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Solid waste Generation :-

- Solid waste generation refers to the production of unwanted or discarded materials from various human activities.
- The amount of solid waste generated is influenced by factors such as population growth, urbanisation, economic development and consumption pattern.
- Agricultural waste, construction and demolition waste, Disaster waste, Industrial waste, Muni Municipal solid waste etc are the examples of solid waste generation.

- Globally, solid waste generation rates are on the rise, with estimates suggesting that by 2050, the world could generate 3.40 billion tons of waste annually, up from 2.01 billion tons in 2016.

Sources of Solid waste :-

1) Residential waste :- waste generated from households including food scraps, packaging materials, paper, clothing and garden waste.

2) Industrial waste :- Solid waste which is generated from manufacturing and industrial processes, which can include scrap metals, chemicals, plastics and hazardous waste.

3) Agricultural waste :- wastes generated from farming activities, such as crop residues, straw, fruit-stones, peels, manure and pesticides containers.

4) Construction and demolition waste :- waste generated from the construction, reconstruction of building, roads and other infrastructure such as - concrete, wood, metals and debris.

5) Disaster waste:- waste generated from and arising due to a disaster like a natural disaster as earthquakes, floods, Tsunamis, cyclones, wildfires, winter storm and volcanoes or larger accidents caused by humans.

6) Municipal services:- waste from street cleaning, landscaping and public parks, including leaves, dirt, and litter.

characteristics of solid waste:-

The characteristics of solid waste ~~to~~ vary widely depending on the source and type of waste. key characteristics include:-

1) composition:- The constituents of the waste, such as organic material, paper, plastics, metals, glass and hazardous materials. The composition can affect the methods used for the waste management and recycling.

2) Density:- The mass per unit volume of waste, which impacts collection, transportation and disposal methods. waste with higher density is heavier and may require different handling method.

3) Moisture content:- The amount of water contained in the waste. which can influence the choice of treatment processes such as composting and incineration.

4) calorific value:- High calorific value waste is more suitable for incineration and energy recovery.

5) physical properties:- size, shape and texture of the waste particles, which can affect handling and processing techniques.

6) Biodegradability:- The ability of the waste to decompose naturally through biological processes. for eg- organic waste is biodegrade, which plastics are not.

7) Toxicity:- The presence of hazardous substances that can pose risks to human health and the environment.

Solids waste management rules 2016 :-

The solid waste management Rules, 2016 were notified by the Goverment of India on April 8, 2016 under the Environment (protection) Act 1986.
These rules replaced the municipal solid wastes (Management and Handling) Rules, 2000 and brought in comprehensive changes to address the growing concerns of solid waste management in urban and Rural areas :-

key features of these rules are :-

1) Scope and applicability :- The rules apply to all waste generators including residental, institutional, commercial and industrial entities across urban and rural areas.

2) Collection and Disposal :-
- urban local Bodies (ULBs) are responsible for ensuring door-to-door collection of segregated waste.
- ULBs should establish waste processing facilities, such as composting units and material recovery facilities, to manage segregated waste.

3. ULBs should integrate waste pickers and rag pickers into the formal waste management system, providing them with occupational safety and health safeguards.

4. penalties and Monitoring :-
- penalties can be imposed for non-compliance with the segregation, collection and processing requirements.
- State govt. and ULBs must monitor the implementation of the rules and submit annual reports on their progress.

5. promotion of waste-to-energy :-
The rules promote the establishment of waste-to-energy plants for the processing of non-recyclable dry waste.

6. Responsibilities of waste Generators :-
Bulk waste generators such as hotels, restaurants and event organizers must manage their own waste by segregating it and ensuring its proper processing.

7. prohibition of Burning :- open burning of waste is strictly prohibited under these rules.

These rules aim to improve the efficiency of solid waste management processes, enhance environmental sustainability, and ensure better public health outcomes.

E-waste generation :-
E-waste or electronic-waste refers to discarded electrical and electronic devices.

The generation of e-waste is a rapidly growing global issue due to the increasing use of electronics, the fast pace of technological advancements, and the corresponding reduction in the lifespan of electronic devices.
Globally, millions of tons of e-waste are generated annually, with significant contribution from both developed and developing countries.

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Sources of E-waste :-

1) Consumer electronics :- E-waste generated from items like televisions, computers, smartphones, tablets and gaming materials.

2) Household Appliances :- Refrigerators, washing machines, microwaves, AC and vacuum cleaner are E-waste.

3) IT and Telecommunication Equipment :- printers, servers, scanners, fax machines, modems and telephones.

4) Lighting :- fluorescent tubes, compact fluorescent lamps (CFLs) and LED lights.

5) Medical Devices :- Medical instrument such as monitors, MRI Machines and lab equipment.

6) Industrial electronics :- Tools, Machinery and monitoring and control instrument used in manufacturing and other industrial applications.

Characteristics of E-waste :-

1) Complex composition :- E-waste contains a mix of valuable materials (e.g. gold, silver, platinum, copper, aluminum and hazardous substances.

2) Toxicity :- Hazardous components in e-waste can pose significant health risks if not handled properly. for example- lead in cathode ray tubes (CRT) and mercury in flat-screen displays can cause serious health and environmental issues.

3) Non-Biodegradability :- Many components in e-waste, such as plastics and metals are non-biodegradable, leading to long-term environmental pollution if not properly recycled.

4) Rapid ~~decade~~ growing of e-waste:-
technological advancement and consumer demand for the latest contribute to the quick turn-over of electronic products, leading to a continuous increase in e-waste generation.

5) Improper disposal and recycling of e-waste can lead to the leaching of toxic substances into soil & water, affecting ecosystems and human health.

6) ~~Exposure~~ to hazardous substances in e-waste can cause respiratory issues, skin diseases, neurological damage and other serious health problems.

7) Resource intensity:- The production of electronic devices requires significant amounts of energy and raw-materials, making the recovery and recycling of e-waste critical to conserving resources.

E-waste management rules, 2016:-

The E-waste management Rules, 2016, notified by the Ministry of Environment, forest and climate change, Govt. of India come into effect on 1 Oct, 2016. These rules replaced the E-waste (Management and Handling) Rules 2011, and aimed to strengthen the regulatory framework for the management of electronic waste.

Key provisions of the E-waste management rules, 2016 are-

1) Scope and ~~Applicability~~ Applicability:- The rules apply to every producer, manufacturer, consumer, bulk consumer, collection centre, dealer and ~~recycler~~ recycler involved in the manufacture, sale, purchase, and processing of electronic equipment or component specified in the rules.

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2) Extended producer Responsibility:-

- producers are required to implement EPR, which includes setting up systems for the collection and channelization of e-waste, either individually or collectively. producer must obtain EPR authorization from the central pollution control Board (CPCB)
- producers ~~through~~ must ensure the proper recycling or disposal of e-waste by engaging with authorized dismantlers and recyclers.

3) Role of collection centres:-

Authorized collection centres are responsible for the proper collection, storage and channelization of e-waste to authorized dismantlers or recyclers.

4) public Awareness & Education:-

producers, either individually or collectively, must conduct public awareness campaigns to inform consumers about the hazards of e-waste and proper methods of disposal.

5) Compliance & Monitoring:-

SPCB and CPCB are responsible for monitoring and ensuring compliance with the rules. They must conduct inspection and take action against violators.

6) Non-compliance with the provisions of the rules can attract penalties under environment (protection) Act, 1986.

7) To reduce the use of hazardous substances in electrical and electrical equipment.

8) The e-waste management Rules, 2016 aim to create a structured and effective e-waste mangement system in India, promoting sustainability and minimizing the adverse environmental and health impacts of e-waste.

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plastic waste generation :-

plastic waste generation refers to the production of waste materials composed of synthetic or semi-synthetic organic compound that are discarded after use.
The global increase in plastic production and consumption has led to a significant rise in plastic waste. It is estimated that millions of tons of plastic wastes are generated annually world wide.

sources of plastic wastes :-

1) packing materials :- single use plastics such as bags, bottles, containers, wrappers and straw used in food and beverage industries, retail and e-commerce.

2) Consumer products :- Household items like toys, furniture, clothing and ~~toth~~ kitchen utensils.

3) Construction :- plastic used in pipes, insulation materials, flooring and fitting.

4) Electronics :- plastics components used in devices such as computers, smartphones and appliances.

5) Agriculture :- products such as plastic films, irrigation pipes and greenhouse covering.

6) Medical wastes :- Medical disposable like syringes, gloves, and packing for pharmaceuticals.

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characteristics of plastic waste :-

1) Durability :- plastics are highly durable and resistant to degradation, which contributes to their long lifespan and persistence in the environment.

2) Lightweight :- plastics are lightweight, which makes them convenien for transportation and use but also prone to being carried away by wind and water. leading to widespread pollution.

3) versatility :- plastics can be molded into various shapes and forms making them suitable for a wide range of application.

4) Non-Biodegradability :- Most plastics do not decomposes naturally and can persist in the environment for hundreds of years.

5) Chemical composition :- plastics are made from polymers that can contain various additives. including stabilisers, plasticisers and colorants. Some of which may be toxic.

6) ~~plastic waste~~ Environmental impact :-
plastics wastes contributes to land, water and air pollution. Microplastics, small plastics particles resulting from the breakdown of larger items, can contaminate water bodies and

7) Economic value :- Despite being waste, plastics can have economic value when recycled, as they can be reprocessed into new products.

8) plastics can leach harmful chemicals into the soil, affecting plant growth and entering the food chain.

9) Burning plastics waste releases toxic gases, contributing to air pollution and health issues.

key provisions of plastic waste Management Rules, 2016 :-

i) Reduction :- Minimizing the use of single use plastics and encouraging reusable alternatives.

ii) collection and segregation :- setting up efficient systems for the collection and segregation of plastic waste.

iii) Recycling :- Developing recycling infrastructure to reprocess plastic waste into new products, reducing the need for virgin plastic production.

iv) public awareness :- Educating the public about the importance of reducing plastic use and properly disposing of plastic waste.

v) Regulation & policy :- Implementing regulations to ban or restrict the use of certain types of certain types of plastics and promote sustainable alternatives.

vi) Extended producer Responsibility (EPR) :-
producer, importers and brand owners must establish a system to collect back the plastic waste generated by their products. They must submit an EPR plan detailing the collection and recycling processes to the State pollution control Boards (SPCB) or pollution control committees.

vii) Reduce plastic pollution and promote environmental sustainability by ensuring proper management of plastic-waste.

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Importance of Environment (protection) Act, 1986 :-

The Environment (protection) Act, 1986 is a significant piece of legislation in India, serving as a comprehensive framework for the protection and improvement of the environment.

i) The Act provides a unified and comprehensive legal framework for the protection and improvement of the environment. It addresses all environmental issues and gives the central govt. wide powers to regulate and control pollution and environmental degradation.

ii) The Acts helps in preempting environmental damage.

iii) The Act includes provisions to regulate the handling, storage and disposal of hazardous substance, ensuring that these materials do not pose a threat to public health or the environment.

iv) The regulation of industrial processes to control pollution. This includes the power to close down or prohibit operation of industries violating environmental standards.

v) It encourage public participation in environmental protection and promoting environmental education and awareness.

vi) The Act empowers authorities to take legal action against individual or organisation violating environmental regulations.

vii) It promotes research and the development of technologies and methods for preventing pollution and improving environmental quality.

public Health and Safety:-
By controlling pollution and managing hazardous substances, the Act contributes significantly to protecting public health and ensuring a safe and healthy environment for present and future generations.
The Environment (protection) Act 1986, thus plays a crucial role in safeguarding India's environmental resources, promoting sustainable development.