Solid Waste Management and Pollution Test 3

Number of Questions: 25 **Time: 60 min.**

Directions for questions 1 to 25: Select the correct alternative from the given choices.

1. Which of the following factors is primarily responsible for causing air pollution in modern days is
(A) Dust storms
(B) Forest fires
(C) Industries and automobiles
(D) None

2. The most hazardous gaseous air pollutant for human health is:
(A) Nitrogen
(B) Carbondioxide
(C) Oxygen
(D) Sulphurdioxide

3. Among the given choices below; which of the following is not a primary air pollutant?
(A) PAN
(B) Volatile organic compounds like hydrocarbon
(C) Suspended particulate matter
(D) Oxides of nitrogen

4. During temperature inversion in atmosphere, air pollutants tend to.
(A) Accumulate above inversion layer
(B) Accumulate below inversion layer
(C) Disperse laterally
(D) Disperse vertically

5. For ambient air quality standard, the permissible SO_2 for residential and industrial areas in India is
(A) 40 $\mu g/m^3$ (B) 50 $\mu g/m^3$
(C) 65 $\mu g/m^3$ (D) 35 $\mu g/m^3$

6. The frequency of sound is measured in (units):
(A) Hertz (B) Doboson unit (DU)
(C) Decibel (dB) (D) None

7. As per IS:4954 – 1964; An acceptable noise level for residential and business urban areas is
(A) 40-50 dB (B) 30-40 dB
(C) 15-25 dB (D) 50-60 dB

8. Noise is measured in units of:
(A) Bacqueral (B) Doboson
(C) Hertz (D) Decibel

9. The method of refuse disposal, involving burial in trenches, is called
(A) Incineration (B) Composting
(C) Polverisation (D) None

10. The quantity of refuse produced in an average Indian city or a town is of the order of:
(A) $\frac{1}{4}-\frac{1}{5}$ t/c day (B) 4 – 6 t/c day
(D) 2 – 4 t/c day (D) 1 – 2 t/c day

11. The sound pressure level for a jet plane on the ground with sound pressure of 200 μ bar should be
(A) 40 dB (B) 80 dB
(C) 100 dB (D) 120 dB

12. Express 350 $\mu g/m^3$ of SO_2 in ppm at STP?
(A) 0.122 (B) 0.142
(C) 0.20 (D) 0.31

13. An air parcel having 50°C temperature moves from ground level to 800 m elevation in dry air following the adiabatic lapse rate. The resulting temperature of air parcel at 800 m elevation will be?
(A) 40°C (B) 35°C
(C) 42°C (D) 50°C

14. The maximum dispersion of pollutants in atmosphere occur when
(A) Environmental lapse rate is equal to adiabatic lapse rate
(B) Environmental lapse rate is less than adiabatic lapse rate
(C) Environmental lapse rate is greater than adiabatic lapse rate
(D) None

15. Elevation and temperature data for a place are tabulated below:

Elevation, m	Temperature °C
10 m	25.25°C
250 m	15.70°C

Based on the above data, lapse rate can be referred as:
(A) Sub-adiabatic (B) Super adiabatic
(C) Neutral (D) inversion

16. If energy content of solid waste as discarded is 14,700 kJ/kg. Find energy content on dry basis if moisture content of solid waste is 20%
(A) 18375 kJ/kg (B) 18000 kJ/kg
(C) 14,700 kJ/kg (D) 15,000 kJ/kg

17. The composition of certain MSW sample and specific weight of its various components are given below:

Component	Percent by weight	Specific weight (kg/m3)
Food waste	70	300
Dirt ash	20	500
Plastics	10	65

The specific weight (kg/m^3) of the MSW sample is
(A) 209 (B) 319
(C) 217 (D) 234

18. A waste water stream (flow = $3m^3/s$) with ultimate BOD 110 mg/ℓ is joining a small river (flow = $10m^3/s$),

ultimate BOD = 5 mg/ℓ. Both water streams get mixed up simultaneously at where cross sectional area of the river is 70 m^2.Assuming K = 0.25 / day, the BOD (in mg/ℓ) of the river water, 10 km downstream of the mixing point is

(A) 8.832 gm/m^3 (B) 24 gm/m^3
(C) 15 gm/m^3 (D) none

19. The reference pressure used in determination of sound pressure level is:

(A) 20 db (B) 10 μPa
(C) 20 μPa (D) 10 db

20. Which one of the following is the correct sound intensity expression with usual notations.

(A) dB = 10 $\log_{10}(I/I_0)^2$
(B) dB = 10 $\log_{10}(I/I_0)$
(C) dB = 10 $\log_{10}(I-I_0)^2$
(D) dB = 10 $\log_{10}(I-I_o)$

21. A source emitting 40 dB, 70 dB, 110 dB of different times in a day. What is average noise produces by source in a day?

(A) 220 dB (B) 80 dB
(C) 74 dB (D) 100 dB

22. Which among the following are two biodegradable components of municipal solid waste

(A) Leather and tin cans
(B) Plastics and wood
(C) Cardboard and glass
(D) Food waste and garden trimmings

23. Two electrostatic precipitators are in series. The fractional efficiencies of the upstream and downstream ESPS for size *dp* are 90% and 80% respectively. What is the overall efficiency of the system for same *dp*?

(A) 93% (B) 95%
(C) 98% (D) 90%

24. SO_2 and CO adversely effects

(A) Oxygen carrying capacity of blood and functioning of lungs respectively.
(B) Functioning of the respiratory system and brain respectively.
(C) Functioning of the respiratory system and oxygen carrying capacity of blood respectively.
(D) Functioning of air passage and chess respectively.

25. Two air pollution control devices that are usually used to remove very fine particles from the flue gas are:

(A) Cyclone and venture scrubber
(B) Cyclone and packed scrubber
(C) Electrostatic precipitator and fabric filter
(D) Settling chamber and tray scrubber

Answer Keys

1. C	**2.** D	**3.** A	**4.** B	**5.** B	**6.** A	**7.** A	**8.** D	**9.** B	**10.** A
11. D	**12.** A	**13.** C	**14.** C	**15.** B	**16.** A	**17.** D	**18.** A	**19.** C	**20.** A
21. D	**22.** D	**23.** C	**24.** C	**25.** C					

Hints and Explanations

1. Industries and automobile is primarily responsible for causing air pollution in modern days. Choice (C)

2. Sulphur dioxide is the most hazardous gaseous air pollutant. Choice (D)

3. PAN is not a primary air pollutant. Choice (A)

5. The permissible SO_2 for residential and Industrial area in India is 50 μg/m^3. Choice (B)

6. Frequency of sound is measured in Hertz. Choice (A)

7. An acceptable noise level of 40–50 dB in residential area is allowed. Choice (A)

8. Decibel is the unit to measure noise. Choice (D)

11. Sound pressure level in (dB)

$$= 20 \log_{10}\left[\frac{P_{rms}}{20}\right]$$

P_{rms} = 200 μ bar
= 200 × 10^5μPa [1 bar = 100kPa= 10^5Pa]
= 20 × 10^6μ.Pa

$$dB = 20 \log_{10}\frac{20\times10^6\ \mu.P_a}{20\ \mu.P_a}$$

= 20 × 6 = 120 dB Choice (D)

12. At STP

$$1PPM = \frac{M}{22.4}\times 10^3 \mu g l m^3$$

$$1\mu g/m^3 = \frac{22.4}{M\times10^3}\ PPM$$

$$350\ \mu g/m^3 = \frac{22.4}{M\times10^3}\times 350\ PPM$$

Where M = molecular weight of SO_2
= 32 + (2 × 16) = 64

$$= \frac{22.4\times350}{64\times10^3}$$

= 0.122 PPM. Choice (A)

13. For adiabatic lapse rate: There is a decrease in temperature of 1°C for every 100 m

i.e., $\frac{dT}{dZ} = -1°C/100m$

$100m \rightarrow -1°C$

$800m \rightarrow ?$

$$\frac{800(-1\,°C)}{100} = -8\,°C$$

$\therefore$ The resulting temperature

$= 50 - 8 = 42°C.$ Choice (C)

15. Lapse rate $= \frac{dT}{dZ} = \frac{25.25 - 15.70}{250 - 10}$

$$= \frac{9.55}{240} = 0.039$$

$$= \frac{-3.97\,°C}{100\ m}$$

Adiabatic lapse rate $= \frac{-1\,°C}{100\ m}$

$\therefore$ Lapse rate > ALR

$\Rightarrow$ Super adiabatic. Choice (B)

16. Energy content on dry basis

$= \text{Energy content as discarded} \times \left[\frac{100}{100 - mc}\right]$

where mc - moisture content.

$$= 14,1700 \times \frac{100}{100 - 20}$$

$= 18375$ KJ/kg. Choice (A)

17. $$\frac{100}{\text{specific weight of MSW}} = \frac{\%\text{Foodwaste}}{\text{specific weight of foodwaste}} + \frac{\%\text{dirt ash}}{\text{specific weight of dirt ash}} + \frac{\%\text{plastics}}{\text{specific weight of plastics}}$$

$$\frac{100}{\text{specific weight of MSW}} = \frac{70}{300} + \frac{20}{500} + \frac{10}{65}$$

Specific weight of MSW (kg/m^3) = 234. Choice (D)

18. BOD of mixture $= \frac{Q_1 \times (BOD)_1 + Q_2 \times (BOD)_2}{Q_1 + Q_2}$ s

$$= \frac{(3)(110) + (10 \times 5)}{3 + 10}$$

$= 29.23$ gm/m^3

(BOD) of mixture at 10 km downstream of mixing point

$y_{10\text{km}} = y_0(1 - 10^{-Kt})$

Time taken to reach 10 km,

$t = \frac{\text{distance}}{\text{velocity}}$;

velocity of flow $= \frac{Q_1 + Q_2}{A} = \frac{10 + 3}{70}$

$V = 0.185$ m/sec

$\therefore \quad t = \frac{10 \times 1000}{0.185} \times \frac{1}{24 \times 60 \times 60}$,

$t = 0.625$ day

$y_{10} = 29.23\ [1 - 10^{-0.25 \times 0.625}]$

$= 8.832\ \frac{\text{gm}}{\text{m}^3}$ Choice (A)

21. $\overline{L_P} = 20 \log_{10} \frac{1}{N} \Sigma (10)^{L_{N/20}}$

$$= 20 \log_{10} \frac{1}{3}\left[10^{\frac{40}{20}} + 10^{\frac{70}{20}} + 10^{\frac{110}{20}}\right]$$

$= 100.54$dB. Choice (D)

23. Particles removed by ESP1 = 90%

Only 10 % particles remains left and flows through ESP 2.

So, Particles removed by ESP2 = 80 % of 10% = 8%

$\therefore$ Overall efficiency = 90 + 8 = 98% Choice (C)