Time 1:00 Hour

29.5

Max Marks: 30
Date: 28-03-2018

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

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

3.75

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?

6(b). Write down the features/assumptions of Gaussian plume model? (1x5=5)

(b)

Features/assumptions of Gaussian plume model :-

i. Wind speed is assumed constant.
ii. Temperature, relative humidity are invariable
iii. Passive Pollutants (non-reactive)
iv. Concentration of the pollutants is conserved about the centre-axis.
v. Steady state.

3.75

Q7. Give at least one effect of Ozone, Pan, Mercury and NOx on plants/vegetation? (1x4=4)

Ozone: When concentration of ozone increases, yellow spots appear on plant leaves.

1

U/A

Q8. Mention **four indoor sources** and corresponding pollutants in a typical household? (1x4=4)

(a). Paints : Volatile Organic compounds, Pb

(b). Tobacco smoke : particulate matters, VOC, smoke

(c). Aerosols : particulate matter, organic compounds

(d). Garbage : CH_4, nitrogenous gases.

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

Marble in presence of SO_2 and moisture corrodes and form calcium sulphate. The lustre of the surface is decreased and it turns yellow.

3

$$\underbrace{CaCO_3}_{\text{marble (Calcium carbonate)}} + H_2O + SO_2 \longrightarrow \underbrace{CaSO_4}_{\text{Calcium sulphate}} + H_2O + CO_2$$

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)

(a). Temperature gradient = $-1^\circ C / 100\ m$

$$\frac{T-17}{4600-2200} = \frac{-1}{100} \Rightarrow T-17 = -24 \Rightarrow \boxed{T = -7^\circ C}$$

(b). Temperature gradient = $-0.6^\circ C / 100\ m$

$$\frac{T-17}{4600-2200} = \frac{-0.6}{100} \Rightarrow T-17 = -14.4 \Rightarrow \boxed{T = 2.6^\circ C}$$

5

Q11. a) Write down the Gaussian plume equation and define every parameter

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)

(a). $$C(x,y,z,H) = \frac{Q}{2\pi\sigma_z\sigma_y u}\left[\exp\left(\frac{-y^2}{2\sigma_y^2}\right)\right]\left[\exp\left(-\frac{(z-H)^2}{2\sigma_z^2}\right) + \exp\left(\frac{-(z+H)^2}{2\sigma_z^2}\right)\right]$$

C : concentration at coordinates (x, y, z) (g/m^3)

H : effective stack height (m)

Q : emmision rate (g/sec)

σ_z, σ_y : standard deviation coefficients in z and y directions (m)

y : horizontal distance from axis (m)

z : receptor height (m)

u : wind speed in x-direction (m/sec)

4

(b). $\sigma_y = 30\ m$, $\sigma_z = 50\ m$, $Q = 20\ g/s$, $u = 4\ m/s$

$$C = \frac{Q}{\pi\sigma_z\sigma_y u} = \frac{20}{\pi(30)(50)(4)} = 1.06\ mg/m^3$$