Entry No: 2016EE30511 Name AKSHAT AGARWAL Room no LH-325 S.No: 455

CVL 100: Environmental Science

Major Examination

Time 1:00 Hour

Max Marks: 30

Date: 28-03-2018

Note: All the answers are to be written on question paper only

22 1/2 / 30

2 1/30

Question 1-5 carry 25% negative marking. (1×5=5)

Q 1. Air (Prevention and Control of Pollution) act was laid down in?

a) 1974 b) 1976 c) 1981 D) 1984

Q 2. In Bhopal gas tragedy (1984), major culprit was:

(a) Methyl isocyanate b) Phosphate carbaryl (c) Carbon monoxide (d) Mercuric Sulphate

Q 3. Pasquill- Gifford Stability Class "E" signifies:

a) Very Unstable b) Unstable c) Stable d) Neutral

Q 4. Which is the major human health effect because of benzene air pollution:

a) Cardiovascular b) Leukemia c) Respiratory d) Brain & Kidney

Q5. For a completely unstable meteorological condition, which relationship holds true:

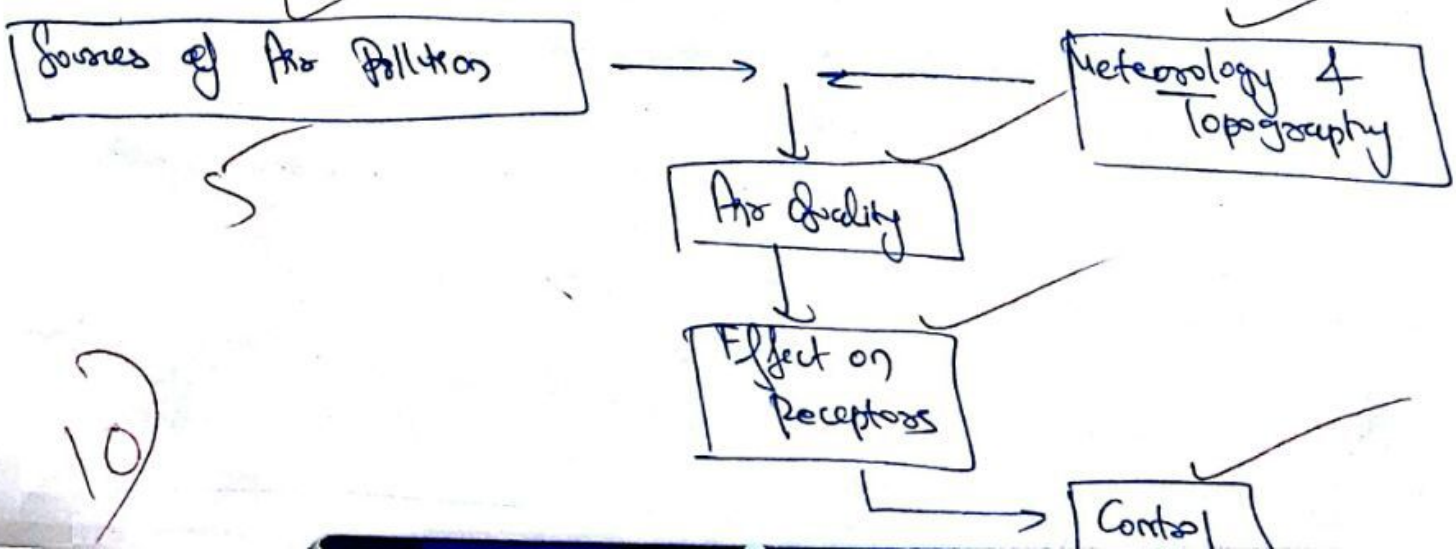
a) ELR=DALR b) ELR> DALR c) DALR>ELR d) DALR>>ELR

Q6. Attempt only one out of 6(a) and 6(b)

6(a). Define air pollution definition based on system approach? (1x5=5)

6(b). Write down the features/assumptions of Gaussian plume model?

6(a) Air pollution based on system approach can be defined as follows:→



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Q7. Give at least one effect of Ozone, Pan, Mercury and NOx on plants/vegetation (1x4=

* Ozone (O_3) - Carcinogenic & cause cancer of exposed to excess ozone
* PAN (Peroxy Acetyl Nitrate) - Adversely affects the reproduction of plants (through gases & buds).
* Mercury - decreases fertility of soil by affecting the fixated nitrogen, thus harming the growth of vegetation.
* NOx (Oxides of nitrogen) - corrosion of leaves & stems of plants & trees.

Q8. Mention **four indoor sources** and corresponding pollutants in a typical household?

Four Indoor sources of air pollution and their pollutants (1x4=4)

① Refrigerators → Pollutant - CFCs (chlorofluorocarbons)
② Gas stoves → Pollutant - methane (CH_4)
③ Fireworks in fireplaces at home → ~~carbon~~ particles (soot), smoke } → Pollutant
④ Heaters → Pollutant → CO_2, CO (in case of deficiency of oxygen, i.e. if the heater is operated in a closed room)

Q9. How marble is affected by SO_2? Briefly describe with chemistry reaction. (1x3=3)

Since one of the major components of acid rain is H_2SO_3 (which is essentially $SO_2 + H_2O$), marble when exposed exposed to acid rain starts corroding & its colour starts getting yellowish. The process is governed by the following reaction:→

$$SO_2 + H_2O + CaCO_3 \longrightarrow CaSO_4 + CaSO_4 \cdot 2H_2O$$

This way, we can see that the Taj Mahal in Agra is losing its beauty because of the yellowing of its white colour due to acid rain.

Q10. A parcel is at height of 2.2Km and has a temperature of 17° C, if it rises vertically up till 4.6 Km. Calculate the temperature of parcel at that height, assuming parcel is rising under (a) dry adiabatic lapse rate and (b) saturated adiabatic lapse rate? (1x5=5)

By definition, we know that lapse rate (γ_d)

$\Rightarrow \gamma_d = -\frac{dT}{dz}$

For the given case, $T_1 = 17°C$ & $z_1 = 2.2$ km & T_2 = unknown at $z_2 = 4.6$ km

$\Rightarrow \gamma_d = \frac{-(T_2 - 17)}{4.6 - 2.2} = \frac{17 - T_2}{2.4}$

∴ If we know the value of dry adiabatic lapse rate & saturated adiabatic lapse rate [which for a stable system → SALR < DALR], we can find out the value of T_2 as → $T_2 = 17 - \gamma_d(2.4)$ ⇒ T_2 for DALR < T_2 for SALR

Q11. a) Write down the Gaussian plume equation and define every parameter → Continued at the back

b) What would be the maximum ground level concentration at centre line when emission rate from a stack is 20 g/s and average wind speed is 4 m/s. Consider horizontal and vertical dispersion coefficient to be 30 m and 50 m? (1x4=4)

Gaussian Plume equation is stated as follows →

$$\chi(x,y,z,H) = \frac{Q_M}{2\pi\sigma_y\sigma_z\bar{u}} \left[e^{\frac{-y^2}{\sigma_y^2}} \right] \left[e^{-\frac{(z-H)^2}{\sigma_z^2}} + e^{-\frac{(z+H)^2}{\sigma_z^2}} \right]$$

where → χ = concentration of the plume (g/m³)

x = distance downwind (m)

y = cross-wind distance (m)

z = receptor height (m)

H = effective stack height (m) = $H_s + \Delta h$

Q_M = emission rate (strength of source) (g/s)

σ_y = dispersion coefficient for horizontal direction (m)

σ_z = dispersion coefficient for vertical direction (m)

$\bar{u}$ = mean wind velocity (m/s) (average wind velocity)

π = constant = 3.14159265 4