



Summer-17 EXAMINATION
Model Answer

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Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based one equivalent concept.



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	plant. <ul style="list-style-type: none">Oil: oil from industrial equipment, crude oil tankers.	
c)	<p>Pollutants from urea plant</p> <ul style="list-style-type: none">Oil and greaseAmmoniaFluoridesPhosphateNaOHUrea <p>From above pollutants urea and ammonia are causing serious health effects of human.</p> <ol style="list-style-type: none">Urea can be irritating to skin, eyes, and the respiratory tract. Repeated or prolonged contact with urea in fertilizer form on the skin may cause dermatitis.The substance decomposes on heating above melting point, producing toxic gases, and reacts violently with strong oxidants, nitrites, inorganic chlorides, chlorites and perchlorates, causing fire and explosion.Ammonia is irritating and corrosive. Exposure to high concentrations of ammonia in air causes immediate burning of the nose, throat and respiratory tract. This can cause bronchiolar and alveolar edema, and airway destruction resulting in respiratory distress or failure.	2 mark each for any two pollutant with effect
d)	<p>Solid waste: Solid waste means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources.</p>	1



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Classification of solid waste		3
Types	Example of sources	
Food wastes	Animal, fruits and vegetable residues resulting from the handling and preparation, cooking and eating of foods	
Rubbish	1. combustible papers, plastics, leather, cardboard, wood, rubber etc. 2. Non-combustible glass, aluminium cans, crockery, tin cans, dirt, construction wastes.	
Ashes and residue	Material remaining from the burning of wood, coal, and coke and other combustible wastes in homes, stores, industrial and municipal facilities for the purpose of heating and cooking	
Demolition and construction waste	Wastes from construction, remoulding, repairing of residential, commercial and industrial buildings	
Special waste	1. street sweepings. 2. road side litter from municipal litter containers. 3. Dead animals	
Treatment plant waste	From water, waste water and industrial waste treatment plants	
Hazardous wastes	Chemical Biological Flammable explosive	

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	Agricultural wastes	Planting Harvesting of crops, fields etc.	
1B	Attempt any one		6
a)	<p>Air pollution control by wet scrubber</p> <p>The term wet scrubber describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.</p> <p>A venturi scrubber is designed to effectively use the energy from the inlet gas stream to atomize the liquid being used to scrub the gas stream. This type of technology is a part of the group of air pollution controls collectively referred to as wet scrubbers.</p> <p>A venturi scrubber consists of three sections: a converging section, a throat section, and a diverging section. The inlet gas stream enters the converging section and, as the area decreases, gas velocity increases (in accordance with the Bernoulli equation). Liquid is introduced either at the throat or at the entrance to the converging section.</p> <p>The inlet gas, forced to move at extremely high velocities in the small throat section, shears the liquid from its walls, producing an enormous number of very tiny droplets.</p> <p>Particle and gas removal occur in the throat section as the inlet gas stream mixes with the fog of tiny liquid droplets. The inlet stream then exits through the diverging section, where it is forced to slow down.</p> <p>Venturis can be used to collect both particulate and gaseous pollutants, but they are more effective in removing particles than gaseous pollutants.</p>		4



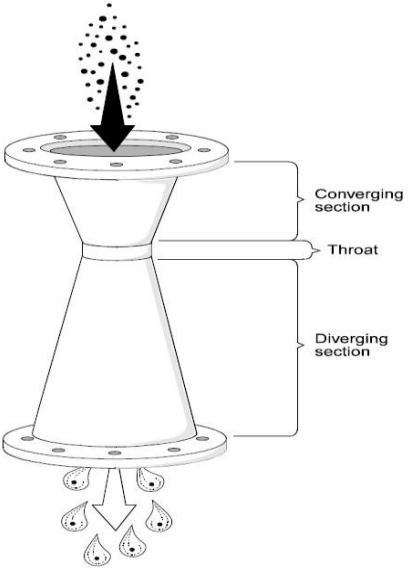
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	<p>Venturi scrubbers can have the highest particle collection efficiencies (especially for very small particles) of any wet scrubbing system.</p> <p>They are the most widely used scrubbers because their open construction enables them to remove most particles without plugging or scaling. Venturis can also be used to absorb pollutant gases; however, they are not as efficient for this as are packed or plate towers.</p>  <p>The diagram shows a Venturi scrubber with three main sections: a top wide 'Converging section', a narrow middle 'Throat', and a bottom wide 'Diverging section'. Air with particles enters from the top, is forced through the throat where it is captured by water droplets, and then exits from the bottom. Labels on the right side identify the 'Converging section', 'Throat', and 'Diverging section'.</p>	<p>2</p>
<p>b)</p>	<p>3R principle</p> <p>Reuse: In today's world use and through materials is increasing and hence solid waste. Instead of throwing that material or item if it is used again, energy and environment can be saved. Solid waste generation also will be reduced. In industry various boxes, cans, pallets etc are used for material handling. These can be used again for same purpose. e.g. Catalyst drums can be used again to fill catalyst.</p> <p>Recycle : Recycling is a process to change materials (waste) into new products to prevent waste of potentially useful materials, reduce the consumption of</p>	<p>2</p>



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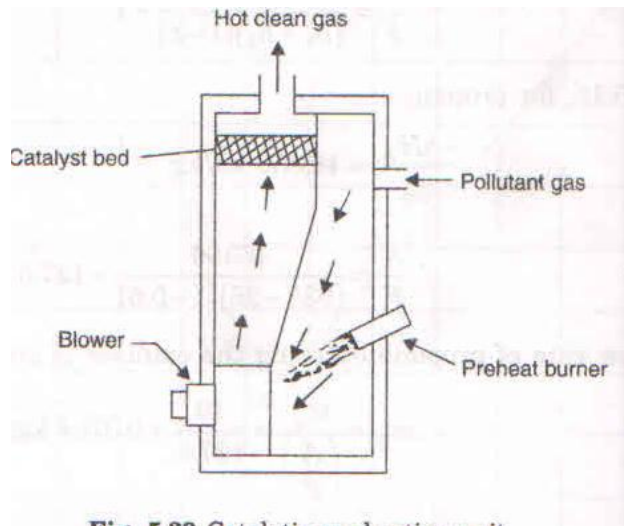
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	<p>fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling) by reducing the need for "conventional" waste disposal, and lower greenhouse gas emissions as compared to plastic production. Recycling is a key component of modern waste reduction and is the third component of the "Reduce, Reuse, and Recycle" waste hierarchy. Recyclable materials include many kinds of glass, paper, metal, plastic, textiles, and electronics. In the strictest sense, recycling of a material would produce a fresh supply of the same material-for example, used office paper would be converted into new office paper, or used foamed polystyrene into new polystyrene.</p> <p>e.g. Plastic water bottles can be recycled to get plastic again.</p> <p>Reduce: When you avoid making garbage in the first place, you don't have to worry about disposing of waste or recycling it later. Changing your habits is the key - think about ways you can reduce your waste when you shop, work and play. There's a ton of ways for you to reduce waste, save yourself some time and money, and be good to the Earth at the same time. Buy products in bulk. Larger, economy-size products or ones in concentrated form use less packaging and usually cost less per ounce.</p> <p>e.g. Unnecessary use of plastic and paper can be avoided in packing.</p>	2
2	Attempt any four	16
a)	<p>Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials.</p> <p>Catalytic Incinerator</p>	1 3



b)

Ground Water Pollution

Groundwater pollution (also called groundwater contamination) occurs when pollutants are released to the ground and make their way down into groundwater. It can also occur naturally due to the presence of a minor and unwanted constituent, contaminant or impurity in the groundwater, in which case it is more likely referred to as contamination rather than pollution.

Sources of contamination in ground water:

- i) Domestic wastes
- ii) Industrial wastes
- iii) Agricultural wastes
- iv) Run-off from urban areas
- v) Soluble effluents

Sea Pollution:

The seas and oceans receive the brunt of human waste, whether it is by deliberate dumping or by natural run-off from the land. In fact over 80% of all

2

2

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	<p>marine pollution comes from land-based activities and many pollutants are deposited in estuaries and coastal waters. Here the pollutants enter marine food chains, building up their concentrations until they reach toxic levels. It often takes human casualties to alert us to pollution and such was the case in Minimata Bay in Japan when many people died as a result of a pollutant building up in food chains. A factory was discharging waste containing methyl mercury in low concentrations into the sea and as this pollutant passed through food chains it became more concentrated in the tissues of marine organisms until it reached toxic levels. Black tar-like oil is sometimes washed onto beaches not only causing a nuisance to holidaymakers but also killing many sea-birds. The oil mainly comes from tankers which wash out their holds while out at sea to save time in port</p>	
c)	<p>Waste water classification</p> <p>Industrial waste water Municipal sewage wastewater Agricultural waste water</p> <p>Physical Characteristics of waste water: i) Temperature ii) Odor iii) Color iv) Total dissolved solids v) Turbidity</p> <p>Chemical Characteristics of waste water: i) Chemical oxygen demand(COD) ii) pH iii) Acidity or alkalinity iv) hardness v) Total carbon vi) Chlorine demand</p>	<p>1</p> <p>1.5</p> <p>1.5</p>
d)	<p>Methods for collecting solid waste</p> <p>Communal storage point:- Waste is collected in concrete bins located at one point. Daily it is transferred to deposal area by vehicle.</p> <p>Block collection:- in block collection the waste is brought in a container by individuals to a waiting vehicle which travels a regular route twice or thrice a</p>	<p>1 mark each</p>



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	<p>week. The containers are emptied by the vehicle crew and returned to the individuals.</p> <p>Kerbside collection:- In this method waste is brought in containers and placed on the footway in advance of the collection time to be retrieved latter.</p> <p>Ghanta Gadi: - In this method vehicle is coming near the building by sounding bail. Peoples are transferring waste from their house to ghantagadi.</p>	
e)	<p>The necessity of environmental audit for any chemical plant:</p> <p>i) It helps in assessing whether the existing environmental practices being followed are satisfactory and whether the environmental protection regulations are complied with.</p> <p>ii) It provides an opportunity for comprehensive review of environmental policies, management systems, organizations and practices and to assess whether introduction of new innovative practices are necessary to comply with the stringent regulations from time to time.</p> <p>iii) It protects against possible penalties or regulatory risk.</p> <p>iv) It contributes its modest share towards sustainable development and gives due credit for environmental management.</p> <p>v) It provides an up to date environmental data base which may be useful in emergencies and also while making decision on plant modifications.</p>	04 1 mark each for any four
3	Attempt any four	16
a)	<p>Working principle of fabric filter</p> <p>Dust-laden gas or air enters the fabric filter through hoppers (large funnel-shaped containers used for storing and dispensing particulate) and is directed into the fabric filter compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it.</p>	02



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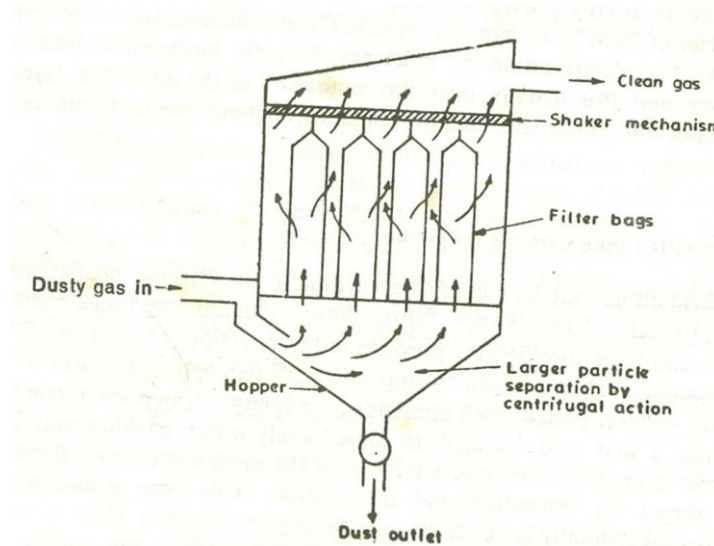
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When sufficient pressure drop (ΔP) occurs, the cleaning process begins. Cleaning can take place while the fabric filter is online (filtering) or is offline (in isolation).



02

b) Effect of air pollution on human health:

1) **Sulfur dioxide (SO₂) :**

i) SO₂ is an irritant gas which can easily get oxidized to sulfur trioxide and in the presence of water, these can form sulfurous and sulfuric acid

ii) The health problems related to the mucous membrane and respiratory tract are due to sulfate aerosols.

iii) Chronic effects of SO₂ include increased probabilities of bronchitis, "colds" of long duration and suppression of immune system.

2) **Hydrocarbons :**

iv) The health effects of hydrocarbons have been noted in occupational exposures to tetra methyl lead, benzene, etc.

v) Inhaling formaldehyde can cause irritation.

04



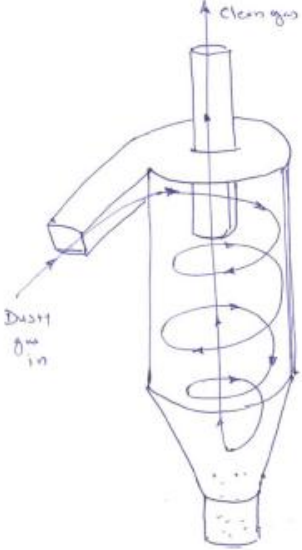
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	<p>Sprinkler : To sprinkle waste water on filter Filter: To hold biological slime Feed pipe : Inlet for waste water Filter support: To hold filter media Effluent channel: to take out treated waste water</p>	
d)	<p>Working of cyclone separator</p> <p>A dust laden gas enters in a cyclone separator takes spiral motion. It utilizes a centrifugal force generated by spinning gas stream to separate particle matter from the gas. The centrifugal force on a particles in spinning gas stream is much greater than gravity, there for it is effective in removing small particles. The gas spirals downwards to the bottom of the cone and at, and at the bottom the gas flow reverses to form an inner vortex which leaves through the outlet pipe. Cyclone separator is used to separate gas-solid, gas-liquid in Cement industry ,Oil refinery, Petrochemical Plant, Power plants, and Metallurgical Industry etc.</p> 	02



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e)	<p>Role of pollution control board :-</p> <ol style="list-style-type: none">1. To promote cleanliness of streams and wells in different areas of the States through prevention, control and abatement of water pollution;2. To improve the quality of air and to prevent, control or abate air pollution in the country;3. Advise the Government on any matter concerning prevention and control of water and air pollution and improvement of the quality of air;4. Plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water and air pollution;5. Plan and organise training of persons engaged in programmes for prevention, control or abatement of water and air pollution;6. Organise through mass media, a comprehensive mass awareness programme on prevention, control or abatement of water and air pollution;7. Collect, compile and publish technical and statistical data relating to water and air pollution and the measures devised for their effective prevention, control and abatement;8. Prepare manuals, codes and guidelines relating to treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts;9. Disseminate information in respect of matters relating to water and air pollution and their prevention and control;10. Lay down, modify or annul, in consultation with the State Government concerned, the standards for stream or well, and lay down standards for quality of air;11. Establish or recognize laboratories to enable the Board to perform;12. Perform such other functions as and when prescribed by the	04 1 mark each for any four
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	<p>Government of India.</p> <p>13. To issue directions to any industry, local bodies, or other authority for violation of the notified general emission and effluent standards, and rules relating to hazardous waste, bio-medical waste, hazardous chemicals, industrial solid waste, municipal solid waste including plastic waste under the Environment (Protection) Rules, 1986.</p>	
f)	<p>Preliminary treatment consists of screening , comminuting and grit removal.</p> <p>Large quantities of floating rubbish such as cans, cloth, and wood and other larger objects present in waste water are usually removed by metalbars, acting like strainers as the waste water moves beneath them in an open channel.</p> <p>Removal of gross solids is generally accomplished by passing wastewater through mixed or moving screens. The modern mechanical screens cum filters include rotary, self-cleaning, gravity type units and circular overhead fed vibratory units which are effective in reducing the suspended solid and BOD.</p> <p>Grit is removed in the early stages of treatment in grit channels or tanks. Grit, being heavier than organic solids, can be separated from organic solids by careful regulation of the flow velocity in the grit tanks.</p> <p>If the waste water contains appreciable quantities of oil and grease, then it is advisable to remove as much of these as possible, in the preliminary treatment itself to avoid adverse effects on the rest of plant.</p> <p>Primary Treatment</p> <p>The objective of primary treatment is the removal of settleable organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming. Approximately 25 to 50% of the incoming biochemical oxygen demand (BOD₅), 50 to 70% of the total suspended solids (SS), and</p>	2
		2



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	<p>65% of the oil and grease are removed during primary treatment. Some organic nitrogen, organic phosphorus, and heavy metals associated with solids are also removed during primary sedimentation but colloidal and dissolved constituents are not affected.</p> <p>The primary method include:</p> <ol style="list-style-type: none">1. Screening2. Comminuting3. Grit removal4. Sedimentation	
4 A	Attempt any three	12
a)	<p>Activated sludge process</p> <p>Principle - a biological wastewater treatment process which speeds up waste decomposition. Activated sludge is added to wastewater, and the mixture is aerated and agitated. After a certain amount of time, the activated sludge is allowed to settle out by sedimentation and is disposed of (wasted) or reused (returned to the aeration tank)</p> <p>Working</p> <p>A basic activated sludge process consists of several interrelated components:</p> <ul style="list-style-type: none">• An aeration tank where the biological reactions occur• An aeration source that provides oxygen and mixing• A tank, known as the clarifier, where the solids settle and are separated from treated wastewater• A means of collecting the solids either to return them to the aeration tank, (return activated sludge [RAS]), or to remove them from the process (waste activated sludge [WAS]). <p>Aerobic bacteria thrive as they travel through the aeration tank. They</p>	2



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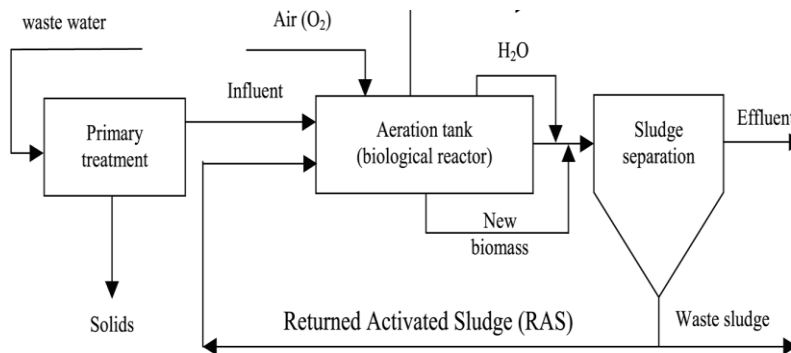
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multiply rapidly with sufficient food and oxygen. By the time the waste reaches the end of the tank (between four to eight hours), the bacteria has used most of the organic matter to produce new cells. The organisms settle to the bottom of the clarifier tank, separating from the clearer water. This sludge is pumped back to the aeration tank where it is mixed with the incoming wastewater or removed from the system as excess, a process called wasting. The relatively clear liquid above the sludge, the supernatant, is sent on for further treatment as required



2

b)

Sludge Thickening

The sludge thickening involves removal of water from the sludge and reduces sludge volume as much as possible so that the sludge can be handled more efficiently. The common method for thickening is gravity settling.

Working of gravity thickener: In gravity thickener the sludge is subjected to gentle agitation by means of a slow stirrer which enhances settling. The stirring action serves to release trapped water and gases from the sludge, allowing it to become denser or thicker. The thickened underflow of sludge is withdrawn from the bottom of the tank; the effluent or supernatant overflows a weir and is pumped back to the inlet of the treatment plant. . In this manner the combined sludge from primary and secondary settlers can be thickened so

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	as to contain 5-9% solids.	
c)	<p>Sources of air pollution :</p> <p>i) Natural sources: The natural sources of air pollution are volcanic eruptions releasing poisonous gases such as SO₂, H₂s and CO etc. forest fires, natural organic and inorganic decays marsh gases, deflation of sand and dust, extra-terrestrial bodies, cosmic dust, pollen grains of flowers, soil debris, comets and fungal spores.</p> <p>Manmade sources such as</p> <p>ii) Rapid Industrialization: The industries such as pulp and paper, chemical, petroleum refineries, mining iron and steel works are responsible for nearly 20% of air pollution.</p> <p>iii) Transportation: Automobile exhaust release smoke and to a little extent leads particles. The chief sources from automobiles are a) exhaust system b) fuel tank c) Carburetor, d) crank case.</p> <p>iv) Burning of fossil fuel and fires: The conventional sources of energy are wood, coal and fossil fuels. The byproducts of burning of fossil fuel, wood, and coal are nothing but poisonous gases such as CO, CH₄, SO₂, NO etc.</p> <p>v) Deforestation: The deforestation by man for his own needs has disturbed the balance of O₂ and CO₂ in atmosphere.</p> <p>v) Increase in population: An increase in population leads to global warming and emission of greenhouse gases.</p> <p>vi) Agricultural activities: Various biocides used for agricultural purposes cause air pollution as it poisonous substances are carried away by wind.</p> <p>vi) Solid waste disposal : Backyard burning and open burning of heaps of solid wastes results in the emission of smoke and pollutants like NO, CO, CO₂ etc</p>	2



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	<p>vii) Radioactive fallout: Nuclear reactions, nuclear weapon testing, chemical processing plants, hospitals, research laboratories contribute radio nuclides into air.</p> <p>viii) Construction activities: During construction activity various pollutants are emitted into the atmosphere.</p>	
d)	<p>Business Benefits of ISO14000:</p> <ol style="list-style-type: none">1. Efficiency, discipline and operational integration with ISO 90002. Greater employee involvement in business operations with a more motivated workforce3. Easier to obtain operational permits and authorizations4. Assists in developing and transferring technology within the company5. Helps reduce pollution6. Fewer operating costs7. Savings from safer workplace conditions8. Reduction of costs associated with emissions, discharges, waste handling, transport & disposal9. Improvements in the product as a result of process changes10. Safer products11. Minimizes hazardous and non-hazardous waste12. Conserves natural resources - electricity, gas, space and water with resultant cost savings13. Prevents pollution and reduces wastage14. Demonstrates to customers that the firm has met environmental expectations.15. Meets potential national and international government purchasing requirements.	<p>½ mark each for any 8</p>



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	<p>16. Delivers profits from marketing "green" products</p> <p>17. Provides a competitive marketing tool</p> <p>18. Improves international competitiveness</p> <p>19. Improves the organization's relationship with insurance companies</p> <p>20. Elimination of costs associated with conformance to conflicting national standards</p> <p>21. Process cost savings by reduction of material and energy input</p> <p>22. Satisfying investor / shareholder criteria</p> <p>23. Helps reduce liability and risk</p> <p>24. Improved access to capital</p>	
4B	Attempt any one	6
a)	<p>Environmental Problems due to black liquor in pulp and paper industry:</p> <p>i) The spent cooking liquor commonly called black liquor is treated to recover its chemical content for reuse and its organic content as heat.</p> <p>ii) The dark color of the effluent is due to the lining compounds which are not easily biodegradable and hence it imparts persistent color to the receiving water streams and inhibits photosynthesis and other natural self-purification process of the water streams.</p> <p>iii) The immediate oxygen demand of the effluent brings about depletion of oxygen of the receiving stream create adverse effects to aquatic life.</p> <p>iv) The chemicals present in the effluent, e.g. sulfites, phenols, free chlorine, methyl mercaptant are harmful to fauna and flora of the receiving water.</p> <p>v) The settle able materials present may sink to the bottom and interfere with aquatic life.</p>	<p>02 mark each for any three points</p>
b)	<p>Environment Audit Procedure:</p> <p>The general approach followed for environmental audit overs three main</p>	



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	<p>phases, namely collection of information, evaluation of information collected and formulation of conclusions, including identification of aspects needing improvement. These phases cover pre audit preparation, a site visit normally involving interviews with personnel and inspection of facilities and post-visit activities.</p> <p>Environmental Audit procedure involve following activities viz., the pre-audit, at site and post-audit phases.</p> <p>Pre Audit Activities: The activities in the pre audit phase cover the nomination of the audit team, setting out of terms of reference and priorities, making all concerned aware of the objectives and scope of environmental audit and preparation of a background note.</p> <p>On site Audit Activities: In the on site phase, it is ensured the audit team and interact staff interact throughout, a thorough inspection is made in the field, sampling and tests are made as necessary, relevant records are reviewed, various persons are interviewed and tentative findings are discussed with the management.</p> <p>Post Audit Activities: In the post audit phase, the draft report is circulated for review and comments based on which the final report is prepared, and action plan is evolved. The feedback from the follow up action is provided for the next audit.</p>	02 02 02
5	Attempt any four	16
a)	High Volume Sample	2



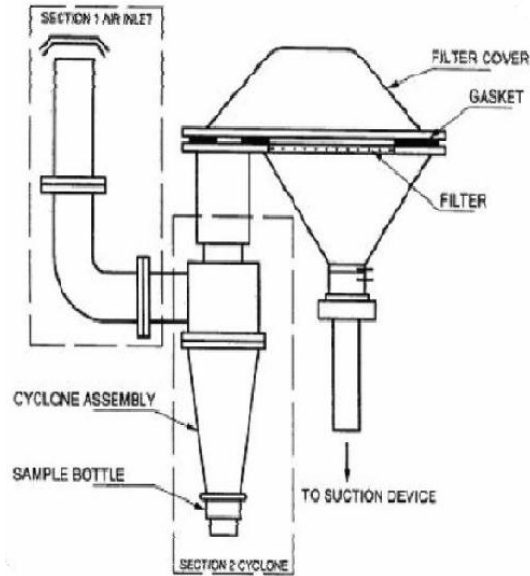
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The sampler uses a continuous duty blower to suck in an air stream. When fitted with a particle size classifier, it separates particles greater than $10\mu\text{m}$ size from the air stream. The air stream is then passed through a filter paper to collect particles lesser than $10\mu\text{m}$ size (PM10). Gravimetric measurements yield values of suspended particulate matter (SPM), as the sum of the two fractions, and PM 10, the material retained on the filter paper. The sampler can also be used to sample gaseous pollutants. A stream of unfiltered air is bubbled through a reagent, which either reacts chemically with the gas of interest or into which the gas is dissolved. Wet chemical techniques are then used to measure the concentration of the gas.

b)

Sources of biomedical waste

- Hospital
- Pathological labs
- Research centers

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	<p>The classification of medical waste:</p> <ol style="list-style-type: none"> i. General waste ii. Sharps iii. Culture and stocks of infectious agents and associated biological iv. Bulk human blood and blood products v. Pathological wastes vi. Isolation wastes vii. Animal wastes viii. Radio-active wastes ix. Antineo plastic drugs x. Chemical waste <p>Biomedical waste handling</p> <p>It is handled in four steps</p> <ol style="list-style-type: none"> 1. Categorization of waste : General waste, Sharps, Culture an stocks of infectious agents and associated biological, Bulk human blood and blood products, Pathological wastes 2. Color coding to container of waste categories with multiple treatment options 3. Label for Bio-Medical Waste Containers/Bags 4. Label for transport of Bio-Medical Waste Containers/Bags 	2																				
c)	<p>Drinking water quality standards specified by WHO</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">Sr. No.</th> <th style="width: 35%;">constituent</th> <th style="width: 25%;">Recommended max. concentration in mg/l</th> <th style="width: 35%;">Max. permissible concentration in mg/l</th> </tr> </thead> <tbody> <tr> <td></td> <td>Physical:</td> <td></td> <td></td> </tr> <tr> <td>1</td> <td>Turbidity(units)</td> <td>5</td> <td>25</td> </tr> <tr> <td>2</td> <td>Color(units)</td> <td>5</td> <td>50</td> </tr> <tr> <td></td> <td>Chemical</td> <td></td> <td></td> </tr> </tbody> </table>	Sr. No.	constituent	Recommended max. concentration in mg/l	Max. permissible concentration in mg/l		Physical:			1	Turbidity(units)	5	25	2	Color(units)	5	50		Chemical			1 mark each for any four points
Sr. No.	constituent	Recommended max. concentration in mg/l	Max. permissible concentration in mg/l																			
	Physical:																					
1	Turbidity(units)	5	25																			
2	Color(units)	5	50																			
	Chemical																					

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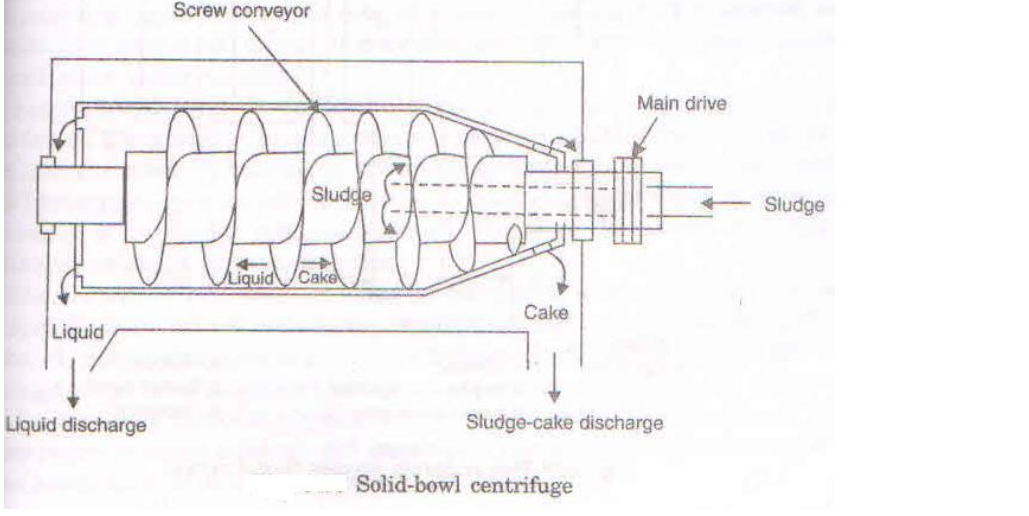
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	3	pH, units	7-8.5	6.5 or 9.2	
	4	Total solids	500	1500	
	5	Calcium	75	200	
	6	Magnesium	50	150	
	7	Iron	0.3	1.0	
	8	Copper	1.0	1.5	
	9	Sulphate	200	400	
	10	Phenols	0.001	0.002	
		Toxic			
	11	Arsenic	-	0.2	
	12	Chromium	-	0.05	
	13	Cyanide	-	0.01	
	14	Lead	-	0.1	
d)	Need of ISO14001: i) Environmental improvements ii) Regulatory compliance iii) Improvement of corporate image iv) Cost containment & cost saving v) Competitive advantage vi) Opening of international market & partners vii) Improvement in employee awareness about environment viii) An ethical or social commitment				1 mark each for any four
e)	Sludge dewatering and disposal is accomplished by mechanical methods, the most common being centrifugation and filtration, which includes pressure filtration and vacuum filtration. In centrifugation, conditioned sludge is added to a rotating bowl that separates the sludge into a cake and a dilute stream. The solid cake is transported within the bowl and is removed by a screw conveyor at one end of the bowl the liquid is removed at the opposite end. Centrifugation is a compact method which requires careful control of process variables.				02 Mark



		2
6	Attempt any four	
a)	<p>Cyclone Scrubber</p> <p>Cyclone scrubber is the high energy scrubber, and has cyclone means of breaking up the scrubbing liquid into small droplets and simultaneously creating turbulence. It has internal rotating mechanical part, where the liquid dispersion contact is achieved by the simultaneous introduction of the liquid medium and the gas stream. The scrubbing liquid dribbles down on the rotating part and its stuck violently and disintegrated into fines droplets that are thrown readily by the centrifugal force and are removed quite easily. These scrubbers have a high initial cost, high operating cost and require considerable maintenance. The quantities of water required and wasted also are very high.</p>	2



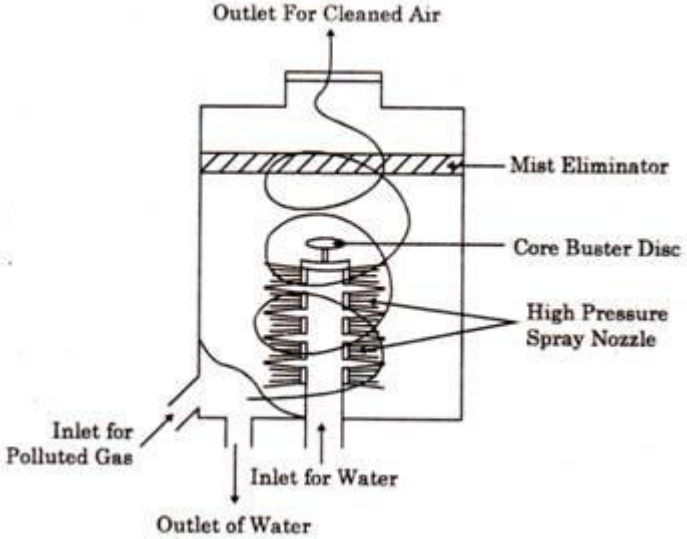
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		2
b)	<p>Electrostatic Precipitator</p> <p>Working: The most basic precipitator contains a row of thin vertical wires, and followed by a stack of large flat metal plates oriented vertically, with the plates typically spaced about 1 cm to 18 cm apart, depending on the application. In cylindrical design a wire is hanged with weight inside a cylinder.</p> <p>The air or gas stream flows horizontally through the spaces between the wires, and then passes through the stack of plates. A negative voltage of several thousand volts is applied between wire and plate. If the applied voltage is high enough an electric (corona) discharge ionizes the gas around the electrodes. Negative ions flow to the plates and charge the gas flow particles. The ionized particles, following the negative electric field created by the power supply, move to the grounded plates.</p> <p>Advantages:</p> <ol style="list-style-type: none">1. It can collect very fine particles which can not be collected in other equipments.	



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	<p>2. It can collect particles in both dry and wet form.</p> <p>Disadvantages:</p> <ol style="list-style-type: none">1. It operated at very high voltage hence safeguard is required.2. It requires trained personal to handle it.	
c)	<p>BOD and COD</p> <p>BOD: - It is the amount of oxygen required to degrade organic waste present in water by purely biological means.</p> <p>The biological oxygen demand, ie, BOD in wastewater, is a measure of the quantity of bio-organic substances in wastewater. These can be in the form of fat, oils, carbohydrates and proteins. BOD also helps to determine the quantum of organic chemicals contained in wastewater that are synthetic and biodegradable.</p> <p>COD: - It is the amount of oxygen required to degrade organic waste present in water by purely chemical means.</p> <p>COD can help gauge the quantum of both biodegradable and nonbiodegradable organics. It is quick method to determine strength of waste in water.</p>	<p>02</p> <p>02</p>
d)	<p>Pollution control in ammonia plant</p> <ul style="list-style-type: none">• One source of pollution is the sulfur dioxide, resulting from the combustion of coke, oil products or natural gas, when desulfurization is not sufficient. Since it is catalyst poison, careful desulfurization is required.• The main constituents from ammonia plant are carbon particle, oil droplets, and hydrogen sulphide and nitrogen wash tail gases.• Vacuum filtration of carbon slurry has resulted complete recovery of carbon. The carbon obtained is the dried and send to other applications like paint, printing ink and rubber industries. The carbon cake is obtained from	<p>4</p>



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	<p>the filter.</p> <ul style="list-style-type: none">• The oil separators are used like coke as an adsorbent to reduce oil content upto 10 mg/L.• The hydrogen sulphide is removed and burnt. The SO₂ obtained used to manufacture sulphuric acid.• The nitrogen is used in the purification step to remove carbon monoxide and to recover the heat content of tail gases.• The main water pollutants, resulting from ammonia production are the heated water effluents, and diluted ammonia-containing waters. Organic compound could also be present. The latter is a result of condensation.• The solution of these problems is in the secondary use of the heated effluents for heat utilization. Ammonia could be stripped by steam, or used directly as fertilizer.	
e)	<p>Methods used for Wastewater sampling are, i) grab sampling ii) composite sampling.</p> <p>Grab sampling is just what it sounds like; all of the test material is collected at one time. As such, a grab sample reflects performance only at the point in time that the sample was collected, and then only if the sample was properly collected.</p> <p>OR</p> <p>Composite sampling consists of a collection of numerous individual discrete samples taken at regular intervals over a period of time, usually 24 hours. The material being sampled is collected in a common container over the sampling period. The analysis of this material, collected over a period of time, will therefore represent the average performance of a wastewater treatment plant during the collection period.</p>	<p>2</p> <p>2</p>



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	<p>When wastewater flow and composition are relatively uniform grab samples of a fixed volume can be manually taken at given time intervals and composite sample obtained. If the flow rate varies the volume of the grab sample collected is proportional to the flow.</p>	
f)	<p>Wealth from waste</p> <p>Waste, currently viewed as a menace, can soon be a resource for micro-enterprise development at a large scale. Such an intervention has a two-fold objective of:</p> <p>Reduction of pressure induced by waste on the environment. Creation of opportunities for income and employment generation.</p> <p>Waste contains paper, metal, glass, bio degradable material and plastic. If it is properly segregated or collected at source it could be source of wealth.</p> <p>Possible ways by which income can be generated are</p> <ol style="list-style-type: none">1. Recycling of paper2. Recovery of precious metals from e-waste3. Making of RDF from plastic waste4. Electricity generation from combustible waste5. Organic fertilizer from bio degradable waste6. Bio gas production from leftover food and vegetable.7. Recycling of plastic	4