

TAMILNADU PUBLIC SERVICE COMMISSION



TNPSC

ASSISTANT DIRECTOR

2000

MULTIPLE CHOICE QUESTIONS

(INDUSTRIAL SAFETY AND HEALTH)

CODE : 515

ENGLISH
MEDIUM

YouTube @ RLA ACADEMY



BASED ON
SYLLABUS

10 UNITS COVERED

USEFUL FOR



MECHANICAL



ELECTRICAL



CHEMICAL



INDUSTRIAL



TEXTILE



PRODUCTION

**UNIT III: ENVIRONMENTAL ENGINEERING, OCCUPATIONAL SAFETY AND HEALTH
IN CHEMICAL INDUSTRY, MECHANICS OF MACHINERY AND MANAGEMENT IN
TEXTILE INDUSTRY**

QUESTION

Q1. A textile processing unit discharges wastewater containing high concentrations of biodegradable organic matter into its treatment plant. During performance evaluation, the environmental engineer uses a parameter that represents the amount of oxygen required by microorganisms to biologically oxidize organic pollutants present in the sample. This parameter is widely used to assess wastewater strength and treatment efficiency. Which parameter is being identified?

- A. Chemical Oxygen Demand (COD)
- B. Biochemical Oxygen Demand (BOD)
- C. Total Dissolved Solids (TDS)
- D. Turbidity Index

Q2. A textile mill has 50 fluorescent lighting fixtures, each rated at 40 W. During an energy audit, the safety officer calculates the total electrical load imposed by the lighting system. Assuming all fixtures operate simultaneously under rated conditions, what is the total lighting load?

- A. 1000 W
- B. 1500 W
- C. 2000 W
- D. 2500 W

Q3. A chemical manufacturing facility generates acidic wastewater containing dissolved heavy metals. Before biological treatment, the wastewater must undergo a process that adjusts pH and precipitates metal ions to facilitate removal. Which treatment unit is most suitable for this application?

- A. Neutralization Tank
- B. Trickling Filter

C. Cyclone Separator

D. Cooling Tower

Q4. In occupational safety management, a work permit system is implemented before carrying out potentially hazardous activities such as hot work, confined space entry, and maintenance operations. What is the primary function of a work permit system?

A. Increasing production output

B. Authorizing and controlling hazardous work activities

C. Measuring wastewater quality

D. Estimating machinery efficiency

Q5. Regarding industrial hygiene programs in chemical industries, which of the following statements is NOT correct?

A. They identify workplace health hazards.

B. They help prevent occupational diseases.

C. They eliminate the need for personal protective equipment in all situations.

D. They involve monitoring of workplace exposures.

Q6. A textile processing plant generates wastewater with an initial Biochemical Oxygen Demand (BOD) of 600 mg/L. After biological treatment, the BOD is reduced to 120 mg/L. The environmental engineer must evaluate the treatment efficiency to determine compliance with discharge standards. Assuming no dilution effects, what is the percentage BOD removal achieved by the treatment plant?

A. 60%

B. 70%

C. 80%

D. 90%

Q7. A safety engineer evaluates various noise-control materials for installation around high-speed textile machinery. One material exhibits excellent sound absorption characteristics due to its porous internal structure, which dissipates acoustic energy as heat. Which property primarily contributes to effective noise absorption?

- A. High Reflectivity**
- B. High Porosity**
- C. High Density Only**
- D. High Thermal Expansion**

Q8. A hazardous chemical storage facility develops an emergency preparedness program to minimize consequences during accidental releases. The safety management team follows a systematic sequence for emergency planning and response. Which of the following represents the correct sequence?

- A. Emergency Response → Hazard Identification → Risk Assessment**
- B. Hazard Identification → Risk Assessment → Emergency Planning → Emergency Response**
- C. Risk Assessment → Emergency Response → Hazard Identification**
- D. Emergency Planning → Hazard Identification → Incident Investigation**

Q9. A chemical manufacturing plant stores large quantities of flammable solvents. During a safety audit, engineers identify a potential ignition source near the storage area. To reduce fire risk, management decides to eliminate the ignition source rather than relying solely on protective equipment. Which risk-control principle is being applied?

- A. Risk Transfer**
- B. Hazard Elimination**
- C. Administrative Control Only**
- D. Consequence Analysis**

Q10. A welfare officer in a chemical industry is responsible for promoting employee well-being, improving working conditions, and supporting worker welfare programs.

Which term best describes the systematic effort to enhance the physical, mental, and social well-being of workers?

- A. Industrial Hygiene
- B. Occupational Welfare
- C. Process Safety Management
- D. Hazard Analysis

Q11. A chemical processing plant performs a comprehensive safety audit after a series of near-miss incidents involving solvent handling operations. The audit team reviews procedures, equipment conditions, employee practices, and emergency preparedness measures. During discussions, the team emphasizes that audits are not merely compliance exercises but also proactive tools for accident prevention. Evaluate the following statements.

Assertion (A): Safety audits help reduce the probability of industrial accidents.

Reason (R): Safety audits identify deficiencies in safety management systems before major incidents occur.

- A. Both A and R are true, and R is the correct explanation of A.
- B. Both A and R are true, but R is not the correct explanation of A.
- C. A is true, but R is false.
- D. A is false, but R is true.

Q12. A safety engineer monitors workplace noise levels in a weaving section over an eight-hour shift. The recorded sound pressure level rises sharply during machine start-up, remains relatively constant during production, and decreases during shutdown. A graph of noise level versus time shows a long plateau at approximately 95 dB(A). What does the plateau region primarily indicate?

- A. Intermittent noise exposure
- B. Constant operating noise during production
- C. Instrument calibration error
- D. Complete absence of machinery operation

Q13. A textile factory employs 250 workers. During a safety inspection, it is observed that 20 workers are not using the prescribed personal protective equipment (PPE). Assuming all workers were required to wear PPE, what percentage of workers complied with the PPE requirement?

- A. 88%
- B. 90%
- C. 92%
- D. 96%

Q14. A safety professional is applying Kohlberg's Theory of Moral Development while evaluating ethical decision-making behavior among supervisors in a chemical manufacturing facility. According to the theory, individuals at higher levels of moral development make decisions based on universal ethical principles rather than personal gain or fear of punishment. Which theoretical property best characterizes the highest stage of moral reasoning?

- A. Obedience to avoid punishment
- B. Conformity to group expectations
- C. Compliance with organizational rules only
- D. Commitment to universal ethical principles

Q15. A textile manufacturing plant experiences excessive humidity fluctuations that adversely affect yarn quality and process stability. Management decides to install equipment that continuously controls moisture content in the production environment while maintaining worker comfort. Which equipment is most appropriate for this purpose?

- A. Cyclone Separator
- B. Humidification and Air Conditioning System
- C. Shell-and-Tube Heat Exchanger
- D. Rotary Dryer

Q16. Consider the following statements regarding hazardous waste management in chemical industries:

- 1. Hazardous wastes may exhibit toxicity, corrosivity, ignitability, or reactivity.**
- 2. Proper labeling and segregation are essential before disposal.**
- 3. Hazardous wastes can always be mixed with domestic waste without treatment.**
- 4. Authorized disposal facilities are generally required for final treatment and disposal.**

Which of the following combinations is correct?

- A. 1, 2 and 4 only**
- B. 1 and 3 only**
- C. 2 and 3 only**
- D. 1, 2, 3 and 4**

Q17. A garment manufacturing company invests ₹10,00,000 in a productivity improvement project. The annual net cash inflow expected from the project is ₹2,50,000. For preliminary investment appraisal, management calculates the simple payback period. What is the payback period?

- A. 2 years**
- B. 3 years**
- C. 4 years**
- D. 5 years**

Q18. A chemical processing unit handles highly flammable solvents and operates several hot-work activities such as welding and cutting. The safety officer must implement the most effective preventive measure to reduce fire hazards during maintenance work. Which principle should receive the highest priority?

- A. Allow hot work without supervision**
- B. Implement a hot-work permit system and remove ignition hazards**
- C. Store additional flammable materials near the work area**

D. Ignore atmospheric testing requirements

Q19. All of the following are important objectives of industrial hygiene programs EXCEPT:

- A. Recognition of workplace health hazards**
- B. Evaluation of employee exposure levels**
- C. Prevention of occupational diseases**
- D. Maximization of pollutant generation**

Q20. During workplace noise assessment in a textile weaving department, sound levels are measured using a sound level meter. Which unit is commonly used to express occupational noise levels?

- A. Pascal (Pa)**
- B. Decibel (dB)**
- C. Newton (N)**
- D. Watt (W)**

Q21. A chemical manufacturing facility stores chlorine cylinders and concentrated acids in separate storage areas. During a safety inspection, the safety officer observes that incompatible chemicals are stored near a common drainage channel. In the event of leakage, a dangerous chemical reaction may occur, producing toxic gases that could affect workers and nearby communities. To prevent such incidents, management decides to redesign the storage arrangement. Which safety measure is most appropriate?

- A. Increasing production rate**
- B. Segregation of incompatible chemicals**
- C. Reducing lighting levels**
- D. Increasing inventory levels**

Q22. A textile industry introduces a structured quality improvement initiative where employee teams regularly identify process defects, analyze root causes, and recommend corrective actions. The program emphasizes continuous improvement rather than inspection alone. Management considers this initiative a component of a broader organizational philosophy focused on customer satisfaction and process excellence. Under which classification does this approach fall?

- A. Preventive Maintenance**
- B. Total Quality Management (TQM)**
- C. Hazardous Waste Management**
- D. Financial Accounting**

Q23. A safety officer is conducting a hazard study for a new chemical processing unit before commissioning. The study involves identifying possible deviations from intended operating conditions using guide words such as "more," "less," "none," and "reverse." The objective is to systematically identify hazards and operability problems before startup. Which hazard identification technique is being applied?

- A. SWOT Analysis**
- B. HAZOP Study**
- C. Break–Even Analysis**
- D. Financial Ratio Analysis**

Q24. An occupational health assessment is conducted in a textile weaving department where workers are continuously exposed to machine noise. According to common occupational health guidelines, prolonged exposure above a certain noise level may require hearing conservation programs and protective equipment. Which of the following values is generally considered an important occupational noise action level?

- A. 55 dB(A)**
- B. 70 dB(A)**
- C. 85 dB(A)**
- D. 120 dB(A)**

Q25. A wastewater treatment facility receives effluent from a textile dyeing process. The treatment flowchart includes equalization, coagulation–flocculation, sedimentation, biological treatment, and final disinfection before discharge. The engineer must identify the correct sequence represented by the treatment process. Which sequence is correct?

- A. Equalization → Coagulation–Flocculation → Sedimentation → Biological Treatment → Disinfection**
- B. Biological Treatment → Equalization → Sedimentation → Disinfection**
- C. Sedimentation → Equalization → Coagulation → Disposal**
- D. Disinfection → Biological Treatment → Equalization**

Q26. A garment manufacturing company invests ₹15,00,000 in an automated fabric cutting system. The project is expected to generate annual net savings of ₹3,00,000 through reduced material wastage and labor costs. Management wants to estimate the simple payback period before approving the investment. Assuming constant annual savings and no salvage value, determine the payback period of the project.

- A. 3 years**
- B. 4 years**
- C. 5 years**
- D. 6 years**

Q27. A chemical industry implements a comprehensive risk assessment program before introducing a new hazardous process. The objective is to identify potential hazards, estimate their consequences, and evaluate the likelihood of occurrence before selecting appropriate controls. Which fundamental principle of risk management is being applied?

- A. Risk should be ignored until an accident occurs.**
- B. Hazards must be identified before risks can be controlled.**
- C. Safety controls are unnecessary if production targets are achieved.**
- D. Risk assessment is performed only after equipment failure.**

Q28. A wastewater treatment engineer must remove persistent organic pollutants that are resistant to conventional biological treatment. The selected process generates highly reactive hydroxyl radicals capable of oxidizing complex contaminants into less harmful substances. Which treatment method is being applied?

- A. Activated Sludge Process**
- B. Trickling Filter**
- C. Advanced Oxidation Process (AOP)**
- D. Primary Sedimentation**

Q29. A textile processing unit plans to reduce its dependence on fossil fuels by installing a renewable energy system that converts sunlight directly into electrical energy. The electricity generated will be used to power lighting systems and auxiliary equipment within the plant. Which renewable energy technology is being utilized?

- A. Solar Photovoltaic System**
- B. Diesel Generator**
- C. Coal-Fired Boiler**
- D. Gas Turbine System**

Q30. A belt drive system is used to transmit power from an electric motor to a drafting roller assembly in a textile machine. The maintenance engineer observes that the system operates smoothly because the belt absorbs minor shocks and vibrations generated during operation. Which system property is primarily responsible for this behavior?

- A. Rigidity**
- B. Elasticity and Flexibility**
- C. Brittleness**
- D. Magnetic Permeability**

Q31. A textile manufacturing company invests ₹20,00,000 in an ergonomic workstation improvement project. The annual reduction in injury-related costs and productivity losses is estimated at ₹4,00,000. Management wishes to evaluate the

project's simple payback period before implementation. Assuming the savings remain constant each year and no residual value is considered, what is the payback period?

- A. 3 years
- B. 4 years
- C. 5 years
- D. 6 years

Q32. A safety engineer compares a proactive safety management system with a reactive safety management system in two chemical manufacturing facilities. One system focuses on identifying hazards and implementing controls before accidents occur, while the other primarily responds after incidents have already happened. Which statement correctly distinguishes the proactive approach?

- A. It depends mainly on accident investigations after losses occur.
- B. It focuses on hazard identification and prevention before incidents occur.
- C. It eliminates the need for risk assessment.
- D. It operates only during emergency situations.

Q33. A chemical plant develops a detailed plan describing evacuation procedures, communication systems, medical response arrangements, and coordination with external emergency services in the event of a major toxic release affecting nearby communities. What is this document commonly called?

- A. Work Permit
- B. Onsite Emergency Plan
- C. Offsite Emergency Plan
- D. Material Balance Sheet

Q34. A quality improvement team in a garment manufacturing unit collects defect data and arranges the causes in descending order of frequency. The objective is to identify the few critical causes responsible for most product defects so that corrective actions can be prioritized. Which quality management tool is being applied?

- A. Fishbone Diagram
- B. Pareto Analysis
- C. Scatter Diagram
- D. Flow Process Chart

Q35. An employee working in a textile spinning department develops a respiratory disorder after prolonged exposure to cotton dust. Medical evaluation confirms that the illness is directly related to workplace exposure. How should this condition be classified?

- A. Occupational Disease
- B. Public Health Emergency
- C. Environmental Disaster
- D. Mechanical Failure

Q36. A textile machinery manufacturer is selecting materials for drafting rollers used in high-speed spinning operations. The rollers must maintain dimensional accuracy, resist wear caused by continuous fiber contact, and operate reliably under varying humidity and temperature conditions. Frequent replacement would increase maintenance costs and reduce production efficiency. Which material property is most critical for ensuring long service life of the drafting rollers?

- A. High Wear Resistance
- B. High Electrical Resistance
- C. High Thermal Expansion
- D. High Transparency

Q37. Assertion (A): Safety audits are considered proactive tools in industrial safety management.

Reason (R): Safety audits systematically identify deficiencies and opportunities for improvement before major accidents occur.

- A. Both A and R are true, and R correctly explains A.

B. Both A and R are true, but R does not explain A.

C. A is true, but R is false.

D. A is false, but R is true.

Q38. A safety officer conducts a study to evaluate both the probability of a hazardous event occurring and the severity of its consequences. The objective is to determine the overall significance of identified hazards and prioritize control measures accordingly. What is this process called?

A. Risk Assessment

B. Material Handling

C. Inventory Control

D. Cost Accounting

Q39. A garment manufacturing company produces 25,000 units of a particular product. The total manufacturing cost incurred during the period is ₹12,50,000. Management wishes to determine the average manufacturing cost per unit for pricing and profitability analysis. Which formula should be used?

A. $\text{Cost per Unit} = \text{Total Cost} \div \text{Number of Units Produced}$

B. $\text{Cost per Unit} = \text{Number of Units Produced} \div \text{Total Cost}$

C. $\text{Cost per Unit} = \text{Profit} \div \text{Production Quantity}$

D. $\text{Cost per Unit} = \text{Revenue} \div \text{Production Quantity}$

Q40. A chemical processing facility adopts the hierarchy of controls as part of its occupational safety program. The management team must choose among elimination, substitution, engineering controls, administrative controls, and personal protective equipment. According to the hierarchy, which control method is generally considered the most effective?

A. Personal Protective Equipment

B. Administrative Controls

C. Engineering Controls

D. Hazard Elimination

Q41. A chemical manufacturing company develops a unique process-control software that significantly reduces hazardous operating conditions in its reactors. Management wishes to protect the intellectual creation from unauthorized copying while retaining exclusive commercial rights. The legal protection sought applies to original software code rather than physical machinery. Which Intellectual Property Right (IPR) is most appropriate for this purpose?

- A. Patent
- B. Copyright
- C. Trademark
- D. Industrial Design

Q42. A textile weaving machine experiences frequent stopping problems because the rotating shaft continues to move even after power is disconnected. To improve operational safety and reduce machine stopping distance, engineers install a mechanical device designed to absorb kinetic energy and stop motion rapidly. Which device is most suitable?

- A. Cone Drum
- B. Drafting Roller
- C. Brake
- D. Cam

Q43. Consider the following statements regarding occupational diseases in chemical industries:

1. Occupational diseases may result from long-term exposure to hazardous substances.
2. Early detection programs help reduce disease severity.
3. Personal protective equipment is never required if monitoring is performed.
4. Medical surveillance is an important preventive measure.

Which combination is correct?

- A. 1, 2 and 4 only
- B. 1 and 3 only
- C. 2 and 3 only
- D. 1, 2, 3 and 4

Q44. A garment production unit manufactures 40,000 shirts with a total production cost of ₹24,00,000. Management wants to determine the average manufacturing cost per shirt for pricing decisions and profitability analysis. Which value represents the unit production cost?

- A. ₹40
- B. ₹50
- C. ₹60
- D. ₹70

Q45. A chemical storage facility handles large quantities of flammable solvents. During a safety review, engineers recommend removing unnecessary combustible materials from the storage area and ensuring adequate separation distances between tanks. Which fire-prevention principle is primarily being applied?

- A. Increasing fuel availability
- B. Controlling combustible materials
- C. Eliminating emergency response plans
- D. Increasing ignition sources

Q46. All of the following are objectives of collective bargaining EXCEPT:

- A. Resolving employer-employee disputes
- B. Negotiating wages and working conditions
- C. Improving industrial relations
- D. Eliminating all labor laws

Q47. During environmental monitoring of a chemical plant, the concentration of sulfur dioxide in ambient air is reported in a unit commonly used for gaseous pollutants at very low concentrations. Which unit is most frequently used?

- A. kg/m^3
- B. ppm
- C. N/m^2
- D. Joule

Q48. A spinning department reports a high incidence of worker fatigue, musculoskeletal discomfort, and reduced productivity. Investigation reveals poor workstation design, awkward postures, and repetitive manual tasks. Which discipline should be applied to address these issues systematically?

- A. Thermodynamics
- B. Ergonomics
- C. Fluid Mechanics
- D. Cost Accounting

Q49. A company implements a confidentiality policy requiring employees to protect proprietary process information, customer data, and trade secrets from unauthorized disclosure. This requirement primarily relates to which professional ethical principle?

- A. Confidentiality
- B. Collective Bargaining
- C. Occupational Crime
- D. Hazard Analysis

Q50. A safety management system follows the sequence:

Hazard Identification → Risk Assessment → Risk Control → Monitoring → Review

What is the primary purpose of the final review stage in this process?

- A. To increase hazard levels
- B. To verify effectiveness and improve the system continuously
- C. To eliminate documentation
- D. To avoid future audits

Q51. A chemical manufacturing facility introduces a comprehensive risk management system before commissioning a new solvent recovery unit. Engineers first identify hazards, estimate their likelihood, evaluate consequences, and then implement control measures. Management emphasizes that no hazard should be accepted merely because an accident has not occurred previously. Which fundamental principle of occupational safety is being applied?

- A. Accident Acceptance Principle
- B. Prevention Before Occurrence Principle
- C. Production Maximization Principle
- D. Corrective Action After Failure Principle

Q52. A wastewater treatment engineer must remove dissolved organic pollutants that are resistant to biological degradation. The selected treatment method involves injecting ozone and ultraviolet radiation to generate highly reactive hydroxyl radicals capable of destroying refractory contaminants. Which treatment method is being used?

- A. Activated Sludge Process
- B. Chemical Coagulation
- C. Advanced Oxidation Process
- D. Primary Sedimentation

Q53. A textile processing industry installs solar thermal collectors on its facility roof. The collected energy is used to preheat boiler feed water and reduce fuel consumption during steam generation. Which renewable energy principle is being utilized?

- A. Conversion of solar radiation into thermal energy
- B. Conversion of wind energy into electrical energy

**UNIT III: ENVIRONMENTAL ENGINEERING, OCCUPATIONAL SAFETY AND HEALTH
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ANSWER AND EXPLANATION

Q1. A textile processing unit discharges wastewater containing high concentrations of biodegradable organic matter into its treatment plant. During performance evaluation, the environmental engineer uses a parameter that represents the amount of oxygen required by microorganisms to biologically oxidize organic pollutants present in the sample. This parameter is widely used to assess wastewater strength and treatment efficiency. Which parameter is being identified?

- A. Chemical Oxygen Demand (COD)
- B. Biochemical Oxygen Demand (BOD)
- C. Total Dissolved Solids (TDS)
- D. Turbidity Index

Answer: B. Biochemical Oxygen Demand (BOD)

Explanation: Biochemical Oxygen Demand (BOD) measures the amount of dissolved oxygen consumed by microorganisms while decomposing biodegradable organic matter in water. It is one of the most important indicators of wastewater pollution strength. High BOD values indicate significant organic contamination and greater oxygen depletion potential in receiving water bodies. Wastewater treatment plants aim to reduce BOD before discharge. Therefore, BOD is widely used for evaluating biological treatment performance and environmental impact.

Q2. A textile mill has 50 fluorescent lighting fixtures, each rated at 40 W. During an energy audit, the safety officer calculates the total electrical load imposed by the lighting system. Assuming all fixtures operate simultaneously under rated conditions, what is the total lighting load?

- A. 1000 W
- B. 1500 W
- C. 2000 W
- D. 2500 W

Answer: C. 2000 W

Explanation: The total electrical load is calculated by multiplying the number of fixtures by the power rating of each fixture. $P = N \times P \text{ individual}$. $P = 50 \times 40$. $P = 2000 \text{ W}$. Adequate lighting is essential in textile industries to reduce accidents and improve worker productivity. Energy audits help identify opportunities for reducing electricity consumption.

Q3. A chemical manufacturing facility generates acidic wastewater containing dissolved heavy metals. Before biological treatment, the wastewater must undergo a process that adjusts pH and precipitates metal ions to facilitate removal. Which treatment unit is most suitable for this application?

- A. Neutralization Tank
- B. Trickling Filter
- C. Cyclone Separator
- D. Cooling Tower

Answer: A. Neutralization Tank

Explanation: Neutralization tanks are widely used in industrial wastewater treatment to adjust pH levels. By adding suitable chemicals, acidic or alkaline streams can be brought within an acceptable pH range. Heavy metals often precipitate as hydroxides during pH adjustment, making them easier to remove. This process protects downstream biological treatment units from toxic conditions. Therefore, a neutralization tank is the most appropriate equipment.

Q4. In occupational safety management, a work permit system is implemented before carrying out potentially hazardous activities such as hot work, confined space entry, and maintenance operations. What is the primary function of a work permit system?

- A. Increasing production output
- B. Authorizing and controlling hazardous work activities
- C. Measuring wastewater quality
- D. Estimating machinery efficiency

Answer: B. Authorizing and controlling hazardous work activities

Explanation: A work permit system is a formal administrative control used to manage hazardous tasks. It ensures that risks are identified, precautions are implemented, and responsible personnel approve the activity before work begins. Permit systems are particularly important for hot work, confined space entry, electrical isolation, and maintenance operations. They reduce the likelihood of accidents by enforcing safety procedures. Therefore, the primary purpose is authorization and control of hazardous work.

Q5. Regarding industrial hygiene programs in chemical industries, which of the following statements is NOT correct?

- A. They identify workplace health hazards.
- B. They help prevent occupational diseases.
- C. They eliminate the need for personal protective equipment in all situations.
- D. They involve monitoring of workplace exposures.

Answer: C. They eliminate the need for personal protective equipment in all situations.

Explanation: Industrial hygiene focuses on the anticipation, recognition, evaluation, and control of workplace hazards. Monitoring exposure to chemicals, dust, noise, and other harmful agents is a key activity. While engineering and administrative controls are preferred, personal protective equipment (PPE) remains necessary when residual risks exist. Industrial hygiene programs do not eliminate PPE requirements in all cases.

Q6. A textile processing plant generates wastewater with an initial Biochemical Oxygen Demand (BOD) of 600 mg/L. After biological treatment, the BOD is reduced to 120 mg/L. The environmental engineer must evaluate the treatment efficiency to determine compliance with discharge standards. Assuming no dilution effects, what is the percentage BOD removal achieved by the treatment plant?

- A. 60%
- B. 70%
- C. 80%
- D. 90%

Answer: C. 80%

Explanation: The percentage removal efficiency is calculated using: $\text{Efficiency} = \frac{\text{BOD in} - \text{BOD out}}{\text{BOD in}} \times 100 = \frac{600 - 120}{600} \times 100 = 80\%$. BOD removal efficiency indicates the effectiveness of biological treatment processes in reducing organic pollution. Higher removal efficiencies generally reflect better treatment performance. Therefore, the wastewater treatment plant achieved 80% BOD reduction.

Q7. A safety engineer evaluates various noise-control materials for installation around high-speed textile machinery. One material exhibits excellent sound absorption characteristics due to its porous internal structure, which dissipates acoustic energy as heat. Which property primarily contributes to effective noise absorption?

- A. High Reflectivity
- B. High Porosity
- C. High Density Only
- D. High Thermal Expansion

Answer: B. High Porosity

Explanation: Porous materials contain interconnected void spaces that allow sound waves to penetrate the material. As the sound energy travels through these pores, frictional losses convert part of the acoustic energy into heat. This mechanism reduces reflected noise and improves sound absorption performance. Such materials are commonly used in industrial noise-control applications. Therefore, high porosity is the key property responsible for sound absorption.

Q8. A hazardous chemical storage facility develops an emergency preparedness program to minimize consequences during accidental releases. The safety management team follows a systematic sequence for emergency planning and response. Which of the following represents the correct sequence?

- A. Emergency Response → Hazard Identification → Risk Assessment
- B. Hazard Identification → Risk Assessment → Emergency Planning → Emergency Response
- C. Risk Assessment → Emergency Response → Hazard Identification
- D. Emergency Planning → Hazard Identification → Incident Investigation

Answer: B. Hazard Identification → Risk Assessment → Emergency Planning → Emergency Response

Explanation: Emergency preparedness begins with identifying hazards present within the facility. After hazards are identified, risk assessments are conducted to estimate potential consequences and likelihoods. Based on these findings, emergency plans and procedures are developed. During an actual incident, emergency response actions are implemented according to the established plan. Therefore, option B represents the correct sequence.

Q9. A chemical manufacturing plant stores large quantities of flammable solvents. During a safety audit, engineers identify a potential ignition source near the storage area. To reduce fire risk, management decides to eliminate the ignition source rather than relying solely on protective equipment. Which risk-control principle is being applied?

- A. Risk Transfer
- B. Hazard Elimination
- C. Administrative Control Only
- D. Consequence Analysis

Answer: B. Hazard Elimination

Explanation: Hazard elimination is the most effective level in the hierarchy of controls. It involves completely removing the hazard or the source of danger from the workplace. By eliminating ignition sources near flammable materials, the likelihood of fire is significantly reduced. This approach is generally more effective than relying solely on procedural controls or personal protective equipment. Therefore, the principle being applied is hazard elimination.

Q10. A welfare officer in a chemical industry is responsible for promoting employee well-being, improving working conditions, and supporting worker welfare programs. Which term best describes the systematic effort to enhance the physical, mental, and social well-being of workers?

- A. Industrial Hygiene
- B. Occupational Welfare
- C. Process Safety Management

D. Hazard Analysis

Answer: B. Occupational Welfare

Explanation: Occupational welfare refers to organized efforts aimed at improving workers' quality of life and working conditions. It includes welfare facilities, health programs, recreational activities, and employee support services. Welfare officers play an important role in implementing such initiatives. Effective occupational welfare improves morale, productivity, and job satisfaction. Therefore, the correct term is occupational welfare.

Q11. A chemical processing plant performs a comprehensive safety audit after a series of near-miss incidents involving solvent handling operations. The audit team reviews procedures, equipment conditions, employee practices, and emergency preparedness measures. During discussions, the team emphasizes that audits are not merely compliance exercises but also proactive tools for accident prevention. Evaluate the following statements.

Assertion (A): Safety audits help reduce the probability of industrial accidents.

Reason (R): Safety audits identify deficiencies in safety management systems before major incidents occur.

- A. Both A and R are true, and R is the correct explanation of A.
- B. Both A and R are true, but R is not the correct explanation of A.
- C. A is true, but R is false.
- D. A is false, but R is true.

Answer: A. Both A and R are true, and R is the correct explanation of A.

Explanation: Safety audits are systematic evaluations of workplace safety practices, procedures, and management systems. They help identify unsafe conditions, procedural weaknesses, and regulatory non-compliance before accidents occur. By correcting deficiencies proactively, organizations reduce risk exposure and improve safety performance. Effective audits contribute to continuous improvement in occupational safety management. Therefore, both the assertion and reason are true, and the reason correctly explains the assertion.

Q12. A safety engineer monitors workplace noise levels in a weaving section over an eight-hour shift. The recorded sound pressure level rises sharply during machine

start-up, remains relatively constant during production, and decreases during shutdown. A graph of noise level versus time shows a long plateau at approximately 95 dB(A). What does the plateau region primarily indicate?

- A. Intermittent noise exposure
- B. Constant operating noise during production
- C. Instrument calibration error
- D. Complete absence of machinery operation

Answer: B. Constant operating noise during production

Explanation: A plateau in a noise-versus-time graph indicates that the measured sound level remains relatively constant over a period of time. In industrial environments, this often corresponds to steady machine operation. Continuous exposure to noise levels around 95 dB(A) may require hearing conservation measures such as ear protection and exposure monitoring. The graph therefore represents sustained production-related noise.

Q13. A textile factory employs 250 workers. During a safety inspection, it is observed that 20 workers are not using the prescribed personal protective equipment (PPE). Assuming all workers were required to wear PPE, what percentage of workers complied with the PPE requirement?

- A. 88%
- B. 90%
- C. 92%
- D. 96%

Answer: C. 92%

Explanation: The number of workers complying with PPE requirements is: $250 - 20 = 230$. The compliance percentage is: $230/250 \times 100 = 92\%$. PPE compliance is an important indicator of workplace safety culture and effectiveness of safety training programs. High compliance levels generally reduce occupational injury risk. Therefore, the PPE compliance rate is 92%.

Q14. A safety professional is applying Kohlberg's Theory of Moral Development while evaluating ethical decision-making behavior among supervisors in a chemical

manufacturing facility. According to the theory, individuals at higher levels of moral development make decisions based on universal ethical principles rather than personal gain or fear of punishment. Which theoretical property best characterizes the highest stage of moral reasoning?

- A. Obedience to avoid punishment
- B. Conformity to group expectations
- C. Compliance with organizational rules only
- D. Commitment to universal ethical principles

Answer: D. Commitment to universal ethical principles

Explanation: Kohlberg's highest level of moral development emphasizes ethical reasoning based on universal principles of justice, fairness, and human rights. Individuals at this stage evaluate actions according to broader ethical values rather than personal interests or external rewards. Such reasoning is important in professional ethics and safety management. Ethical leadership often reflects higher stages of moral development. Therefore, commitment to universal ethical principles is the defining characteristic.

Q15. A textile manufacturing plant experiences excessive humidity fluctuations that adversely affect yarn quality and process stability. Management decides to install equipment that continuously controls moisture content in the production environment while maintaining worker comfort. Which equipment is most appropriate for this purpose?

- A. Cyclone Separator
- B. Humidification and Air Conditioning System
- C. Shell-and-Tube Heat Exchanger
- D. Rotary Dryer

Answer: B. Humidification and Air Conditioning System

Explanation: Textile manufacturing processes often require precise control of humidity and temperature. Excessively dry conditions can increase yarn breakage, while excessive humidity can affect product quality and worker comfort. Humidification and air conditioning systems regulate environmental conditions to maintain optimal operating parameters. Such systems improve process consistency and productivity. Therefore, the most suitable equipment is a humidification and air conditioning system.

Q16. Consider the following statements regarding hazardous waste management in chemical industries:

1. Hazardous wastes may exhibit toxicity, corrosivity, ignitability, or reactivity.
2. Proper labeling and segregation are essential before disposal.
3. Hazardous wastes can always be mixed with domestic waste without treatment.
4. Authorized disposal facilities are generally required for final treatment and disposal.

Which of the following combinations is correct?

- A. 1, 2 and 4 only
- B. 1 and 3 only
- C. 2 and 3 only
- D. 1, 2, 3 and 4

Answer: A. 1, 2 and 4 only

Explanation: Hazardous wastes possess characteristics such as toxicity, corrosivity, ignitability, and reactivity that may threaten human health and the environment. Proper segregation and labeling prevent accidental mixing and facilitate safe handling. Disposal is generally performed through authorized treatment, storage, and disposal facilities. Mixing hazardous waste with domestic waste is prohibited because it increases environmental risks and complicates treatment. Therefore, statements 1, 2, and 4 are correct while statement 3 is incorrect.

Q17. A garment manufacturing company invests ₹10,00,000 in a productivity improvement project. The annual net cash inflow expected from the project is ₹2,50,000. For preliminary investment appraisal, management calculates the simple payback period. What is the payback period?

- A. 2 years
- B. 3 years
- C. 4 years
- D. 5 years

Answer: C. 4 years

Explanation: The payback period is calculated as: Payback Period = Initial Investment / Annual Cash Inflow = $\frac{10,00,000}{2,50,000} = 4$ years. The payback period indicates the time required to recover the original investment. It is widely used for preliminary screening of industrial projects. Shorter payback periods generally imply lower investment risk.

Q18. A chemical processing unit handles highly flammable solvents and operates several hot-work activities such as welding and cutting. The safety officer must implement the most effective preventive measure to reduce fire hazards during maintenance work. Which principle should receive the highest priority?

- A. Allow hot work without supervision**
- B. Implement a hot-work permit system and remove ignition hazards**
- C. Store additional flammable materials near the work area**
- D. Ignore atmospheric testing requirements**

Answer: B. Implement a hot-work permit system and remove ignition hazards

Explanation: Hot-work activities are among the most common causes of industrial fires and explosions. A hot-work permit system ensures that hazards are identified, combustible materials are removed, and appropriate precautions are implemented before work begins. Atmospheric testing, fire watches, and emergency preparedness are often included in the permit process. These controls significantly reduce the probability of ignition. Therefore, implementing a hot-work permit system is the most appropriate safety measure.

Q19. All of the following are important objectives of industrial hygiene programs EXCEPT:

- A. Recognition of workplace health hazards**
- B. Evaluation of employee exposure levels**
- C. Prevention of occupational diseases**
- D. Maximization of pollutant generation**

Answer: D. Maximization of pollutant generation

Explanation: Industrial hygiene focuses on anticipating, recognizing, evaluating, and controlling workplace hazards that may affect employee health. Exposure monitoring and hazard assessment help identify risks before adverse health effects occur. Effective industrial hygiene programs contribute to the prevention of occupational diseases and improvement of working conditions. Increasing pollutant generation directly contradicts the objectives of industrial hygiene.

Q20. During workplace noise assessment in a textile weaving department, sound levels are measured using a sound level meter. Which unit is commonly used to express occupational noise levels?

- A. Pascal (Pa)
- B. Decibel (dB)
- C. Newton (N)
- D. Watt (W)

Answer: B. Decibel (dB)

Explanation: Noise levels are commonly measured and reported in decibels (dB), which represent a logarithmic scale of sound intensity. Occupational noise assessments frequently use dB(A) weighting to account for human hearing sensitivity. Monitoring noise exposure helps prevent hearing loss and supports compliance with occupational health regulations. Sound level meters are calibrated to provide readings in decibels.

Q21. A chemical manufacturing facility stores chlorine cylinders and concentrated acids in separate storage areas. During a safety inspection, the safety officer observes that incompatible chemicals are stored near a common drainage channel. In the event of leakage, a dangerous chemical reaction may occur, producing toxic gases that could affect workers and nearby communities. To prevent such incidents, management decides to redesign the storage arrangement. Which safety measure is most appropriate?

- A. Increasing production rate
- B. Segregation of incompatible chemicals
- C. Reducing lighting levels
- D. Increasing inventory levels

Answer: B. Segregation of incompatible chemicals

Explanation: Chemical incompatibility is a major source of industrial accidents involving toxic releases, fires, and explosions. Segregating incompatible substances prevents unintended chemical reactions during leaks, spills, or emergencies. Proper storage arrangements, drainage isolation, and hazard labeling are important components of chemical safety management. This approach reduces both occupational and environmental risks. Therefore, segregation of incompatible chemicals is the most appropriate control measure. It forms a key principle of safe plant layout and hazard prevention.

Q22. A textile industry introduces a structured quality improvement initiative where employee teams regularly identify process defects, analyze root causes, and recommend corrective actions. The program emphasizes continuous improvement rather than inspection alone. Management considers this initiative a component of a broader organizational philosophy focused on customer satisfaction and process excellence. Under which classification does this approach fall?

- A. Preventive Maintenance
- B. Total Quality Management (TQM)
- C. Hazardous Waste Management
- D. Financial Accounting

Answer: B. Total Quality Management (TQM)

Explanation: Total Quality Management is a comprehensive management philosophy that focuses on continuous improvement across all organizational activities. It encourages employee participation, customer focus, defect prevention, and process optimization. Quality circles, root-cause analysis, and continuous improvement programs are common TQM tools. The objective is long-term organizational excellence through systematic quality enhancement. Therefore, the described initiative is classified under TQM. It is widely used in textile and garment industries to improve competitiveness.

Q23. A safety officer is conducting a hazard study for a new chemical processing unit before commissioning. The study involves identifying possible deviations from intended operating conditions using guide words such as "more," "less," "none," and

"reverse." The objective is to systematically identify hazards and operability problems before startup. Which hazard identification technique is being applied?

- A. SWOT Analysis
- B. HAZOP Study
- C. Break-Even Analysis
- D. Financial Ratio Analysis

Answer: B. HAZOP Study

Explanation: HAZOP (Hazard and Operability Study) is a structured hazard identification methodology widely used in process industries. It systematically examines process deviations using predefined guide words. The technique helps identify potential hazards, operability issues, and design weaknesses before plant operation. HAZOP studies are an essential component of process safety management. They improve plant safety by identifying risks at an early stage.

Q24. An occupational health assessment is conducted in a textile weaving department where workers are continuously exposed to machine noise. According to common occupational health guidelines, prolonged exposure above a certain noise level may require hearing conservation programs and protective equipment. Which of the following values is generally considered an important occupational noise action level?

- A. 55 dB(A)
- B. 70 dB(A)
- C. 85 dB(A)
- D. 120 dB(A)

Answer: C. 85 dB(A)

Explanation: Noise exposure levels around 85 dB(A) are widely recognized as an important occupational action level in many industrial standards and hearing conservation programs. Prolonged exposure above this level may increase the risk of hearing impairment. Employers often implement noise monitoring, engineering controls, and hearing protection measures when exposure approaches or exceeds this value. Worker training and audiometric testing may also be required. Therefore, 85 dB(A) is commonly used as a significant occupational noise threshold.

Q25. A wastewater treatment facility receives effluent from a textile dyeing process. The treatment flowchart includes equalization, coagulation–flocculation, sedimentation, biological treatment, and final disinfection before discharge. The engineer must identify the correct sequence represented by the treatment process. Which sequence is correct?

- A. Equalization → Coagulation–Flocculation → Sedimentation → Biological Treatment → Disinfection
- B. Biological Treatment → Equalization → Sedimentation → Disinfection
- C. Sedimentation → Equalization → Coagulation → Disposal
- D. Disinfection → Biological Treatment → Equalization

Answer: A. Equalization → Coagulation–Flocculation → Sedimentation → Biological Treatment → Disinfection

Explanation: Wastewater treatment follows a logical sequence designed to progressively remove contaminants. Equalization stabilizes flow and pollutant concentrations. Coagulation–flocculation destabilizes suspended particles, which are then removed during sedimentation. Biological treatment degrades biodegradable organic matter. Finally, disinfection destroys pathogenic microorganisms before discharge or reuse. Each stage prepares the wastewater for the next treatment step. Therefore, option A correctly represents the treatment flow sequence.

Q26. A garment manufacturing company invests ₹15,00,000 in an automated fabric cutting system. The project is expected to generate annual net savings of ₹3,00,000 through reduced material wastage and labor costs. Management wants to estimate the simple payback period before approving the investment. Assuming constant annual savings and no salvage value, determine the payback period of the project.

- A. 3 years
- B. 4 years
- C. 5 years
- D. 6 years

Answer: C. 5 years

Explanation: The simple payback period is calculated as: Payback Period = Initial Investment/Annual Savings = $\frac{15,00,000}{3,00,000} = 5$ years. The payback period indicates the time

required to recover the initial investment. It is commonly used in textile and manufacturing industries for preliminary investment appraisal. Shorter payback periods are generally preferred because they reduce financial risk.

Q27. A chemical industry implements a comprehensive risk assessment program before introducing a new hazardous process. The objective is to identify potential hazards, estimate their consequences, and evaluate the likelihood of occurrence before selecting appropriate controls. Which fundamental principle of risk management is being applied?

- A. Risk should be ignored until an accident occurs.
- B. Hazards must be identified before risks can be controlled.
- C. Safety controls are unnecessary if production targets are achieved.
- D. Risk assessment is performed only after equipment failure.

Answer: B. Hazards must be identified before risks can be controlled.

Explanation: Risk management begins with hazard identification because risks cannot be evaluated or controlled unless hazards are first recognized. Once hazards are identified, their likelihood and consequences can be assessed systematically. Appropriate engineering, administrative, and personal protective measures can then be implemented. This proactive approach reduces accident potential and improves workplace safety. Therefore, hazard identification is the foundation of effective risk management.

Q28. A wastewater treatment engineer must remove persistent organic pollutants that are resistant to conventional biological treatment. The selected process generates highly reactive hydroxyl radicals capable of oxidizing complex contaminants into less harmful substances. Which treatment method is being applied?

- A. Activated Sludge Process
- B. Trickling Filter
- C. Advanced Oxidation Process (AOP)
- D. Primary Sedimentation

Answer: C. Advanced Oxidation Process (AOP)

Explanation: Advanced Oxidation Processes utilize highly reactive oxidizing species, particularly hydroxyl radicals, to destroy refractory organic contaminants. These

methods are effective for pollutants that resist conventional biological treatment. Examples include ozone-based oxidation, UV/H₂O₂ systems, and Fenton processes. AOPs are increasingly used in industrial wastewater treatment where high removal efficiency is required. Therefore, the treatment method described is an Advanced Oxidation Process. It represents an advanced environmental engineering solution.

Q29. A textile processing unit plans to reduce its dependence on fossil fuels by installing a renewable energy system that converts sunlight directly into electrical energy. The electricity generated will be used to power lighting systems and auxiliary equipment within the plant. Which renewable energy technology is being utilized?

- A. Solar Photovoltaic System
- B. Diesel Generator
- C. Coal-Fired Boiler
- D. Gas Turbine System

Answer: A. Solar Photovoltaic System

Explanation: Solar photovoltaic systems convert sunlight directly into electricity using semiconductor materials. Unlike solar thermal systems, photovoltaic panels produce electrical energy rather than heat. They are widely used to reduce electricity costs and carbon emissions in industrial facilities. The technology is renewable, environmentally friendly, and increasingly economical. Therefore, the textile unit is utilizing a solar photovoltaic system. This contributes to sustainable industrial development.

Q30. A belt drive system is used to transmit power from an electric motor to a drafting roller assembly in a textile machine. The maintenance engineer observes that the system operates smoothly because the belt absorbs minor shocks and vibrations generated during operation. Which system property is primarily responsible for this behavior?

- A. Rigidity
- B. Elasticity and Flexibility
- C. Brittleness
- D. Magnetic Permeability

Answer: B. Elasticity and Flexibility

Explanation: Belt drives possess inherent elasticity and flexibility, allowing them to absorb shocks and damp vibrations during power transmission. This characteristic protects machine components from sudden load variations and improves operating smoothness. Flexible power transmission systems are particularly useful in textile machinery where continuous and uniform motion is important. Excessive rigidity could transmit vibrations directly to connected equipment. Therefore, elasticity and flexibility are the key properties responsible for smooth operation.

Q31. A textile manufacturing company invests ₹20,00,000 in an ergonomic workstation improvement project. The annual reduction in injury-related costs and productivity losses is estimated at ₹4,00,000. Management wishes to evaluate the project's simple payback period before implementation. Assuming the savings remain constant each year and no residual value is considered, what is the payback period?

- A. 3 years
- B. 4 years
- C. 5 years
- D. 6 years

Answer: C. 5 years

Explanation: The payback period is calculated by dividing the initial investment by the annual savings. $\text{Payback Period} = 20,00,000 / 4,00,000 = 5$ years. This metric indicates how long it will take to recover the original investment. Ergonomic improvements often reduce injuries, absenteeism, and productivity losses. Although payback period ignores the time value of money, it remains a useful preliminary appraisal tool.

Q32. A safety engineer compares a proactive safety management system with a reactive safety management system in two chemical manufacturing facilities. One system focuses on identifying hazards and implementing controls before accidents occur, while the other primarily responds after incidents have already happened. Which statement correctly distinguishes the proactive approach?

- A. It depends mainly on accident investigations after losses occur.
- B. It focuses on hazard identification and prevention before incidents occur.
- C. It eliminates the need for risk assessment.
- D. It operates only during emergency situations.

Answer: B. It focuses on hazard identification and prevention before incidents occur.

Explanation: Proactive safety management emphasizes anticipation, prevention, and risk reduction before accidents take place. Hazard identification, risk assessment, audits, and preventive controls are key components. Reactive systems rely more heavily on lessons learned after incidents occur. Modern safety management strongly favors proactive approaches because they reduce accident probability. Therefore, option B correctly distinguishes proactive safety management.

Q33. A chemical plant develops a detailed plan describing evacuation procedures, communication systems, medical response arrangements, and coordination with external emergency services in the event of a major toxic release affecting nearby communities. What is this document commonly called?

- A. Work Permit
- B. Onsite Emergency Plan
- C. Offsite Emergency Plan
- D. Material Balance Sheet

Answer: C. Offsite Emergency Plan

Explanation: An offsite emergency plan addresses emergencies that may affect people, property, or the environment outside the plant boundary. It involves coordination among industries, local authorities, emergency responders, hospitals, and community representatives. The objective is to minimize consequences to the surrounding population. Such plans complement onsite emergency plans that focus primarily on plant personnel and facilities. Therefore, the document described is an offsite emergency plan.

Q34. A quality improvement team in a garment manufacturing unit collects defect data and arranges the causes in descending order of frequency. The objective is to identify the few critical causes responsible for most product defects so that corrective actions can be prioritized. Which quality management tool is being applied?

- A. Fishbone Diagram
- B. Pareto Analysis
- C. Scatter Diagram

D. Flow Process Chart

Answer: B. Pareto Analysis

Explanation: Pareto Analysis is based on the principle that a small number of causes often account for a large proportion of problems. By arranging causes according to frequency or impact, management can focus resources on the most significant issues. This approach supports continuous improvement and efficient problem solving. Pareto charts are widely used in TQM programs. Therefore, the quality tool being applied is Pareto Analysis.

Q35. An employee working in a textile spinning department develops a respiratory disorder after prolonged exposure to cotton dust. Medical evaluation confirms that the illness is directly related to workplace exposure. How should this condition be classified?

- A. Occupational Disease
- B. Public Health Emergency
- C. Environmental Disaster
- D. Mechanical Failure

Answer: A. Occupational Disease

Explanation: An occupational disease is a health condition caused primarily by exposure to hazards encountered during employment. Examples include respiratory disorders, hearing loss, skin diseases, and chemical poisoning. In textile industries, prolonged exposure to cotton dust may lead to byssinosis and other respiratory conditions. Occupational health programs aim to prevent such diseases through monitoring and control measures. Therefore, the condition is classified as an occupational disease.

Q36. A textile machinery manufacturer is selecting materials for drafting rollers used in high-speed spinning operations. The rollers must maintain dimensional accuracy, resist wear caused by continuous fiber contact, and operate reliably under varying humidity and temperature conditions. Frequent replacement would increase maintenance costs and reduce production efficiency. Which material property is most critical for ensuring long service life of the drafting rollers?

- A. High Wear Resistance
- B. High Electrical Resistance

C. High Thermal Expansion

D. High Transparency

Answer: A. High Wear Resistance

Explanation: Drafting rollers are continuously subjected to frictional contact with fibers and moving machine components. Excessive wear can alter roller dimensions, affect yarn quality, and increase maintenance requirements. High wear resistance helps maintain surface integrity and operational accuracy over long periods. This property contributes directly to equipment reliability and productivity. Therefore, wear resistance is the most important material property for drafting rollers. It is a key consideration in textile machinery design.

Q37. Assertion (A): Safety audits are considered proactive tools in industrial safety management.

Reason (R): Safety audits systematically identify deficiencies and opportunities for improvement before major accidents occur.

- A. Both A and R are true, and R correctly explains A.
- B. Both A and R are true, but R does not explain A.
- C. A is true, but R is false.
- D. A is false, but R is true.

Answer: A. Both A and R are true, and R correctly explains A.

Explanation: Safety audits evaluate safety systems, procedures, equipment, and compliance status before incidents occur. Their purpose is to identify weaknesses and recommend corrective actions proactively. By detecting deficiencies early, organizations can prevent accidents rather than merely responding afterward. This preventive approach distinguishes audits from purely reactive measures. Therefore, the assertion is true, and the reason correctly explains why audits are considered proactive tools.

Q38. A safety officer conducts a study to evaluate both the probability of a hazardous event occurring and the severity of its consequences. The objective is to determine the overall significance of identified hazards and prioritize control measures accordingly. What is this process called?

- A. Risk Assessment

B. Material Handling

C. Inventory Control

D. Cost Accounting

Answer: A. Risk Assessment

Explanation: Risk assessment is a systematic process used to identify hazards, evaluate their likelihood, estimate consequences, and determine overall risk levels. It forms the foundation of modern occupational safety and health management systems. The results help organizations prioritize corrective actions and allocate resources effectively. Risk assessment supports proactive accident prevention strategies. Therefore, the described activity is known as risk assessment. It is an essential component of industrial safety programs.

Q39. A garment manufacturing company produces 25,000 units of a particular product. The total manufacturing cost incurred during the period is ₹12,50,000. Management wishes to determine the average manufacturing cost per unit for pricing and profitability analysis. Which formula should be used?

A. Cost per Unit = Total Cost ÷ Number of Units Produced

B. Cost per Unit = Number of Units Produced ÷ Total Cost

C. Cost per Unit = Profit ÷ Production Quantity

D. Cost per Unit = Revenue ÷ Production Quantity

Answer: A. Cost per Unit = Total Cost ÷ Number of Units Produced

Explanation: Unit costing is an important tool in textile and garment industry management. It helps determine product pricing, profitability, and cost-control opportunities. The formula divides total production cost by the number of units produced. This provides the average cost incurred for each unit manufactured. Managers use this information for budgeting and decision-making. Therefore, option A represents the correct costing formula.

Q40. A chemical processing facility adopts the hierarchy of controls as part of its occupational safety program. The management team must choose among elimination, substitution, engineering controls, administrative controls, and personal protective equipment. According to the hierarchy, which control method is generally considered the most effective?

- A. Personal Protective Equipment
- B. Administrative Controls
- C. Engineering Controls
- D. Hazard Elimination

Answer: D. Hazard Elimination

Explanation: The hierarchy of controls ranks risk-control measures according to their effectiveness. Hazard elimination is placed at the top because it removes the source of danger entirely. Once a hazard is eliminated, exposure cannot occur. Other controls reduce risk but do not completely remove the hazard. Therefore, elimination provides the highest level of protection. It is the preferred approach whenever technically and economically feasible.

Q41. A chemical manufacturing company develops a unique process-control software that significantly reduces hazardous operating conditions in its reactors. Management wishes to protect the intellectual creation from unauthorized copying while retaining exclusive commercial rights. The legal protection sought applies to original software code rather than physical machinery. Which Intellectual Property Right (IPR) is most appropriate for this purpose?

- A. Patent
- B. Copyright
- C. Trademark
- D. Industrial Design

Answer: B. Copyright

Explanation: Copyright protects original literary, artistic, and software works from unauthorized reproduction and distribution. Computer software source code is generally protected under copyright law. Unlike patents, copyright does not require novelty testing of technical inventions. It grants exclusive rights to the creator for reproduction and use. Software developers commonly rely on copyright protection. Therefore, copyright is the most appropriate IPR for software code protection.

Q42. A textile weaving machine experiences frequent stopping problems because the rotating shaft continues to move even after power is disconnected. To improve

operational safety and reduce machine stopping distance, engineers install a mechanical device designed to absorb kinetic energy and stop motion rapidly. Which device is most suitable?

- A. Cone Drum
- B. Drafting Roller
- C. Brake
- D. Cam

Answer: C. Brake

Explanation: Brakes are mechanical devices used to slow down or stop moving machinery by converting kinetic energy into heat through friction. In textile machinery, brakes improve operational control and worker safety. They reduce stopping time and help prevent accidents during maintenance or emergency shutdowns. Proper braking systems are critical in high-speed textile operations. Therefore, a brake is the most appropriate device.

Q43. Consider the following statements regarding occupational diseases in chemical industries:

1. Occupational diseases may result from long-term exposure to hazardous substances.
2. Early detection programs help reduce disease severity.
3. Personal protective equipment is never required if monitoring is performed.
4. Medical surveillance is an important preventive measure.

Which combination is correct?

- A. 1, 2 and 4 only
- B. 1 and 3 only
- C. 2 and 3 only
- D. 1, 2, 3 and 4

Answer: A. 1, 2 and 4 only

Explanation: Occupational diseases often develop after prolonged exposure to hazardous agents such as chemicals, dusts, and noise. Early detection through medical surveillance

allows timely intervention and treatment. PPE remains necessary whenever residual risks cannot be eliminated through engineering controls. Therefore, statement 3 is incorrect. Medical surveillance and preventive health programs play a major role in occupational health management. Hence, statements 1, 2, and 4 are correct.

Q44. A garment production unit manufactures 40,000 shirts with a total production cost of ₹24,00,000. Management wants to determine the average manufacturing cost per shirt for pricing decisions and profitability analysis. Which value represents the unit production cost?

- A. ₹40
- B. ₹50
- C. ₹60
- D. ₹70

Answer: C. ₹60

Explanation: Unit production cost is calculated as: $\text{Unit Cost} = \frac{\text{Total Cost}}{\text{Number of Units}} = \frac{24,00,000}{40,000} = ₹60$. Unit costing is an essential management tool in garment industries. It helps determine selling prices, profit margins, and cost-control opportunities. Accurate costing supports effective business decisions.

Q45. A chemical storage facility handles large quantities of flammable solvents. During a safety review, engineers recommend removing unnecessary combustible materials from the storage area and ensuring adequate separation distances between tanks. Which fire-prevention principle is primarily being applied?

- A. Increasing fuel availability
- B. Controlling combustible materials
- C. Eliminating emergency response plans
- D. Increasing ignition sources

Answer: B. Controlling combustible materials

Explanation: Fire requires fuel, oxygen, and an ignition source. By reducing or controlling combustible materials, the probability and severity of fire incidents can be significantly reduced. Good housekeeping and proper storage practices are important

fire-prevention measures. Separation distances further reduce the risk of fire spread. Therefore, controlling combustible materials is the correct fire-safety principle.

Q46. All of the following are objectives of collective bargaining EXCEPT:

- A. Resolving employer-employee disputes
- B. Negotiating wages and working conditions
- C. Improving industrial relations
- D. Eliminating all labor laws

Answer: D. Eliminating all labor laws

Explanation: Collective bargaining is a structured negotiation process between employers and employee representatives. It addresses issues such as wages, working conditions, benefits, and workplace policies. The objective is to achieve mutually acceptable agreements and maintain harmonious industrial relations. Labor laws remain applicable regardless of collective bargaining outcomes. Therefore, eliminating labor laws is not an objective of collective bargaining.

Q47. During environmental monitoring of a chemical plant, the concentration of sulfur dioxide in ambient air is reported in a unit commonly used for gaseous pollutants at very low concentrations. Which unit is most frequently used?

- A. kg/m^3
- B. ppm
- C. N/m^2
- D. Joule

Answer: B. ppm

Explanation: Parts per million (ppm) is widely used to express low concentrations of gaseous pollutants in air. Environmental and occupational exposure limits for many chemicals are specified in ppm. The unit provides a convenient way to represent trace concentrations. Monitoring pollutant concentrations in ppm helps ensure compliance with air-quality standards. Therefore, ppm is the correct unit.

Q48. A spinning department reports a high incidence of worker fatigue, musculoskeletal discomfort, and reduced productivity. Investigation reveals poor workstation design, awkward postures, and repetitive manual tasks. Which discipline should be applied to address these issues systematically?

- A. Thermodynamics
- B. Ergonomics
- C. Fluid Mechanics
- D. Cost Accounting

Answer: B. Ergonomics

Explanation: Ergonomics focuses on designing workplaces, equipment, and tasks to match human capabilities and limitations. Proper ergonomic design reduces fatigue, discomfort, and injury risks while improving productivity. In textile industries, workstation layout and posture are critical considerations. Ergonomic interventions enhance both worker well-being and operational performance. Therefore, ergonomics is the appropriate discipline.

Q49. A company implements a confidentiality policy requiring employees to protect proprietary process information, customer data, and trade secrets from unauthorized disclosure. This requirement primarily relates to which professional ethical principle?

- A. Confidentiality
- B. Collective Bargaining
- C. Occupational Crime
- D. Hazard Analysis

Answer: A. Confidentiality

Explanation: Confidentiality is an ethical obligation requiring individuals to safeguard sensitive information obtained through their professional activities. It applies to technical data, business information, customer records, and trade secrets. Violations of confidentiality may result in legal, financial, and reputational consequences. Maintaining confidentiality is an important aspect of professional conduct. Therefore, the correct classification is confidentiality.

Q50. A safety management system follows the sequence:

Hazard Identification → Risk Assessment → Risk Control → Monitoring → Review

What is the primary purpose of the final review stage in this process?

- A. To increase hazard levels
- B. To verify effectiveness and improve the system continuously
- C. To eliminate documentation
- D. To avoid future audits

Answer: B. To verify effectiveness and improve the system continuously

Explanation: The review stage evaluates whether implemented controls are functioning effectively and achieving desired safety objectives. It identifies opportunities for improvement and ensures the safety management system remains relevant. Continuous review is a key element of modern occupational safety programs. Feedback from monitoring activities is incorporated into future planning. Therefore, the primary purpose of review is continuous improvement and verification of effectiveness.

Q51. A chemical manufacturing facility introduces a comprehensive risk management system before commissioning a new solvent recovery unit. Engineers first identify hazards, estimate their likelihood, evaluate consequences, and then implement control measures. Management emphasizes that no hazard should be accepted merely because an accident has not occurred previously. Which fundamental principle of occupational safety is being applied?

- A. Accident Acceptance Principle
- B. Prevention Before Occurrence Principle
- C. Production Maximization Principle
- D. Corrective Action After Failure Principle

Answer: B. Prevention Before Occurrence Principle

Explanation: Modern safety management is based on preventing accidents before they occur rather than reacting afterward. Hazard identification and risk assessment are proactive tools used to reduce risk at its source. Historical absence of accidents does not guarantee future safety. Preventive measures significantly reduce occupational injuries and losses. Therefore, prevention before occurrence is a fundamental principle of industrial safety. It forms the basis of risk-based safety management systems.