

ENVIRONMENTAL CHEMISTRY

Single Correct Answer Type

1. The process which does not evolve CO_2 in air is:

a) Burning	b) Breathing	c) Organic decay	d) Photosynthesis
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2. Ozone layer of stratosphere requires protection from indiscriminate use of

a) Pesticides	b) Atomic explosions
c) Aerosols and high flying jets	d) Balloons
3. Lead exhausted in the atmosphere by automobiles using leaded petrol (i.e., tetraethyl lead for improving octane number) is a lethal air pollutant, which causes:

a) Paralysis of muscles and loss of appetite
b) Nervous depression
c) Gastritis and diarrhea
d) All of the above
4. Mercury is emitted into air by:

a) Burning coal	b) Burning garbage	c) Coal fire	d) Steam engine
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5. Green house effect is caused by

a) NO_2	b) CO	c) NO	d) CO_2
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6. Bhopal gas tragedy of 1984 was caused by

a) Carbon monoxide	b) Phosgene	c) Methyl cyanate	d) Methyl isocyanate
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7. London smog is found in:

a) Summer during day time
b) Summer during morning time
c) Winter during morning time
d) Winter during day time
8. Phosphate pollution is caused by

a) Weathering of phosphate rocks only	b) Agricultural fertilizers only
c) Phosphate rocks and sewage	d) Sewage and agricultural fertilizers
9. Carbon monoxide, emitted by automobiles, prevents transport of oxygen in body due to

a) Combining with oxygen to form carbon dioxide
b) Destruction of haemoglobin
c) Preventing reaction between oxygen and haemoglobin
d) Forming stable compound with haemoglobin
10. Carbonaceous particles having size less than 10^{-6} m are called:

a) Gril	b) Aggregates	c) Aerosols	d) Smoke
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11. The biotic and abiotic components that are affected adversely from harmful substances are called

a) Target	b) Receptor	c) Atmosphere	d) Both (a) and (b)
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12. Radioactive pollution is caused by

a) Solid pollutants	b) Liquid pollutants	c) Gaseous pollutants	d) None of these
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13. Which of the following is/are the main agents of soil erosion?

a) Wind and water	b) Rocks	c) Sand	d) None of these
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14. Which of the following is present in maximum amount in acid rain?

a) HNO_3	b) H_2SO_4	c) HCl	d) H_2CO_3
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- a) Algae b) Smoke c) Mist d) Fumes
30. The instrument used for measuring soil salinity is
a) Photometer b) Voltmeter c) Conductivity meter d) Calorimeter
31. Growing more trees help to:
a) Reduce oxygen in the environment
b) Increase carbon dioxide in the environment
c) Reduce carbon dioxide only in the environment
d) Reduce CO₂ and increase O₂ in the environment
32. The progressive warming up of the earth surface is mainly due to:
a) Automobile exhaust
b) Blanketing effect of carbon dioxide in atmosphere
c) Reforestation
d) Thickening of ozone layer
33. Biodegradable pollutant is
a) Domestic waste b) DDT c) Mercury salt d) Aluminium foil
34. Which of the following is the uppermost region of the atmosphere?
a) Stratosphere b) Troposphere c) Exosphere d) Thermosphere
35. Drained sewage has BOD
a) More than that of water b) Less than that of water
c) Equal to that of water d) None of these
36. Ozone is an important constituent of stratosphere because it
a) Prevents the formation of smog over large cities
b) Removes poisonous gases of the atmosphere by reacting with them
c) Absorbs ultraviolet radiations which is harmful to human life
d) Destroys bacteria which are harmful to human life
37. Which of the following causes water pollution?
a) Flyash b) Auto exhausts c) Aeroplanes d) Pesticides
38. A secondary pollutant is
a) CO b) CO₂ c) PAN d) Aerosol
39. Cyclone collector is used for minimising
a) Radioactive pollution b) Air pollution c) Noise pollution d) Water pollution
40. Which of the following is responsible for the depletion of the ozone layer in the upper strata of the atmosphere?
a) Polyhalogens b) Ferrocenes c) Fullerenes d) Freons
41. Result of ozone hole is
a) Green house effect b) Global warming
c) Acid rain d) UV rays reach the earth
42. Pick up the correct statement
a) CO plays a major role in photochemical smog
b) London smog has an oxidising character whereas Los Angeles smog is reducing in nature
c) Classical smog is good for health but photochemical smog not
d) Los Angeles smog forms in day time whereas London smog forms in early morning hours
43. The water pollutants mainly responsible for the eutrophication are
a) Cd, Pb and Hg present in industrial waste.
b) Heavy metals present in mining waste.
c) Detergents and fertilizers containing phosphate anion.
d) Polychlorinated biphenyls.

44. What does BOD₅ represent?
 a) Biological ozone depletion in five days
 b) Dissolved oxygen left after five days
 c) Dissolved oxygen consumed in five days
 d) Micro-organisms killed by ozone in sewage treatment plants in five hours
45. Gas released during Bhopal tragedy was
 a) Methyl isocyanate
 b) Potassium isothiocyanate
 c) Sodium isothiocyanate
 d) Ethyl isothiocyanate
46. It is dangerous to leave the car engine running in a closed garage, because it may cause serious pollution due to poisoning by emission of:
 a) CO₂
 b) CO
 c) Unburnt petrol
 d) SO₂
47. The brown haze of photochemical smog is largely attributable to
 a) NO
 b) NO₂
 c) $\begin{array}{c} \text{CH}_3\text{COONO}_2 \\ || \\ \text{O} \end{array}$
 d) CH₂ = CHCH = O
48. Solid component of the earth consisting of soil, rocks and mountains is called
 a) Hydrosphere
 b) Lithosphere
 c) Atmosphere
 d) Biosphere
49. Which of the following is not considered to be a pollutant?
 a) NO₂
 b) CO₂
 c) O₃
 d) C_xH_y
50. Gradual warming of the atmosphere due to trapping of long wave radiations is called:
 a) Air pollution
 b) Air heating
 c) Photosynthesis
 d) Greenhouse effect
51. Most poisonous pollutant in water is:
 a) Zinc
 b) Phosphate
 c) Arsenic
 d) Detergent
52. Air pollution is not caused by
 a) Pollen grains
 b) Hydroelectric power
 c) Industries
 d) Automobiles
53. Photochemical smog is caused by
 a) CO
 b) CO₂
 c) O₃
 d) NO₂
54. A fertile soil is likely to have a pH of:
 a) 3
 b) 9
 c) 6-7
 d) 14
55. Lead in water can cause:
 a) Eye disease
 b) Arthritis
 c) Kidney damage
 d) Hair falling
56. Which of the following pollutants is main product of automobile exhaust?
 a) CO
 b) CO₂
 c) NO
 d) Hydrocarbons
57. Select the incorrect statement.
 a) Water is considered pure if it has BOD less than 5 ppm
 b) In COD determination, the pollutants resistant to microbial oxidation are not oxidised by oxidising agent like K₂Cr₂O₇
 c) The lower the concentration of DO, the more polluted is the water sample
 d) The tolerable limit of lead in drinking water is 50 ppm
58. Methane gas producing field is
 a) Wheat field
 b) Paddy field
 c) Cotton field
 d) Groundnut field
59. Which of the following is secondary air pollutant?
 a) Photochemical smog
 b) NO₂
 c) Dust particles
 d) SO₂
60. The greatest affinity for haemoglobin is shown by
 a) NO
 b) CO
 c) O₂
 d) CO₂
61. The principal gas evolved from sludge digestion tank is:
 a) CO
 b) CO₂
 c) CH₄
 d) N₂

62. PAN stands for
 a) CH_2O
 b) $\text{CH}_2 = \text{CH} - \text{CHO}$
 c) $\text{CH}_3\text{CH}_2\text{O} - \text{N} = \text{O}$
 $\text{CH}_3 - \text{C} - \text{OONO}_2$
 d) $\begin{array}{c} \parallel \\ \text{O} \end{array}$
63. Which of the following region is the coldest?
 a) Stratosphere b) Troposphere c) Mesosphere d) Thermosphere
64. Which is not an example of gaseous air pollutant?
 a) Oxides of halogens b) Oxides of sulphur c) Oxides of carbon d) Oxides of nitrogen
65. Which of the following statements about control of particulate pollution is false?
 a) Gravity settling chamber removes larger particles from the air.
 b) Cyclone collector removes fine particles in the diameter range 5-20 microns.
 c) Wet scrubbers are used to wash away all types of particulates.
 d) In electrostatic precipitator, the particulates are made to acquire positive charge which are then attracted by the negative electrode and removed.
66. Which of the following is not regarded as a pollutant?
 a) NO_2 b) CO_2 c) O_3 d) Hydrocarbons
67. The contribution of which of the following pollutants is least for causing atmospheric pollution?
 a) Nitrogen oxides b) Sulphur oxides c) Hydrocarbon d) Particulates
68. Which of the following process is involved in the biochemical treatment of sewage effluents?
 a) Oxidation b) Reduction c) Dehydration d) Fermentation
69. Which of the following is responsible for peeling of ozone umbrella?
 a) PAN b) Coal burning c) CFCs d) CO_2
70. Main pollutants released from iron and steel industry are:
 a) CO , CO_2 and SO_2 b) NO , SO_3 and H_2S c) CO_2 , H_2S and NO_2 d) CO_2 , NO_2 and SO_3
71. Which is not a green house gas?
 a) CO_2 b) CH_4 c) N_2O d) Chlorofluorocarbons
72. Smog is:
 a) Nothing but black smoke
 b) A combination of smoke and fog
 c) A liquid particle resulting from vapour condensation
 d) A solid particle, e.g., flyash
73. Which of the following is a biodegradable pollutant?
 a) Plastic b) Sewage c) Asbestos d) Mercury
74. Which of the following is secondary pollutant?
 a) CO_2 b) N_2O c) PAN d) SO_2
75. Highly toxic gas which causes headache, visual difficulty, paralysis and even death is:
 a) CO_2 b) O_3 c) CO d) All of these
76. Which of the following gases cause pollution when present in the exhaust fumes of vehicles?
 a) CO_2 b) CO c) Water vapours d) C_2H_6
77. Main pollutants released from petroleum refineries are
 a) CO , SO_2 and H_2S b) CO_2 , NO and SO_3 c) CO_2 , H_2S and NO_2 d) SO_3 , NO_2 and CO_2
78. The depletion of ozone layer in the stratosphere would lead to:
 a) Increased human cataracts and skin cancer
 b) Reduction of planktons in ocean water

: ANSWER KEY :

1)	d	2)	c	3)	d	4)	b	5)	d	6)	d	7)	c	8)	d
9)	d	10)	d	11)	d	12)	d	13)	a	14)	b	15)	c	16)	b
17)	a	18)	b	19)	a	20)	b	21)	d	22)	c	23)	c	24)	a
25)	a	26)	b	27)	b	28)	a	29)	a	30)	c	31)	d	32)	b
33)	a	34)	c	35)	a	36)	c	37)	d	38)	c	39)	b	40)	d
41)	d	42)	d	43)	c	44)	c	45)	a	46)	b	47)	b	48)	b
49)	b	50)	d	51)	c	52)	b	53)	d	54)	c	55)	c	56)	c
57)	b	58)	b	59)	d	60)	a	61)	c	62)	d	63)	c	64)	a
65)	d	66)	b	67)	a	68)	a	69)	c	70)	a	71)	c	72)	b
73)	b	74)	c	75)	c	76)	b	77)	a	78)	d	79)	a	80)	d
81)	a	82)	d	83)	a	84)	a	85)	a	86)	b	87)	a	88)	c
89)	c	90)	d	91)	c	92)	c	93)	c	94)	c	95)	a	96)	c
97)	c	98)	b	99)	b	100)	c	101)	d	102)	b	103)	c	104)	b
105)	d														

: HINTS AND SOLUTIONS :

- 2 (c)
Aerosols and high flying jets release nitric oxide into the upper atmosphere which leads to the destruction of ozone layer
- 5 (d)
Green house effect is caused by CO₂.
- 6 (d)
Bhopal gas tragedy of 1984 was caused by methyl isocyanate (MIC). This gas was released from a pesticide manufacturing plant union carbide.
- 9 (d)
Carbon monoxide is highly toxic to living being because it has an ability to form more stable carboxyhaemoglobin complex with haemoglobin due to which the delivery of oxygen to the organs and tissues is blocked
- 19 (a)
Oxides of nitrogen and chlorofluorocarbons, when reach into the stratosphere, react with ozone molecules and convert them into oxygen. Thus, these compounds lead to depletion of ozone layer.
- $$\begin{array}{l} \text{NO} + \text{O}_3 \longrightarrow \text{NO}_2 + \text{O}_2 \\ \text{oxide of nitrogen} \end{array}$$
- $$\begin{array}{l} \text{CF}_2\text{Cl}_2 \\ \text{chlorofluoro carbon} \end{array} \xrightarrow{h\nu} \dot{\text{C}}\text{Cl} + \dot{\text{C}}\text{F}_2\text{Cl}$$
- $$\dot{\text{C}}\text{Cl} + \text{O}_3 \longrightarrow \text{Cl}\dot{\text{O}} + \text{O}_2$$
- 21 (d)
CFC (Chlorofluorocarbons) are causing depletion of ozone in the stratosphere. This occurs because ultra violet light also causes CFC's to decompose, producing atomic chlorine. The chlorine atoms react with ozone molecules, resulting in a net removal of O₃ molecules from the stratosphere.
- 23 (c)
Chlorofluoro, carbons *ie*, freons are non reactive, non inflammable, non toxic organic molecules, these are widely used in air conditioners, refrigerators
- 27 (b)
Microorganisms present in the soil act as a sink for carbon monoxide
- 30 (c)
Conductivitymeter is used for measuring soil salinity
- 39 (b)
Cyclone collector is used to remove particulate particles, thus it minimises air pollution
- 40 (d)
Freons or chlorofluoro carbons are responsible for depletion of the ozone layer in the upper strata of the atmosphere. They are used as propellants, aerosol spray caps, refrigerants, fire fighting reagents etc. They are stable and chemically inert compounds. They absorb UV-radiation and break down liberating free atomic chlorine which causes decomposition of ozone through free radical reaction. This results in the depletion of the ozone layer.
Freons are mainly freon-1 (CFCl₃) and freon – 12 (CF₂Cl₂). They form free radical of chlorine in the presence of UV-radiation. Such free radical decomposes O₃ as follows



42

(d)

Classical or London type smog is formed by the combination of soot particles with oxides of sulphur while climate is cool and humid. Due to presence of soot and oxides of sulphur, it is reducing in nature.

Photochemical smog or Los Angeles smog is obtained from nitrogen oxides when climate is warm, dry and sunny. Due to presence of O_3 and NO_2 (strong oxidising agents), it is oxidising in nature. CO does not play any role in the formation of photochemical smog

43

(c)

Detergents and fertilizers contain phosphates as additives. The addition of phosphorous to water, in the form of the phosphate anion (PO_4^{3-}), encourages the formation of algae, which reduces the dissolved oxygen concentration of water. This process is known as eutrophication.

44

(c)

BOD_5 means, dissolved oxygen consumed in five days

45

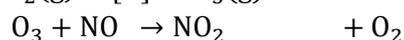
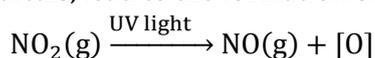
(a)

Methyl isocyanate (MIC) gas was released during Bhopal tragedy

47

(b)

Photochemical smog is initiated by the photochemical dissociation of NO_2 and the resulting secondary reactions involving unsaturated hydrocarbons, other organic compounds and free radicals, lead to the formation of organic peroxides and ozone.



Brown gas

(In high concentration

Forms haze)

Hydrocarbons + O_3 , O_2 , O, NO_2 , NO peroxides, peroxyacetyl nitrate, formaldehyde, ozone aldehyde, acrolein, etc. oxidised hydrocarbons and ozone in the presence of humidity cause photochemical smog, which dissipates at night.

57

(b)

In COD determination, the pollutants, which are resistant to microbial oxidation, are also oxidised by strong oxidising agents such as $\text{K}_2\text{Cr}_2\text{O}_7$

58

(b)

Methane gas producing field is paddy field. It is also known as marsh gas

60

(a)

Nitrous oxide (NO) has the highest affinity towards haemoglobin. However, due to its larger size, it cannot be inhaled

63

(c)

Mesosphere is the coldest region having -100°C temperature

65

(d)

In electrostatic precipitator, the electrode plate is positively charged. Thus, the particulates acquire negative charge and are attracted by the negative electrode plate

66

(b)



Carbon dioxide, being limiting factor, when present in small amount (*ie*, 0.033%), has no adverse effect but when its concentration is slightly higher than 0.033%, it has an adverse effect on our climate. Thus, in normal conditions, CO₂ is not regarded as a pollutant

73 (b)

Sewage is a biodegradable pollutant because it is easily decompose by microorganism

74 (c)

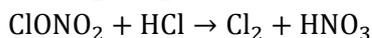
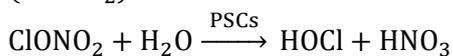
Pollutants which are formed by reaction of primary pollutants (persist in the environment in the form they are passed into it) are called as secondary pollutants *e. g.*, peroxyacyl nitrates (PAN) are formed through reaction between nitrogen oxides and hydrocarbons in the presence of sunlight.

81 (a)

In stratosphere, chlorofluorocarbons (CF₂Cl₂, CFCl₂) etc. are responsible for the depletion of ozone layer

82 (d)

PSCs (polar stratospheric clouds) of type II provide a surface for the conversion of chlorine nitrate (ClONO₂) and HCl into HOCl and Cl₂



91 (c)

In troposphere, as we move towards the altitude, the density and pressure of air decreases. Due to which temperature also decreases

92 (c)

Oxygen gas does not absorb I.R. radiation of high wavelengths reflected back by earth, hence it does not cause 'green house effect'.

93 (c)

SO₂ affects larynx, between SO₂ and SO₃, SO₃ is more harmful air pollutant and between NO₂ and NO, NO₂ is more toxic. Photochemical smog is caused by oxides of nitrogen

96 (c)

Chlorofluorocarbon is used in air conditioning and in domestic refrigerators for cooling purposes. Its main drawback in this, it is responsible for ozone depletion.

100 (c)

The average residence time of NO is 4 days

105 (d)

Nitrogen dioxide and methane which act as sink for chlorine free radicals and prevent much ozone depletion

Assertion - Reasoning Type

This section contain(s) 10 questions numbered 1 to 10. Each question contains STATEMENT 1(Assertion) and STATEMENT 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

- a) Statement 1 is True, Statement 2 is True; Statement 2 is correct explanation for Statement 1
- b) Statement 1 is True, Statement 2 is True; Statement 2 is **not** correct explanation for Statement 1
- c) Statement 1 is True, Statement 2 is False
- d) Statement 1 is False, Statement 2 is True

- 1 **Statement 1:** For green house effect presence of CO_2 is essential.
Statement 2: With increase in concentration of CO_2 , green house effect increases.
- 2 **Statement 1:** Deforestation, is one main factor contributing to global warming
Statement 2: Besides CO_2 two other gases methane and CFCs one also included under green house gases
- 3 **Statement 1:** Presently, the global atmosphere is warming up
Statement 2: The depletion of stratospheric ozone layer has resulted in increases in ultraviolet radiations reaching the earth
- 4 **Statement 1:** Water having $\text{pH} < 5.5$ is not suitable for drinking purposes.
Statement 2: As the pH of water decreases, the solubility of metal ions increases.
- 5 **Statement 1:** Photochemical smog is produced by nitrogen oxides
Statement 2: Vehicular pollution is a major source of nitrogen oxides
- 6 **Statement 1:** CO combines with haemoglobin
Statement 2: It has affinity for haemoglobin
- 7 **Statement 1:** Suspended particulate matter (SPM) is an important pollutant released by diesel vehicles.
Statement 2: Catalytic converters greatly reduce pollution caused by automobiles.
- 8 **Statement 1:** Presently the global atmosphere is warming up.
Statement 2: The depletion of stratospheric ozone layer has resulted in increase in ultraviolet radiations reaching the earth.
- 9 **Statement 1:** Carbon monoxide combines with haemoglobin.
Statement 2: CO has more affinity for haemoglobin.
- 10 **Statement 1:** Acid rain has a pH less than 5
Statement 2: Oxides of nitrogen and sulphur combine with rain water to produce acidic nature

: ANSWER KEY :

1)	b	2)	b	3)	b	4)	a
5)	b	6)	a	7)	b	8)	b
9)	a	10)	a				

: HINTS AND SOLUTIONS :

- 1 (b)
CO₂ molecules trap the longer wavelength, infrared radiations emitted by earth and causes green house effect.
- 2 (b)
Both Statement I and II are true but Statement II is not correct explanation
- 3 (b)
Both Statement I and II are true but Statement II is not correct explanation
- 4 (a)
The normal rain water has a pH of 5.6 due to dissolution of CO₂ in it.
 $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$
- 5 (b)
Both Statement I and II are true but Statement II is not correct explanation
- 7 (b)
Suspended particulate matter (SPM) consists of soot flyash, dusts of various types. These are hazardous. They stay in air long enough to travel all over the world and bring with them toxic cancer causing pollutant.
- 8 (b)
Global atmosphere is warming up due to increase in concentration of green house gases.
- 9 (a)
CO has more affinity for hemoglobin than that of O₂ and forms stable compound carboxy haemoglobin and reduces the oxygen carrier capacity of the blood.
- 10 (a)
Statement II is correct explanation of Statement I

Matrix - Match Type

This section contain(s) 1 question(s). Each question contains Statements given in 2 columns which have to be matched. Statements (A, B, C, D) in **columns I** have to be matched with Statements (p, q, r, s) in **columns II**.

1. Match the list I and II and pick the correct matching from the codes given below

Column-I

- (A) Polycyclic aromatic hydrocarbons
- (B) Dioxins
- (C) IR active molecules
- (D) Peroxy acetyl nitrate

Column- II

- (p) Global warming
- (q) Photochemical smog
- (r) Carcinogens
- (s) Waste incineration

CODES :

	A	B	C	D
a)	c	d	a	b
b)	d	c	b	a
c)	c	d	b	a
d)	a	b	c	d



: ANSWER KEY :

1)	a
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: HINTS AND SOLUTIONS :

- 1 (a) Polycyclic aromatic hydrocarbons are carcinogens, *ie*, cancer producing dioxins are waste incineration, IR active molecules such as CO_2 are related with global warming. PAN (peroxy acetyl nitrate) forms photochemical smog

