

ANNEXURE - I



SRM VALLIAMMAI ENGINEERING COLLEGE
 (An Autonomous Institution)
 SRM NAGAR, KATTANKULATHUR – 603 203



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No. of Pages used	20	In words	twenty.				

All particulars given above by me are verified and found to be correct.

Signature of the student with date *N.Sivakumar / 4/2/22*

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Part - A			Part - B							Total
Question No.	✓	Marks	Question No.	✓	Marks					
1.	✓		11.	a	I	II	III			
2.	✓			b	✓					
3.	✓		12.	a	✓					
4.	✓			b						
5.	✓		13.	a	✓					
6.	✓			b						
7.	✓		14.	a	✓					
8.	✓			b						
9.	✓		15.	a	✓					
10.	✓			b						
Part - C										
Total			16	a	-✓	I	ii	iii	Total	
				b						
Grand Total										

Grand Total (in words):

Date :

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Of the Chairman / Vice Chairman

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Part - A.1. Primary air pollutants:

These pollutants are emitted directly from the source.

e.g.: particulate matter.

sulphur compounds.

carbon monoxide.

Secondary air pollutant:

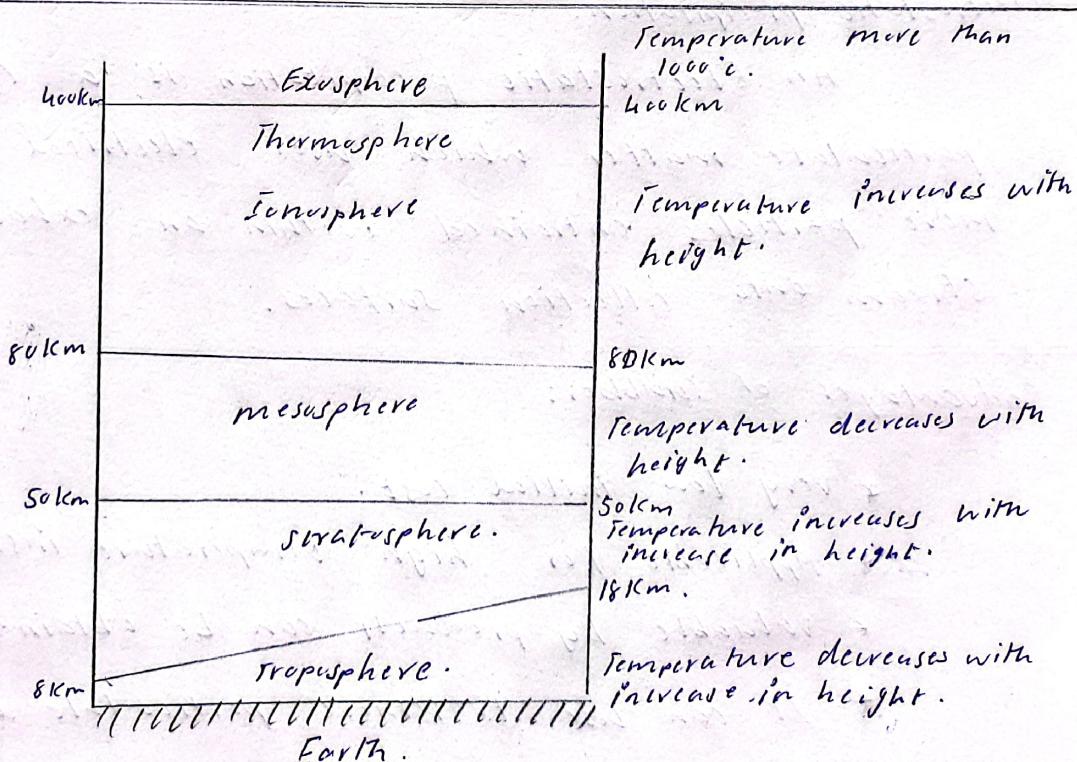
These pollutants are occurred due to the reaction between 2 or more primary air pollutant.

e.g.: ozone.

photochemical smog.

Formaldehyde.

2.



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3.

windrose diagram:

A windrose diagram is a tool which graphically displays wind speed & direction at particular location over a period of time.

Types:

- * compass type.

- * Free type.

4.

Types of plume:

- * Fanning plume.

- * looping plume.

- * neutral plume.

- * lofting plume.

- * fumigating plume.

- * Trapping plume.

5.

electrostatic precipitation:

An Electrostatic precipitation is a control of particulate matter which uses electrical forces to move particles entrained within an exhaust stream onto collection surfaces.

6.

advantages of scrubber:

- * very low initial cost.

- * Applicable for high temperature installation.

- * valuable by-products can be obtained.

- * It can be used to remove particulate & gaseous.

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7. Control equipment for removing gaseous pollutants:

- * Scrubbers.
- * Air filters.
- * By Electrostatic precipitators.

~~Furnaces~~ catalytic reactors.

- * Bi-filters.

8. ^b Adsorption		Adsorption.
* It is a bulk phenomenon.		* It is a surface phenomenon.
* It occurs at uniform reaction rate.		* rate of reaction slowly increases & finally attains equilibrium.
* The temperature does not affect the absorption.		* Adsorption occurs at a lower temperature.
* It is an endothermic process.		* It is an exothermic process.

9. Indoor air pollutant:

These pollutants arise from the use of open fires, unsafe fuels or combustion of biomass fuels, coals & kerosenes Gas stoves or badly installed wooden burning units, with poor ventilation & maintenance can increase indoor levels of carbon monoxide causing indoor pollutant. Indoor air pollution is dust, dirt or gases in the air inside buildings that could be harmful to breathe in.

10.

Noise sources:

- * Construction site.
- * Natural disaster.
- * Industrial units.
- * Aircraft noise.
- * Road traffic noise.

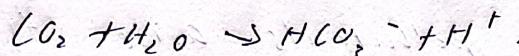
Part-B.

11.

b) Acid rain:

The pH of normal rain water is slightly acidic due to concentration of CO_2 dissolved as rainwater trickles down atmosphere.

Acid rain is defined as concentration of pH is unusually lower than 5.7.

Causes:

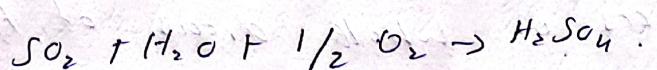
The principal natural phenomena that contribute acid producing gases to the atmosphere are emission from volcanoes & those from biological process that occur on land & in oceans.

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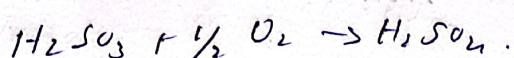
The major biological source of sulfur containing compounds dimethyl sulfide.

The principal cause of acid rain is sulfuric compounds from human sources such as electricity generation, factories & motor vehicles. Coal power plants are one of the most polluting. These gases can travel hundreds of km in the atmosphere before they are converted to acids & deposited. Factories used to have short funnels to let out smoke but this caused many problems. So now factories longer smoke funnels.

In the atmosphere, Sulphur dioxide combines with water vapour to form hydrogen sulfite gas.



Next hydrogen sulfite reacts with oxygen to form sulphuric acid.



Effects:

Both the lower pH & higher aluminium concentration in surface water that occurs as a result of acid rain can damage to fish & aquatic animals.

At pH lower than 5 most fish eggs will not hatch & lower pH can kill adult fish. As lakes become more acidic biodiversity is reduced.

Soil biology can be seriously damaged by acid rain. Some tropical microbes can quickly consume acids but other microbes are unable to tolerate low pH & are killed.

And acid rain can slow the growth of forests, causes leaves & needles to turn brown & fall off & die. In extreme cases trees or whole areas of forest can die. The death of trees is susceptible to other threats. Some scientists have suggested direct links to human health.

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12. a) number of vehicles passing on road = 1500

speed of the vehicle is = 30 km/hr.

$$\text{Total number of car used lead + petrol} = \frac{80}{100} \times 1500 \\ = 1200$$

Average fuel consumption per hour by each vehicle.

$$= 3.75 \text{ l.}$$

Total fuel consumption by 1200 vehicles per hour

$$= 1200 \times 3.75 = 4500 \text{ l/hr.}$$

Total lead contained in fuels = $0.4 \text{ mg/l} \times 500 \text{ l/h}$

$$= 1800 \text{ Mg/l}$$

Since 80% of lead present in the fuel is emitted as particulate aerosol. The lead aerosol present in the air is

$$180 \times \frac{80}{100} = 1440 \text{ Mg/hr.}$$

13.

a) Gravity settling chamber:

This is a simple particulate collection device using the principle of gravity to settle the particulate matter in a gas stream passing through its long chamber.

principle:

The velocity of the gas is reduced in the settling chamber in order to allow the particles to settle down due to gravitational force.

$$V_s = (g(r_p - r)D^2)/18\eta$$

D = diameter of the particle

g = acceleration due to gravity.

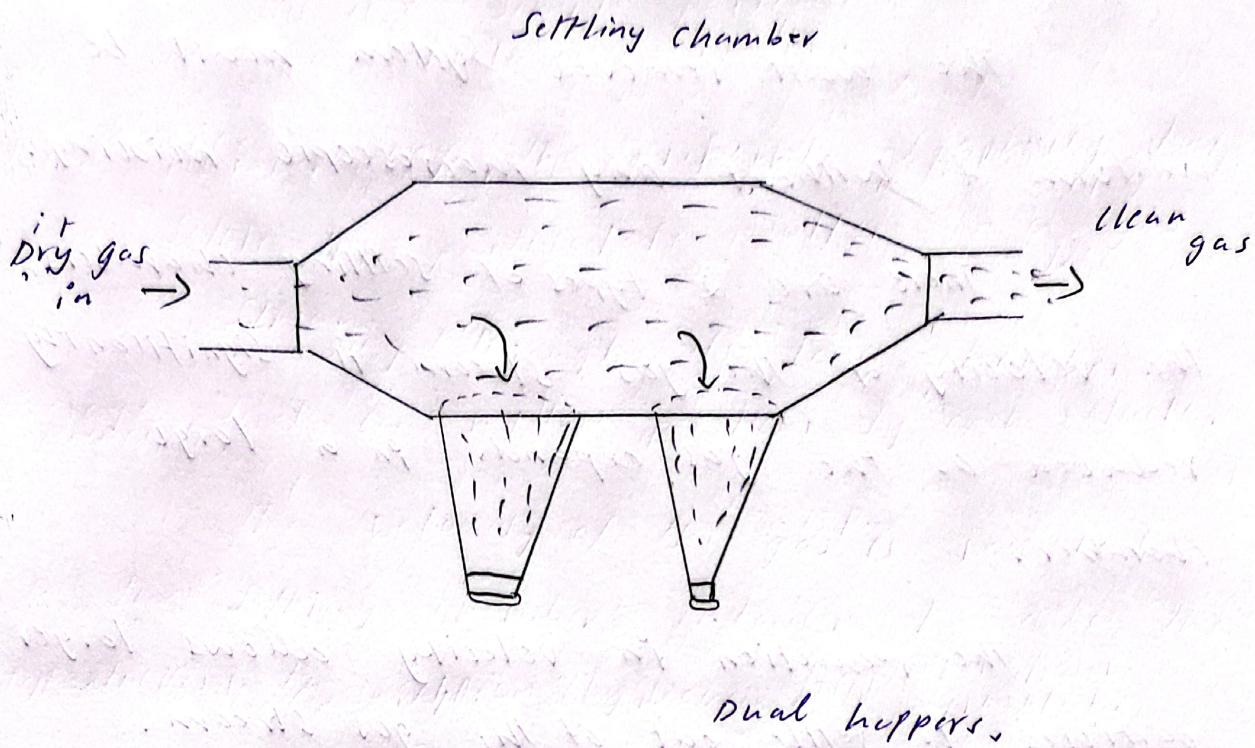
r_p = density of the particles.

r = density of the gas.

η = viscosity of the gas.

This type of technology is the part of the group of air pollution controls collectively referred as "pre cleaners".

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Diagram:

Settling chambers are quite effective in removing only large particles. Therefore, they can be frequently used in combination with other control devices.

Settling chambers are built in the form of long horizontal, rectangular chambers with an inlet at one end & exit at the side or top of opposite end.

Hoppers are used to collect the settled out material, through drag scrapers & screw

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conveyors have also been employed.

The dust removal system must be uniform & without any macroscopic mixing.

There are 2 types of settling chambers. The velocity of the gas stream is significantly reduced as the gas expands in a large chamber.

The reduction in velocity allows larger particles to settle out of the gas stream.

A multiple-tray settling chamber, which cause the gas to flow horizontally between them. While the gas velocity is increased slightly in a multiple tray chamber, when compared to a single expansion chamber,

The collection efficiency generally improves because the particles have a much shorter distance to fall before they are collected.

multiple-tray settling chambers have lower volume requirements than expansion type settling

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chamber for the collection of small particles (15 nm)

140

London Smog or Classical Smog.	Los Angeles Smog. or photochemical Smog.
* This type of smog is observed in 1952 in London.	* This type of smog is observed in 1943 in Los Angeles.
* It involves smoke & fog (smog).	* The word Smog is misnomer here as it does not involve any smoke or fog.
* formed due to the presence of SO ₂ & humidity in the air which combine to form H ₂ SO ₄ fog which deposits on the particulates. Therefore London smog is also known as Sulfurous Smog.	* formed due to photochemical reaction (presence of sunlight) taking place when air contains NO _x & hydrocarbons forming toxic chemicals like peroxyacetyl nitrates, ozone etc... Los Angeles Smog is also known as photochemical smog.
* It is reducing in character chemically it is reducing mixture & hence is called reducing smog.	* It is oxidizing in character. It has high concentration of oxidizing agents hence it is known as oxidizing smog.

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* It causes bronchitis irritation i.e. problem in the lungs.	* It causes Irritation in the eyes.
* It is formed in the months of winter particularly in the morning hours when temperature is low.	* It is formed in the months of summer during afternoon when there is bright sunlight so that photochemical reactions can take place.
* "reduction": In simpler terms addition of hydrogen.	* oxidation: addition of oxygen.

Chemical constituents:

	London smog or classical smog	Los Angeles smog or photochemical smog.
Components	coal smoke (SO_2) stagnant air (fog)	Auto exhaust (CO , NO_x , ROG) Sunlight.
Chemistry	$2SO_2 + O_2 \rightarrow 2SO_3$. $SO_3 + H_2O \rightarrow H_2SO_4$.	$NO_x + ROG + Sunlight \rightarrow O_3 + NO_2 + PAN$ (peroxyacetyl nitrates).

H_2SO_4 - sulphuric acid, NO_x - oxides of nitrogen

ROG - reactive organic gases.

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15.

a) Sick building syndrome -

Sick building syndrome (SBS) is a name for a condition that's thought to be caused by being in a building or other type of enclosed space.

It's attributed to poor indoor air quality.

Symptoms of Sick building syndrome -

- * Throat irritation.
- * breathing difficulties.
- * runny nose.
- * allergy symptoms like sneezing.
- * headaches.
- * dizziness.
- * forgetfulness.
- * irritability.

The symptoms of sick building syndrome most often get better once you leave the hazardous area. In some cases, long term exposure to poor indoor air quality

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can lead to lung disease such as asthma.

Treatment for Sick Building Syndrome:

SBS is primarily treated by alleviating symptoms while reducing your exposure to the causes of these symptoms.

Allergy medications can help alleviate itchy eyes, nose, & skin. over the counter options, such as Benadryl & Zyrtec are widely available.

- * Some steps to treat SBS can also be taken by employers.

- * Use cleaning products with low fumes & no fragrance.

- * Vacuum regularly to remove dust.

- * change out air filters every couple of months.

- * Find the right humidity,

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It recommends an optimal humidity level of 40 to 70 percent.

- * Get a test for possible indoor mold or fungus.
- * update computer monitors & other display systems.
- * change lights as needed.
- * consider investing in LED or blue lights for less energy output.

Part-C.

16. a) Cyclone separator:

Cyclone separators are the most common separating devices called as centrifugal or inertial separators because of the use of centrifugal force for action for the separation process. A cyclone collector can be defined as structure without any moving parts in which the velocity of an inlet gas stream is transformed into a confined vortex from which centrifugal forces lead to drive the suspended particles of the wall of the cyclone body.

principle:

Centrifugal forces separates the particulates from the gas stream instead of gravitational force. Velocity of an inlet

gas stream is transformed into a confined vortex from which centrifugal forces tend to drive the suspended particles to the wall of the cyclone body.

Construction:

Generally a cyclone separator consists of a vertically placed cylinder, an inverted conical base attached to the bottom of the cylinder, a dust hopper to collect the dust & an inlet where the dirty gas enters the cyclone. outlet for clean gas is provided in the centre at the top.

All the parts of the cyclone are designed as per the standard set of dimensions as given.

working:

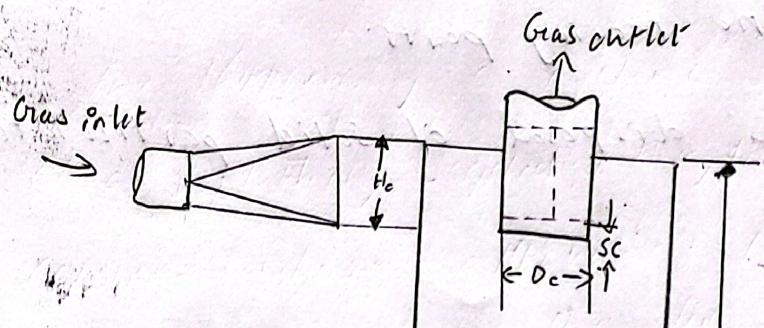
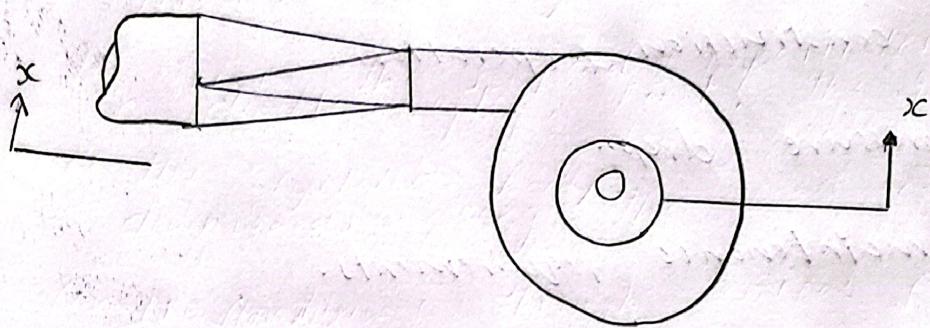
The dirty gas consisting of particulates is made to enter the cyclone with higher

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velocities through inlet, tangentially to the cylinder. The gas path generally follows a double vortex. First, the gas spirals downwards along the wall of the cylinder & continues through conical portion & reaches the bottom.

Then second, the gas stream moves upwards in a narrower inner spiral, concentric with the first & comes out from the cyclone through the outlet pipe. Due to the rapid spiraling movement of gas, the particles are thrown to the wall by the centrifugal force & then they fall to bottom of the body by gravity. They are collected in a storage hopper.

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$$B_c = D_c/4.$$

$$D_e = D_c/2.$$

$$H_c = D_c/2.$$

$$L_c = 2 D_c.$$

$$S_c = D_c/B.$$

$$Z_c = 2 D_c. \quad \text{Section} \quad x-x$$

S_c = arbitrary
usually

$$D_c/4.$$

Dust outlet

Advantages:

- * low initial cost.
- * simple construction & operation.
- * low pressure drop.
- * low maintenance requirements.
- * It has no moving parts.
- * continuous disposal of solid particulates.

Disadvantages:

- * low collection efficiency for particulates below 5-10 μ .
- * Equipment is subject to severe abrasive deterioration.
- * decreasing collection efficiency for decreasing particulate concentration.