Moral Philosophy** – Safety is a fundamental human right; workers deserve safe workplaces.
- **Economic Philosophy** – Safety is good business; reduces costs from accidents, compensation, and lost production.
- **Legal Philosophy** – Safety is a legal obligation; failure to provide safety results in penalties and legal action.
- **Engineering Philosophy** – Safety built into design ("inherent safety").
- **Behavioral Philosophy** – Safety depends on worker behavior; requires training and motivation.
- **Total Safety Philosophy** – Safety is integrated into all organizational functions and decision-making.

Conclusion: Safety philosophy determines how organizations prioritize and implement safety measures.

Q30) What do you mean by the term Total safety? (3 Marks)

Total Safety: Integrated approach to safety management that encompasses all aspects of organizational operations including:

- **All Hazards** – Physical, chemical, biological, ergonomic, psychosocial.
- **All Personnel** – Workers, supervisors, managers, contractors, visitors.
- **All Activities** – Design, procurement, production, maintenance, transport, disposal.
- **All Levels** – Strategic planning to daily operations.
- **All Locations** – On-site, off-site, field operations.
- **All Functions** – Engineering, HR, operations, quality, environment.
- **All Systems** – Management, technical, human, organizational.

Key Principle: Safety is not a separate function but an integral part of every activity and decision.

Conclusion: Total safety means safety is everyone's responsibility, embedded in organizational culture.

Q31) Define: (i) safety (ii) accident (iii) MSDS (3 Marks)

Term	Definition
Safety	Freedom from unacceptable risk; state of being protected from harm, injury, damage, or loss.
Accident	Unplanned, unintended event that results in harm to people, damage to property, or loss of production.
MSDS (Material Safety Data Sheet)	Document providing information on chemical composition, hazards, safe handling, PPE, and emergency procedures for a substance.

CHAPTER B2 – SAFETY MANAGEMENT

Repeated Questions

Q32) State the scientific safety management functions. (3/4 Marks)

Scientific Safety Management Functions:

- **Planning** – Setting safety objectives, policies, programs, and procedures.
- **Organizing** – Establishing safety structure, roles, responsibilities, and authority.
- **Staffing** – Recruiting, training, and developing safety personnel.
- **Directing** – Leading, communicating, and motivating safety performance.
- **Controlling** – Monitoring, measuring, and evaluating safety performance against objectives.
- **Coordinating** – Integrating safety activities with other organizational functions (production, quality, maintenance).

Additional Functions:

- **Inspecting** – Regular workplace inspections and hazard identification.
- **Investigating** – Incident investigation and root cause analysis.
- **Recording** – Documentation and recordkeeping (accidents, inspections, training).
- **Auditing** – Systematic evaluation of safety management systems.

Conclusion: Scientific safety management applies systematic methodology to achieve safety objectives.

Q33) Define safety management? Give the objectives of safety management. (3/4 Marks)

Safety Management: Systematic application of management principles and techniques to identify, evaluate, and control workplace hazards; aims to prevent accidents, injuries, occupational diseases, and property damage.

Objectives of Safety Management:

- **Protect Workers** – Ensure safety, health, and well-being of all employees.
- **Prevent Accidents** – Minimize injuries, fatalities, and property damage.
- **Ensure Legal Compliance** – Meet regulatory requirements (Factories Act, OSHA, ISO 45001).
- **Reduce Costs** – Minimize accident-related financial losses (compensation, medical, downtime).
- **Improve Productivity** – Safe workplaces enhance morale, efficiency, and quality.
- **Promote Safety Culture** – Develop shared commitment to safety at all levels.
- **Emergency Preparedness** – Establish response plans for emergencies.
- **Continuous Improvement** – Systematically improve safety performance.

Conclusion: Safety management integrates safety into organizational operations and culture.

Q34) Describe the functions of health, safety and environment in an industry. (4/7 Marks)

Functions of Health, Safety, and Environment (HSE) in Industry:

Function	Activities
Occupational Health	• Conduct medical examinations (pre-placement, periodic) • Develop occupational disease prevention programs • Monitor worker health status • Provide first aid and emergency medical response • Manage health records
Occupational Safety	• Identify and assess workplace hazards • Develop safety procedures (safe work systems, permits) • Conduct safety inspections and audits • Investigate accidents and incidents • Provide safety training • Ensure use of Personal Protective Equipment (PPE)
Environment Protection	• Monitor environmental emissions (air, water, waste) • Manage hazardous waste disposal • Ensure compliance with environmental regulations • Conduct environmental impact assessments • Develop pollution prevention programs

Function	Activities
	Manage resource conservation and sustainability
HSE Management	• Develop HSE policies and objectives • Implement safety management systems (ISO 45001, ISO 14001) • Monitor and report HSE performance • Liaise with regulatory authorities • Conduct HSE training and awareness programs

Conclusion: HSE functions are interdependent; effective HSE management ensures worker protection and environmental sustainability while enhancing productivity.

Other Important Questions

Q35) Define safety organization and enlist the objectives of safety Organization. (7 Marks)

Safety Organization: Formal structure and system within an organization responsible for implementing, coordinating, and monitoring safety programs and policies. Includes dedicated safety department, safety committees, and designated safety representatives.

Objectives of Safety Organization:

- **Policy Development** – Formulate safety policies, rules, and procedures.
- **Hazard Identification** – Identify workplace hazards and risks systematically.
- **Risk Control** – Implement control measures (engineering, administrative, PPE).
- **Training and Education** – Develop and conduct safety training programs.
- **Inspection and Auditing** – Conduct regular workplace inspections and safety audits.
- **Incident Investigation** – Investigate accidents, injuries, near misses; determine causes.
- **Data Management** – Maintain accident records, statistics, and documents.
- **Legal Compliance** – Ensure compliance with all safety regulations and standards.
- **Emergency Planning** – Develop and implement emergency response plans.
- **Promotion and Awareness** – Promote safety culture through campaigns, communication, and recognition programs.

Conclusion: Safety organization provides systematic structure for implementing safety programs and meeting legal requirements.

Q36) Discuss the safety management and its responsibilities. (7 Marks)

Safety Management: Systematic approach to managing workplace safety through planning, organizing, directing, controlling, and improving safety activities.

Responsibilities of Safety Management:

- **Top Management/CEO:** Provide leadership, allocate resources, establish policy, demonstrate commitment, review performance.
- **Safety Manager/Officer:** Develop safety programs, conduct training, investigate incidents, conduct audits, advise management, maintain records, ensure legal compliance.
- **Line Managers/Supervisors:** Implement safety procedures, conduct daily inspections, provide training to workers, correct unsafe conditions, report incidents, ensure PPE use.
- **Safety Committee:** Review safety performance, recommend improvements, facilitate communication, investigate complaints.
- **All Employees:** Follow safety procedures, report hazards and incidents, use PPE, participate in training, maintain workplace cleanliness.

Key Safety Management Functions:

- **Policy Formulation** – Setting safety objectives and procedures.
- **Implementation** – Operationalizing safety programs.
- **Performance Monitoring** – Measuring effectiveness.
- **Audit and Review** – Evaluating system performance.

Conclusion: Safety management is a shared responsibility across all levels; clear roles and responsibilities are essential for effectiveness.

Q37) Discuss the concept of (safety) management highlighting its need to reduce the

occupational diseases. (7 Marks)

Concept of Safety Management: Systematic application of management principles and techniques to control workplace hazards and prevent accidents, injuries, and diseases.

Need for Safety Management in Reducing Occupational Diseases:

- **Hazard Identification** – Systematic identification of disease-causing agents (chemical, physical, biological).
- **Exposure Assessment** – Quantifying worker exposure levels for targeted control.
- **Control Implementation** – Engineering controls (ventilation, enclosures), administrative controls, PPE selection.
- **Medical Surveillance** – Regular health monitoring for early detection of disease.
- **Compliance Monitoring** – Ensuring adherence to PELs, TLVs, and other exposure limits.
- **Information and Training** – Educating workers on hazards and prevention.
- **Record Keeping** – Tracking exposures, health status, and disease incidence for trend analysis.
- **Continuous Improvement** – Updating controls based on emerging knowledge and technologies.

Conclusion: Systematic safety management prevents occupational diseases through comprehensive hazard identification, exposure control, and worker protection programs.

Q38) Prepare a list of safety organizations in India and world. (3 Marks)**Safety Organizations – India:**

- **DGFASLI** – Directorate General Factory Advice Service & Labour Institutes
- **NSC** – National Safety Council (India)
- **BIS** – Bureau of Indian Standards
- **IIRS** – Industrial Safety & Fire Engineering

Safety Organizations – World:

- **ILO** – International Labour Organization (Geneva)
- **OSHA** – Occupational Safety and Health Administration (USA)
- **ISO** – International Organization for Standardization
- **ACGIH** – American Conference of Governmental Industrial Hygienists
- **ASSP** – American Society of Safety Professionals
- **NIOSH** – National Institute for Occupational Safety and Health (USA)
- **HSE** – Health and Safety Executive (UK)
- **EU-OSHA** – European Agency for Safety and Health at Work

Conclusion: National and international organizations promote safety standards and guidelines.

Q39) Give the objectives of safety management. (3 Marks)**Objectives of Safety Management:**

- **Prevent Accidents** – Minimize workplace injuries, illnesses, and property damage.
- **Protect Workers** – Ensure health, safety, and well-being of all employees.
- **Legal Compliance** – Meet all applicable safety regulations and standards.
- **Reduce Costs** – Minimize accident-related financial losses (compensation, medical, downtime).
- **Improve Productivity** – Enhance morale and efficiency through safe workplaces.
- **Promote Safety Culture** – Develop shared commitment to safety at all levels.
- **Emergency Preparedness** – Establish and maintain emergency response capabilities.

Q40) Discuss safety in chemical process industries highlighting safety of human being, flora and fauna, property and environment. (7 Marks)**Safety in Chemical Process Industries (CPI):**

Scope: Safety management specific to chemical plants, refineries, pharmaceutical units, and similar facilities handling hazardous chemicals.

Safety of Human Beings:

- **Worker Protection** – PPE, exposure monitoring, medical surveillance, training, and emergency response.

- **Community Safety** – On-site/off-site emergency plans; public alert systems; buffer zones.

Safety of Flora and Fauna:

- **Environmental Impact Assessment** – Evaluate impacts on local vegetation and wildlife.
- **Emission Control** – Limit atmospheric emissions (SO₂, NO_x, VOCs) affecting ecosystems.
- **Waste Management** – Safe disposal; prevent contamination of soil and water bodies.
- **Biodiversity Protection** – Measures to protect adjacent ecosystems.

Safety of Property:

- **Fire Protection** – Fire detection, suppression systems; explosion prevention; building design for fire resistance.
- **Equipment Integrity** – Pressure vessel safety; corrosion monitoring; safe operating limits.
- **Loss Prevention** – Insurance, business continuity planning, asset protection.

Environmental Protection:

- **Pollution Prevention** – Cleaner production methods; reduce emissions, effluents, and solid waste.
- **Compliance** – Meet regulatory emission standards (air, water, hazardous waste).
- **Sustainable Operations** – Resource conservation; carbon footprint reduction.

Conclusion: Safety management in chemical industries adopts a holistic approach considering workers, community, ecology, property, and environment.

Q41) Define: (i) safety (ii) accident (iii) MSDS (3 Marks)

(This question appears at the end of B2 as well – same as earlier)

Term	Definition
Safety	Freedom from unacceptable risk; state of being protected from harm, injury, damage, or loss.
Accident	Unplanned, unintended event that results in harm to people, damage to property, or loss of production.
MSDS	Document providing information on chemical composition, hazards, safe handling, PPE, and emergency procedures for a substance.
