

Chapter 4.13: Waste Minimisation and Resource Conservation**Short type questions**

1.	What do you mean by integrated solid waste management? Ans Integrated solid waste management is the application of suitable techniques, technologies and management programmes covering all types of solid waste materials from all sources to achieve the objectives of: - less waste and - effective management of waste shell produced
2.	What are the various costs associated with Waste disposal? Ans The various costs associated with waste disposal is listed as below: ☐ Disposal cost ☐ Inefficient energy use cost ☐ Purchase cost of wasted raw material ☐ Production cost for the waste material ☐ Management time spent on waste material ☐ Lost revenue for what could have been a product instead of waste ☐ Potential liabilities due to waste.
3.	What is “waste minimisation”? Ans Waste minimisation can be defined as "systematically reducing waste at source". It means: • Prevention and/or reduction of waste generated • Efficient use of raw materials and packaging • Efficient use of fuel, electricity and water • Improving the quality of waste generated to facilitate recycling and/or reduce hazard • Encouraging re-use, recycling and recovery.
4.	List the 6 steps of a typical waste minimisation programme? Ans The 6 steps in a typical waste minimisation programme are - Getting Started - Analysing Process Steps - Generating waste minimisation opportunities - Selecting waste minimisation solutions - Implementing waste minimisation solutions - Maintaining waste minimisation

5.	What are the four techniques of Waste Minimisation under Source reduction? Ans The four techniques of WM under Source reduction are : 1. Good Housekeeping 2. Process change 3. Recycling 4. Product modification
6.	What are the 3R's in waste minimisation techniques? Ans Recycle, Recovery and Reuse
7.	Which is the best method to practice Waste minimisation? Waste minimisation is best practiced by reducing the generation of waste at the source itself. After exhausting the source reduction opportunities, attempts should be made to recycle the waste within the unit. Finally, modification or reformulation of products so as to manufacture it with least waste generation should be considered.
8.	What do you mean by the term Re-cycling? Ans Recycling is one of the techniques of WM under source reduction. It is further classified into: 1. On-site Recovery and Reuse: - Reuse of wasted materials in the same process or for another useful application within the industry or production of useful by product is known as recycling. 2. Production of useful by-product: - Modifications of the waste generation process in order to transform the wasted material into a material that can be reused or recycled for another application within or outside the company.
9.	What are the good house keeping measures to reduce losses? Ans. Good housekeeping is one of the techniques of WM under source reduction. Good housekeeping: - Systems to prevent leakages & spillages through preventive maintenance schedules and routine equipment inspections. Also, well-written working instructions, supervision and regular training of workforce would facilitate good housekeeping.
10.	Why is Material and Energy balance important for Waste minimisation programmes? Ans. Material and Energy balances are important for any Waste minimisation programme since they make it possible to identify and quantify previously unknown losses or emissions. These balances are also useful for monitoring the progress achieved in a prevention programme, and evaluating the costs and benefits.

Long type questions

1.	Explain “Sustain Waste Minimisation”? Ans The biggest challenge in Waste Minimisation lies in sustaining Waste Minimisation. The enthusiasm of the Waste Minimisation team wanes off with time. Such tragic ends should be avoided. Backing out from commitment, predominance of production at any cost, absence of rewards and appreciation, and shifting of priorities are some of the commonly encountered reasons, which one should check and avoid. Also monitoring and review of the implemented measures should be communicated to all employees in the industry so that it fans the desires for minimizing wastes. Involvement of as large a number of employees as possible and rewarding the deserving ones, will help long term sustenance of Waste Minimisation. Having implemented Waste Minimisation solutions in the area under study, the Waste Minimisation team should go back to analysing the process steps and identifying and selecting the next wasteful area. In this way, the cycle continues, till all the steps of waste minimisation are exhausted. In a nutshell, a philosophy of minimizing waste must be developed within the company. This means that Waste Minimisation should become an integral part of company's activities. All successful Waste Minimisation programmes, till date, have been founded on this philosophy.
2.	Explain in detail Source Reduction technique of waste minimisation? Ans Reduction at Source is one of the classifications of waste minimisation (WM) techniques. There are 4 techniques of WM under Source reduction which are discussed below: a) Good Housekeeping: Systems to prevent leakages & spillages through preventive maintenance schedules and routine equipment inspections. Also, well-written working instructions, supervision and regular training of workforce would facilitate good housekeeping. b) Process Change: (i) Input Material Change - Substitution of input materials by eco-friendly (non-toxic or less toxic than existing and renewable) material preferably having longer service time. (ii) Better Process Control - Modifications of the working procedures, machine-operating instructions and process record keeping in order to run the processes at higher efficiency and with lower waste generation and emissions. (iii) Equipment Modification - Modification of existing production equipment and utilities, for instance, by the addition of measuring and controlling devices, in order to run the processes at higher efficiency and lower waste and emission generation rates. (iv) Technology Change - Replacement of the technology, processing sequence and/or synthesis route, in order to minimise waste and emission generation during production. c) Recycling: (i) On-site Recovery and Reuse - Reuse of wasted materials in the same process or for another useful application within the industry. (ii) Production of Useful by-product - Modification of the waste generation process in order to transform the wasted material into a material that can be reused or recycled for another application within or outside the company.

	d) Product Modification: Characteristics of the product can be modified to minimise the environmental impacts of its production or those of the product itself during or after its use(disposal).
3.	Draw the various steps involved in a typical waste minimisation programme with a flow chart? Ans. The steps in a typical waste minimisation programme are illustrated below: <pre> graph TD S1["Step 1 : GETTING STARTED Task 1 : Make Waste Minimisation Team Task 2 : List Process Steps (unit operations) Task 3 : Identify & Select Wasteful Process Steps"] S2["Step 2 : ANALYSING YOUR PROCESS STEPS Task 4 : Prepare Process Flow Chart Task 5 : Make Material & Energy Balance Task 6 : Assign Costs to Waste Streams Task 7 : Review of Process to Identify Waste Causes"] S3["Step 3 : GENERATING WASTE MINIMISATION OPPORTUNITIES Task 8 : Develop Waste Minimisation Opportunities Task 9 : Select Workable Opportunities"] S4["Step 4 : SELECTION WASTE MINIMISATION SOLUTIONS Task 10 : Assess Technical Feasibility Task 11 : Assess Economic Viability Task 12 : Evaluate Environmental Aspects Task 13 : Select Solutions for Implementation"] S5["Step 5 : IMPLEMENTING WASTE MINIMISATION SOLUTIONS Task 14 : Prepare for implementation Task 15 : Implement Waste Minimisation Solutions Task 16 : Monitor & Evaluate Results"] S6["Step 6 : MAINTAINING WASTE MINIMISATION Task 17 : Sustain Waste Minimisation Solutions Task 18 : Identify & Select Wasteful Process Steps"] S1 -- "Selection of Waste Minimisation focus" --> S2 S2 -- "Listing of process waste sources" --> S3 S3 -- "Listing of Waste Minimisation Opportunities" --> S4 S4 -- "Listing of Waste Minimisation Solutions" --> S5 S5 -- "Successfully Implemented Waste Minimisation Solutions" --> S6 S6 -- "Feedback loop" --> S1 </pre>