Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 0

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15

QUESTION 1:

Environmental engineering is related to

a. Human health

b. Health of earth

c. Management of natural resources

d. All of the above

Correct Answer: d

QUESTION 2:

Demography is the study of

a. Environmental pollution

b. Earth ecosystem

c. Human population

d. geography

Correct Answer: c

QUESTION 3:

Sustainability can be defined as

a. meeting the needs of the future generation by compromising present development

b. meeting the needs of the present generation without considering future development

c. meeting the needs of the present generation without compromising future development

d. None

Correct Answer: c

QUESTION 4:

Which one is an anthropogenic source of environmental pollution?

a. Forest fire

b. Crop burning

c. Rainwater harvesting

d. Volcanic eruption

Correct Answer: b

QUESTION 5:

What is the full form of EPA?

a. Environmental protection agency

b. Environmental pollution agency

c. Earth protection agency

d. Environmental pollution act

Correct Answer: a

QUESTION 6:

Which of the following is/are responsible for global warming?

a. Population Growth

b. Deforestation

c. Burning fossil fuel

d. All of the above

Correct Answer: d

QUESTION 7:

Which one can be an effective solution to control global warming?

a. Reduce use of fossil fuel

b. Reduce carbon emission

c. Use of renewable energy source

d. All of the above

Correct Answer: d

QUESTION 8:

Which one is not a reason for soil pollution?

a. Afforestation

b. Industrial discharge

c. Acid rain

d. Agricultural activity

Correct Answer: a

QUESTION 9:

What are the different sources of drinking water?

a. River

b. Groundwater

c. Lakes

d. All of the above

Correct Answer: d

QUESTION 10:

What is the effective way of removing pathogenic microorganisms from water?

a. Filtration

b. Disinfection

c. Sedimentation

d. Reverse osmosis

Correct Answer: b

QUESTION 11:

Solar energy is a source of renewable energy.

a. True

b. False

Correct Answer: a

QUESTION 12:

Will e-vehicle reduce environmental pollution?

a. True

b. False

Correct Answer: a

QUESTION 13:

Migration is one of the factors affecting population growth.

a. True

b. False

Correct Answer: a

QUESTION 14:

Is global warming responsible for the flood?

a. True

b. False

Correct Answer: a

QUESTION 15:

Biogas is a non-renewable source of energy.

a. True

b. False

Correct Answer: b

**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 1

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 Total Marks 15 x 2 = 30

1.

How many 60 Watt Incandescent lamps are equivalent to three 15 Watt CFL (69)

a. 7
b. 22
c. 10
d. 21

Correct Answer:- b

Detailed Solution:

2.

Which of the following is a major greenhouse gas responsible for global warming?

a. Carbon dioxide (CO_2)
b. Hydrogen sulphide (H_2S)
c. Carbon monoxide (CO)
d. Oxygen (O_2)

Correct Answer:- a

Detailed Solution:

- The U.S. Environmental Protection Agency and the U.S. National Academy of Sciences release reports concluding that the build-up of carbon dioxide and other "greenhouse gases" in the Earth's atmosphere will likely lead to global warming.

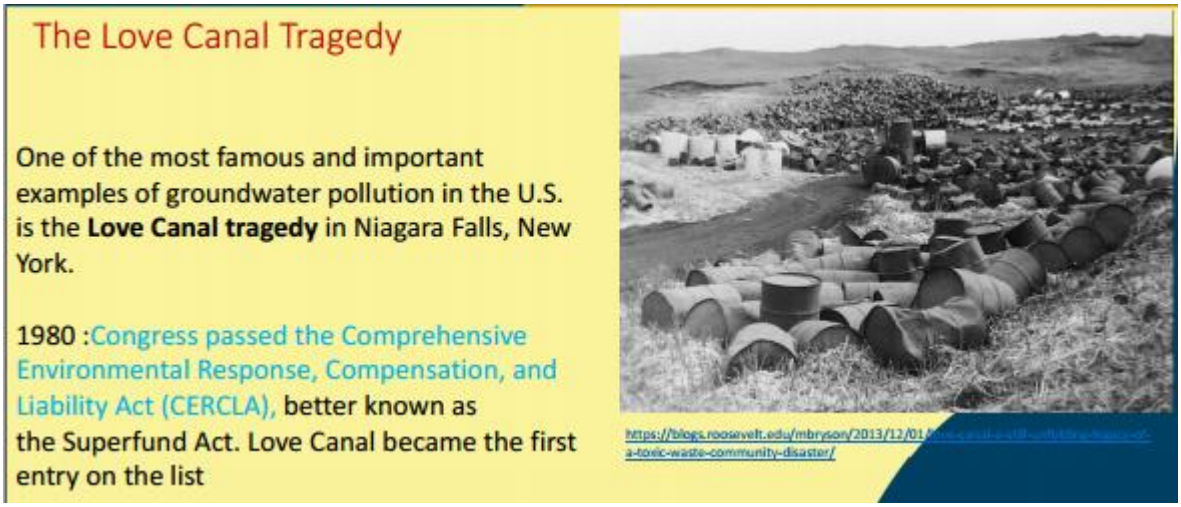
3.

One of the most famous and important examples of groundwater pollution in New York state (USA) is the _____.

a. Chernobyl Accident
b. Donora smog
c. Cuyahoga River fire
d. Love canal tragedy

Correct Answer:- d

Detailed Solution:



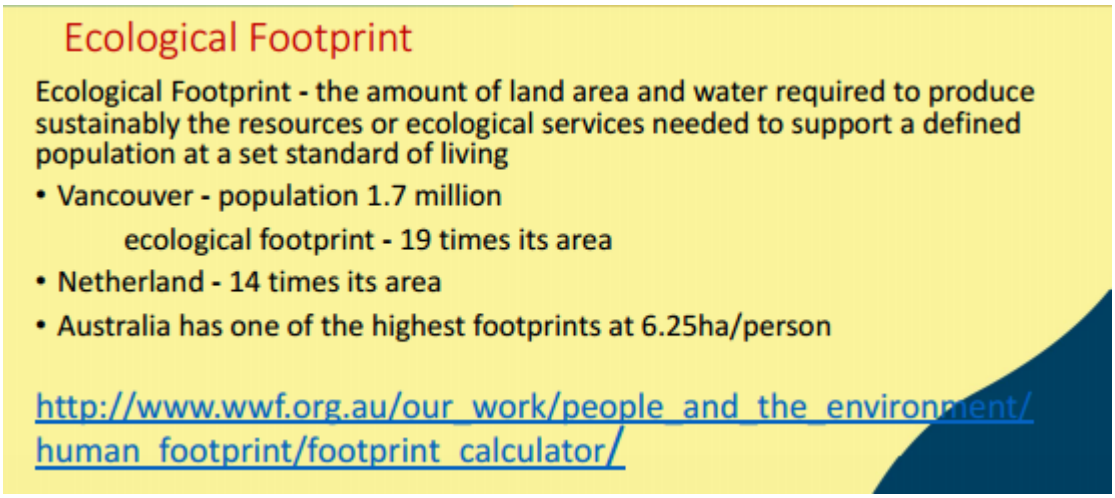
4.

The effect of a defined population on the environment, including land, water and other resources is termed as_____.

a. Ecological Fingerprint
b. Ecological History
c. Ecological Footprint
d. Sustainability

Correct Answer:- c

Detailed Solution:



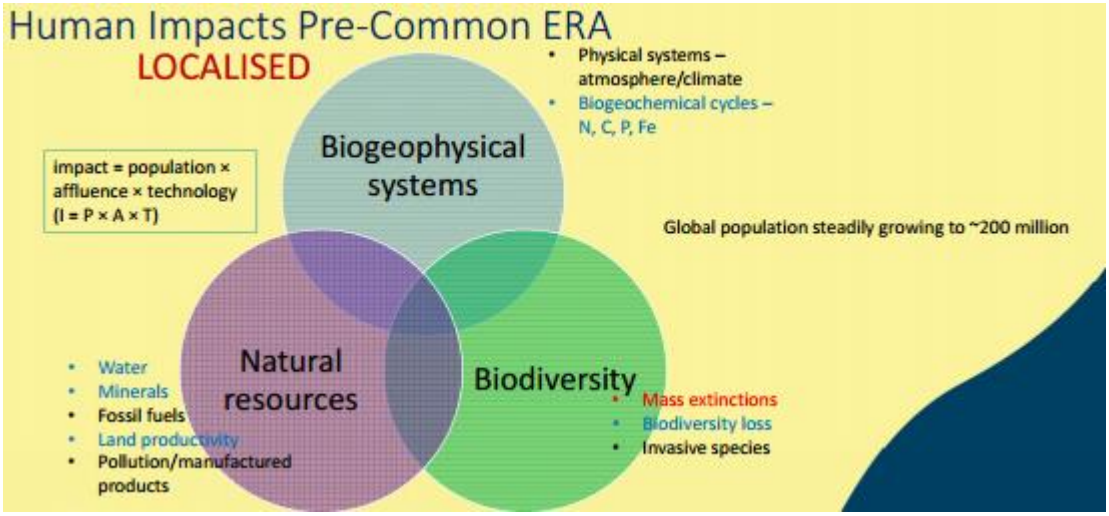
5.

Human impacts on the environmental system can be calculated by which of the following equation?

a. Population × Affluence × Time
b. Population × Affluence × Temperature
c. Population × Affluence × Technology
d. Population × Poverty × Technology

Correct Answer:- c

Detailed Solution:



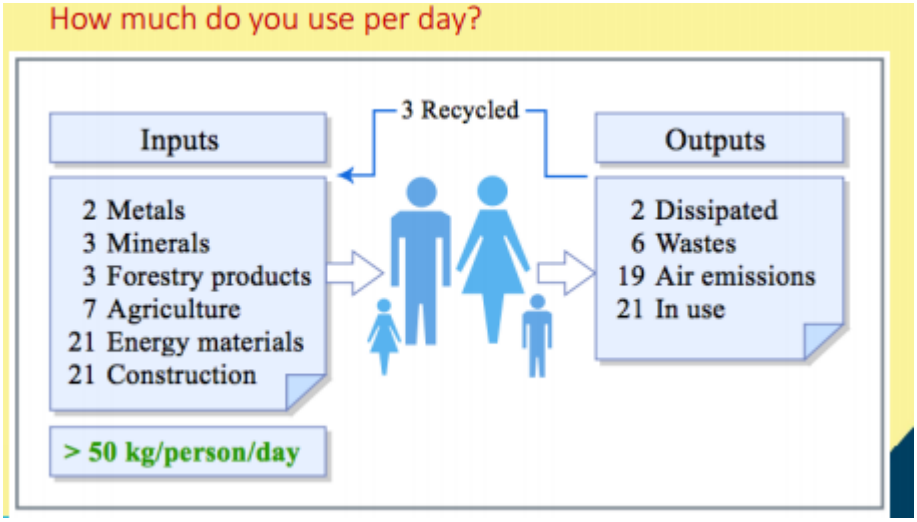
6.

How much input of resources is required per person per day on average?

a. 60 Kg
b. 100 Kg
c. 40 Kg
d. 50 Kg

Correct Answer:- d

Detailed Solution:



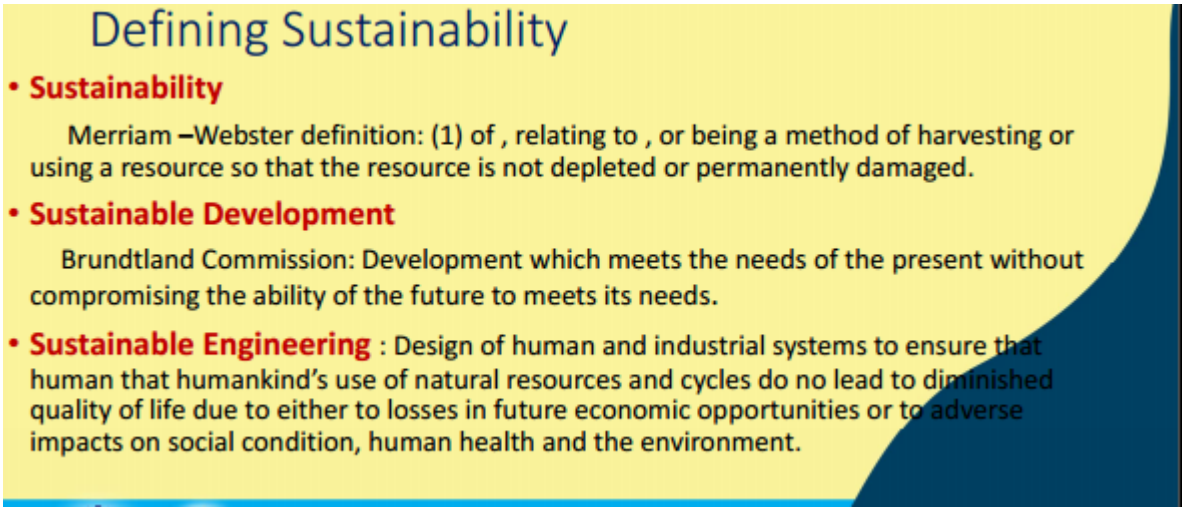
7.

Sustainable development is _____.

a. Meeting the present needs with compromising the ability of future generations
b. Meeting the present needs without compromising the ability of future generations
c. Using the material and resources at maximum levels
d. None of these

Correct Answer:- b

Detailed Solution:



8.

Match the correct options:

1.	MDG 2	A.	Improve maternal health
2.	MDG 6	B.	Global partnership for development
3.	MDG 5	C.	Combat diseases
4.	MDG 8	D.	Universal primary education

a. 1-A, 2-B, 3-C, 4-D
b. 1-B, 2-A, 3-D, 4-C
c. 1-D, 2-C, 3-A, 4-B
d. 1-C, 2-D, 3-B, 4-A

Correct Answer:- c

Detailed Solution:

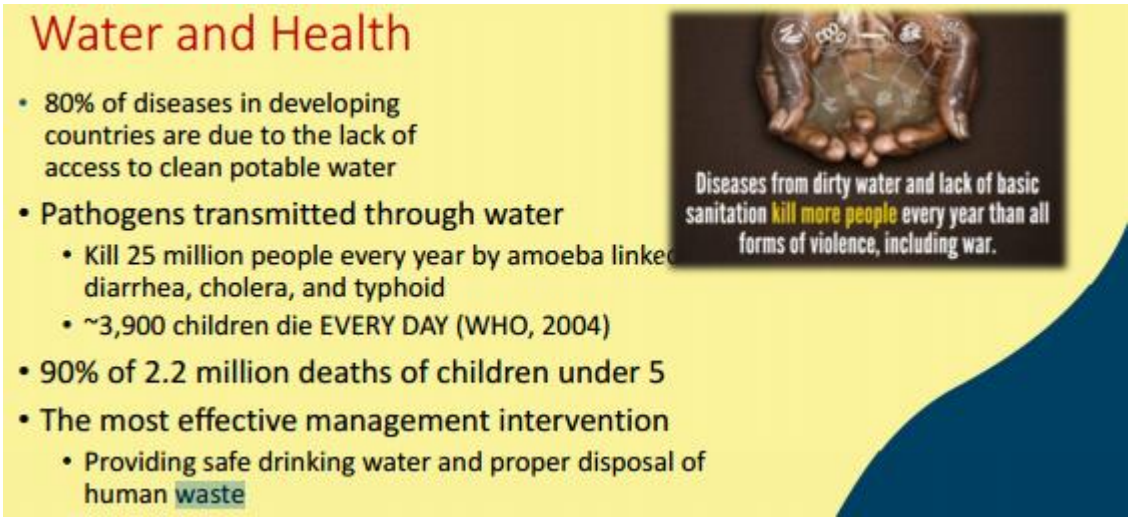
9.

The most effective management intervention of water and health are _____.

a. Provision of safe drinking water and improper disposal of human waste
b. No provision of safe drinking water and proper disposal of human waste
c. Provision of safe drinking water and proper disposal of human waste
d. No provision of safe drinking water and improper disposal of human waste

Correct Answer:- c

Detailed Solution:



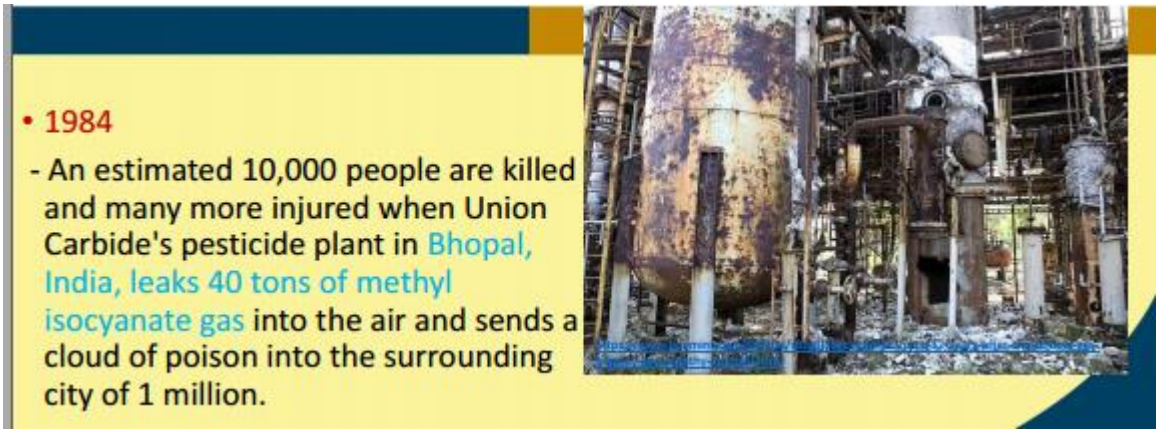
10.

Which gas is responsible for Bhopal Gas Tragedy (1984)?

a. Ethyl Isocyanate
b. Methyl Isocyanide
c. Hydrogen Cyanide
d. Methyl Isocyanate

Correct Answer:- d

Detailed Solution:



Select all the correct answers

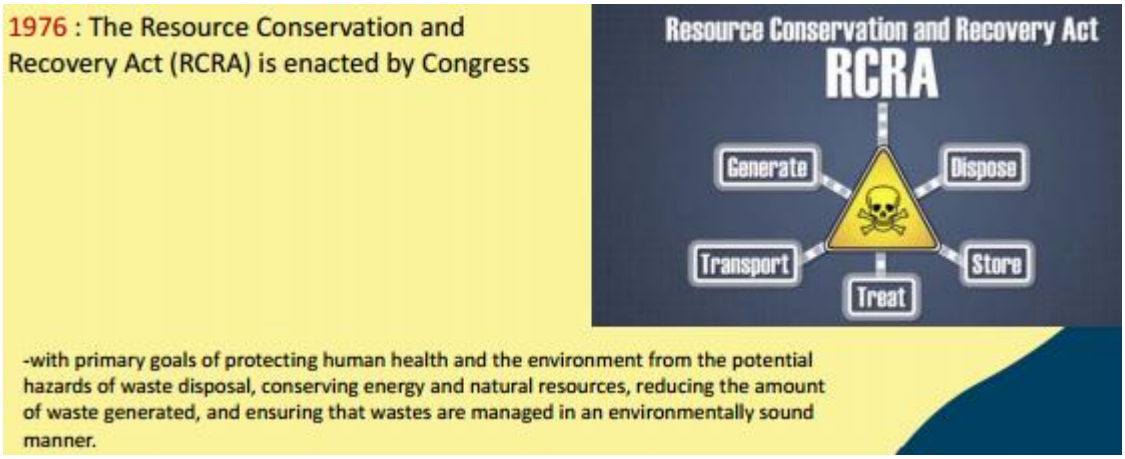
11.

Identify the correct statement/statements regarding the Resource Conservation and Recovery Act (RCRA).

a. It was enacted by Congress in 1978.
b. The primary goal of the act is to protect human health and the environment from the potential hazards of waste disposal, conserving energy and natural resources.
c. It focuses on waste management in the environment.
d. It focuses on waste maximization in the environment.

Correct Answer:- b,c

Detailed Solution:



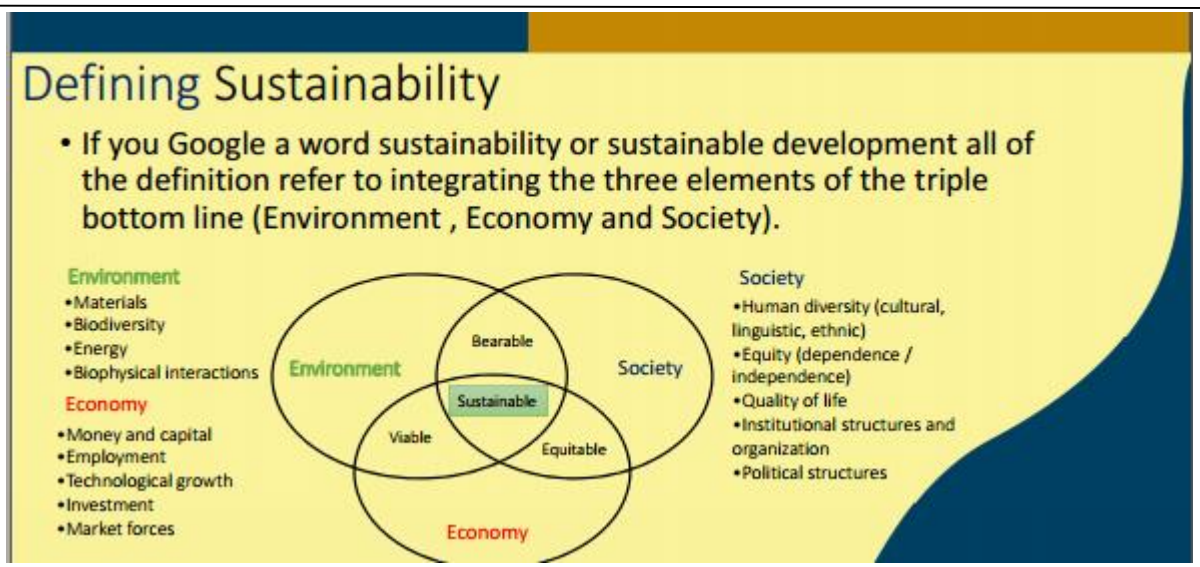
12.

Sustainable development is an integration of which of the following elements:

a. Environment
b. Society
c. Energy
d. Economy

Correct answer:- a,b,d

Detailed Solution:



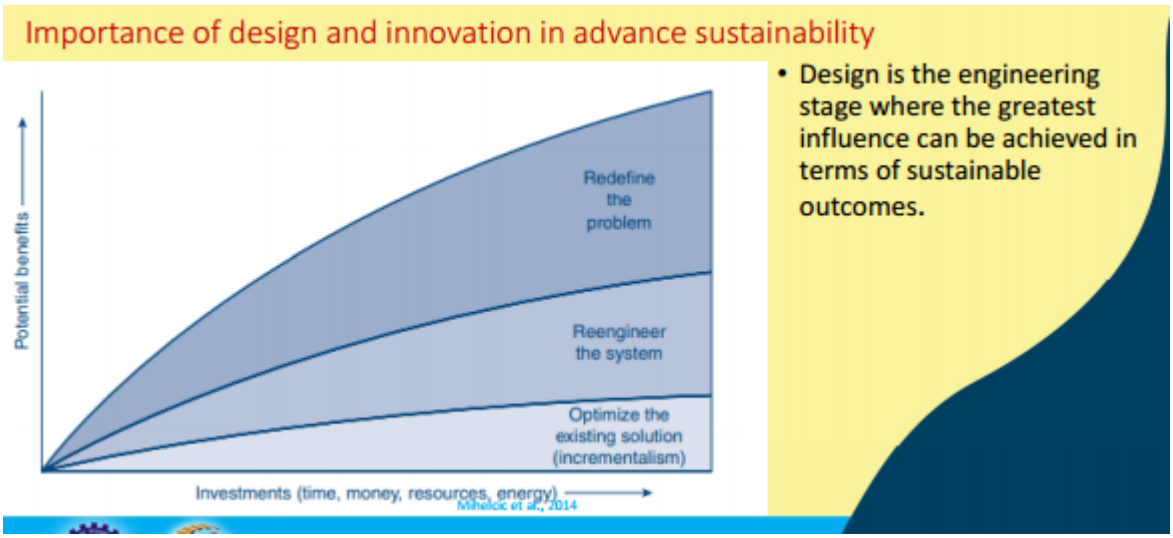
13.

What is the potential benefit of design and innovation in advanced sustainability?

a. Existing solution can be optimized
b. The problem can be redefined
c. The existing system can be interrupted
d. A new system can be corrupted

Correct Answer:- a, b

Detailed Solution:



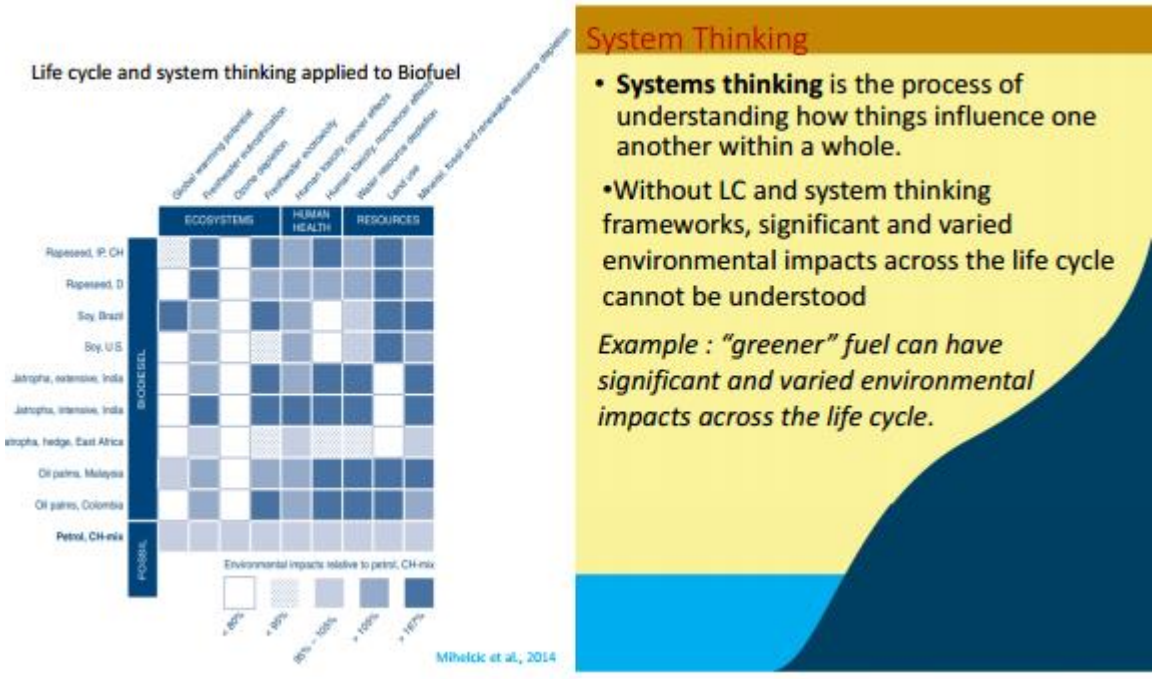
14.

Which of the following statements is/are correct?

a. Systems thinking is the process of understanding how things influence one another within a whole
b. In the circular economy, materials flow in a linear system
c. Without LifeCycle and system thinking frameworks, significant and varied environmental impacts across the life cycle cannot be understood
d. In the circular economy, materials flow in a closed-loop system

Correct Answer:- a, c, d

Detailed Solution:



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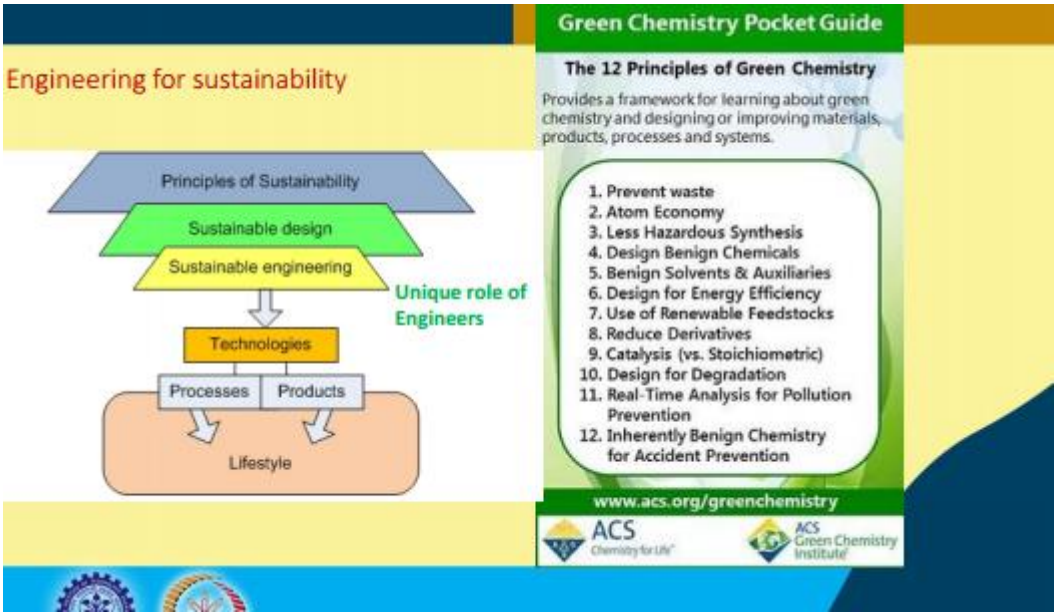
15.

Which of the following is a principle of Green Chemistry?

a. Increased use of derivatives
b. Use of Renewable feedstock
c. Overdue analysis for pollution prevention
d. Less hazardous synthesis

Correct Answer:- b, d

Detailed Solution:



**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 2

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 **Total Marks 15 x 2 = 30**

Section 1:- Choose the correct Answer

1. 100 ml of water is analyzed and found to contain 2.0 mg of TCE. What is the TCE concentration in the water sample in mg/L?

a. 2 mg/L
b. 20 mg/L
c. 200 mg/L
d. 10 mg/L

Correct Answer: b

Detailed Solution:

Concentration of TCE = 2mg/100 ml * 1000 ml/1L = 20 mg/L

2. A gas mixture contains 0.005 moles of carbon monoxide (CO) and 0.995 moles of air. What is the CO concentration in air, expressed in units of ppmv?

a. 5 ppmv
b. 500 ppmv
c. 50 ppmv
d. 5000 ppmv

Correct Answer: d

Detailed Solution:

Concentration of CO in air = (0.005 moles of CO)/(1 mole of total air) * 10^6 ppmv = 5000 ppmv

3. The gas-phase trichloroethylene (TCE) concentration in the air above Lake Superior was 500 micrograms per cubic meter. What is the partial pressure (in atm) of TCE at STP condition?

a. $8.5*10^{-8}$ atm
b. $8.5*10^{-6}$ atm
c. $7.5*10^{-8}$ atm
d. $6.5*10^{-8}$ atm

Correct Answer: a

Detailed Solution:

We know that partial pressure = mole fraction * total pressure

Since the system is atmosphere we take the total pressure = atmospheric pressure (1 atm)

Mole fraction = 500 µg/m^3 * mole/131.5g*10^{-6} g/µg*10^{-3} m^3/L =3.8*10^{-9}mole TCE/ L air

= 3.8*10^{-9}mole TCE/ L air * 22.4 L/ mole air = 8.5*10^{-8} mole TCE/ mole air

Partial pressure = 8.5*10^{-8} *1 atm = = 8.5*10^{-8} atm.

4. There are two gases (A & B) present in a container and exert a pressure of 5 atm on the base of the container. If the volumetric ratio of the gases A:B is 2:3, find the partial pressure exerted by the gas A in the container?
    a. 5 atm
    b. 3 atm
    c. 2 atm
    d. 1 atm

Correct Answer: c

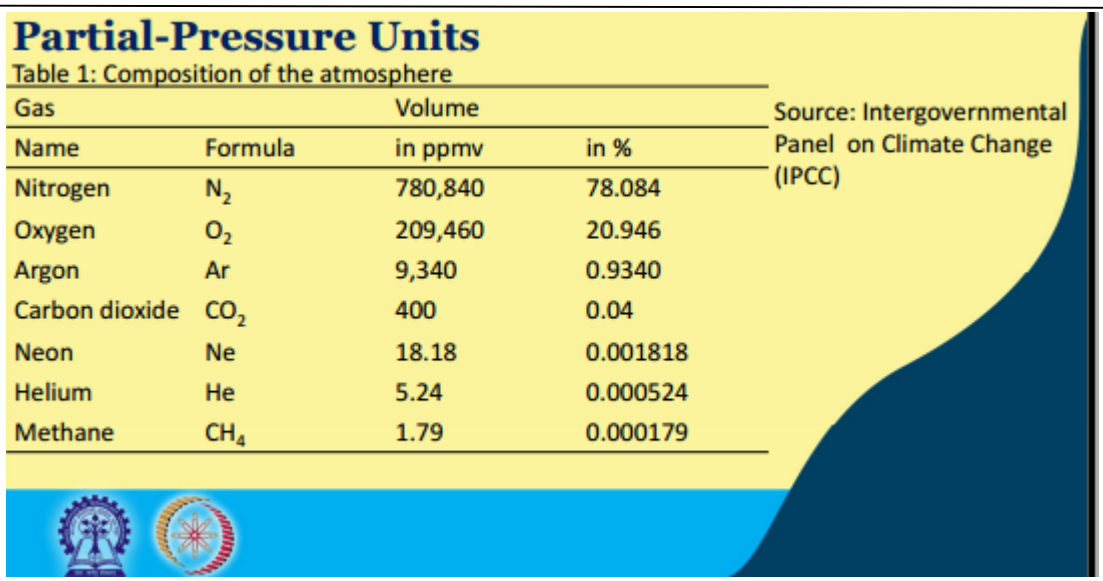
Detailed Solution:

Partial pressure = volumetric proportion of a gas A * total pressure = 2/5 *5 = 2 atm

5. Which of the following gas exerts the highest partial pressure in the atmosphere?
    a. Argon
    b. Methane
    c. Carbon dioxide
    d. Oxygen

Correct Answer: d

Detailed Solution:



Out of the given gases, oxygen exerts more partial pressure because air contains more oxygen content when compared to the other given gases.

6. Calculate the weight of calcium hydroxide ($Ca(OH)_2$) present in 2/3M aqueous $Ca(OH)_2$ solution?

a. 23.5 g
b. 49.3 g
c. 51.2 g
d. 74.0 g

Correct Answer: b

Detailed Solution:

Molecular weight of $Ca(OH)_2$ = 40+(16+1)*2 =74 g

Given the molarity of the solution M = 2/3

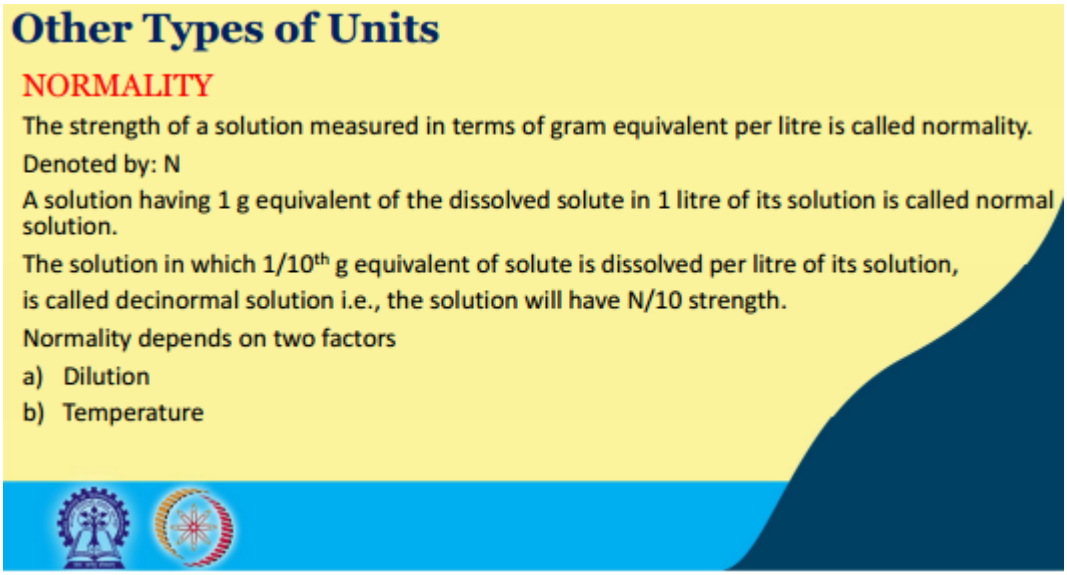
Molarity = Moles/litre
No. of moles = 2/3
1 mole = wt/molecular weight
2/3 = wt/74
Wt. = 2/3 * 74 = 49.3 g
weight of calcium hydroxide ($Ca(OH)_2$) present in 2/3M aqueous solution = 49.3 g

7. The strength of a solution measured as gram equivalent per litre is called _____.

a. Molality
b. Molarity
c. Normality
d. Nolality

Correct Answer: c

Detailed Solution:

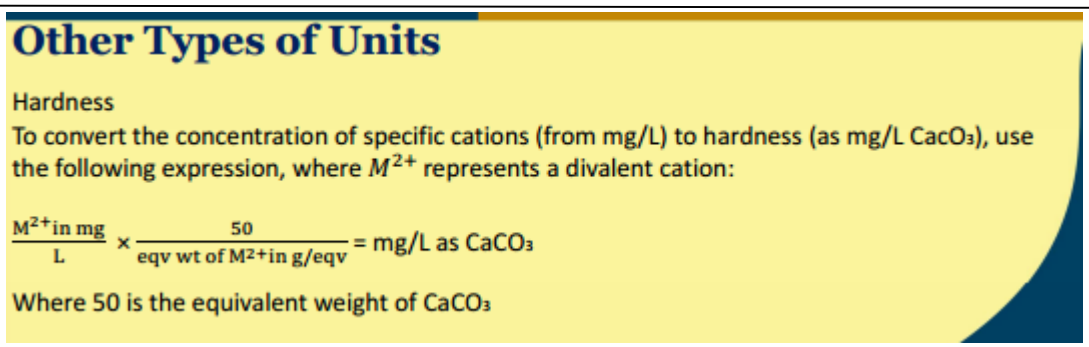


8. Hardness and Alkalinity of water are expressed in terms of _____.

a. mg/L of $Ca(HCO_3)_2$
b. mg/L of $CaCO_3$
c. mg/L of $MgCO_3$
d. mg/L of Al $(HCO_3)_3$

Correct Answer: b

Detailed Solution:



9. Calculate the equivalent weight of calcium bicarbonate?

a. 81 g
b. 162 g
c. 101 g
d. 40 g

Correct Answer: a

Detailed Solution:

calcium bicarbonate $Ca(HCO_3)_2$
Molecular weight = 40 + (1+12+48)*2 = 162
The valency of calcium = 2
Equivalent weight = Molecular weight/valency = 162/2 = 81

10. Calculate the normality of the aqueous solution if 30 grams of sulphuric acid is mixed in 1 litre of water?

a. 1 N
b. 2 N
c. 0.61 N
d. 0.5 N

Correct Answer: c

Detailed Solution:

Molecular weight of H_2SO_4 = 98
Equivalent weight of H_2SO_4 = 98/2 = 49
Normality = 30/49 = 0.61 N

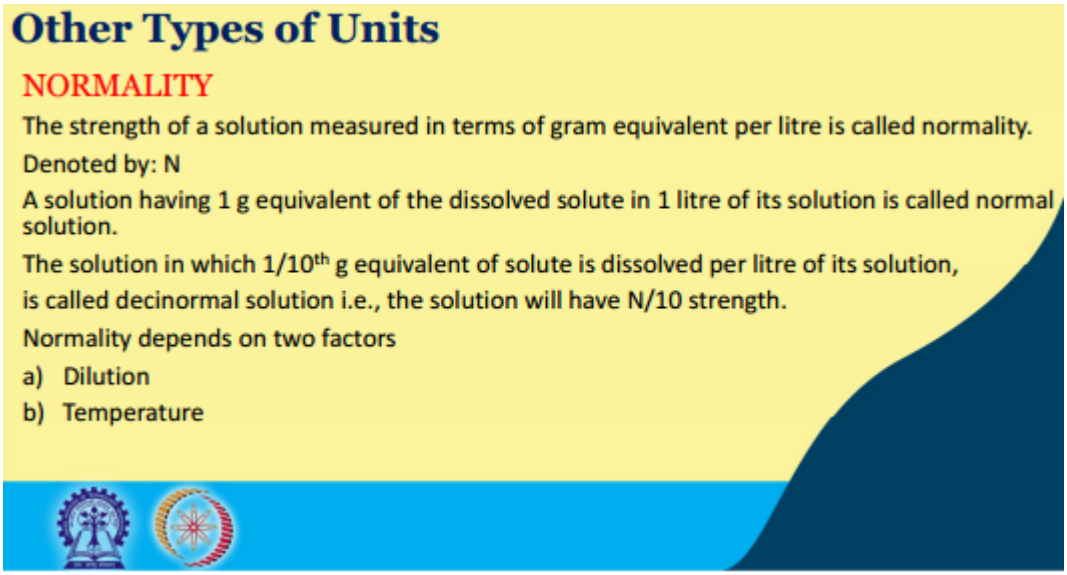
Section 2:- Select all the correct answers

11. Normality depends on which of the following factors?

a. Colour of the solution
b. Dilution of the solution
c. Temperature of the solution
d. Odour of the solution

Correct Answer: b, c

Detailed Solution:

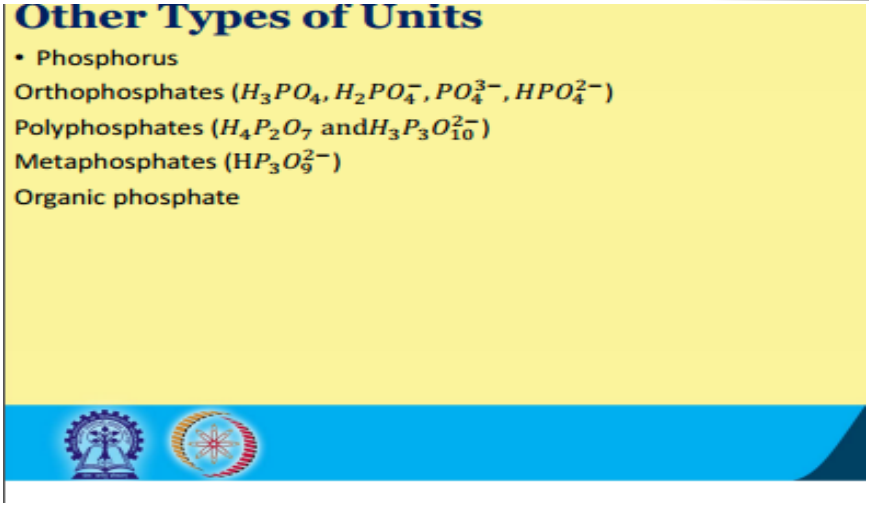


12. Select the orthophosphates from the following.

a. H_3PO_4
b. $H_4P_2O_7$
c. $H_2PO_4^-$
d. $HP_3O_9^{2-}$

Correct Answer: a,c

Detailed Solution:



13. Which of the following ions are responsible for hardness in water?

a. Na^+
b. CO_3^{-2}
c. Ca^{+2}
d. Al^{+3}

Correct Answer: c,d

Detailed Solution:

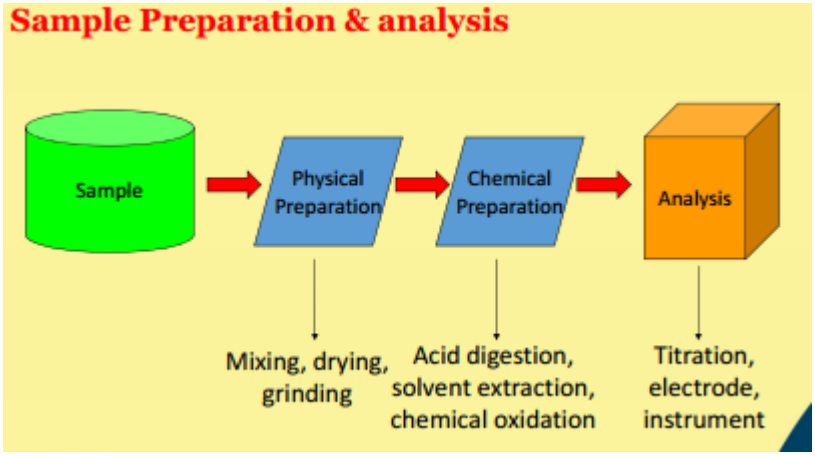
Multivalent cations are responsible for hardness. In the given options, calcium and Aluminium ions are responsible for hardness in water.

14. Which of the following are the different chemical preparation methods for sample analysis?

a. Mixing
b. Chemical oxidation
c. Titration
d. Acid digestion

Correct Answer: b, d

Detailed Solution:

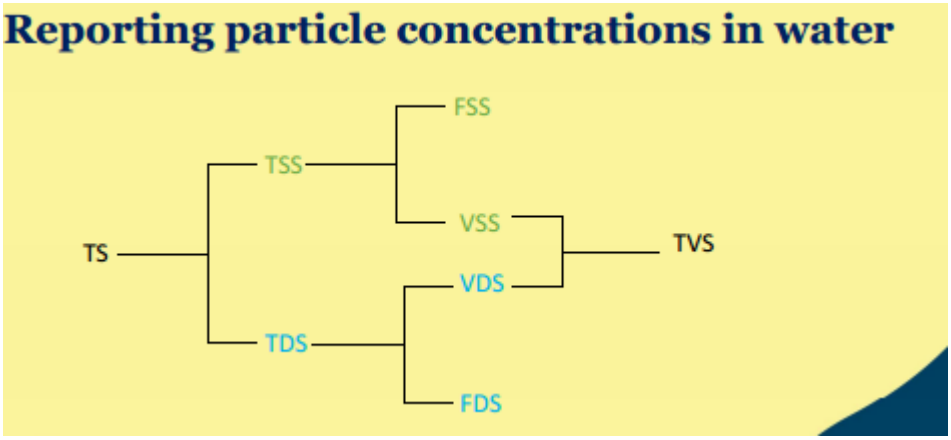


15. What are the different solids components present in Total solids?

a. Total Volatile Solids
b. Fixed Dissolved Solids
c. Dissolved Oxygen
d. Fixed Suspended Solids

Correct Answer: a,b,d

Detailed Solution:



**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 3

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 **Total Marks 15 x 2 = 30**

Section 1:- Choose the correct Answer

1. What is the term for the examination of living and non-living elements and how they interact with each other?

a. Epidemiology

b. Environmental studies

c. Toxicology

d. Ecology

Correct Answer:- b

Detailed Solution:-

2. Which of the following is the kinetic equation for zero order reaction?

a. $[C] = [C_0] - kt$

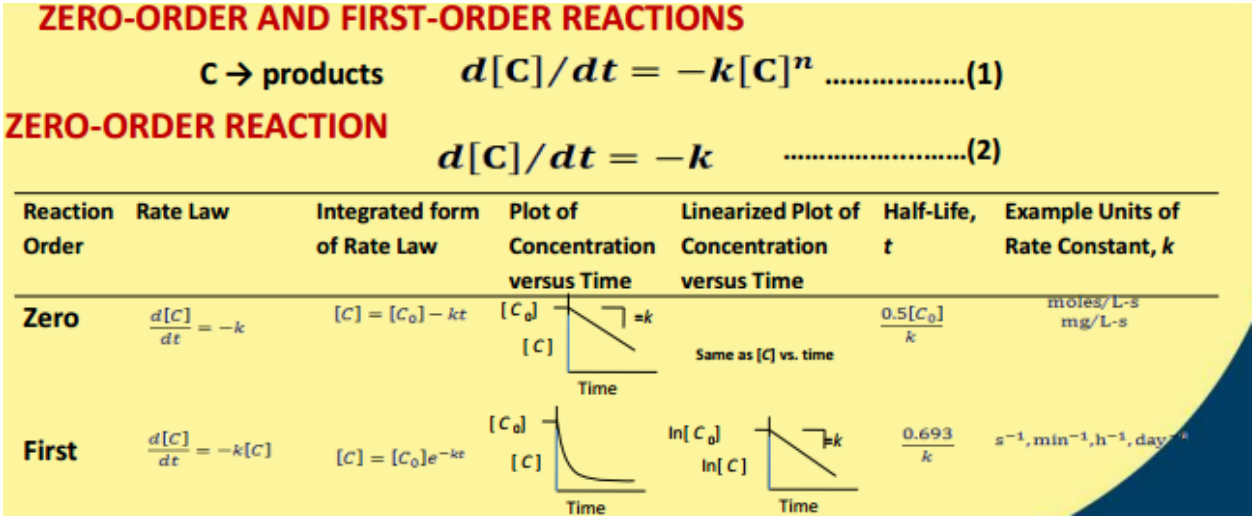
b. $[C] = [C_0]*e^{-kt}$

c. $[C] = [C_0]*kt$

d. $[C] = [C_0] \ln(kt)$

Correct Answer:- a

Detailed Solution:-



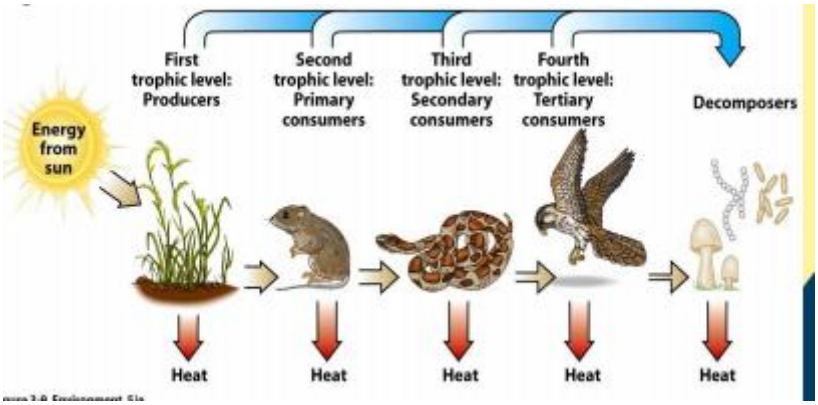
3. Match the following.

i. Producers	a. Animals
ii. Consumers	b. Bacteria, fungi
iii. Decomposers	c. Plants

a. i) a, ii) c, iii) b.
b. i) c, ii) b, iii) a.
c. i) b, ii) c, iii) a.
d. i) c, ii) a, iii) b.

Correct Answer:- d

Detailed Solution:-



4. What do decomposers consume for sustenance?

a. Animals
b. Plants
c. Dead Organisms/Animals
d. Grass

Correct Answer:- c

Detailed Solution:-

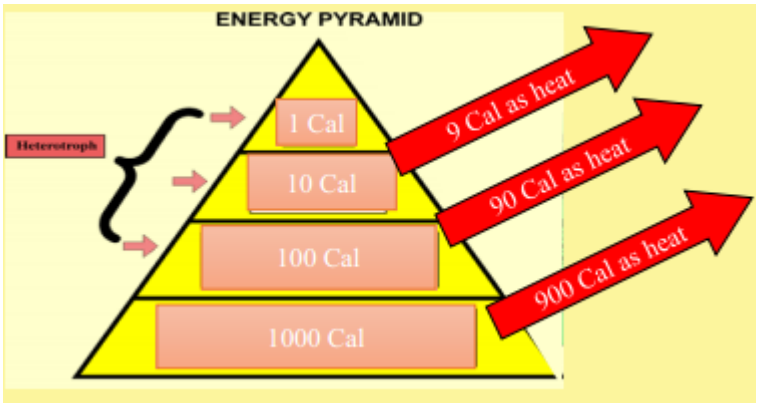
A Decomposer is **an organism that mostly consumes decaying biomass**.

5. The amount of energy available for higher trophic levels on the energy pyramid is _____ than the amount of energy at lower trophic levels of the energy pyramid.

a. Higher
b. No change on
c. Lower
d. Medium

Correct Answer:- c

Detailed Solution:-



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6. Consider the following food chain which occurs in a forest:

Grass → Deer → Lion

If 3750 joules of solar energy is available to the grass, how much energy would the lion get by eating the Deer?

a. 3750 Joules

b. 375 Joules
c. 37.5 Joules
d. 3.75 Joules

Correct Answer:- d

Detailed Solution:-

Since the lion is at the third trophic level, according to the 10% law, the lion will get 0.1*0.1*0.1*3750 = 3.75 joules

7. Calculate the stoichiometric requirement of O_2 to burn 2gram of methane gas completely?

a. 4 g of O_2

b. 64 g of O_2

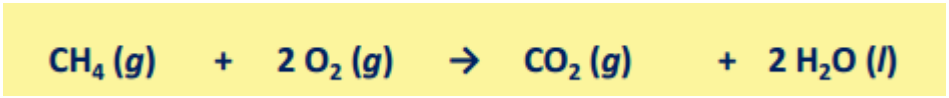
c.16 g of O_2

d. 8 g of O_2

Correct Answer:- d

Detailed Solution:-

The balanced equation is as follows



16 g of methane requires 64 g of O_2; hence 2g of methane requires 8 g of O_2.

8. A town had a population of 300,000 at the end of 2010. Suppose in the year 2020 there were 6000 births and 4500 deaths. And in the same year, there were 1500 emigrants and 500 immigrants. Calculate the percentage of population increase only due to birth in 2020.

a. 2%
b. 2.5%
c. 3%
d. 3.2%

Correct Answer:- a

Detailed Solution:-

percentage of population increase due to birth in 2020 = Births/Initial Population

= 6000/300000 = 0.02*100

= 2%

9. A town had a population of 300000 at the end of the year 2010. Suppose in the year 2020 there were 6000 births and 4500 deaths. And in the same year, there were 1500 emigrants and 500 immigrants. Calculate the net population growth rate in 2020.

a. 0.167%
b. 0.23%
c. 0.315%
d. 0.142%

Correct Answer:- a

Detailed Solution:-

r = (6000-4500) +(500-1500) =500
500/300000 = 1.66* 10^{-3} *100 = 0.167%

10. What is the global biocapacity of Australia?

a. 8.00 gha/person

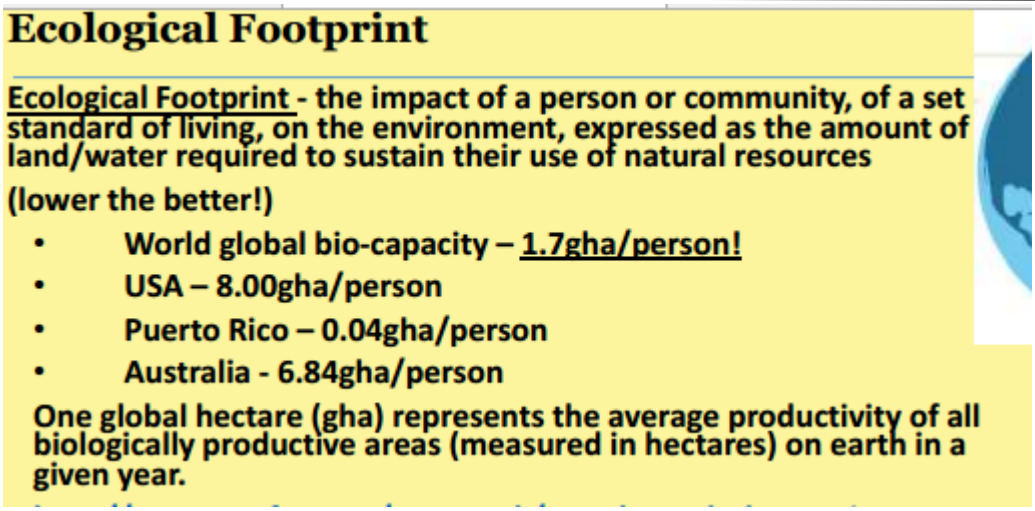
b. 0.04 gha/person

c. 1.7 gha/person

d. 6.84 gha/person

Correct Answer:- d

Detailed Solution:-



Section 2:- Select all the correct answers

11. Which of the following are the biotic components of the ecosystem?

a. Water

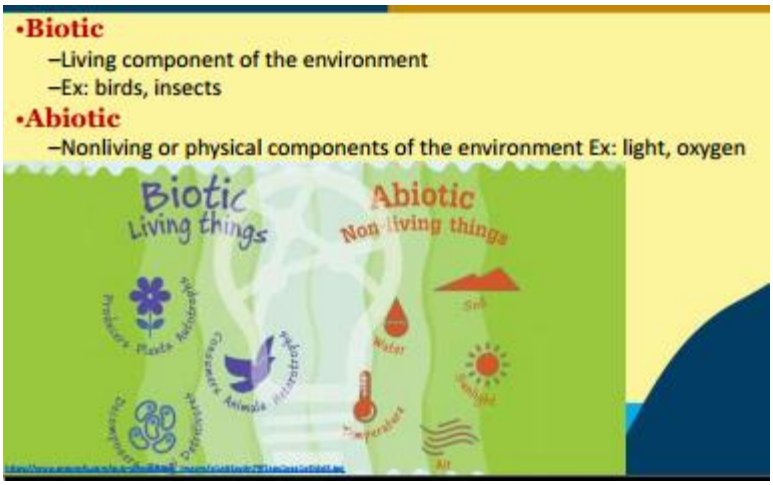
b. Plants

c. Humans

d.Atmospheric Pressure

Correct Answer:- b,c

Detailed Solution:-



12. Which of the following different environmental chemistry approaches are used to evaluate the chemical's fate and treatment?

a. Entropy

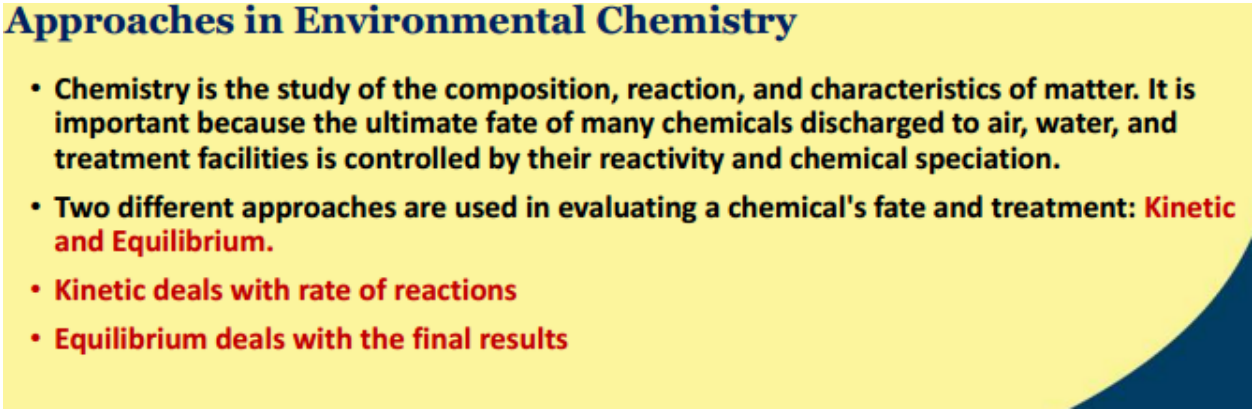
b. Chemical kinetics

c. Gibbs free energy

d. Chemical equilibrium

Correct Answer:- b,d

Detailed Solution:-

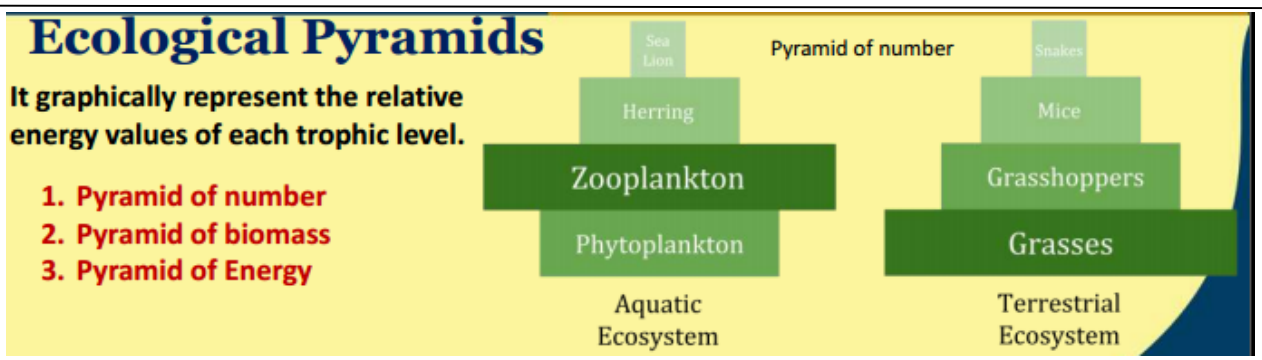


13. Which of the following is a type of Ecological pyramid?

a. The pyramid of numbers
b. The pyramid of carbon
c. The pyramid of biomass
d. The pyramid of energy

Correct Answer:- a, c, d

Detailed Solution:-



14. Which law states that "Energy can neither be created nor be destroyed"?

a. Second law of thermodynamics

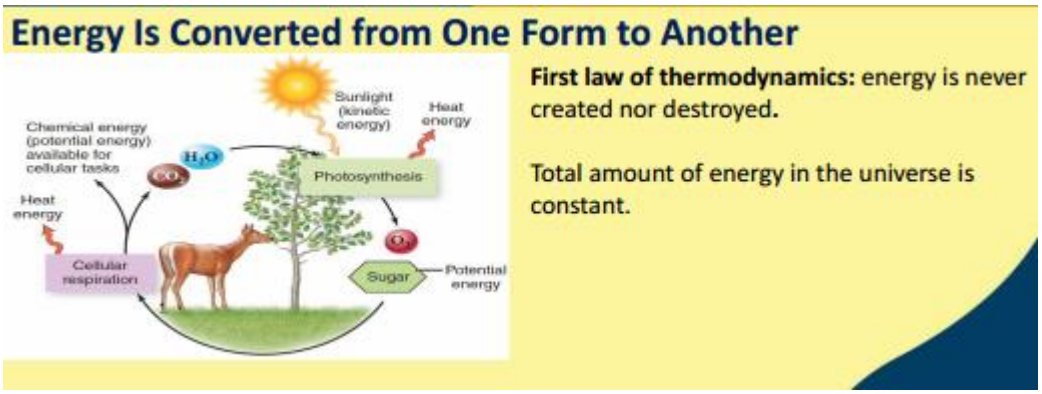
b. First law of thermodynamics

c. Law of conservation of energy

d. Law of conversation of mass

Correct Answer:- b,c

Detailed Solution:-



Law of conservation of energy states that energy can neither be created nor be destroyed.

15. Which of the following statements are correct, corresponding to poverty?

a. The United Kingdom has 17% poverty.

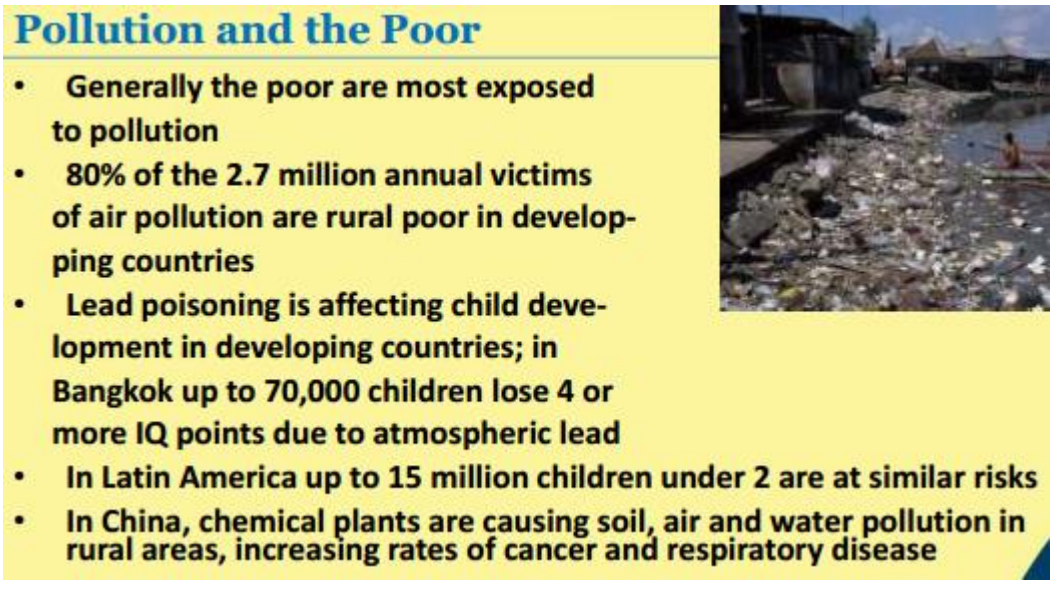
b. The poor are most exposed to environmental pollution.

c. 80% of the annual victims of air pollution are rural poor in developing countries

d. The US had 14% poverty in 2014.

Correct Answer:- b,c

Detailed Solution:-



**************END*********

Introduction to Environmental Engineering and Science – Fundamentals and Sustainability Concepts

Assignment- Week 4

1. Which of the following statements is true?

a. Mass flux is the flow of mass per unit area

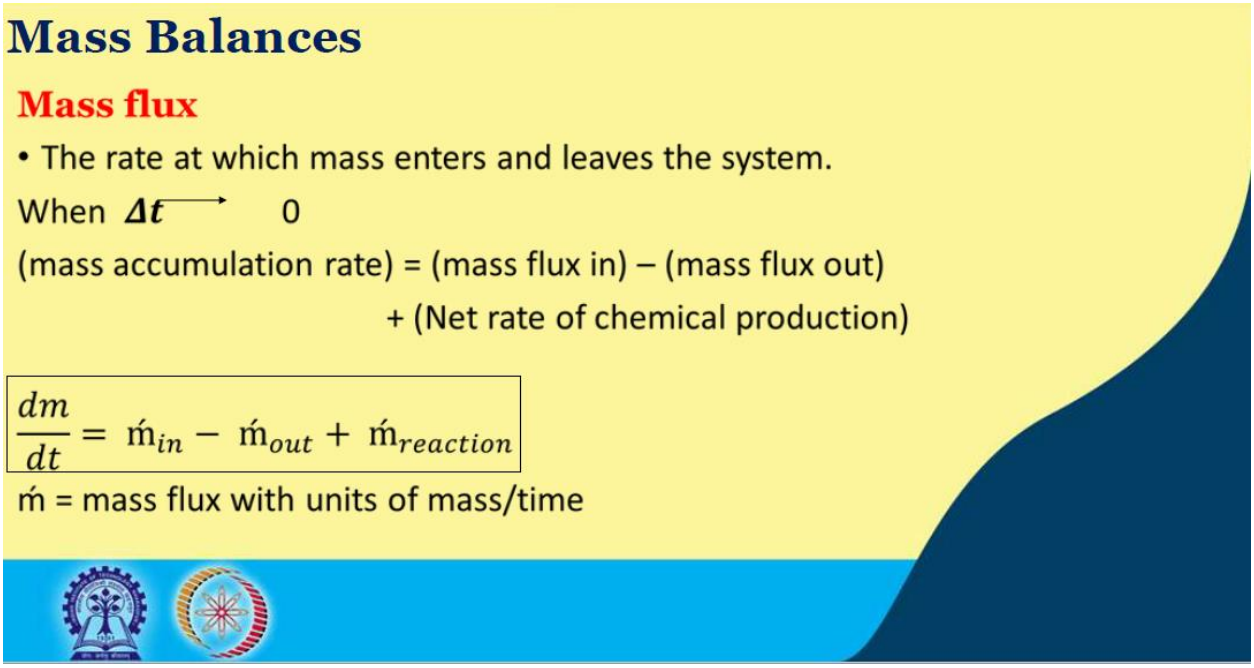
b. Mass flux is only positive in nature

c. Mass flux can be both positive and negative

d. None

Correct Answer:- c

Detailed Solution:-



2. What is the full form of CMBR?

a. Continuously mixed batch reactor

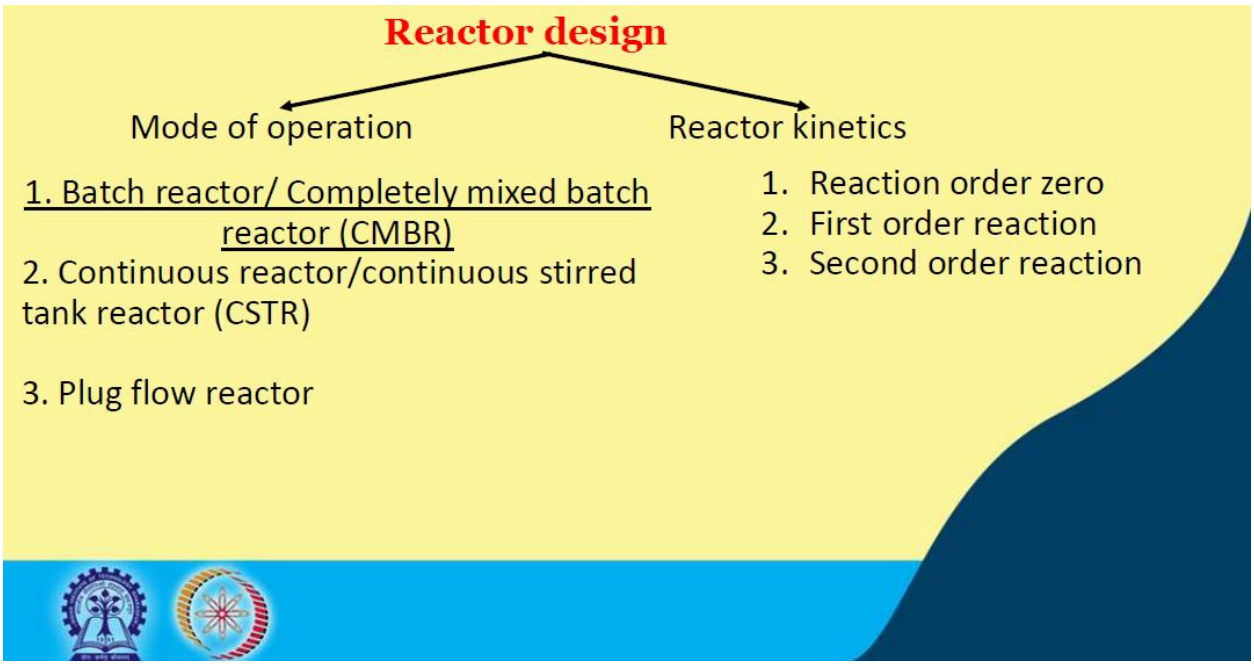
b. Completely mixed batch reactor

c. Completely mixed bulk reactor

d. Continuously mixed bulk reactor

Correct Answer:- b

Detailed Solution:-



3.

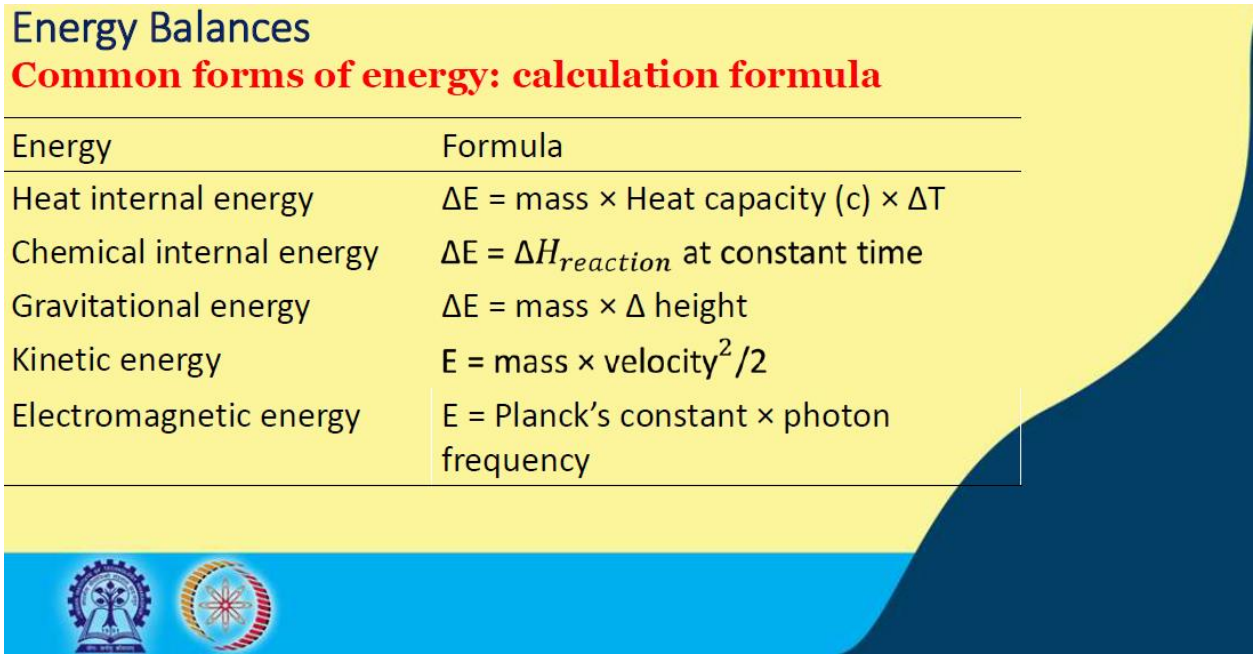
Match the following energy to its correct formula -

1.	Gravitational energy	i)	(Mass × velocity^2)/2
2.	Chemical internal energy	ii)	Mass × change in height
3.	Heat internal energy	iii)	$\Delta H_{reaction}$ at constant time
4.	Kinetic energy	iv)	Mass × heat capacity × change in temperature

a. 1(ii), 2(iii), 3(i), 4(iv)
b. 1(ii), 2(iii), 3(iv), 4(i)
c. 1(i), 2(iii), 3(iv), 4(ii)
d. 1(iv), 2(ii), 3(i), 4(iii)

Correct Answer:- b

Detailed Solution:-



4. The governing equation for CMBR is

a. $\frac{dm}{dt}_{net} = \acute{m}_{in} + \acute{m}_{out} + \acute{m}_{reaction}$

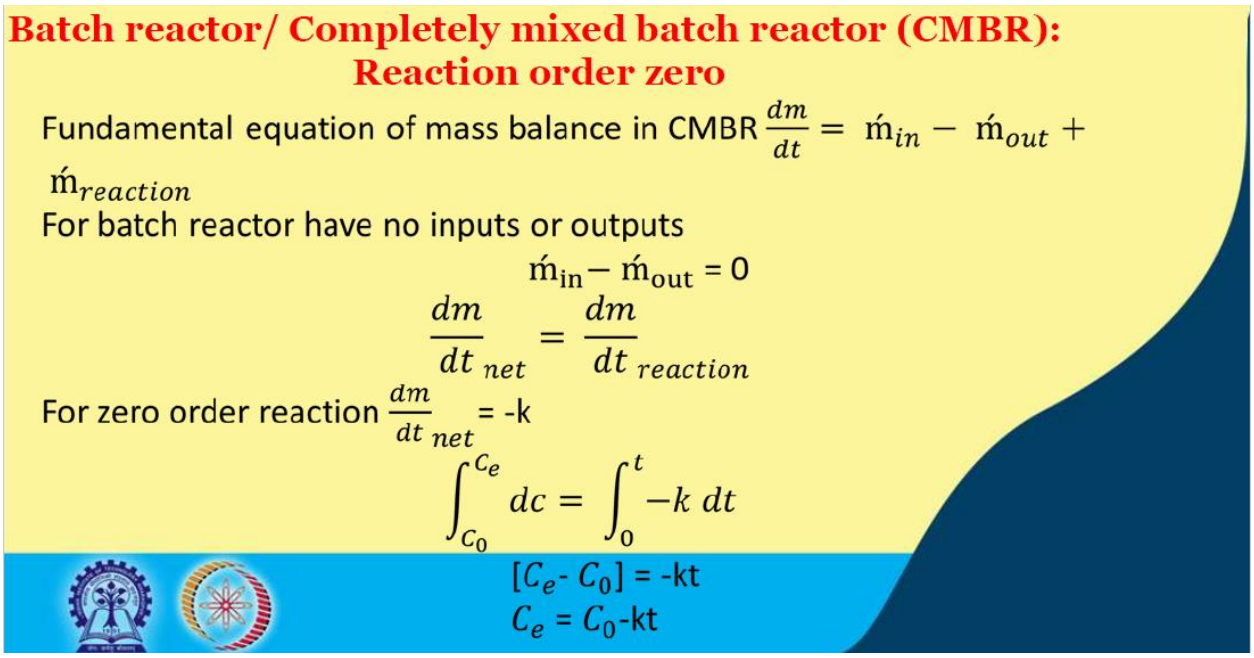
b. $\frac{dm}{dt}_{net} = \acute{m}_{reaction}$

c. $\frac{dm}{dt}_{net} = \acute{m}_{in} - \acute{m}_{out}$

d. $\frac{dm}{dt}_{net} = \acute{m}_{in} - \acute{m}_{reaction}$

Correct Answer:- b

Detailed Solution:-

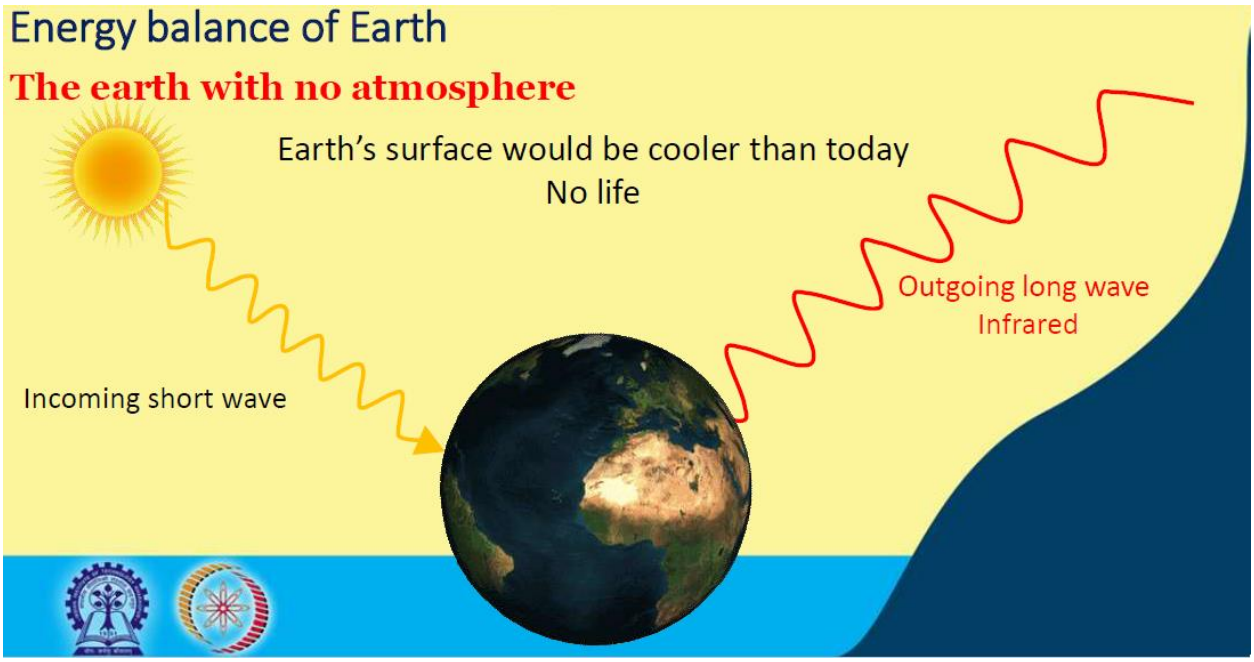


5. Which of the following statements is/are correct?

a. Without atmosphere earth's surface would be cooler than today
b. Without atmosphere earth's surface would be hotter than today
c. The temperature of earth's surface does not depend on the atmospheric presence
d. None of these

Correct Answer:- a

Detailed Solution:-

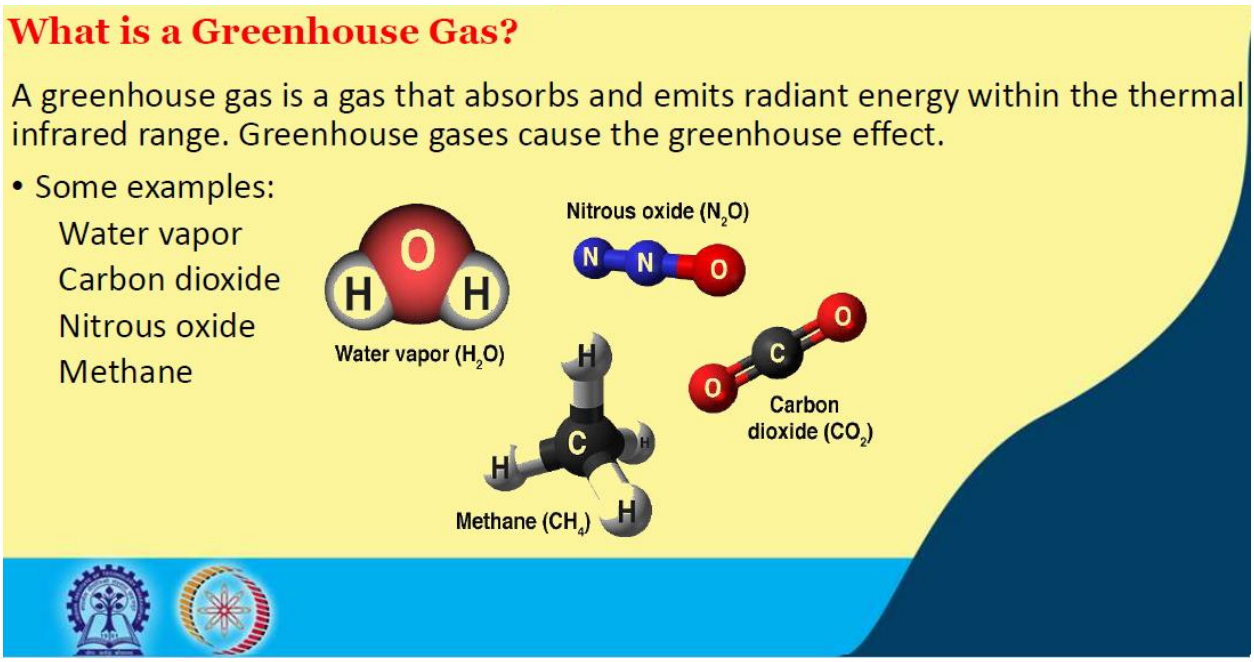


6. Which one is not a greenhouse gas?

a. Methane
b. Nitrogen dioxide
c. Water vapor
d. argon

Correct Answer:- d

Detailed Solution:-



7. which one is the correct formula for first-order reaction kinetics in CSTR?

a. $c_{out} - c_0 = \frac{kV}{Q}$

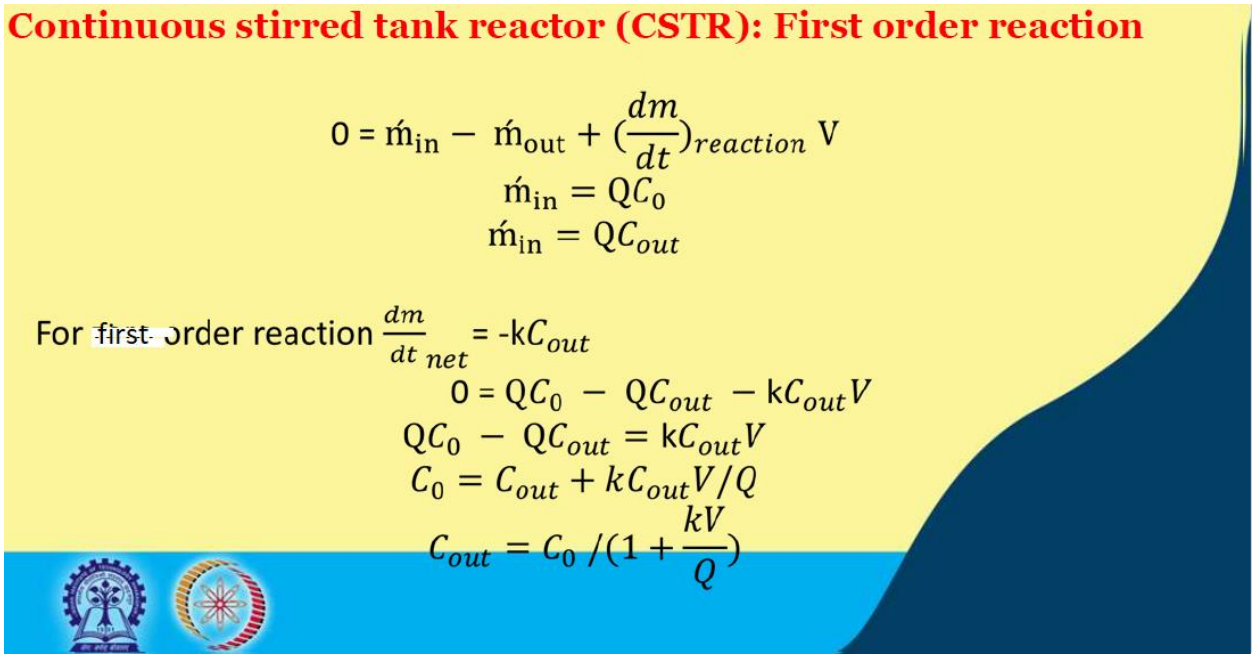
b. $c_{out} - c_0 = -\frac{kV}{Q}$

c. $c_{out} = c_0(1 + \frac{kV}{Q})$

d. $c_{out} = c_0/(1 + \frac{kV}{Q})$

Correct Answer:- d

Detailed Solution:-

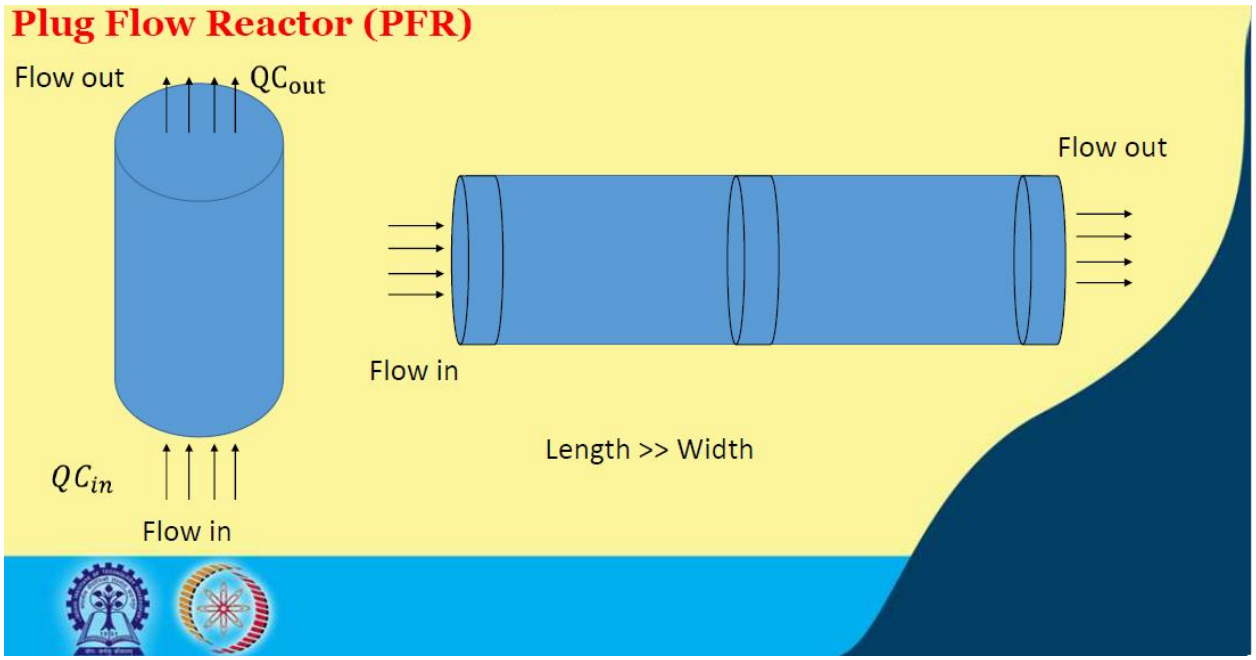


8. Which of the following is true regarding plug flow reactor

a. Length = width
b. Length >> width
c. Length << width
d. None

Correct Answer:- b

Detailed Solution:-



9. Calculate the HRT of a CSTR of volume 100 m^3 operating at a hydraulic loading of 20 m^3/hr

a. 1 day

b. 2 h

c. 4 days

d. 5 h

Correct Answer:- d

Detailed Solution:-

Reaction HRT

$\Theta = V/Q$

V = 300 m^3 and Q = 25 m^3/day. HRT = 100/20 = 5 hours

10. What is the correct unit of mass flux density?

a. $g.s^{-1}.m^2$

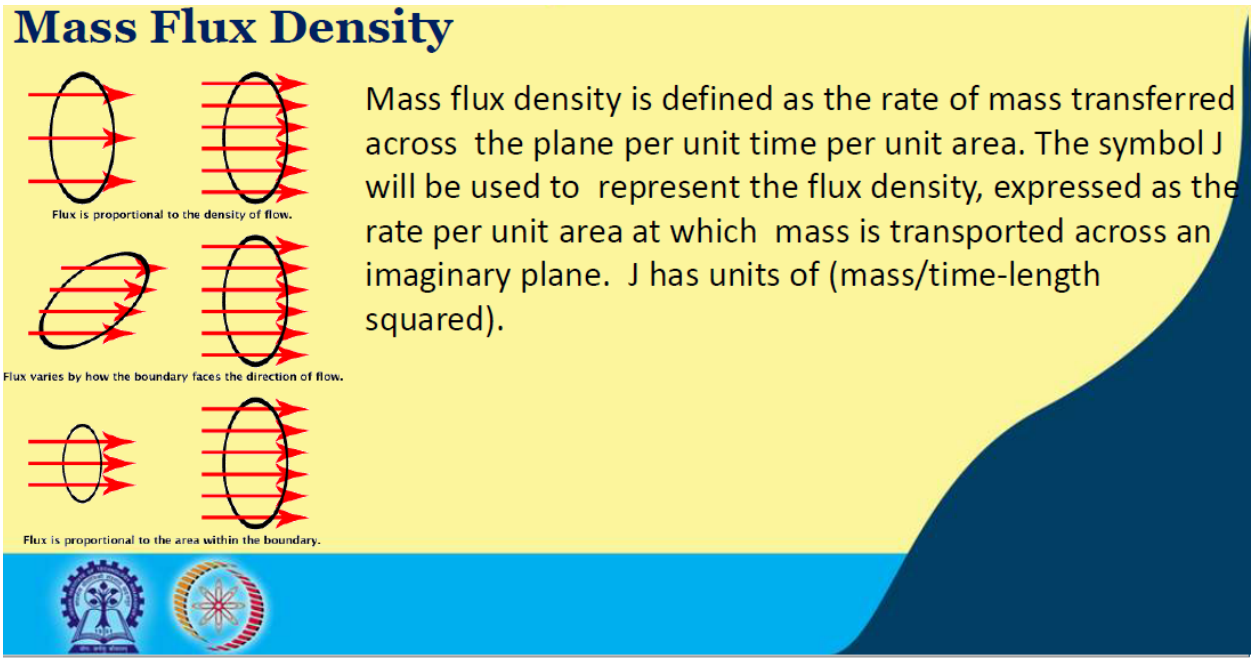
b. $g.s.m^{-2}$

c. $g.s^{-1}.m^{-2}$

d. $g.s^{-2}.m^{-1}$

Correct Answer:- c

Detailed Solution:-



********Select all the correct answers*******

11. Which of the following statements is/are correct?

    a. CMBR operates in batch mode

    b. CMBR operates with a continuous inflow of mass

    c. Liquid content is uniformly mixed in CMBR

    d. CMBR is one of the complex reactor types

Correct Answer:- a, c

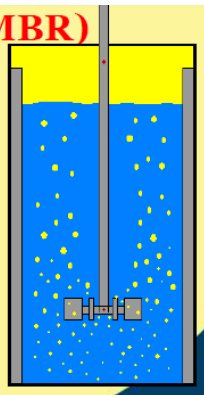
Detailed Solution:-

Batch reactor/ Completely mixed batch reactor (CMBR)

- The simplest reactor type
- Flow is neither entering nor leaving the reactor
- The liquid contents are mixed completely and uniformly

Batch reactor/ Completely mixed batch reactor (CMBR)

Batch reactors are used in a number of industries producing small quantities of high-valued materials such as cell cultivation,
polymer synthesis
and crystallization.
To operate the batch reactor with success, the final quality performance has to maintain with minimum cost. Though operated with the same recipe, the batch process shows batch-to-batch variations in its specified trajectories. Therefore, online process monitoring is essential to achieve successful batch operation.

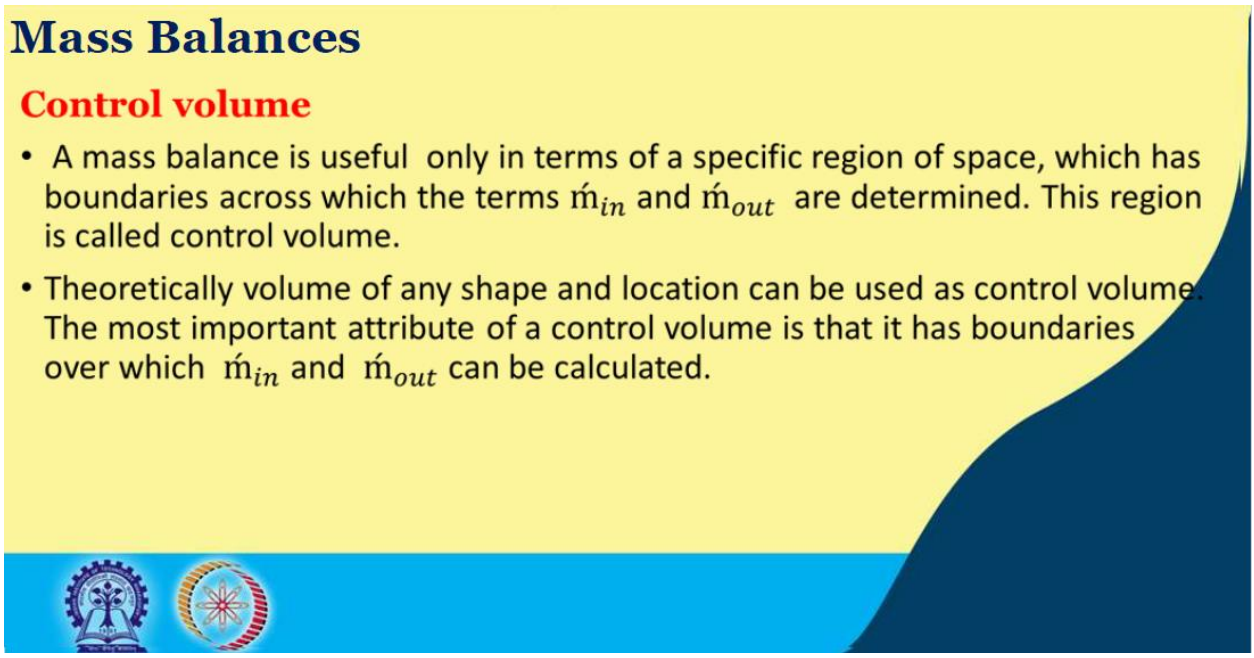


12. Which of the following statements is/are correct?

a. The control volume is a temporal region
b. The control volume is a fixed volume of 1 L
c. The control volume is a spatial region
d. The control volume has boundaries

Correct Answer:- c, d

Detailed Solution:-

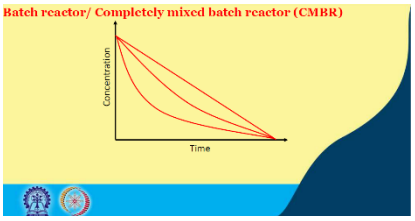


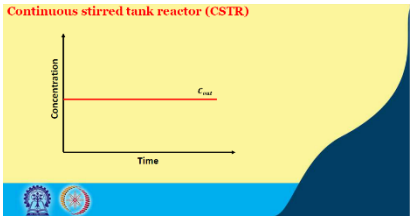
13. Which of the following statements is/are correct?

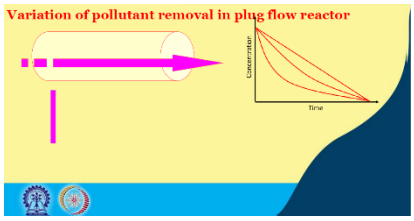
a. Reactant concentration inside the reactor varies with time in CSTR
b. Reactant concentration inside the reactor varies with time in CMBR
c. Reactant concentration inside the reactor varies with time in PFR
d. Reactant concentration inside the reactor doe does not vary with time in CSTR

Correct Answer:- b, c

Detailed Solution:-





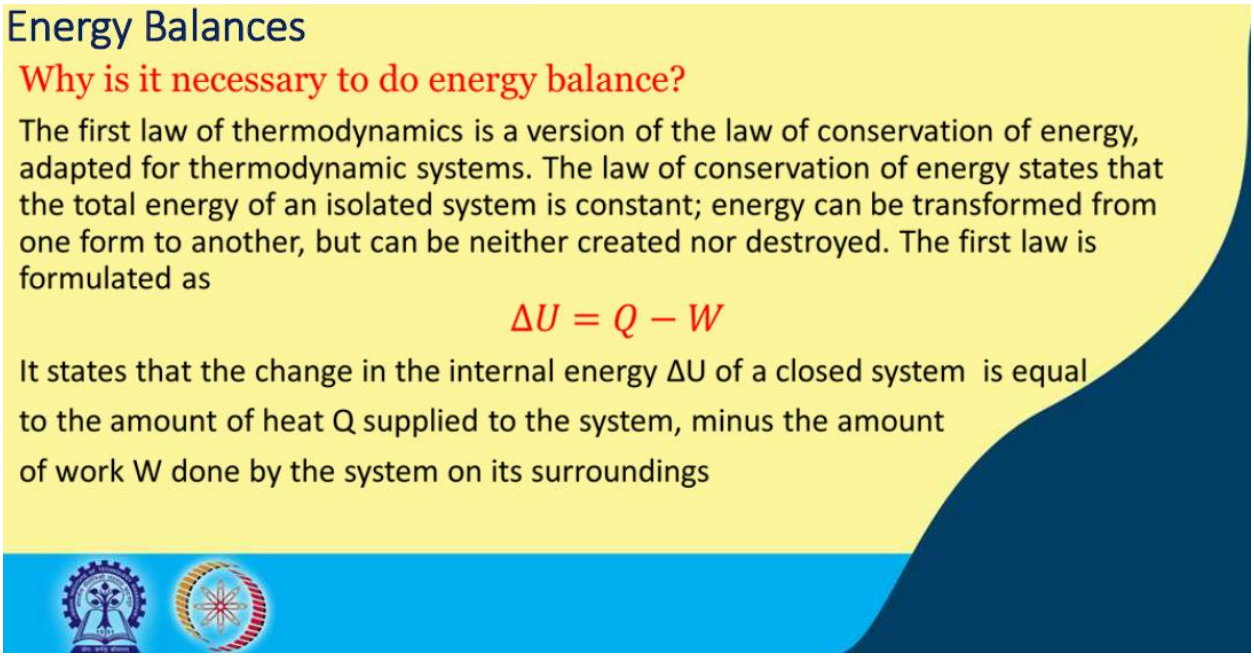


14. Which of the following options related to energy balance is/are correct?

a. The total energy of an isolated system is constant
b. Change in internal energy of a closed system is equal to the work done by the system on the surroundings
c. Change in internal energy of a closed system is equal to the amount of heat supplied to the system, minus the work done by the system on the surroundings
d. The total energy of an isolated system is not constant

Correct Answer:- a, c

Detailed Solution:-



15. which of the following statements is/are correct?

a. advective transport is related to flow velocity

b. Reynold's number is used to predict the fluid flow pattern

c. mechanical dispersion is related to the randomness of fluid molecules

d. turbulent diffusion is due to the random fluctuation in the advective velocity

Correct Answer:- a, b, d

Detailed Solution:-

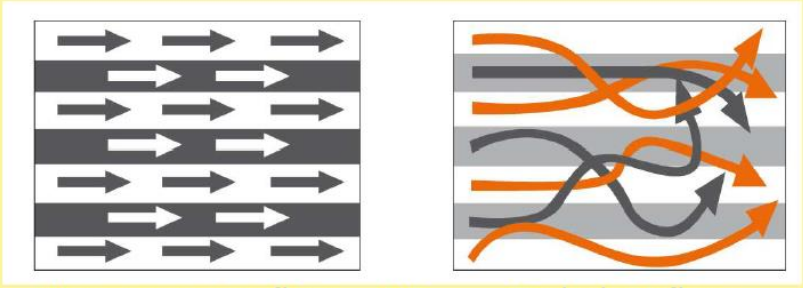
Reynold's number

The **Reynolds number** (**Re**) is an important dimensionless quantity in fluid mechanics used to help predict flow patterns in different fluid flow situations.

At low Reynolds numbers, flows tend to be dominated by laminar (sheet-like) flow, while at high Reynolds numbers turbulence results from differences in the fluid's speed and direction, which may sometimes intersect or even move counter to the overall direction of the flow (eddy currents).

Turbulent Dispersion

Basically turbulent diffusion is due to random fluctuation in advective velocity. A typical one dimensional velocity history at a single point in a turbulent velocity field might look like the figure below.



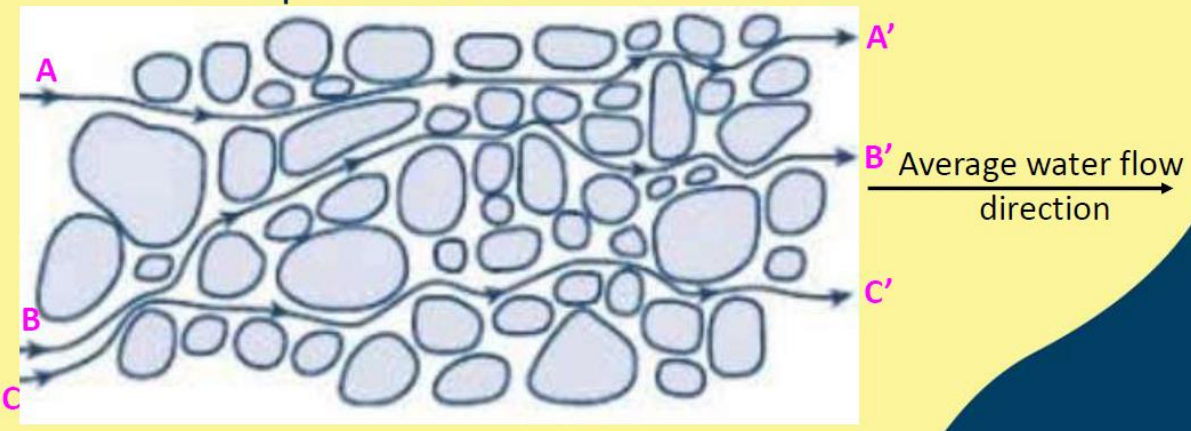
Homogeneous flow VS Turbulent flow

Mass Transport processes

Advection

Advection refers to transport with the mean fluid flow. For example, if the wind is blowing toward the east, advection will carry any pollutants present in the atmosphere toward the east. Similarly, if a bag of dye is emptied into the center of a river, advection will carry the resulting spot of dye downstream, In contrast, dispersion refers to the transport of compounds through the action of random motions.

Mechanical Dispersion



Introduction to Environmental Engineering and Science – Fundamentals and Sustainability Concepts

Assignment- Week 5

Section 1 : Choose the correct answer

1. What is the correct abbreviation of BOD?

a. Biological oxygen demand

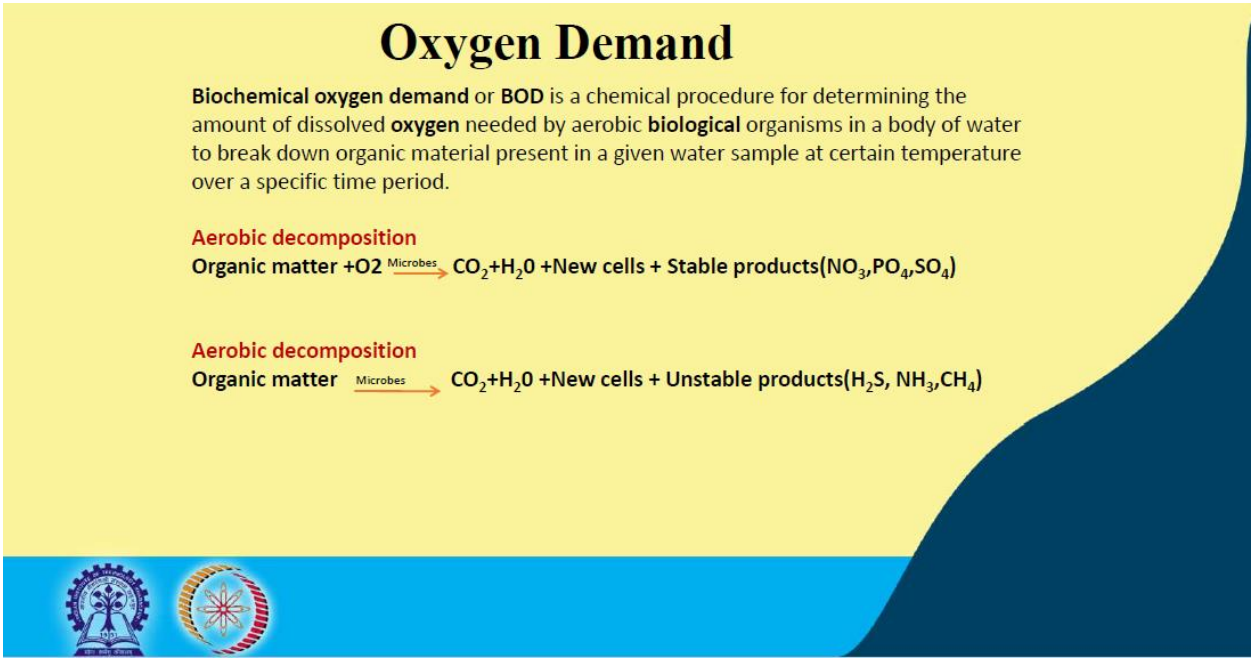
b. Biochemical oxygen demand

c. Bio-geochemical oxygen demand

d. None

Correct Answer:- b

Detailed Solution:-



2. What is the ThOD for 30 mg/L of ethanol (C_2H_5OH) in an aquatic system?

a. 72.5 mg O_2/L
b. 98.4 mg O_2/L
c. 32.6 mg O_2/L
d. 62.6 mg O_2/L

Correct Answer:- d

Detailed Solution:-

$$C_2H_5OH + 3O_2 = 2CO_2 + 3H_2O$$

ThOD = (3 moles of O_2)/1 mole of C_2H_5OH × (32 g O_2)/1 mole O_2 × (1 mole C_2H_5OH)/(46 g C_2H_5OH) × 30 mg/L of C_2H_5OH

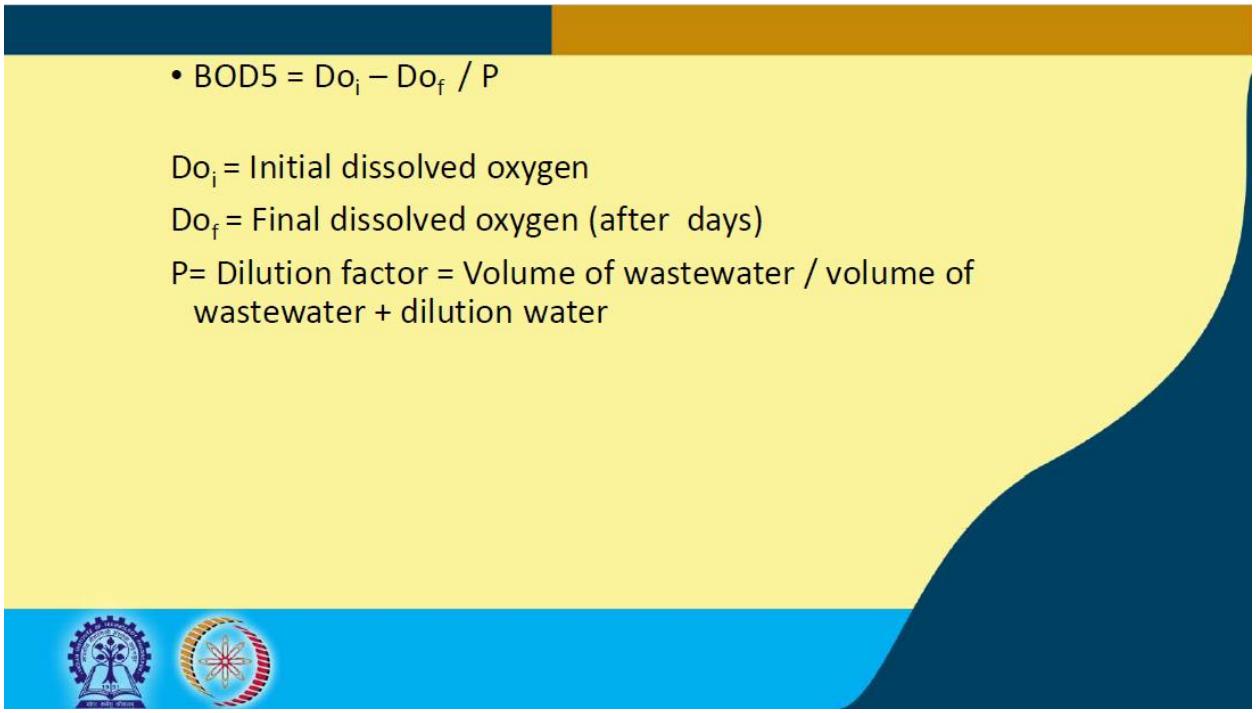
= 62.6 mg O_2/L

3. Which one is the correct formula for BOD_5 of wastewater?

a. $BOD_5 = (DO_i - DO_f)/p$
b. $BOD_5 = (DO_f - DO_i)/p$
c. $BOD_5 = (DO_i - DO_f)p$
d. $BOD_5 = (DO_f - DO_i)p$

Correct Answer:- a

Detailed Solution:-



4.

25 mL of wastewater sample is mixed with dilution water to make a total volume of 300 mL. It is desirable to have at least 2 mg/L DO drop during the 5-day test. What is the minimum detectable BOD_5 with this dilution?

a. 30 mg/L
b. 12 mg/L
c. 24 mg/L
d. 6 mg/L

Correct Answer:- c

Detailed Solution:-

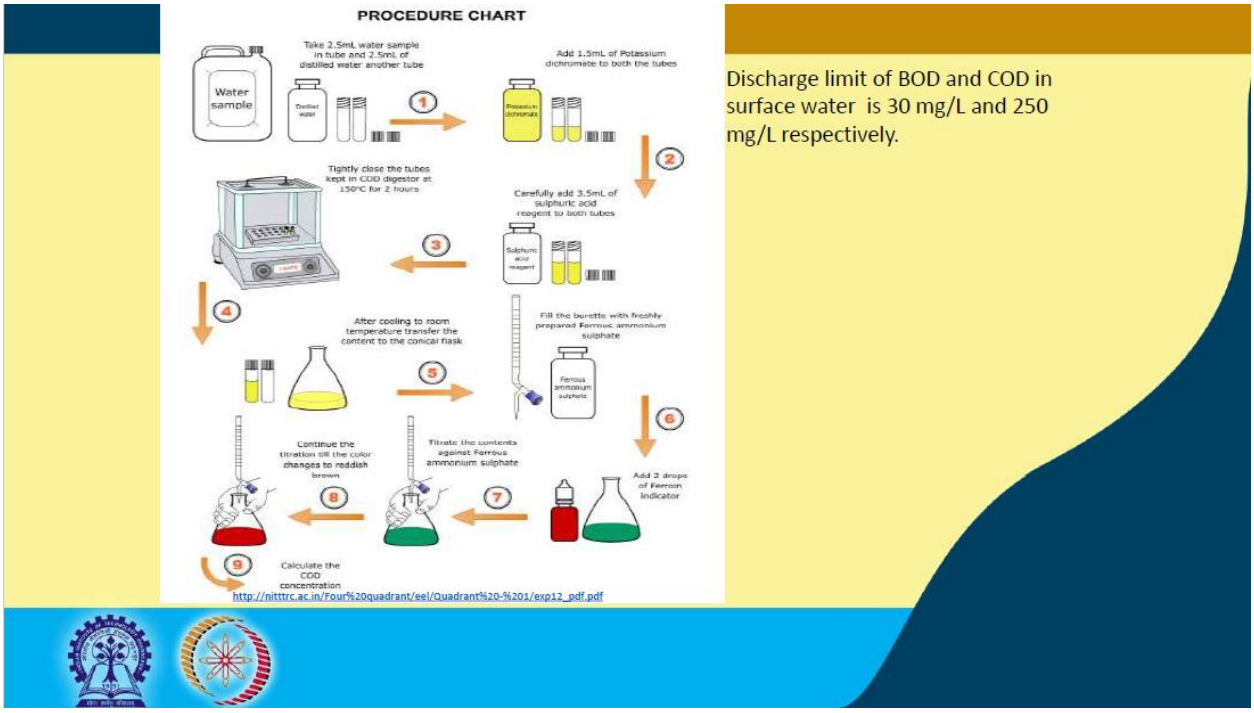
The dilution fraction is p = 25/300. To get at least a drop of 2 mg/L in DO during the 5 day run, the minimum BOD5 needs to be = $(DO_i - DO_f)/p = 2/(25/300) = 24$ mg/L

5. What is the correct approach for COD analysis of a wastewater sample?

a. Digestion time for COD is 30 min
b. Digestion temperature for COD is 150 °C
c. Methyl blue is used as an indicator in COD analysis
d. During titration, color changes from reddish-brown to green

Correct Answer:- b

Detailed Solution:-

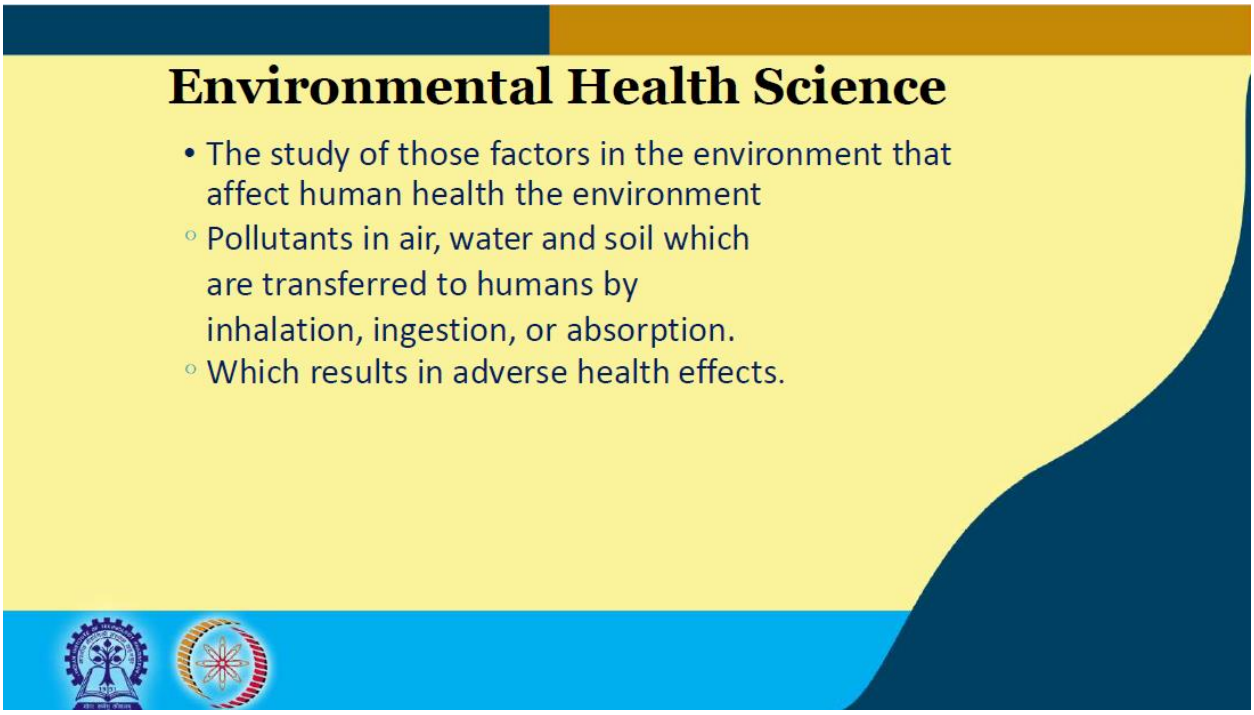


6. What pathways facilitate the transfer of pollutants from the environment to the human body?

a. Inhalation
b. Ingestion
c. Absorption
d. All of the above

Correct Answer:- d

Detailed Solution:-



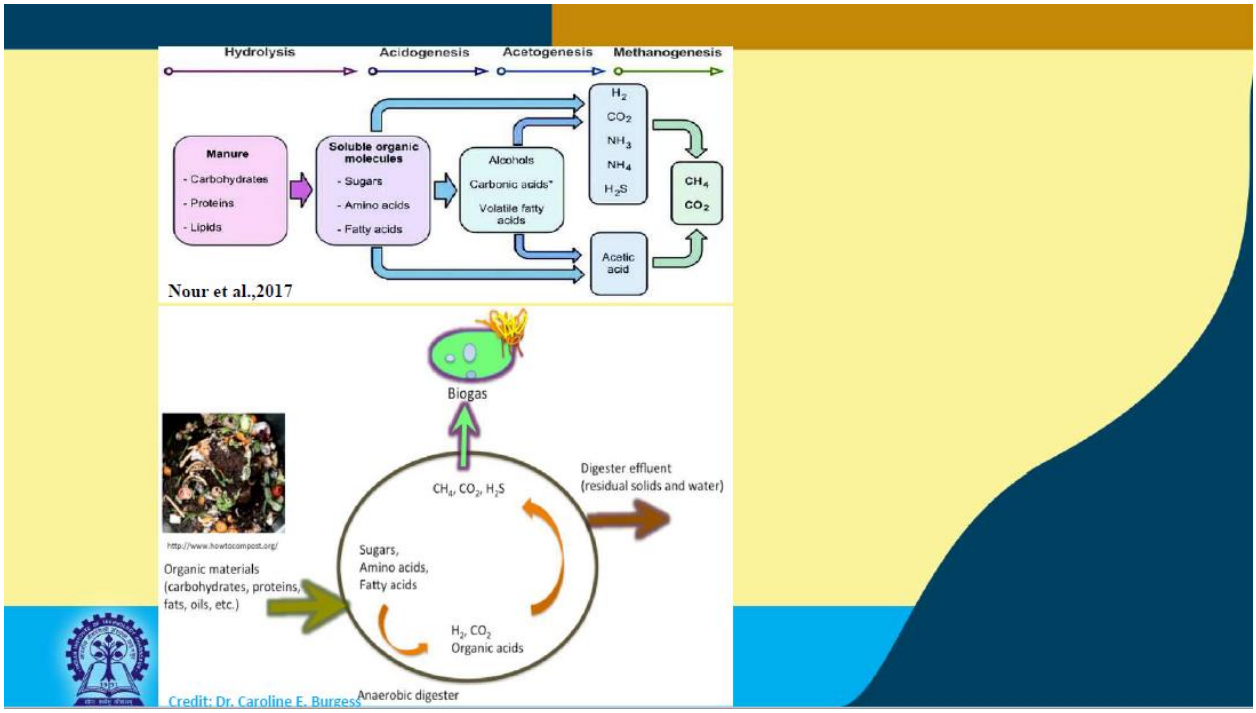
7.

Which of the following is the correct sequence of waste degradation mechanisms in anaerobic digestion?

a. Hydrolysis – acidogenesis – acetogenesis – methanogenesis
b. Acidogenesis – acetogenesis – hydrolysis - methanogenesis
c. Hydrolysis – acetogenesis – acidogenesis - methanogenesis
d. Hydrolysis – methanogenesis – acetogenesis – acidogenesis

Correct Answer:- a

Detailed Solution:-



8.

Limestone is the _____ sink of carbon.

a. Atmospheric

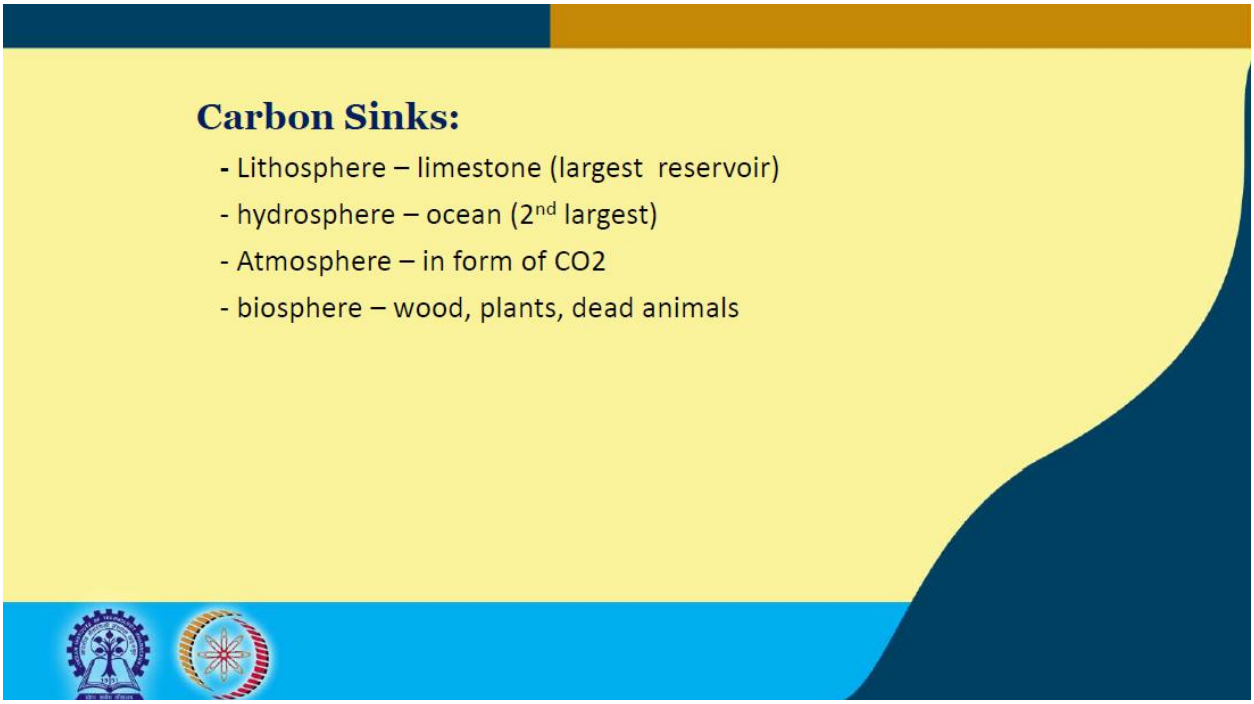
b. Hydrospheric

c. Biospheric

d. Lithospheric

Correct Answer:- d

Detailed Solution:-



9.

Phytoremediation is the process of removing contaminants using _____.

a. plants

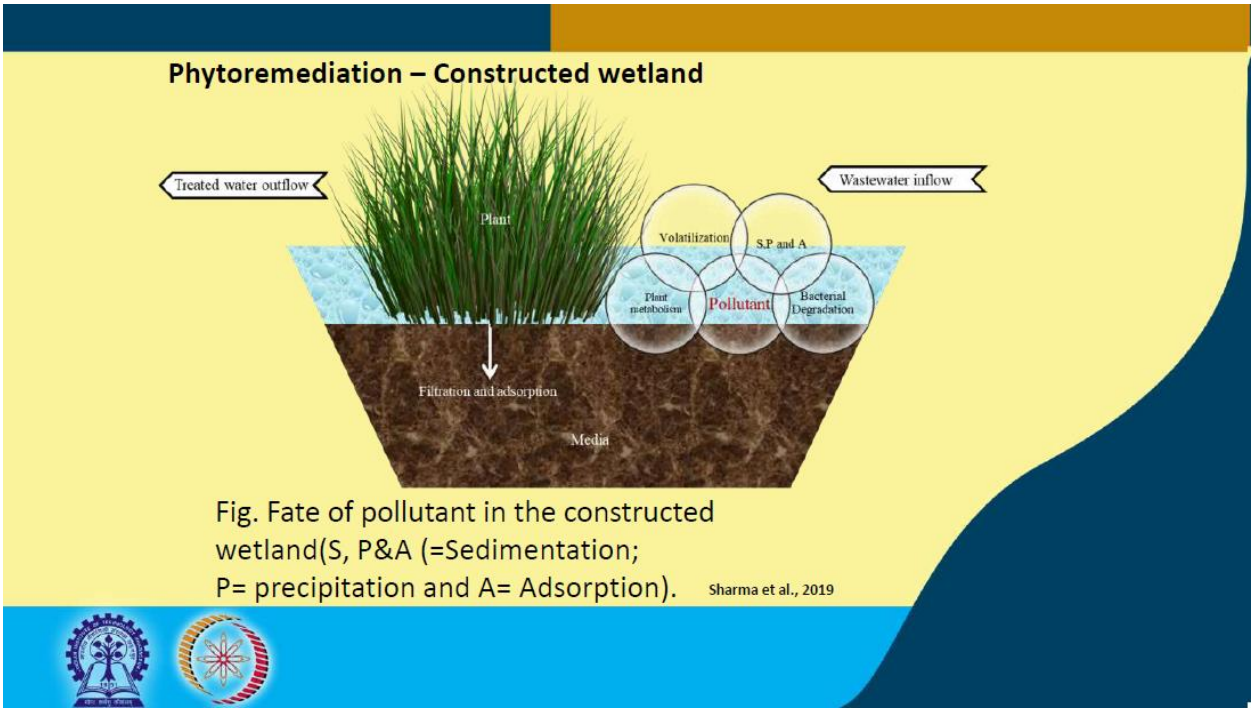
b. nanoparticles

c. microorganisms

d. all of the above

Correct Answer:- a

Detailed Solution:-



10.

Match the followings

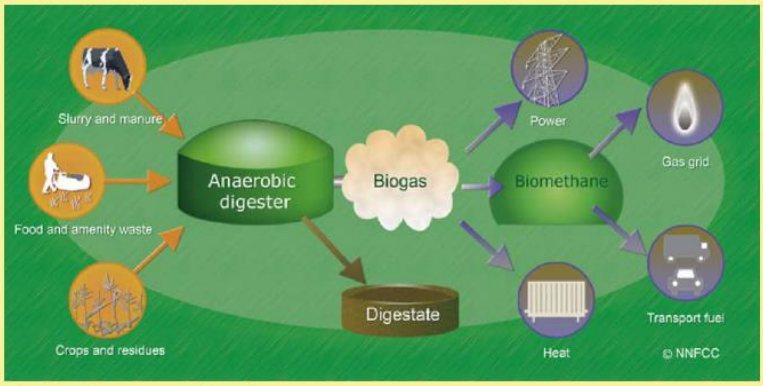
1.	Use of biogas	i)	Reduction in atmospheric release of landfill gas
2.	Benefit of anaerobic digestion	ii)	Amino acid
3.	Conversion of CO_2, H_2 to CH_4	iii)	Transport fuel
4.	Building block of protein	iv)	Methanogenesis

a. 1(i), 2(iii), 3(ii), 4(iv)
b. 1(iii), 2(i), 3(iv), 4(ii)
c. 1(iv), 2(ii), 3(iii), 4(i)
d. 1(ii), 2(i), 3(iv), 4(iii)

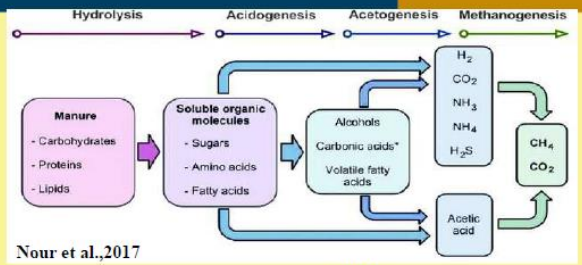
Correct Answer:- b

Detailed Solution:-

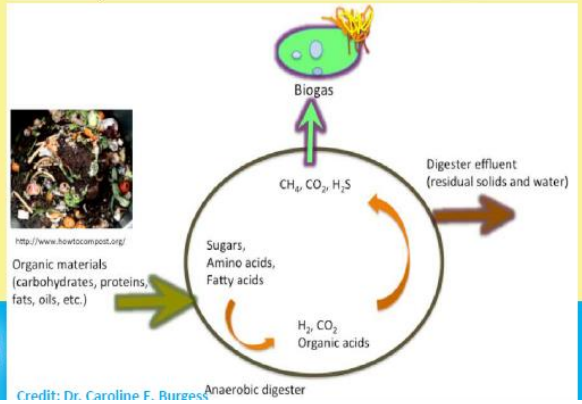
Anaerobic Digestion



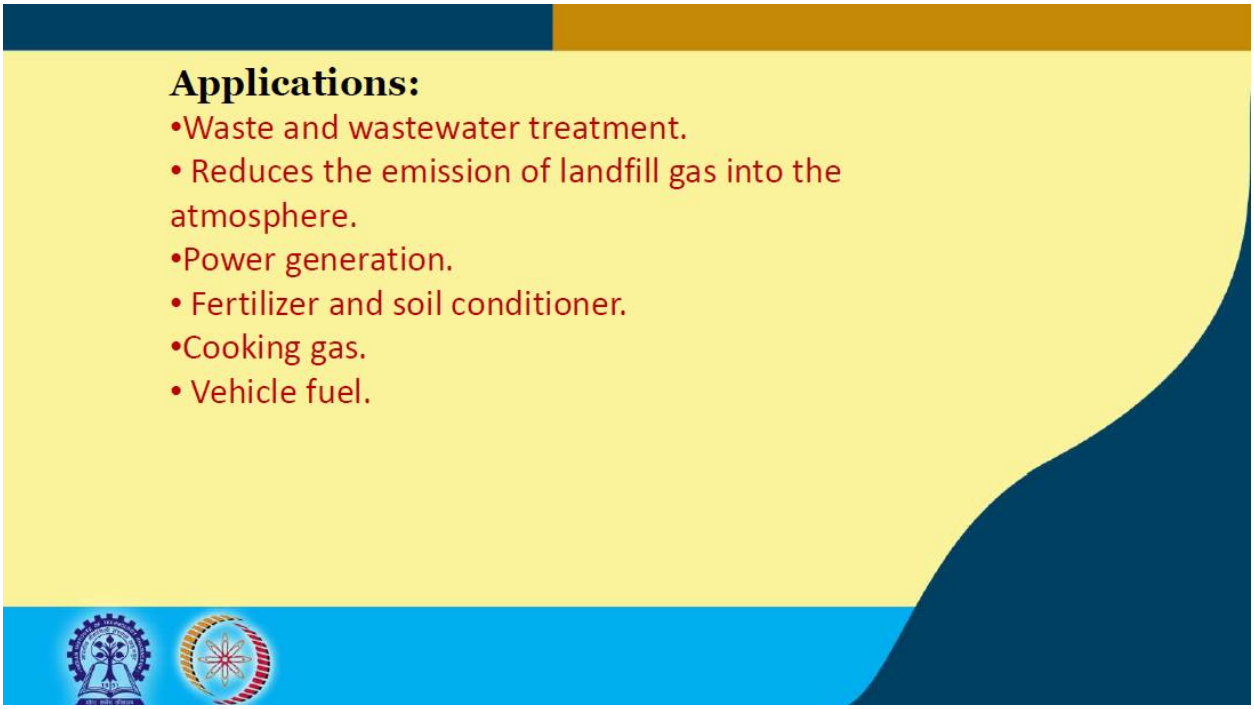
http://www.biogas-info.co.uk/about/



Nour et al.,2017



Credit: Dr. Caroline F. Burgess



Section 2 : Select all the correct answers

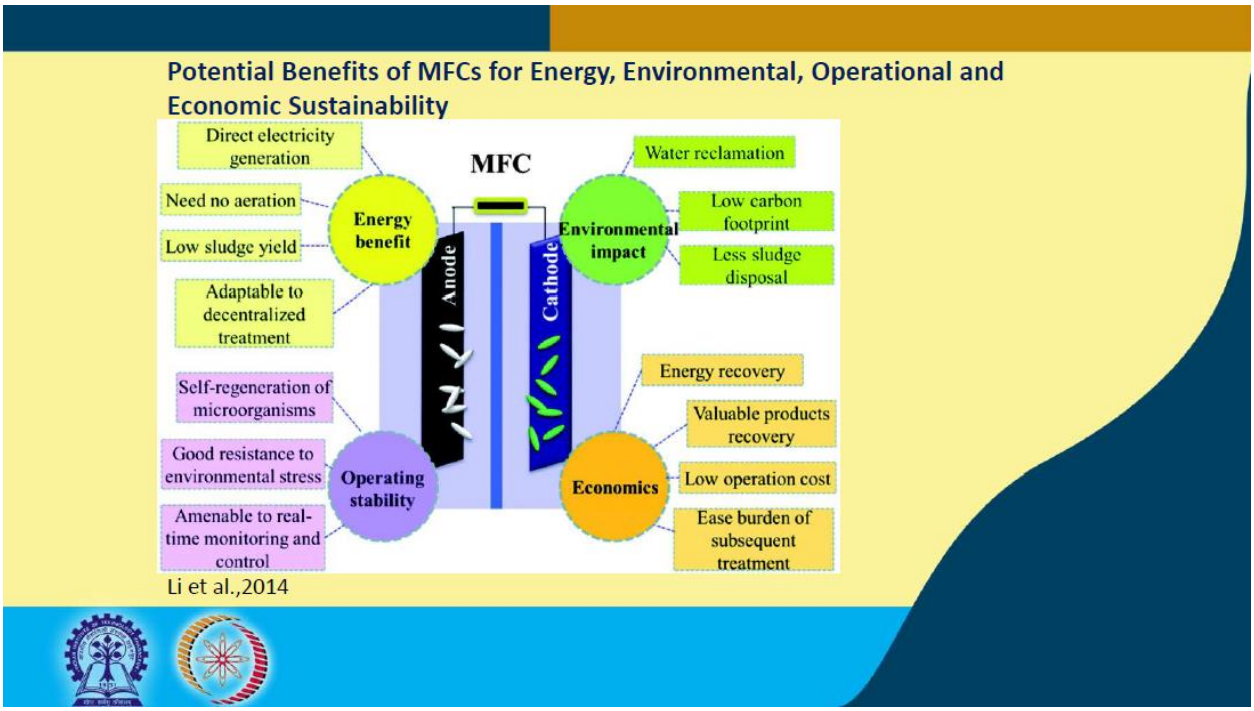
11.

Which of the following options is/are correct related to the microbial fuel cell (MFC)?

a. MFC stands for methanogenic fuel cell
b. MFC involves low sludge yield
c. MFC has a low carbon footprint
d. MFC needs a continuous air supply

Correct Answer:- b, c

Detailed Solution:-



12.

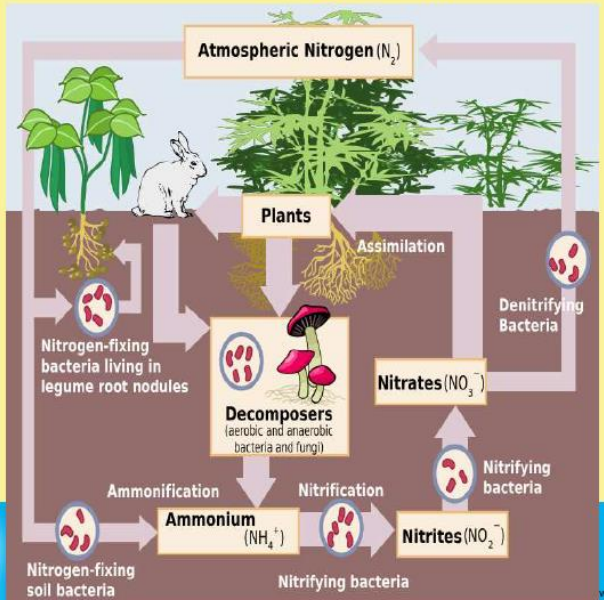
Which of the following statements is/are correct related to the Nitrogen cycle?

a. Nitrification is the process of converting ammonium to nitrate
b. Nitrifying bacteria helps in converting Nitrogen into ammonium
c. Nitrogen assimilation is the process of formation of organic nitrogen compounds from inorganic nitrogen compounds in the environment
d. Denitrifying bacteria convert nitrite into nitrate

Correct Answer:- a, c

Detailed Solution:-

Nitrogen cycle



- 78% of the volume of trophosphere
- Most complex cycle
- N_2 gas can't be used 'as is' – it must be 'fixed' so that organisms can use it
- N_2 gas is modified by "nitrogen-fixing" bacteria in legumes into ammonia (NH_3) – NITROGEN FIXATION – aids in production of sugars/starches
- Bacteria turn wastes and detritus into ammonia – AMMONIFICATION – released into atm
- NH_3 is converted into nitrite (NO_2^-) which is then used to produce nitrate (NO_3^-) - NITRIFICATION

13.

Eutrophication can be avoided by which of the following process?

a. reducing the use of phosphates as builders in detergents

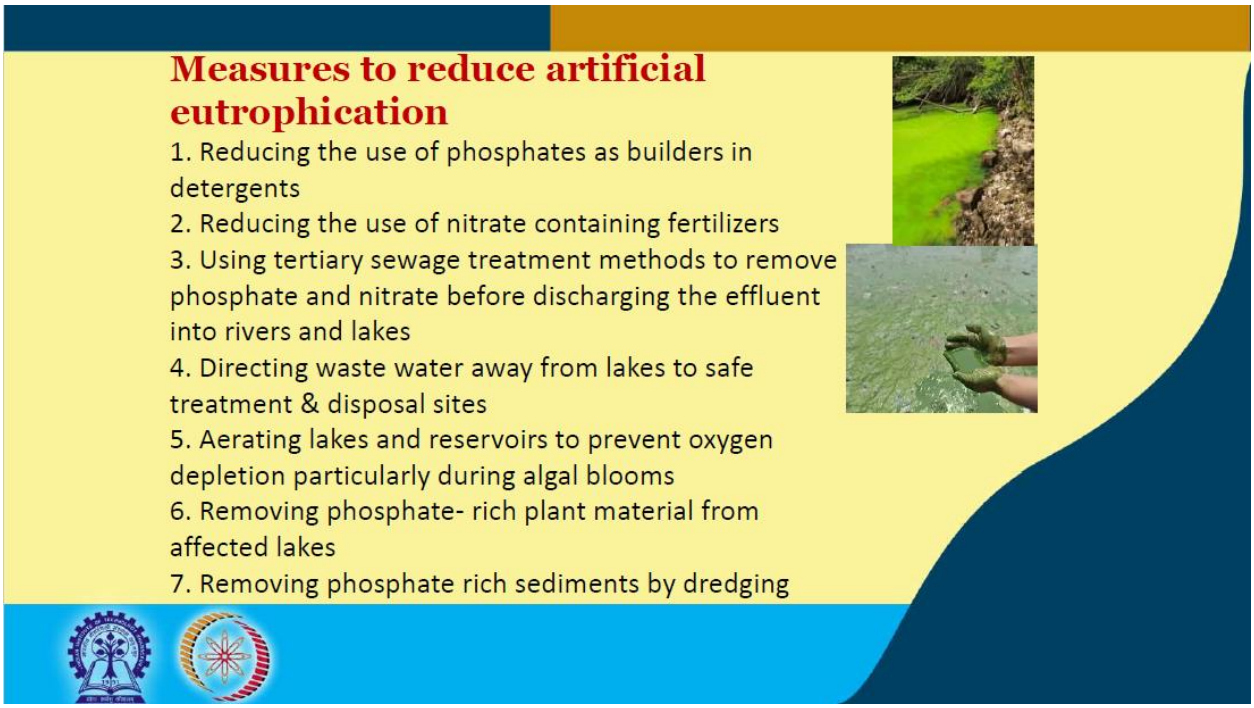
b. adding phosphate-rich plant materials from affected lakes

c. aerating lakes by external sources

d. removing phosphate-rich sediments by dredging

Correct Answer:- a, c, d

Detailed Solution:-



14.

Which of the following statements is/are correct concerning the BOD?

a. BOD of water depends on temperature

b. BOD applies to any material

c. BOD of a sample varies with time

d. High BOD in water leads to high oxygen availability to aquatic animals

Correct Answer:- a, c

Detailed Solution:-

Oxygen Demand

Biochemical oxygen demand or **BOD** is a chemical procedure for determining the amount of dissolved **oxygen** needed by aerobic **biological** organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period.

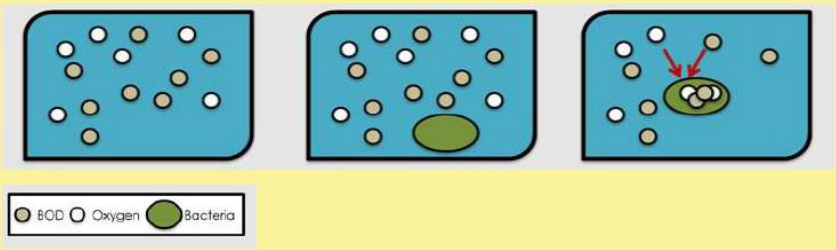
Aerobic decomposition

Organic matter +O2 $\xrightarrow{\text{Microbes}}$ **CO_2+H_20 +New cells + Stable products(NO_3,PO_4,SO_4)**

Aerobic decomposition

Organic matter $\xrightarrow{\text{Microbes}}$ **CO_2+H_20 +New cells + Unstable products(H_2S, NH_3,CH_4)**

Simple BOD concept



In receiving stream, high BOD level can cause depleted oxygen, making it difficult for aquatic animal to survive.

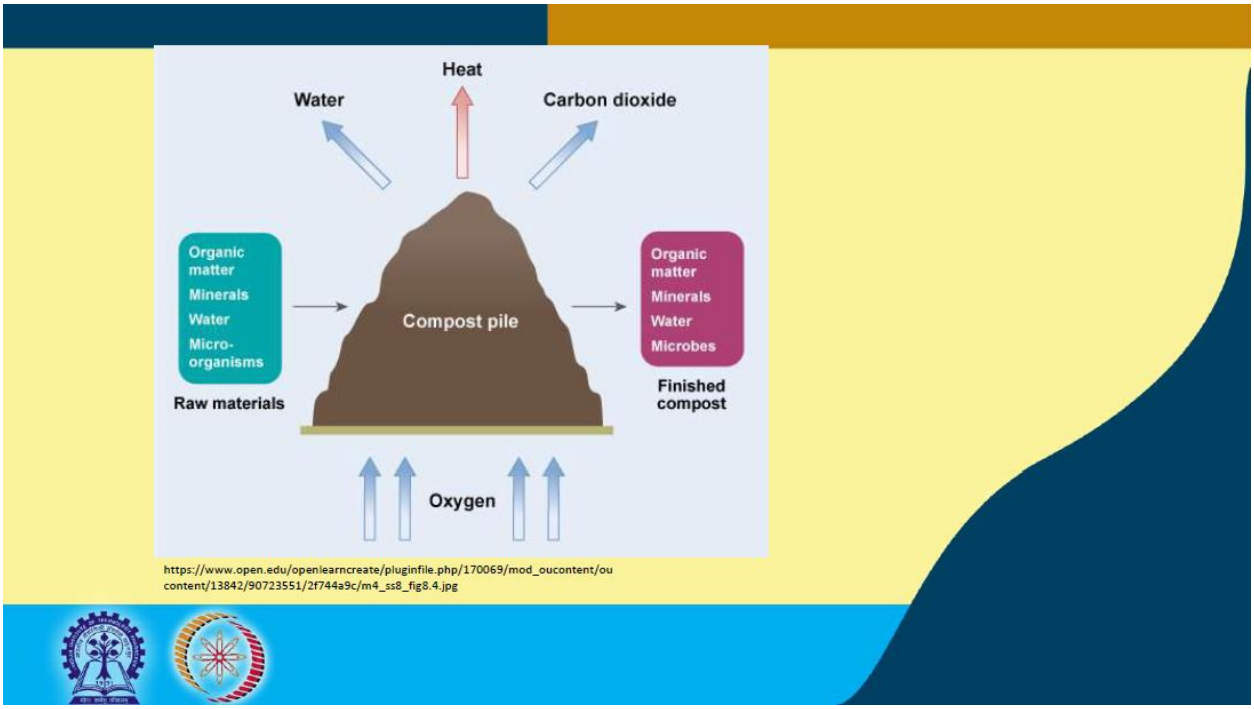
15.

Which of the following statements is/are correct corresponding to the composting process?

a. Composting is an anaerobic process
b. Composting is the adsorption of organic matter onto microorganisms
c. Composting depends on temperature
d. Compost contains nutrients for plant growth

Correct Answer:- c, d

Detailed Solution:-



https://www.open.edu/openlearncreate/pluginfile.php/170069/mod_oucontent/oucontent/13842/90723551/2f744a9c/m4_ss8_fig8.4.jpg

Introduction to Environmental Engineering and Science – Fundamentals and Sustainability Concepts

Assignment- Week 6

1. Which of the following is/are a part of risk management?

    a. Risk identification

    b. Risk control

    c. Risk monitor

    d. All of the above

Correct Answer:- d

Detailed Solution:-

2.

The term used for the dosage of a non-carcinogenic substance considered safe for humans is known as _____.

a. Applied dose

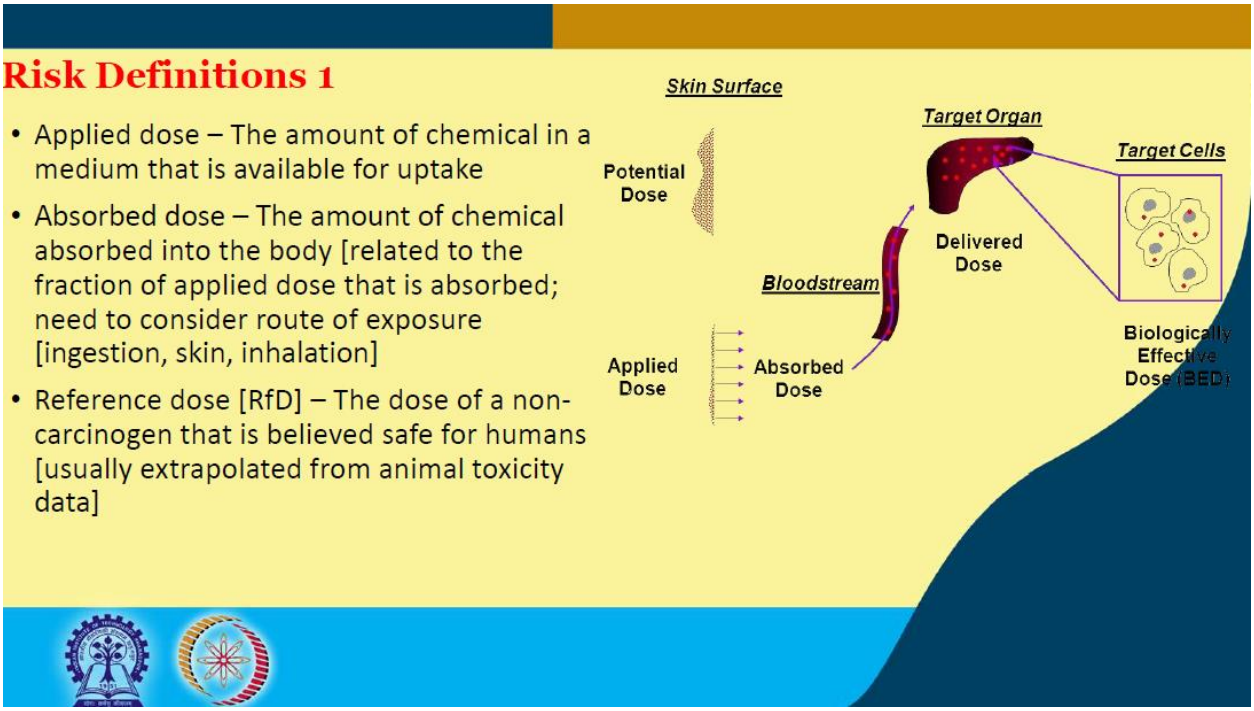
b. Absorbed dose

c. Reference dose

d. None

Correct Answer:- c

Detailed Solution:-



3.

What could be the potential functional unit for Life Cycle Assessment when comparing electric bikes and diesel bikes?

a. One electric bike

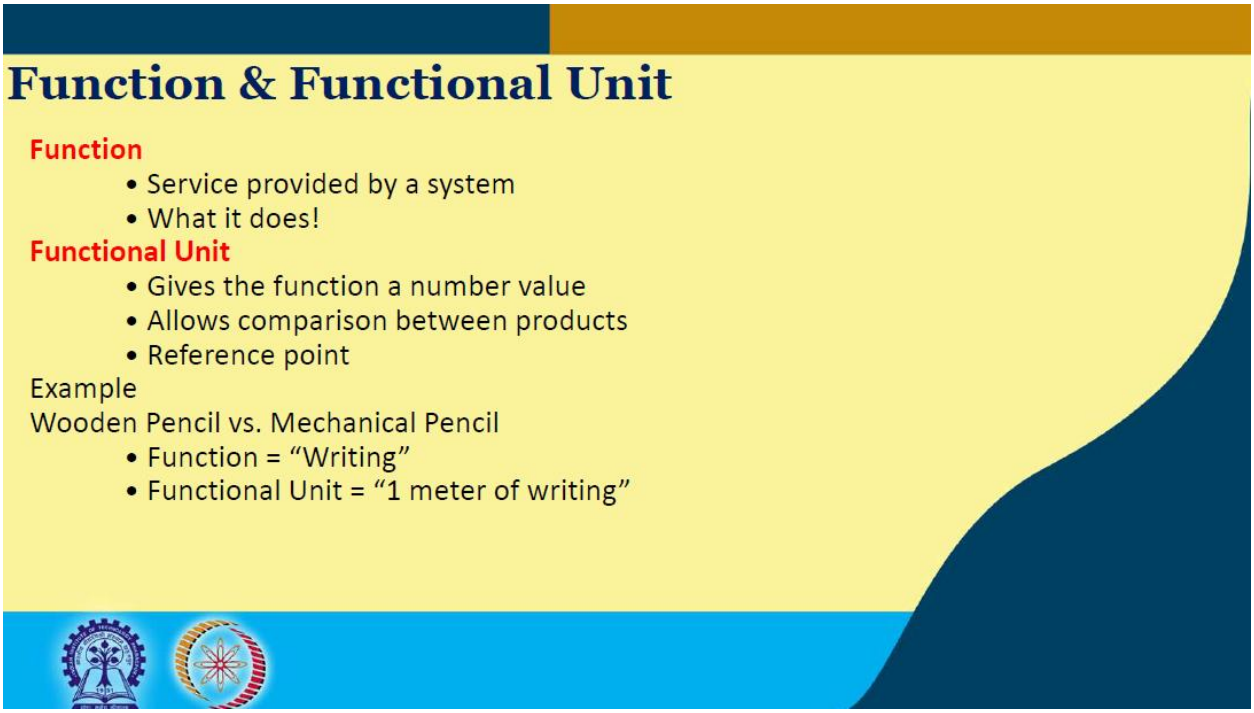
b. One diesel bike

c. Energy required for running 10000 km

d. None of the above

Correct Answer:- c

Detailed Solution:-



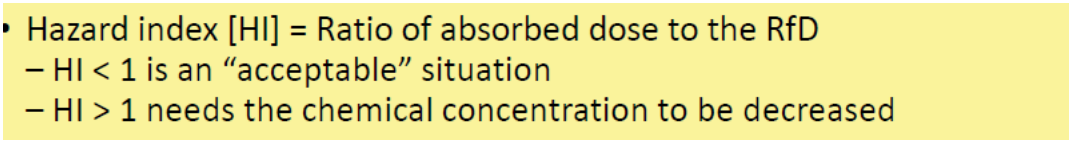
4.

What is the permissible absorbed concentration of Cr(VI) in risk assessment when the RfD value is set at 0.2 mg/L?

a. 0.2 mg/L
b. 0.1 mg/L
c. 0.4 mg/L
d. 0.3 mg/L

Correct Answer:- b

Detailed Solution:-



HI < 1; Absorbed dose/RfD < 1, Absorbed dose < RfD, i.e. 0.1 mg/L (all other options are > RfD)

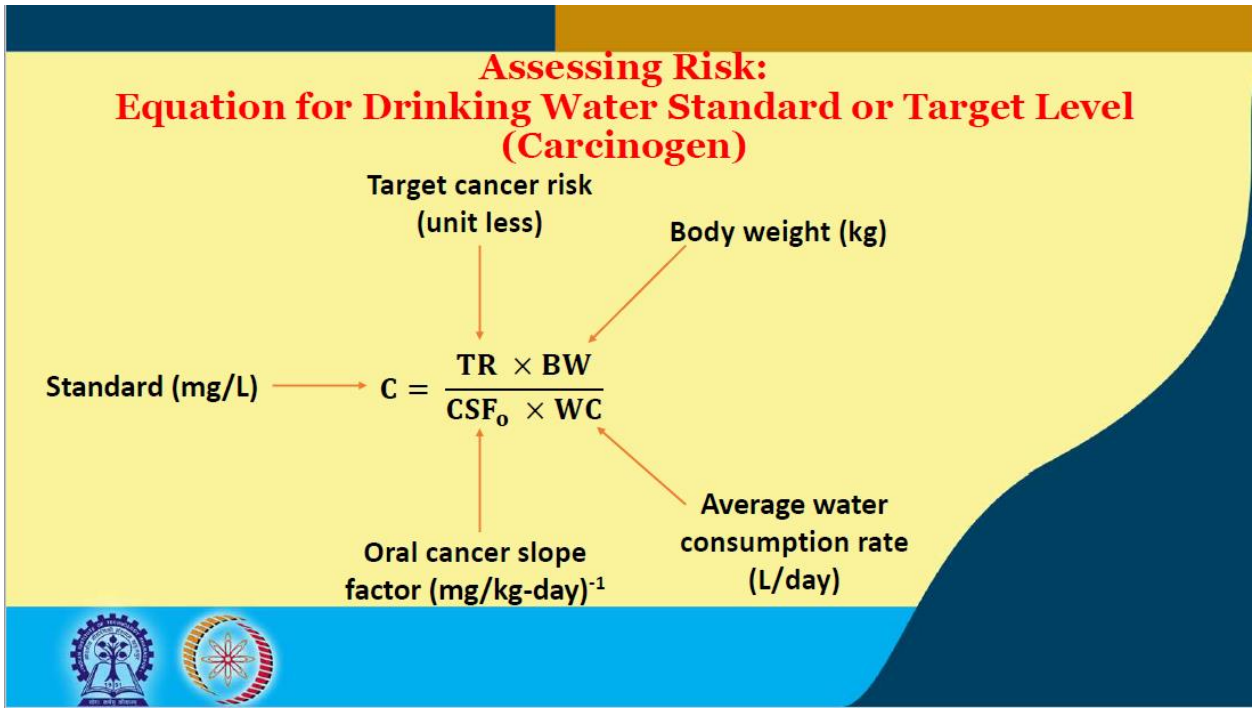
5.

Which of the following is the correct equation for getting drinking water standards for carcinogens?

a. $c = \frac{TR \times BW}{CSF_0 \times WC}$
b. $c = \frac{TR \times BW}{RFD_0 \times WC}$
c. $c = \frac{TR \times BW}{RFD_0 \times IR}$
d. $c = \frac{TR \times BW}{CSF_0 \times IR}$

Correct Answer:- a

Detailed Solution:-

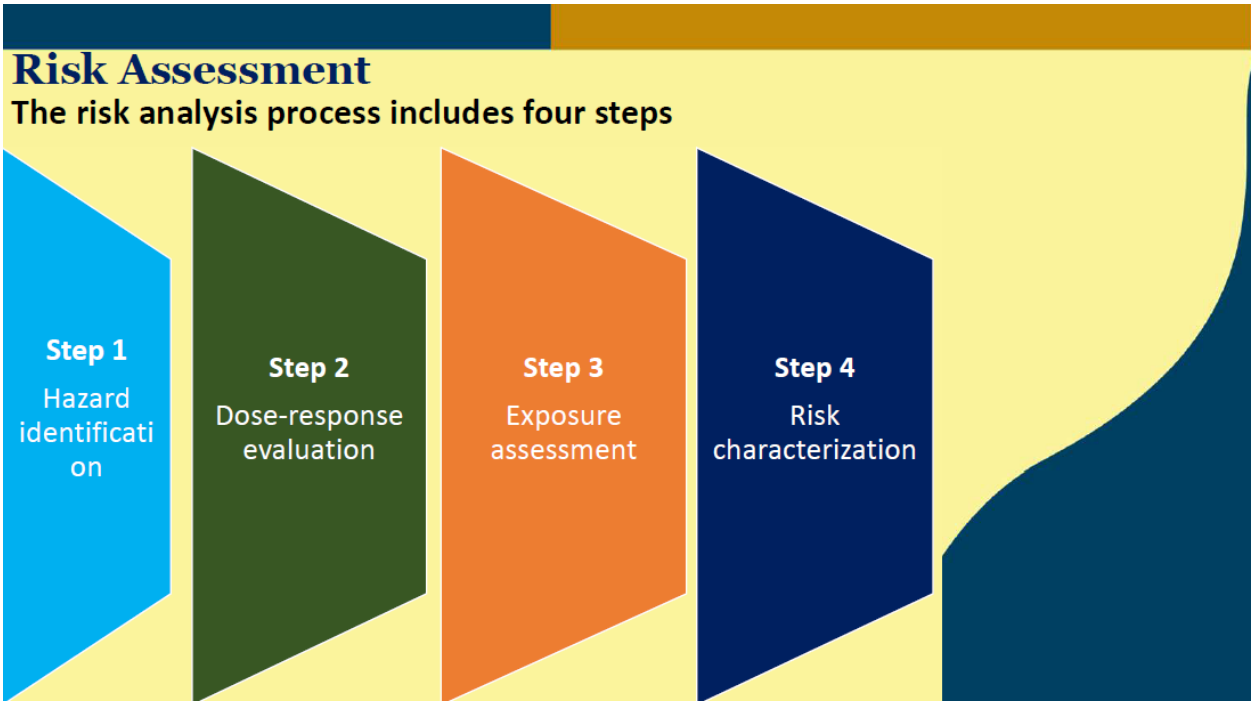


6. What is the correct order of different steps involved in risk assessment?

a. Hazard identification – risk characterization – dose-response evaluation – exposure assessment
b. Hazard identification – dose-response evaluation – risk characterization – exposure assessment
c. Exposure assessment – dose-response evaluation – risk characterization – hazard identification
d. Hazard identification – dose-response evaluation – exposure assessment – risk characterization

Correct Answer:- d

Detailed Solution:-

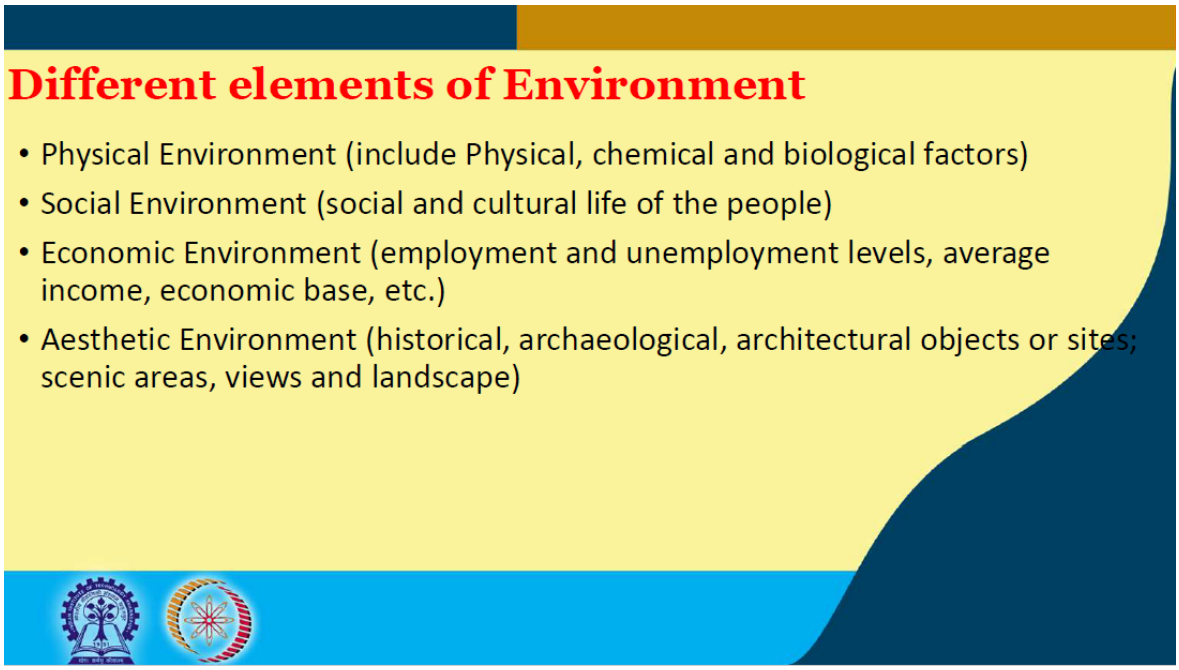


7. Which element of the environment includes the cultural life of people?

a. Physical environment
b. Aesthetic environment
c. Social environment
d. Economic environment

Correct Answer:- c

Detailed Solution:-



8. EIA is the abbreviation of _____.

a. Ecological Impact Assessment

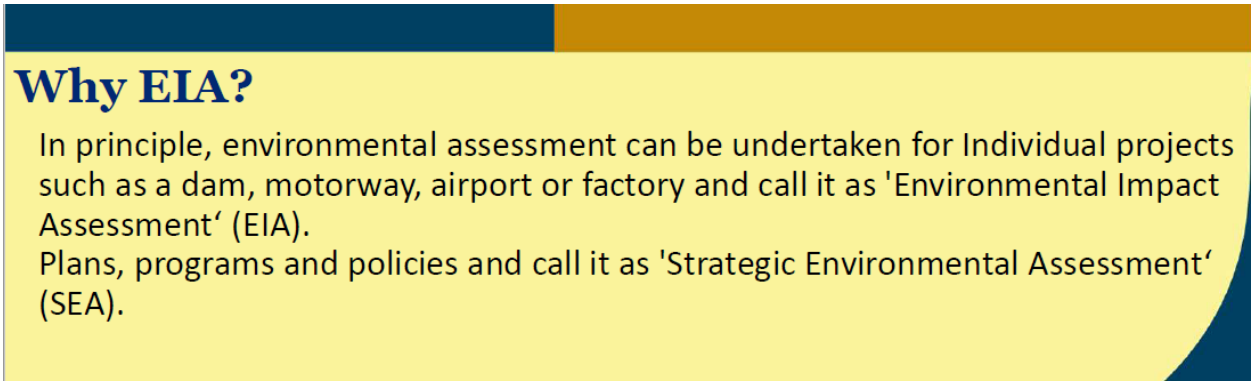
b. Environmental Impact Assessment

c. Ethical Impact Assessment

d. None

Correct Answer:- b

Detailed Solution:-

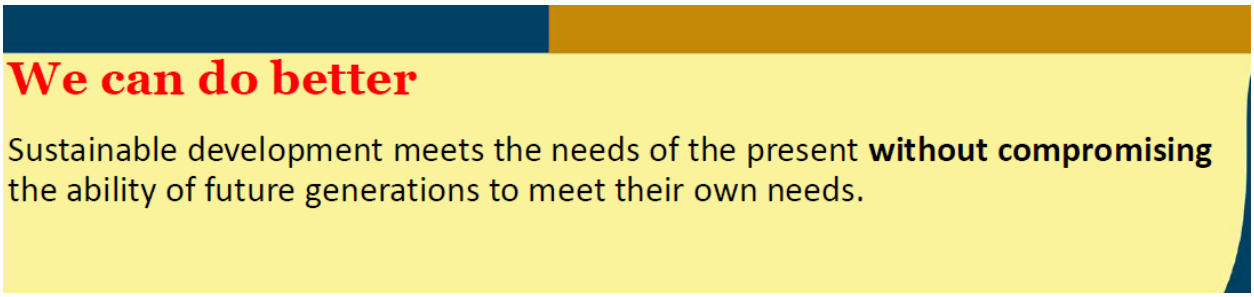


9. Which of the following is the definition of Sustainable development?

a. Fulfilling the need of the present generation only
b. Fulfilling the need of future generations by compromising the need of the present generation
c. Fulfilling the need of the present generation without compromising the ability of future generations to meet their own needs
d. All of the above

Correct Answer:- c

Detailed Solution:-



10.

Which one is the correct sequence of phases for the environmental clearance procedure in India?

a. Screening - scoping – public hearing environment management plan – decision making

b. Screening – scoping – decision making – public hearing environment management plan

c. Screening – public hearing environment management plan – scoping – decision making

d. Public hearing environment management plan – screening – scoping – decision making

Correct Answer:- a

Detailed Solution:-

*****Select all the correct answers***

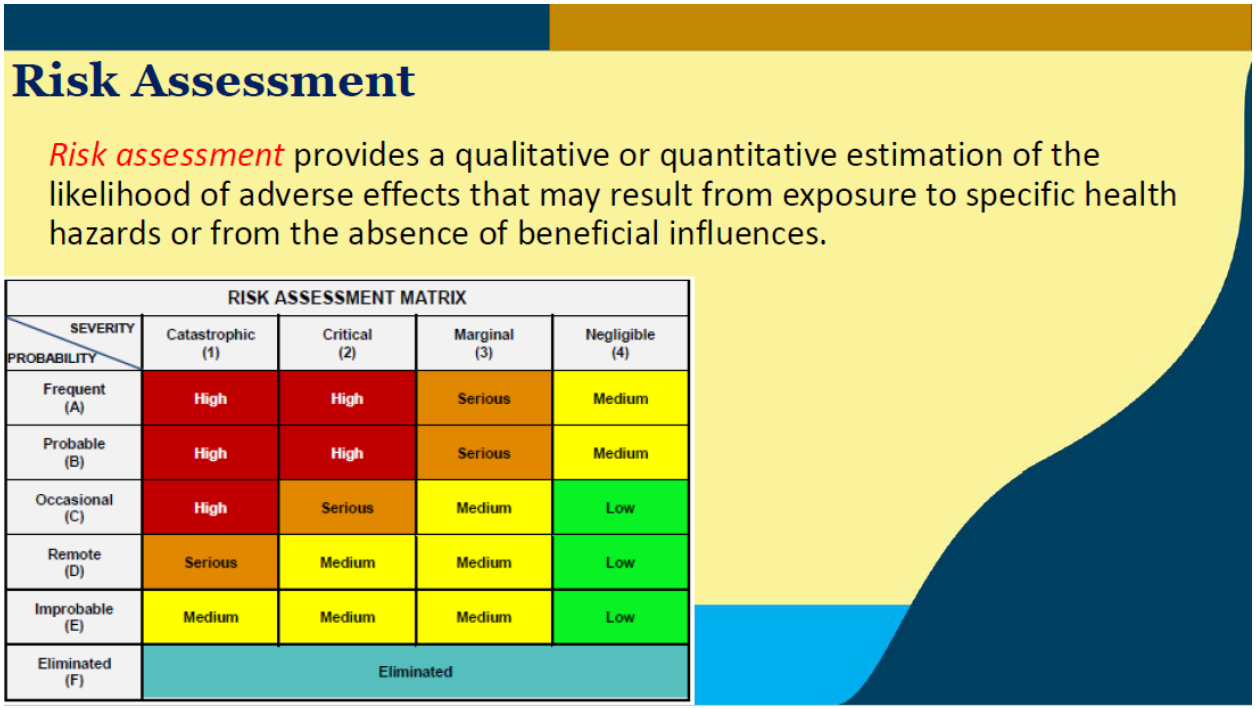
11.

Which of the following statements is/are correct if the risk associated with any incident is low?

a. Probability of occurrence – frequent, severity of the incident - critical
b. Probability of occurrence – occasional, severity of the incident - negligible
c. Probability of occurrence – improbable, severity of the incident - catastrophic
d. Probability of occurrence – improbable, severity of the incident - negligible

Correct Answer:- b, d

Detailed Solution:-

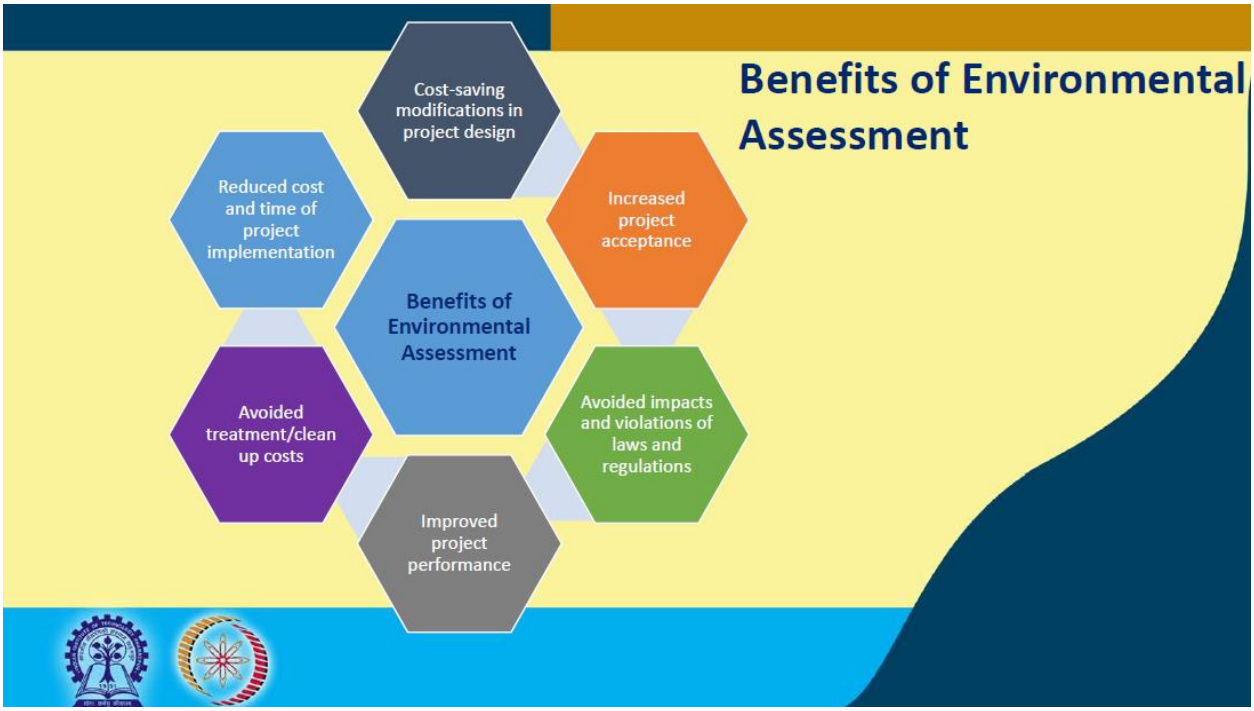


12. Which of the following is/are correct for EIA?

a. EIA helps in increasing project acceptance
b. EIA considers only social impact of any proposed plan prior to decision making
c. EIA helps in avoiding additional treatment/clean-up cost
d. EIA helps in avoiding violation of laws and regulations

Correct Answer:- a, c, d

Detailed Solution:-



13. Which of the following is/are the purpose of scoping?

a. Identify the most important effects to be considered in EIA
b. Minimize the wastage of time on unnecessary investigations
c. Identify information necessary for decision making
d. Utilizing money for all possible investigations

Correct Answer:- a, b, c

Detailed Solution:-

Scoping

The scoping process identifies the issues that are likely to be of most importance during the EIA and eliminates those that are of little concern. Typically, this process concludes with the establishment of Terms of Reference for the preparation of an EIA.

In this way, scoping ensures that EIA studies are focused on the significant effects and time and money are not wasted on unnecessary investigations.

Major issues and impacts that will be important in decision-making on the proposal, and need to be addressed in an EIA

Purpose of scoping is to identify

- The important issues to be considered in an EIA;
- The appropriate time and space boundaries of the EIA study;
- The information necessary for decision-making; and
- The significant effects and factors to be studied in detail.

14. Which of the following is/are different impact categories for the LCA study?

a. Acid rain

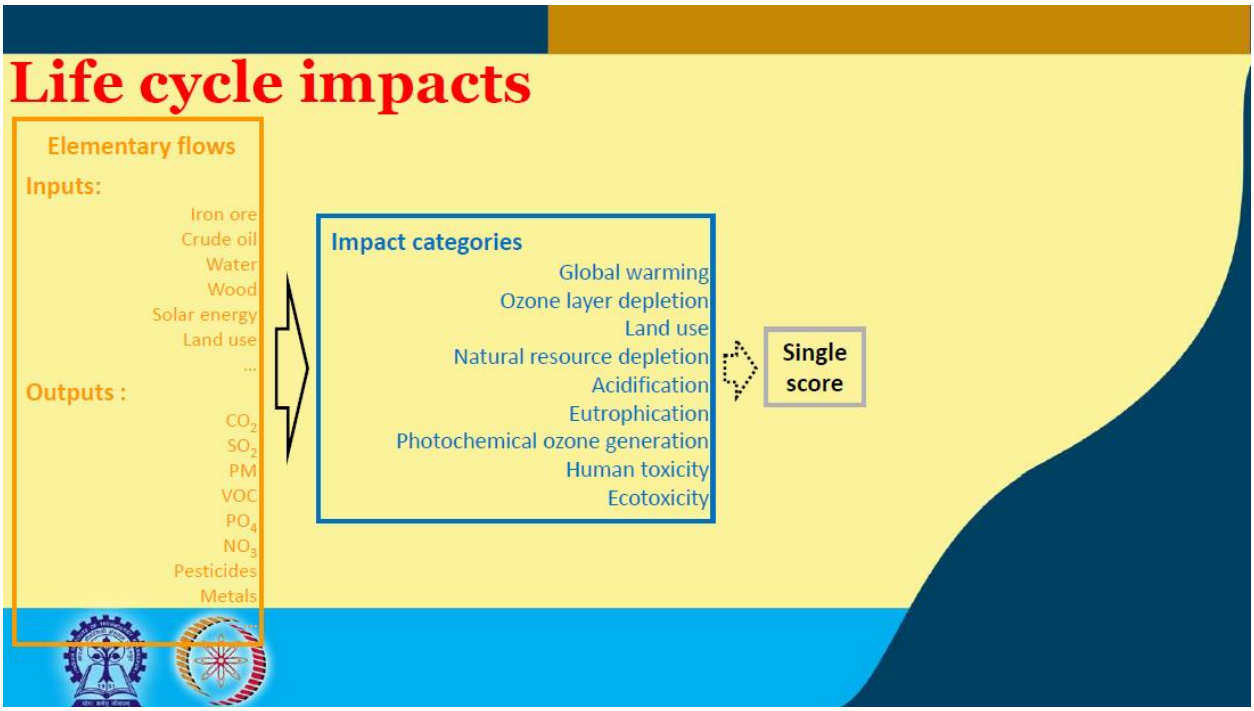
b. Eutrophication

c. Population

d. Ozone layer depletion

Correct Answer:- a, b, d

Detailed Solution:-



15.

Which of the following is classified under ecosystem damage in the context of a Life Cycle Assessment (LCA) study?

a. Ionizing radiations

b. Aquatic ecotoxicity

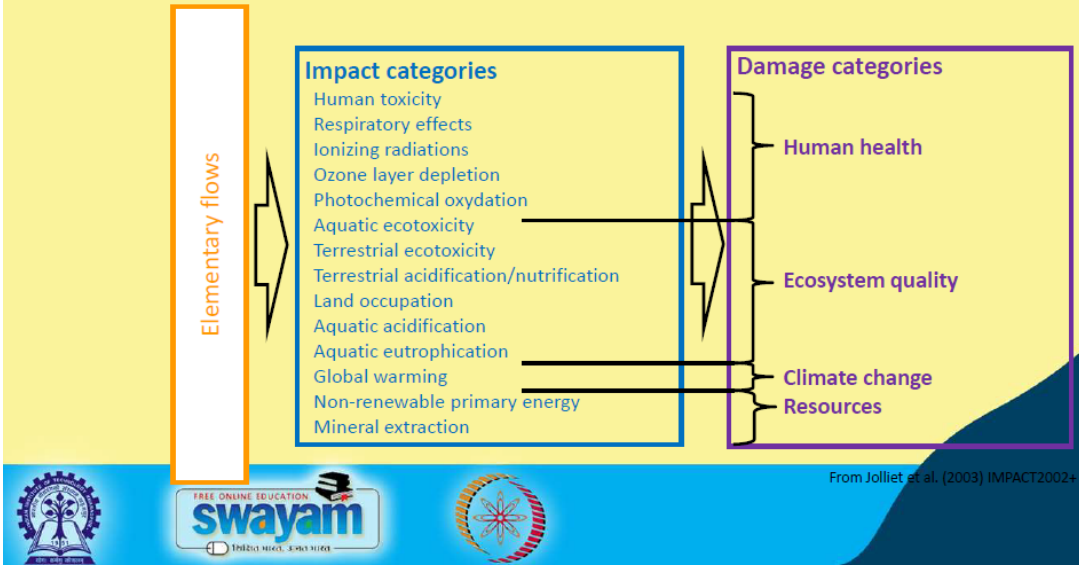
c. Mineral extraction

d. Aquatic eutrophication

Correct Answer:- b, d

Detailed Solution:-

IMPACT2002+ = A combined approach



From Jolliet et al. (2003) IMPACT2002+

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 7

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 Total Marks 15 x 2 = 30

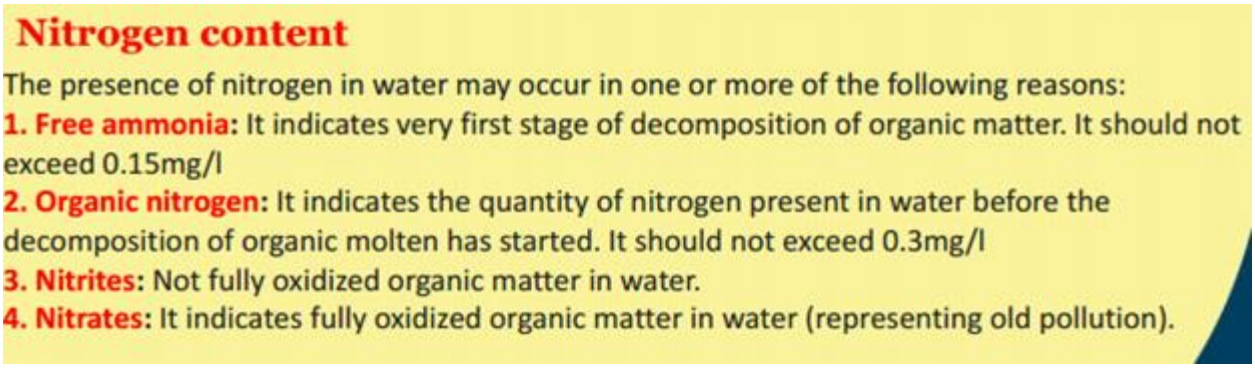
QUESTION 1:

Which form of nitrogen indicates the fully oxidized organic matter in water?

a. Free ammonia
b. Organic Nitrogen
c. Nitrite
d. Nitrate

Correct Answer: d

Detailed Solution:



QUESTION 2:

Name the group of bacteria that can survive with or without free oxygen.

a. Microaerophiles
b. Facultative bacteria
c. Anaerobic bacteria
d. Aerobic bacteria

Correct Answer: b

Detailed Solution:

Classification of bacteria based on oxygen requirement:
Aerobic bacteria: Those which require oxygen for their survival.
Anaerobic bacteria: Those which flourish in the absence of free oxygen.
Facultative bacteria: Those which can survive with or without free oxygen.

QUESTION 3:

Which instrument is used to measure the odour of water?

a. pH meter
b. Conductivity meter
c. Turbidity meter
d. Osmoscope

Correct Answer: d

Detailed Solution:

Taste and odour

Due to dissolved organic matter or inorganic salts, dissolved gases etc.

The **threshold odour number** is the **dilution factor** at which the odour is just detectable.

$$\text{Dilution factor} = \frac{Volume\ of\ raw\ water\ sample + Volume\ of\ distilled\ water\ used\ for\ dilution}{Volume\ of\ raw\ water\ sample}$$

Instrument: Osmoscope
Permissible limit: 1 to 3

QUESTION 4:

100 mL water sample is taken in an empty dry container whose initial weight is 34.563 gm. After oven drying the sample at 103 °C for 24 hours its final weight was measured to be 34.589 gm. Calculate the total solid concentration of water in mg/L.

a. 100 mg/L
b. 160 mg/L
c. 260 mg/L
d. 200 mg/L

Correct Answer: c

Detailed Solution:

Total solids = $\frac{W_2 - W_1}{V} \times 10^6$

W_2 = final weight in gm,

W_1 = initial weight in gm,

V = volume of water sample in ml

Total solids = (34.589-34.563)/100 *10^6 = 260 mg/L

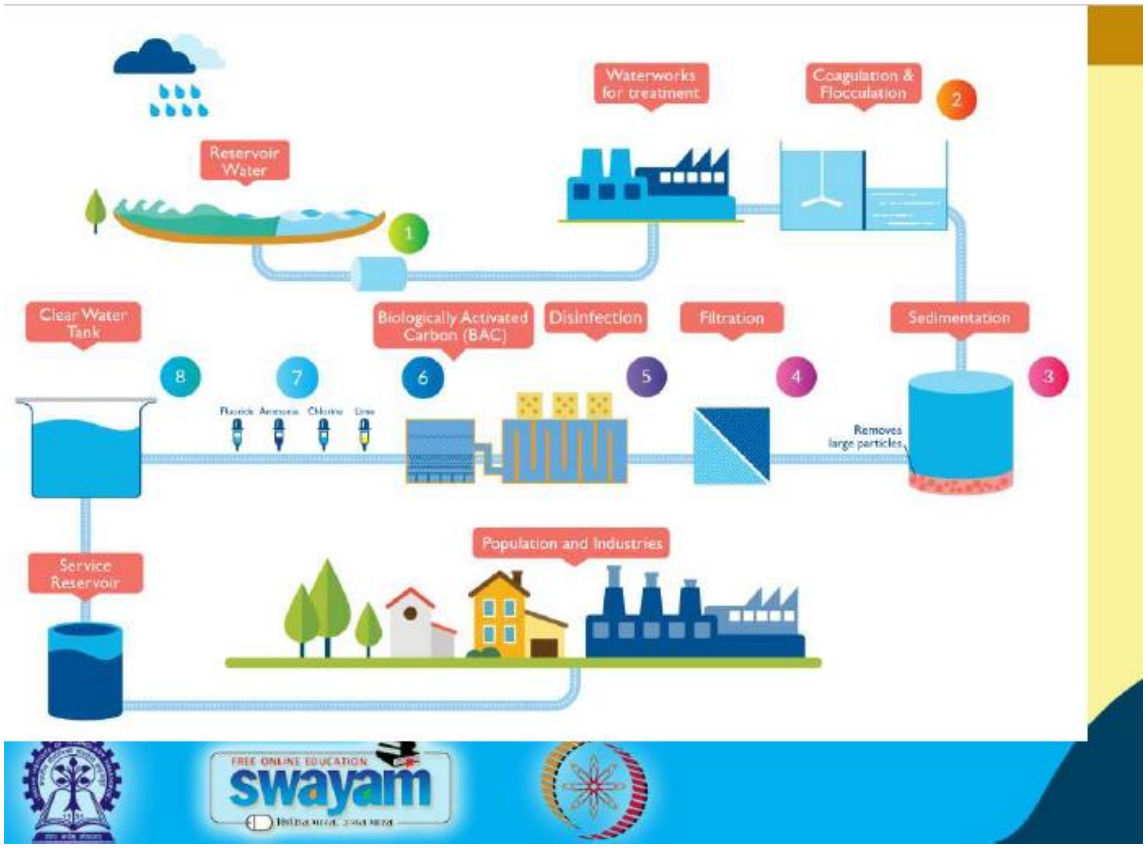
QUESTION 5:

Which of the following is the correct sequence for the processes in surface water treatment?

a. Coagulation & Flocculation--Disinfection--Filtration--Sedimentation
b. Coagulation & Flocculation--Sedimentation--Disinfection--Filtration
c. Coagulation & Flocculation--Sedimentation--Filtration--Disinfection
d. Coagulation & Flocculation--Disinfection--Sedimentation--Filtration

Correct Answer: c

Detailed Solution:



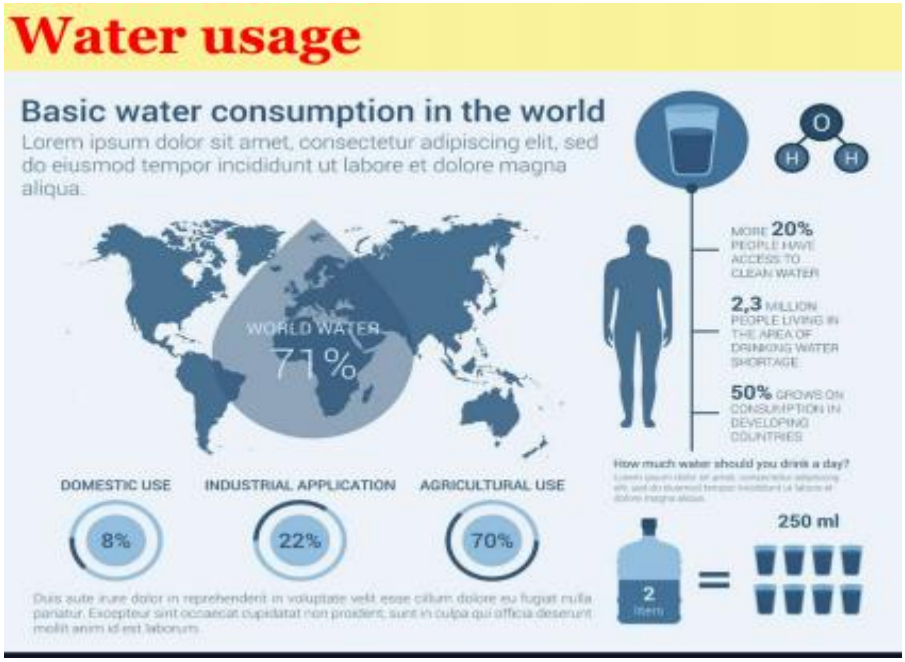
QUESTION 6:

Which of the following statement(s) is/are true regarding water usage?

a. 8% of the water is used for domestic purpose
b. 22% of the water is used for industrial applications
c. 70% of the water is used for agricultural activities
d. All the above

Correct Answer: d

Detailed Solution:



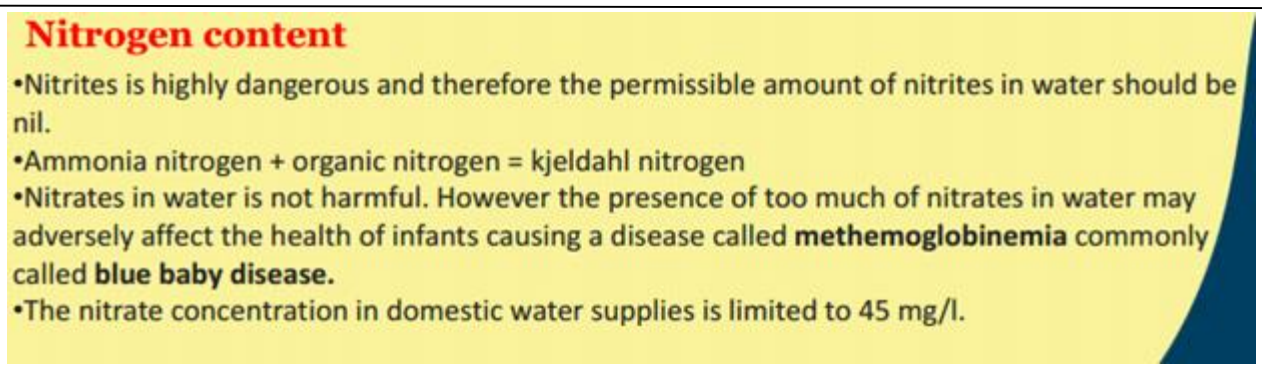
QUESTION 7:

Which disease can result from the ingestion of water containing higher nitrate concentrations?

a. Typhoid
b. Cholera
c. Methamoglobinemia
d. Dysentry

Correct Answer: c

Detailed Solution:



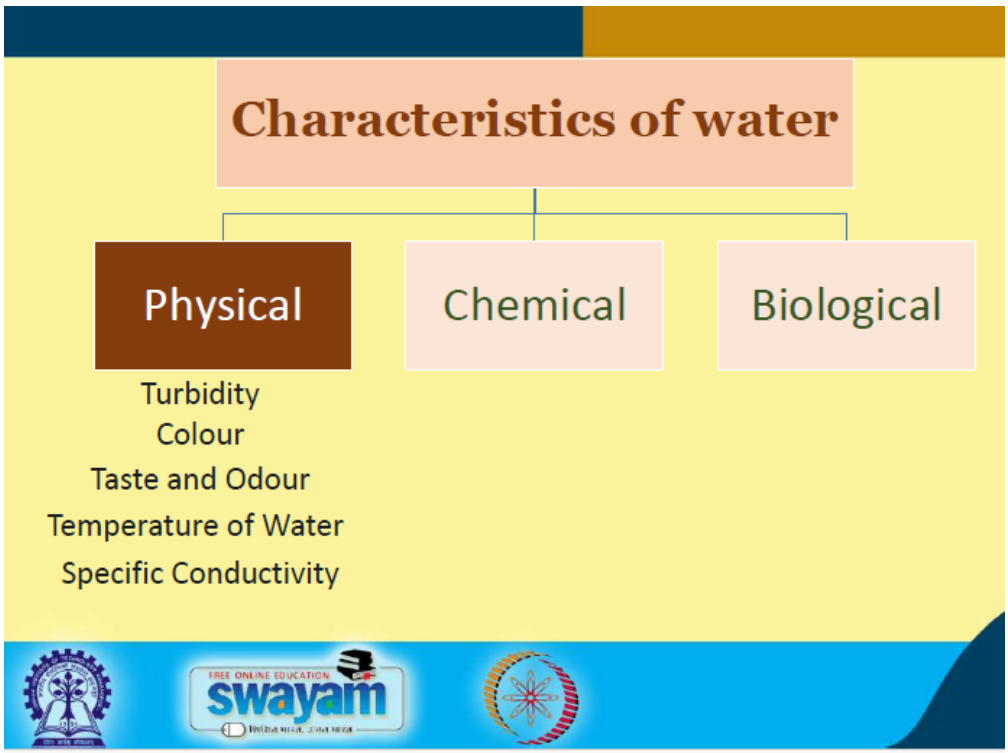
QUESTION 8:

Identify the physical properties of water from the following.

a. Turbidity
b. Colour
c. Total solids
d. Dissolved gas

Correct Answer: a, b

Detailed Solution:



QUESTION 9:

Identify the characteristics of safe water from the following.

a. Contains bacteria
b. Pressence of organic matter
c. Chemically safe
d. Aesthetically acceptable

Correct Answer: c,d

Detailed Solution:

QUESTION 10:

Calculate the quantity of stormwater runoff if the rainfall intensity is 4 mm/min, and the overall runoff coefficient is 0.6. Given the catchment area is 400 ha?

a. 1600 m^3/s
b. 160 m^3/s
c. 2600 m^3/s
d. 260 m^3/s

Correct Answer: b

Detailed Solution:
Quantity of stormwater, Q = C.I.A/360

= 0.6 x 400 ha x 4 mm/min * 60 min/hr /360

= 160 m^3/s

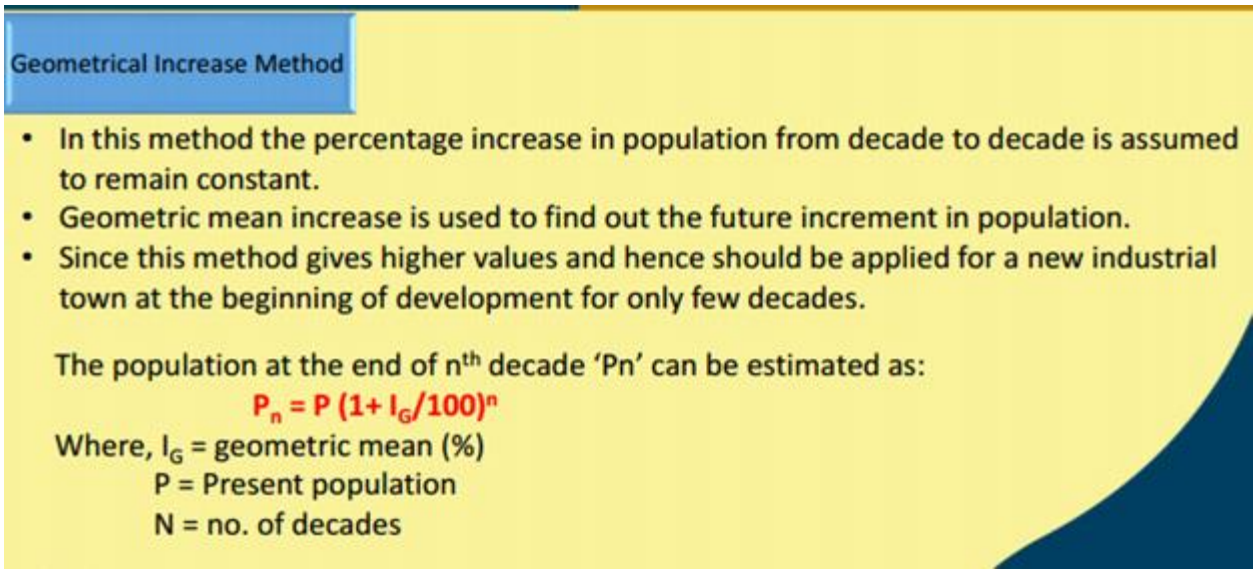
QUESTION 11:

Which population forecasting method is suited for a new industrial town at the beginning of development?

a. Geometrical increase method
b. Arithmetic mean method
c. Graphical method
d. Incremental increase method

Correct Answer: a

Detailed Solution:



QUESTION 12:

Which of the following is not a water borne disease?

a. Cholera
b. Typhoid
c. Asthma
d. Hepatitis B

Correct Answer: c

Detailed Solution:

QUESTION 13:

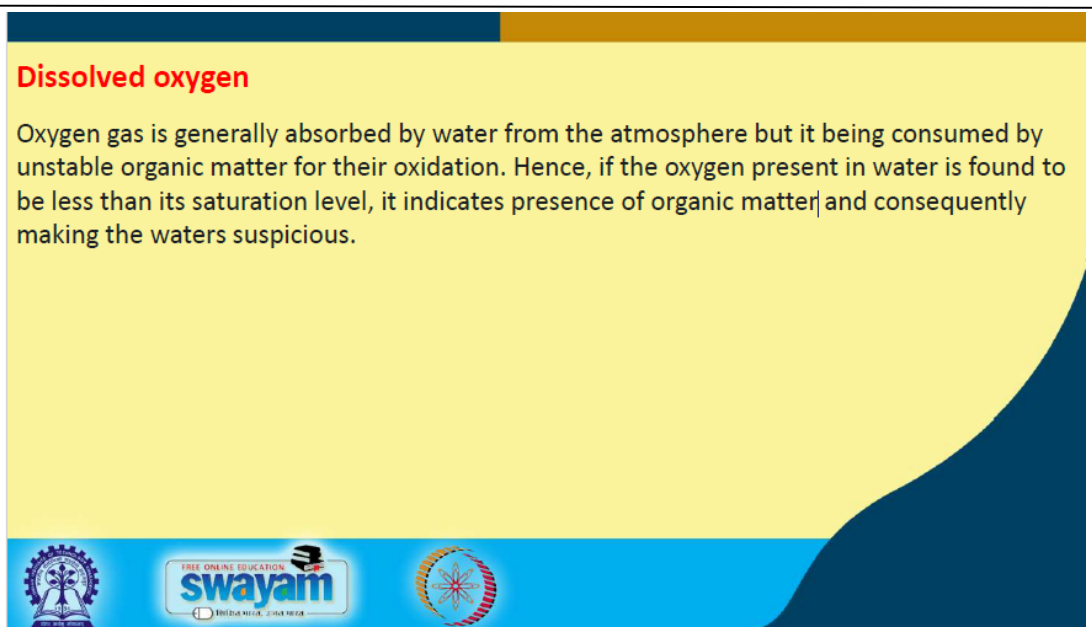
State whether the following statement is True/False.

“If the oxygen present in water is found to be greater than its saturation level, it indicates presence of organic matter.”

a. True
b. False

Correct Answer: b

Detailed Solution:



QUESTION 14:

Predict the population for the year, 2060 from the following population data using the incremental increase method.

Year	1960	1970	1980	1990	2000	2010
Population	858545	1015672	1201553	1691538	2077820	2585862

a. 4526845
b. 6459872
c. 5629112
d. 5412356

Correct Answer: c

Detailed Solution:

Year	Population	Increment (X)	Incremental Increase (Y)
1960	858545	-	-
1970	1015672	157127	-
1980	1201553	185881	+28754
1990	1691538	489985	+304104
2000	2077820	386282	-103703

2010	2585862	508042	+121760
	Total	1727317	350915
	Average	345463	87729

population after n^{th} decade is $P_n = P + n.X + \{n(n+1)/2\}.Y$

n = 5

P_{2060} = 2585862 + (345463 x 5) + {(5*(5+1)/2)} x 87729

= 5629112

QUESTION 15:

Identify the formula for calculating the maximum daily water demand.

a. 2.5 x Average daily demand
b. 2.7 x Average daily demand
c. 1.5 x Average daily demand
d. 1.8 x Average daily demand

Correct Answer: d

Detailed Solution:

Variation in water demand

Maximum daily demand = 1.8 × Average daily demand

Maximum hourly demand = 1.5 × 1.8 × Average daily demand
= 2.7 × Average daily demand

**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 8

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 Total Marks 15 x 2 = 30

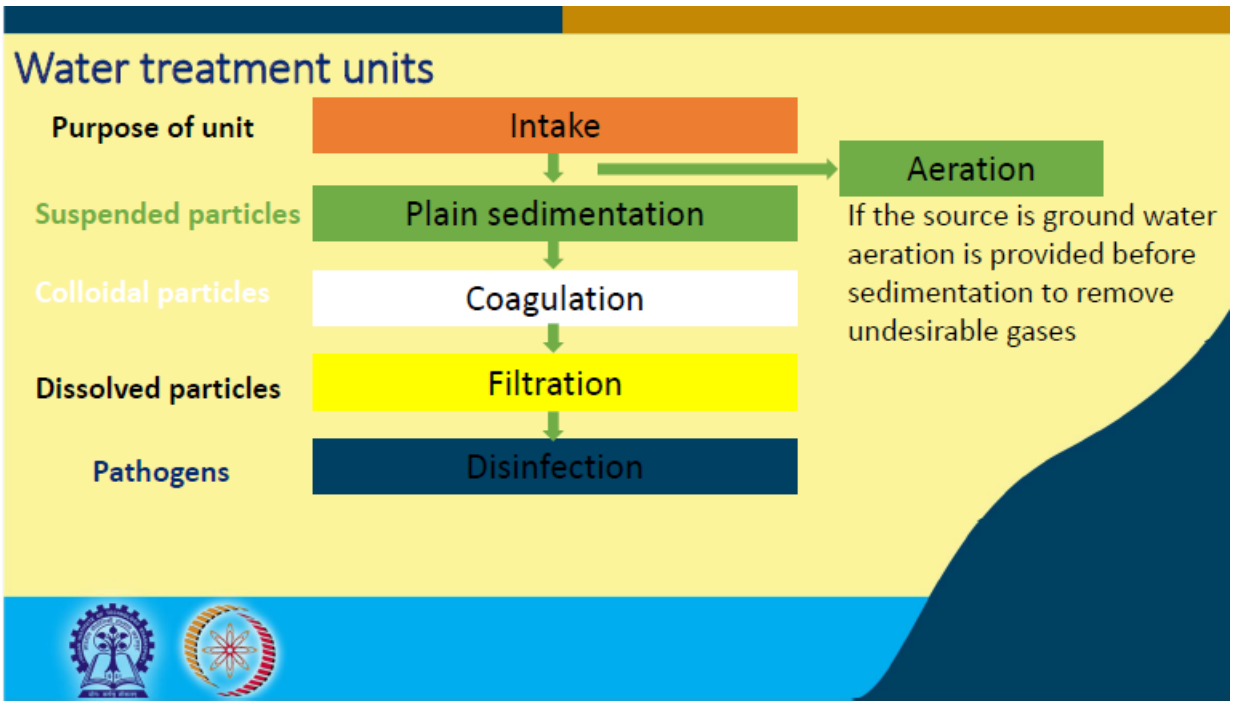
QUESTION 1:

Which treatment process is designed for removing pathogens in a water treatment plant?

a. Plain sedimentation
b. Coagulation
c. Filtration
d. Disinfection

Correct Answer: d

Detailed Solution:



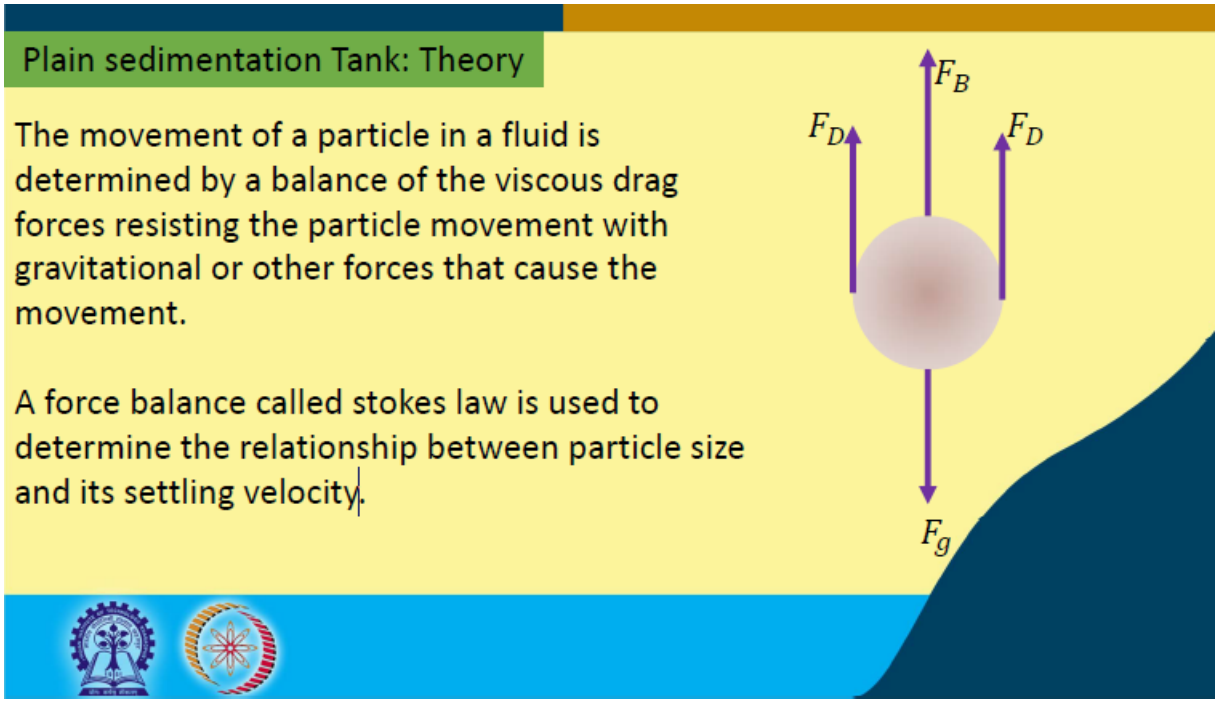
QUESTION 2:

Which of the following law establishes the relationship between particle size and its settling velocity?

a. Pascal's law
b. Darcy's law
c. Stoke's law
d. Hooke's law

Correct Answer: c

Detailed Solution:



QUESTION 3:

Match the following;

A.	Type I	i.	Flocculent particle settling
B.	Type II	ii.	Zone settling
C.	Type III	iii.	Compression settling
D.	Type IV	iv.	Discrete particle settling

a. A-iv, B-i, C-ii, D-iii
b. A-iv, B-i, C-iii, D-ii
c. A-i, B-ii, C-iii, D-iv
d. A-iv, B-iii, C-ii, D-i

Correct Answer: a

Detailed Solution:

QUESTION 4:

A sedimentation tank designed to capture 0.015 mm diameter particles with a specific gravity of 2.65. If the sedimentation tank is designed for a surface overflow rate of 30 $m^3/day/m^2$. Find the efficiency of particle removal. Take the kinetic viscosity of water: 0.01 cm^2/sec.

a. 64.98 %
b. 58.27 %
c. 48.69 %
d. 38.85 %

Correct Answer: b

Detailed Solution:

Settling velocity $v_s = \frac{g(\rho_p - \rho_f)}{18\mu} D_p^2$

= {[9.81*(2.65-1)]/[18*0.01*10^{-4}] }* (0.015*10^{-3})^2
= 2.02*10^{-4} m/s = 17.48 m/day

$\eta = Vs/Vo \times 100$

= (17.48/30) * 100
= 58.27%

QUESTION 5:

Which of the following is not a coagulant?

a. Aluminium sulphate
b. Ferrous Sulphate
c. Sodium hydroxide
d. Sodium sulphate

Correct Answer: c

Detailed Solution:

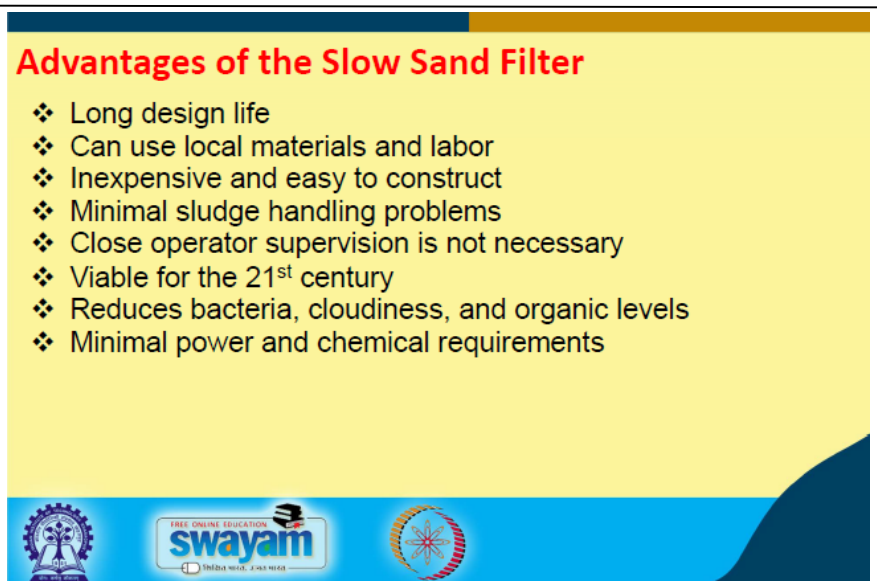
QUESTION 6:

Which of the following is not the characteristic of a slow sand filter?

a. It will have a long design life
b. It requires high power and chemical requirements
c. It is inexpensive and easy to construct
d. It reduces bacteria, colloids, and organic contaminants

Correct Answer: b

Detailed Solution:



QUESTION 7:

Find the length and width of the slow sand filter required to handle 3 MLD of water with a filtration rate of 150 lit/hr/m^2. Assume Length: Width = 1:2.

a. B=10.6 m, L= 11.2 m
b. B=15.2, L=30.4
c. B=20.5, L=41
d. B=25 m, L=50 m

Correct Answer: c

Detailed Solution:

Surface area of slow sand filter = Q/rate of filtration

L x B = $(3*10^6)/(150*24)$ = 833.33 m^2
L = 2B
$2B^2$ = 833.33
B= 20.5 m
L= 41 m

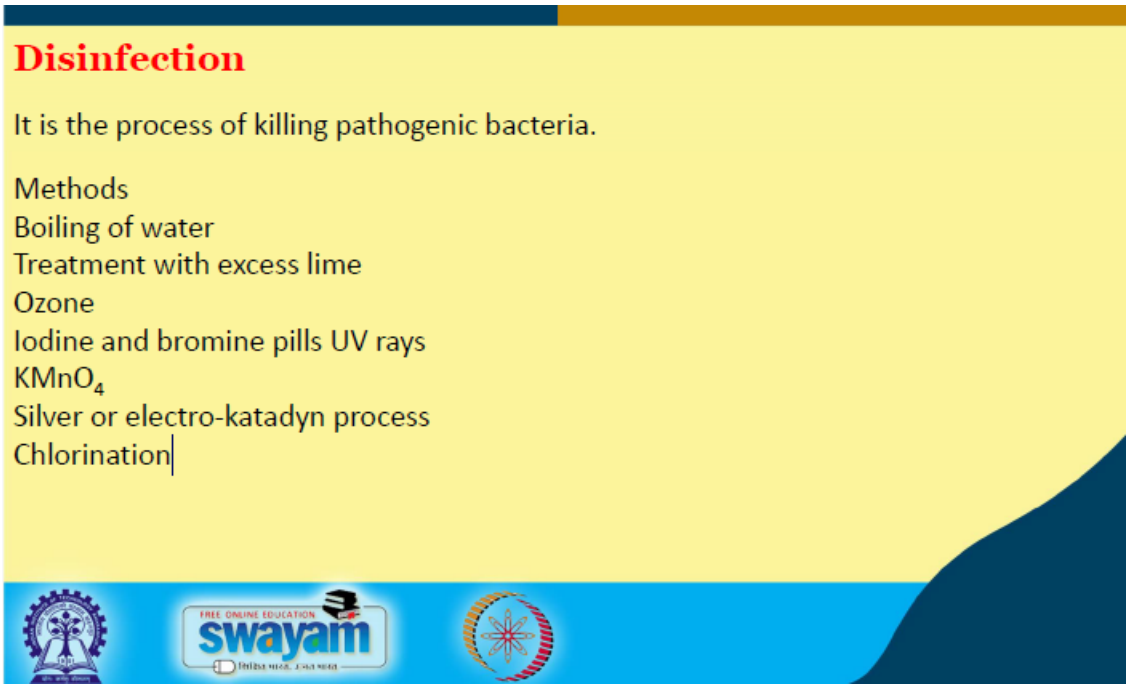
QUESTION 8:

Which of the following is not a disinfection method?

a. Boiling
b. Coagulation
c. Silver or electro-katadyn process
d. Chlorination

Correct Answer: b

Detailed Solution:



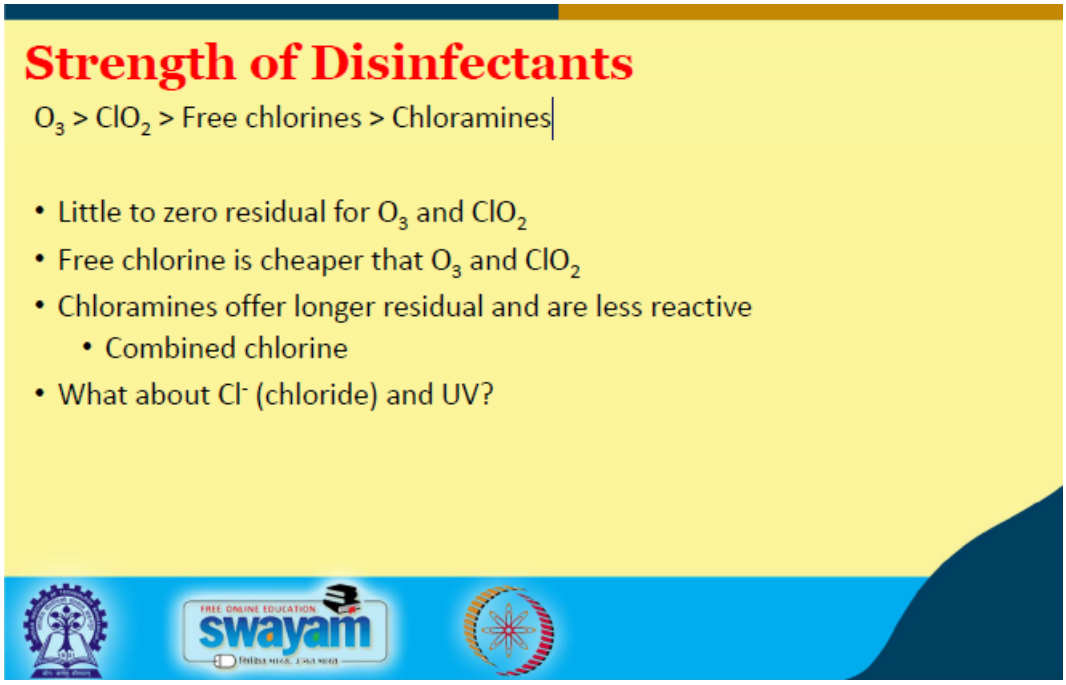
QUESTION 9:

Identify the correct order of chlorine forms in terms of their disinfecting strength.

a. ClO_2 > Free chlorines > Chloramines
b. ClO_2 > Chloramines > Free chlorines
c. ClO_2 = Free chlorines = Chloramines
d. Free chlorines > ClO_2 > Chloramines

Correct Answer: a

Detailed Solution:



QUESTION 10:

Find Cl_2 demand, if Cl_2 dose of 0.8 mg/L is added to have Cl_2 residual of 0.3 mg/L. Find the dose of bleaching powder required if it contains only 20% of Cl_2.

a. Cl_2 demand=0.4 mg/L, Bleaching powder dosage=2 mg/L
b. Cl_2 demand=0.2 mg/L, Bleaching powder dosage=3 mg/L
c. Cl_2 demand=0.4 mg/L, Bleaching powder dosage=5 mg/L
d. Cl_2 demand=0.5 mg/L, Bleaching powder dosage=4 mg/L

Correct Answer: d

Detailed Solution:

Cl_2 demand = Cl_2 dose – Cl_2 residual

= 0.8-0.3 = 0.5 mg/L

Bleaching powder = Cl_2 dose/% of Cl_2 in bleaching powder

= 0.8/(20/100) = 4 mg/L

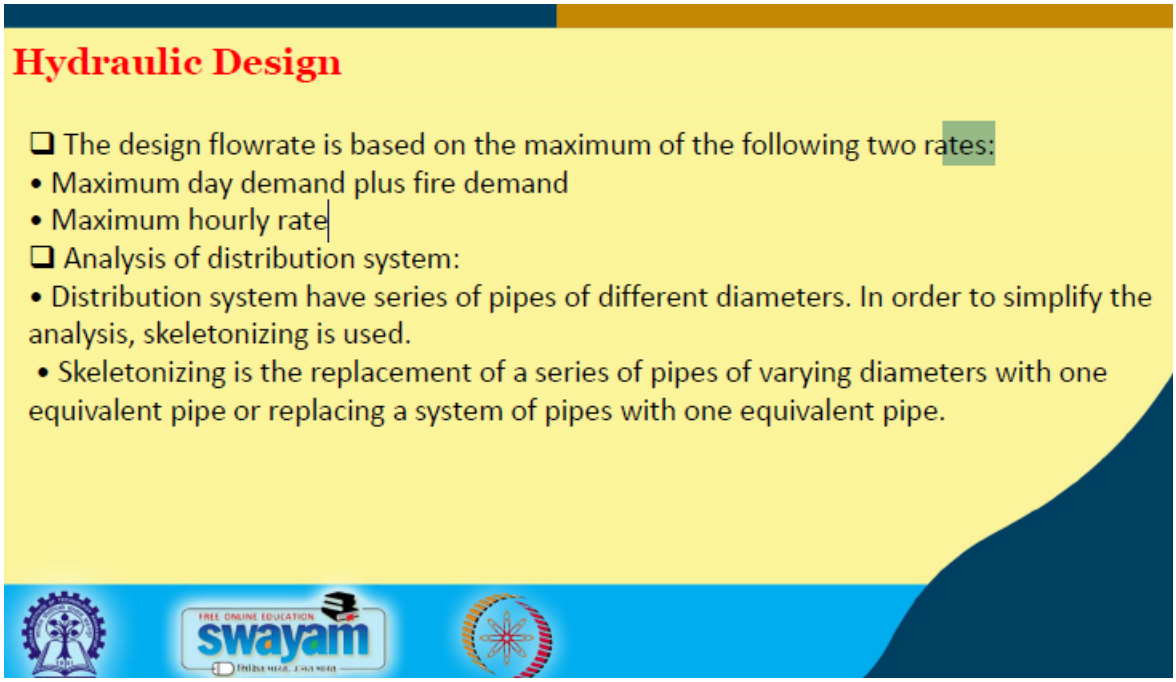
QUESTION 11:

The design flow rate for a water supply system is;

a. Equal to maximum day demand plus fire demand
b. Equal to maximum hourly rate
c. Maximum of Maximum day demand plus fire demand and Maximum hourly rate
d. Minimum of Maximum day demand plus fire demand and Maximum hourly rate

Correct Answer: c

Detailed Solution:



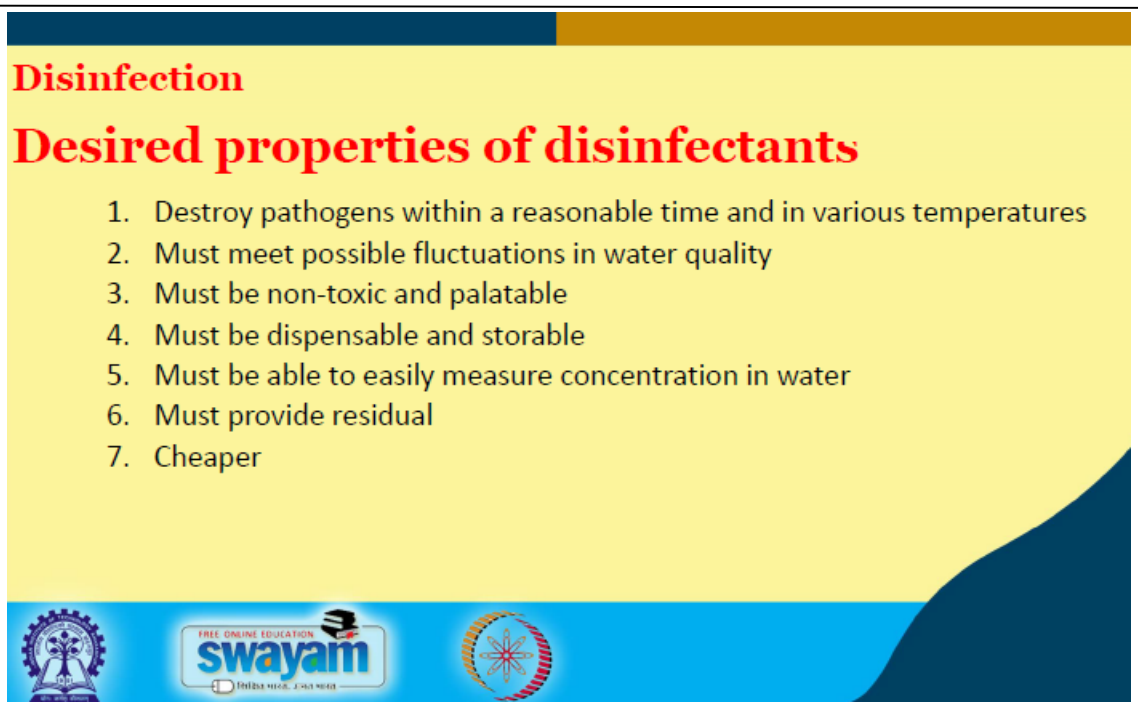
QUESTION 12:

Which of the following is not a desired property of disinfectants?

a. Should not provide any residual
b. Must be non-toxic and palatable
c. Must be dispensable and storable
d. Destroy pathogens within a reasonable time and in various temperatures

Correct Answer: a

Detailed Solution:



QUESTION 13:

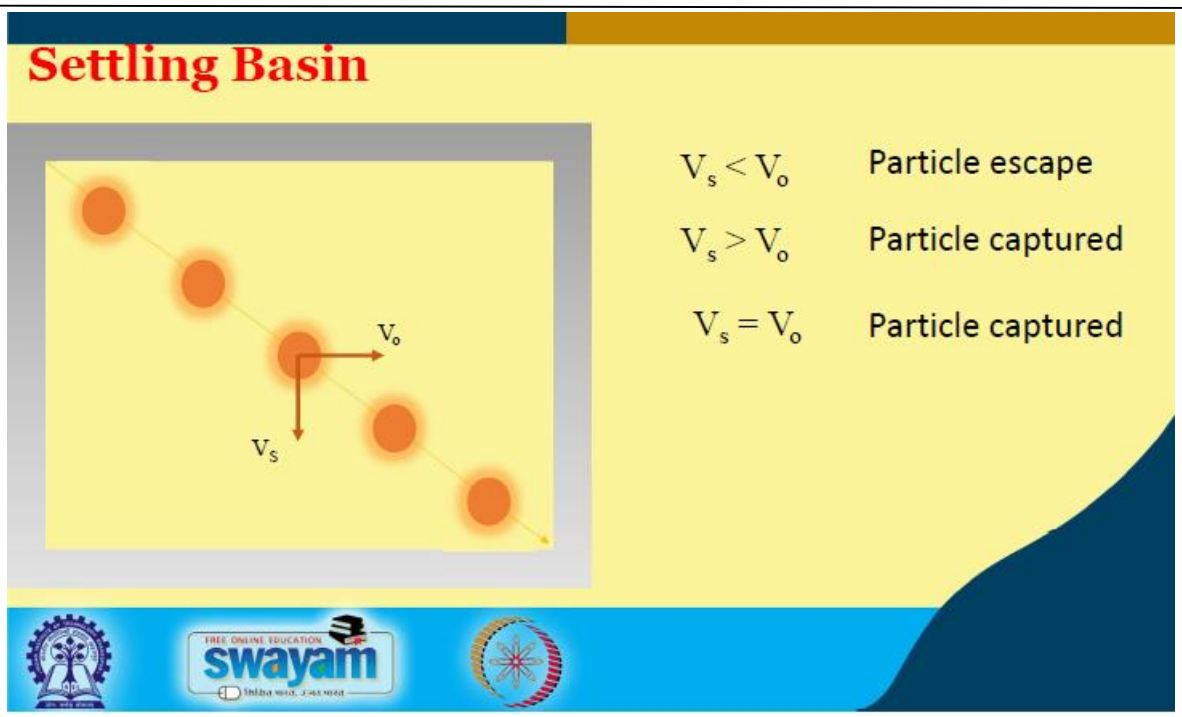
State whether the following statements are True/False.

"The suspended particles tend to escape from the settling basin if the settling velocity exceeds the overflow rate."

a. True
b. False

Correct Answer: b

Detailed Solution:



QUESTION 14:

A 4 number of rapid sand filters treat 20 MLD of water with rate of filtration 4000 lit/hr/m^2. Find the volume of filtered water required to backwash each filter, if backwashing rate is 5 times rate of filtration. Duration of backwash is 15 mins and it is carried out once in every 24 hours.

a. 260.4 m^3
b. 153.9 m^3
c. 364.8 m^3
d. 230.1 m^3

Correct Answer: a

Detailed Solution:

Surface area of rapid sand filter = Q/rate of filtration

L x B = $(20*10^6)/(4000*24)$ = 208.33 m^2

Area of each filter = 208.33/4 =52.08 m^2

Volume of water used in backwash = ROB X DOB X Area of each filter

= 5*4000*(15/60)*52.08 = 260400 litres

QUESTION 15:

Which of the following statement(s) is/are true regarding rapid sand filters?

a. A filter that operates continuously typically requires backwashing on a monthly basis.
b. Large quantities of backwash water and sludge generated from filtration can be directly discharged to the environment.
c. Because of the higher filtration rates, the area requirement of a rapid filtration plant is about 20% of that required for the slow sand filters.
d. Operating a rapid sand filter requires trained personnel.

Correct Answer: c,d

Detailed Solution:

Rapid Sand Filter

Technical description

Pretreatment of the raw water, using chemical flocculation agents in combination with setting tanks, is common where turbidity is high.

Relatively large quantities of filter backwash water, as well as sludge from the settling process, may be generated and require some form of treatment before discharge to the environment.

Because of the higher filtration rates, the area requirement of a rapid filtration plant is about 20% of that required for the slow sand filters.

Rapid Sand Filter

Operation and Maintenance

Operation of a rapid sand filter consists of regular backwashing. The period between backwashes depends on the quality of the water being filtered. The purpose of backwashing is to remove the suspended material that has been deposited in the filter bed during the filtration cycle. Periodic repacking of the filter bed may be required at infrequent intervals to ensure efficient operation.

Level of Involvement

Operating a rapid sand filter requires trained personnel.

**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 9

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 **Total Marks 15 x 2 = 30**

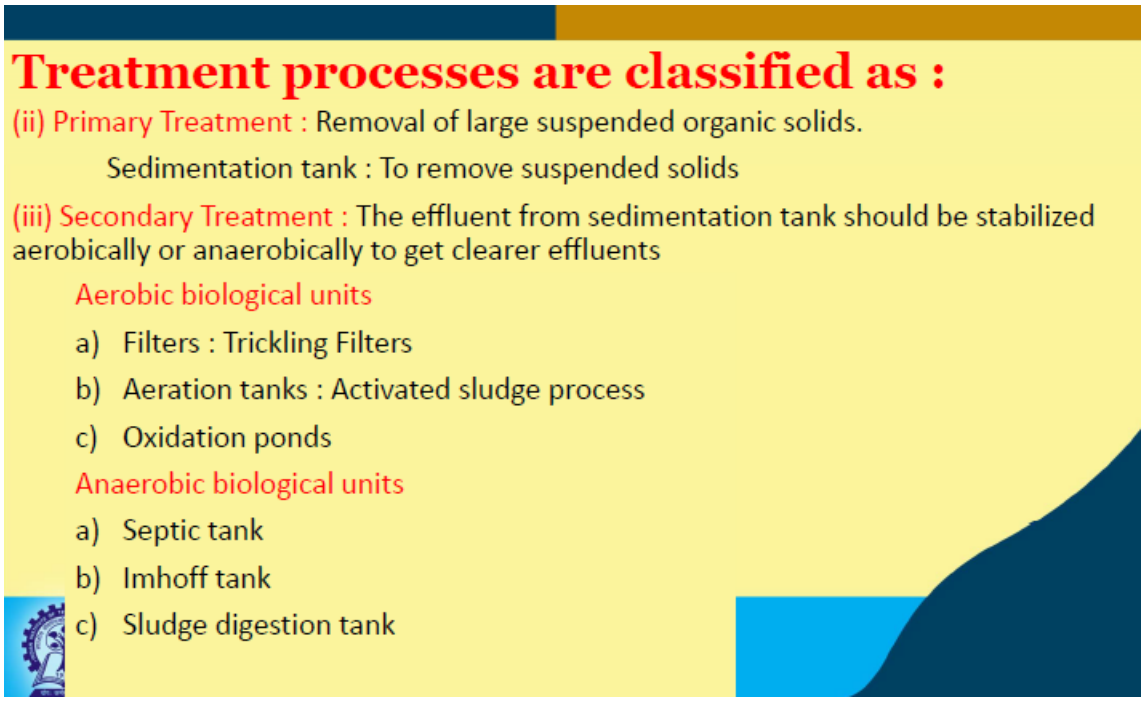
QUESTION 1:

Which of the following is an anaerobic biological unit in wastewater treatment?

a. Trickling filter
b. Activated sludge process
c. Imhoff tank
d. Oxidation pond

Correct Answer: c

Detailed Solution:



QUESTION 2:

Identify the incorrect statement regarding oxygen demand from the following;

a. Biochemical oxygen demand is the quantity of oxygen utilized by a mixed population of microorganisms to biologically degrade the organic matter in the wastewater under anaerobic conditions.
b. Biochemical oxygen demand is the quantity of oxygen utilized by a mixed population of micro-organisms to biologically degrade the organic matter in the wastewater under aerobic condition
c. Chemical oxygen demand is the amount of oxygen consumed during chemical oxidation with potassium permanganate or potassium dichromate in an acid solution.
d. Theoretical oxygen demand is the oxygen demand that can be worked out theoretically

Correct Answer: a

Detailed Solution:

Chemical Oxygen Demand (COD): It is chemical oxidation with potassium permanganate or potassium dichromate in an acid solution.

Theoretical oxygen Demand: It is the oxygen demand that can be worked out theoretically.

What is Biochemical Oxygen Demand (BOD)?

Definition

The quantity of oxygen utilised by a mixed population of micro-organisms to biologically degrade the organic matter in the wastewater under aerobic condition

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QUESTION 3:

Which preliminary treatment unit is designed to remove oils or greases from wastewater?

a. Screening
b. Equalization tank
c. Detritus tank
d. Skimming tank

Correct Answer: d

Detailed Solution:

QUESTION 4:

In a BOD test, the initial DO of the 3 % diluted sample is 9 mg/l, and its final DO after 5 days of incubation at 20 °C is 3 mg/l. Find the 5-day BOD of the sewage sample.

a. 100 mg/L
b. 150 mg/L
c. 200 mg/L
d. 250 mg/L

Correct Answer: c

Detailed Solution:

$y_5^{20^oC}$ = {$[DO]_{initial} - [DO]_{find}$} X Dilution factor

= (9-3) * (100/3) = 200 mg/L

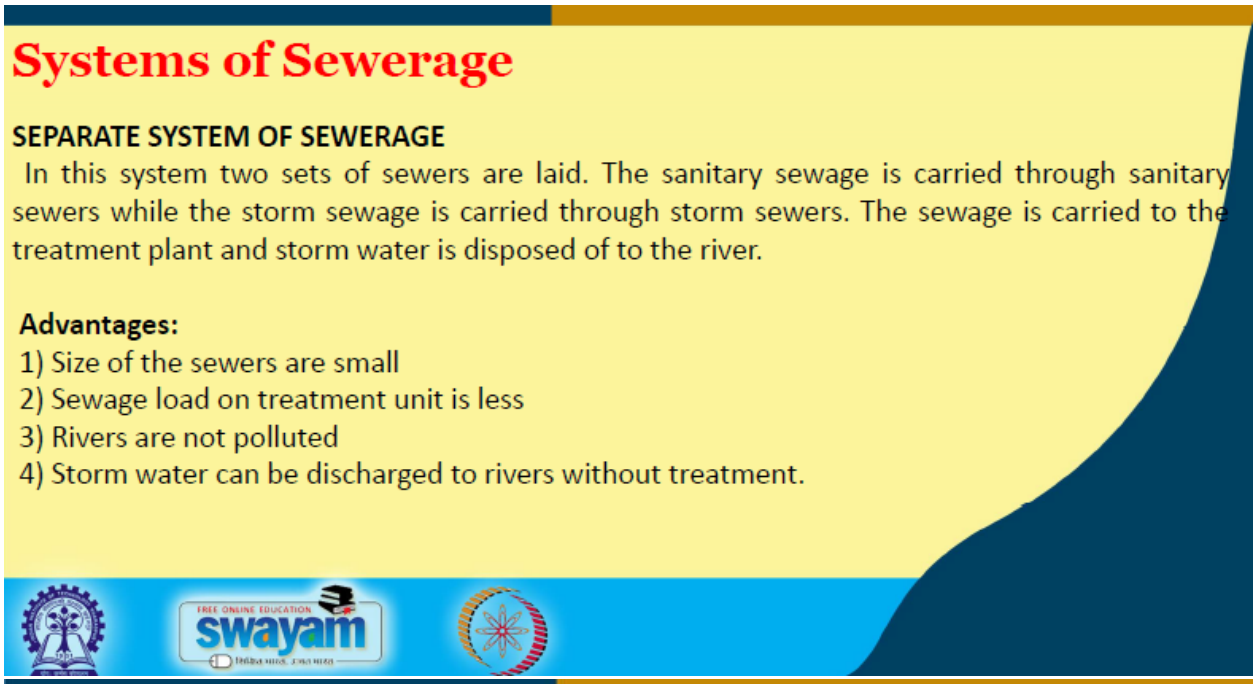
QUESTION 5:

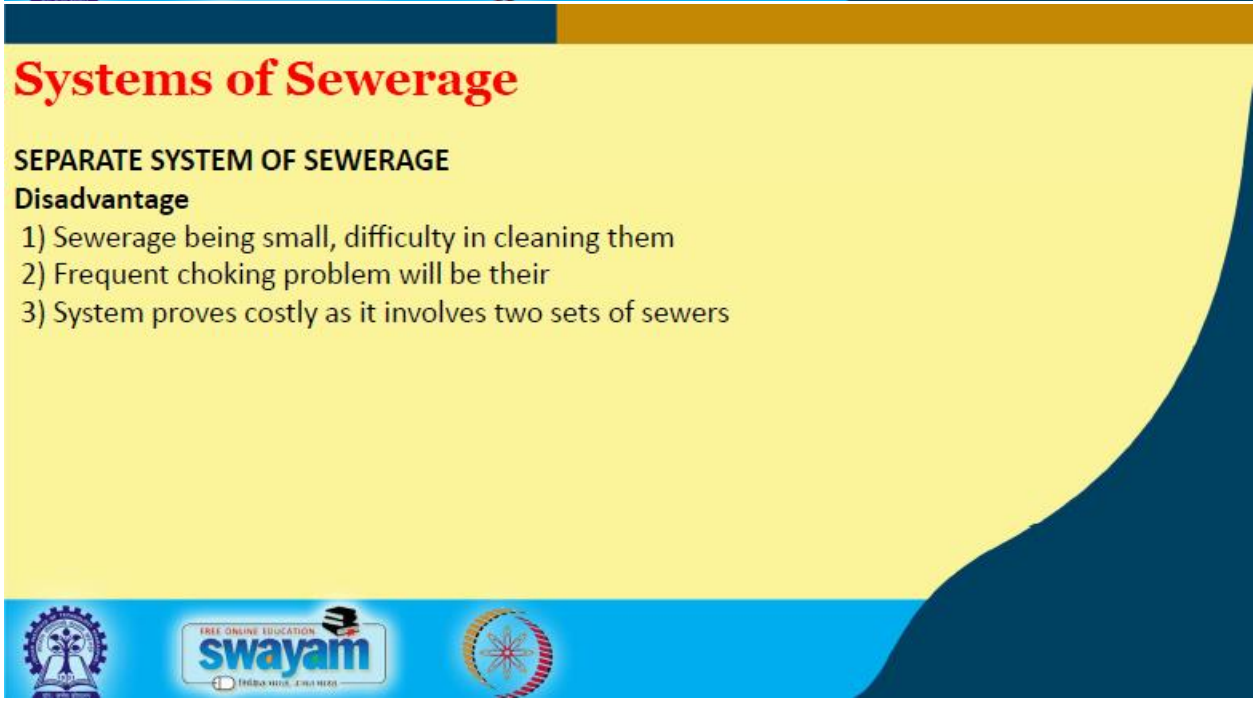
Which of the following statements is not true for a Separate sewerage system?

a. Sewerage being small, difficulty in cleaning them
b. Frequent choking problem
c. System proves costly as it involves two sets of sewers
d. Sewage load on treatment unit is high

Correct Answer: d

Detailed Solution:





QUESTION 6:

State whether the following statement is True/False.

"If BOD_5 / COD varies between 0.63 and 0.68, then the wastewater can be considered to be fully biodegradable."

a. True
b. False

Correct Answer: a

Detailed Solution:

BOD/COD ratio:

1. If BOD_u / COD lies between 0.92 and 1, then the waste water can be considered to be fully biodegradable.
2. If BOD_5 / COD vary between 0.63 and 0.68 then the waste water can be considered to be fully biodegradable wastes.

QUESTION 7:

Match the following;

A.	Preliminary treatment	i.	Chlorination
B.	Primary treatment	ii.	Activated sludge process
C.	Secondary treatment	iii.	Screening
D.	Tertiary treatment	iv.	Sedimentation tank

a. A-iii, B-iv, C-ii, D-i
b. A-iii, B-iv, C-i, D-ii
c. A-i, B-iv, C-ii, D-iii
d. A-ii, B-iv, C-iii, D-i

Correct Answer: a

Detailed Solution:

Treatment processes are classified as :

(i) Preliminary treatment

(ii) Primary treatment

(iii) Secondary or biological treatment

(iv) Tertiary treatment

(I) Preliminary Treatment:

Separating floating materials, heavy inorganic solids.

Processes used :

(a) Screening : Floating matter removal

(b) Grit chambers or detritus tanks : To remove grit or sand

(c) Skimming tanks : To remove oils or greases

Treatment processes are classified as :

(ii) Primary Treatment : Removal of large suspended organic solids.

Sedimentation tank : To remove suspended solids

(iii) Secondary Treatment : The effluent from sedimentation tank should be stabilized aerobically or anaerobically to get clearer effluents

Aerobic biological units

a) Filters : Trickling Filters
b) Aeration tanks : Activated sludge process
c) Oxidation ponds

Anaerobic biological units

a) Septic tank
b) Imhoff tank
c) Sludge digestion tank

Treatment processes are classified as :

(iv) Final or Tertiary treatment: To kill pathogenic bacteria chlorination of sewage.

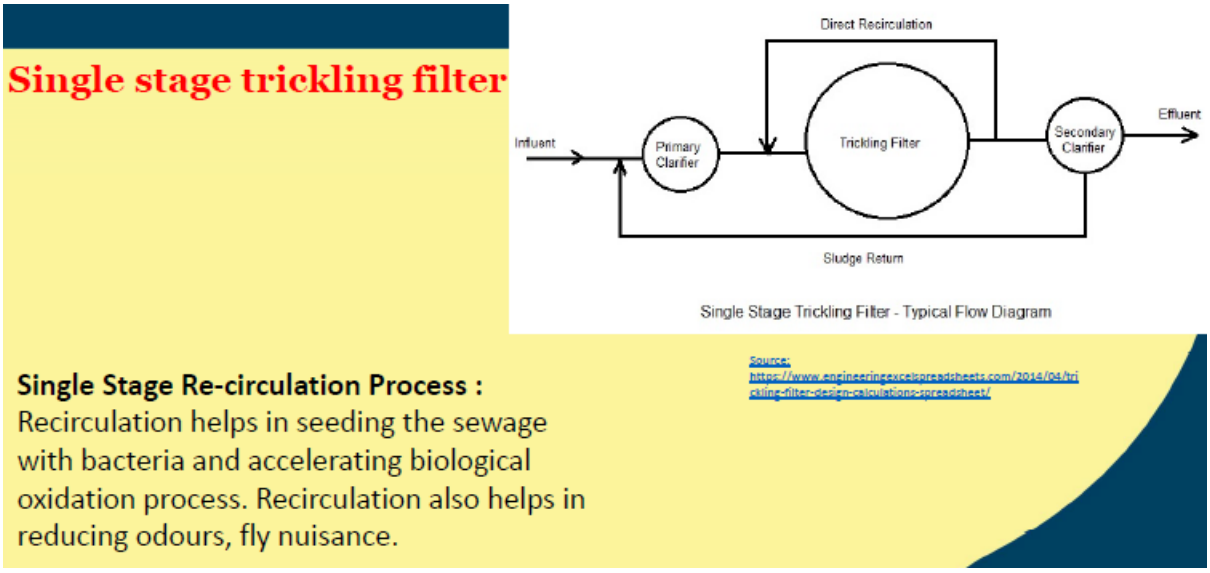
QUESTION 8:

Recirculation in trickling filter helps in;

a. Seeding the sewage with bacteria and accelerating the biological oxidation process
b. Reducing odours and fly nuisance
c. Providing sufficient aeration
d. Both a & b

Correct Answer: d

Detailed Solution:



QUESTION 9:

What is the BOD_5 of industrial sewage if the Population equivalent of that wastewater is 5000 persons?

a. 200 kg/day
b. 400 kg/day
c. 600 kg/day
d. 800 kg/day

Correct Answer: b

Detailed Solution:

Population Equivalent = BOD_5 of industrial sewage per day / BOD_5 of domestic sewage per person per day

5000 = BOD_5 of industrial sewage per day/ (0.08 kg/day/person)

BOD_5 of industrial sewage per day = 5000*0.08 = 400 kg/day

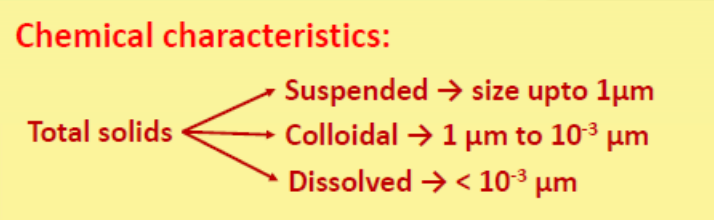
QUESTION 10:

Identify the correct order for the arrangement of solids in their increasing size.

a. Dissolved solids < Suspended solids < Colloidal solids
b. Dissolved solids < Colloidal solids < Suspended solids
c. Colloidal solids < Dissolved solids < Suspended solids
d. Colloidal solids < Suspended solids < Dissolved solids

Correct Answer: b

Detailed Solution:



QUESTION 11:

Identify the wrong statement regarding the grit chamber from the following.

a. Grit chambers are provided to reduce maintenance cost in high-speed centrifuges, which needs almost all grit particles to be removed.
b. Grit chambers are designed to separate out the grit, gravel, sand, egg, sells etc. of size 2 mm or larger.
c. It is a settling tank with lesser detention time of 1 min and flow velocity of 0.2 to 0.3 m/sec.
d. Low flow velocity has to be maintained inside a grit chamber for efficient settling of grit particles.

Correct Answer: d

Detailed Solution:

QUESTION 12:

Find the diameter of the standard trickling filter if the influent BOD is 250 mg/L and the desired effluent BOD is 25 mg/L, to handle 3 MLD of waste water flow. Assume depth = 3m.

a. 46 m
b. 86 m
c. 71 m
d. 40 m

Correct Answer: c

Detailed Solution:

$$\eta = \frac{y_i - y_e}{y_i} \times 100 = \frac{100}{1+0.0044\sqrt{\frac{Qy_i}{V}}}$$

$$\eta = [(250-25)/250]*100 = \frac{100}{1+0.0044\sqrt{\frac{3*250}{V}}}$$

V = 1.176 ha.m

V = $1.176*10^4 m^3$

$$\text{Surface area of TF} = \frac{\pi}{4}d^2 = \frac{Volume}{depth} = \frac{1.176*10\text{^}4}{3}$$

Diameter (d) = 70.64 m

QUESTION 13:

Which of the following is a chemical characteristic of wastewater?

a. Dissolved oxygen
b. Turbidity
c. Colour
d. Odour

Correct Answer: a

Detailed Solution:

Physical characteristics:

1. Turbidity
2. Colour
3. Odour
4. Temperature

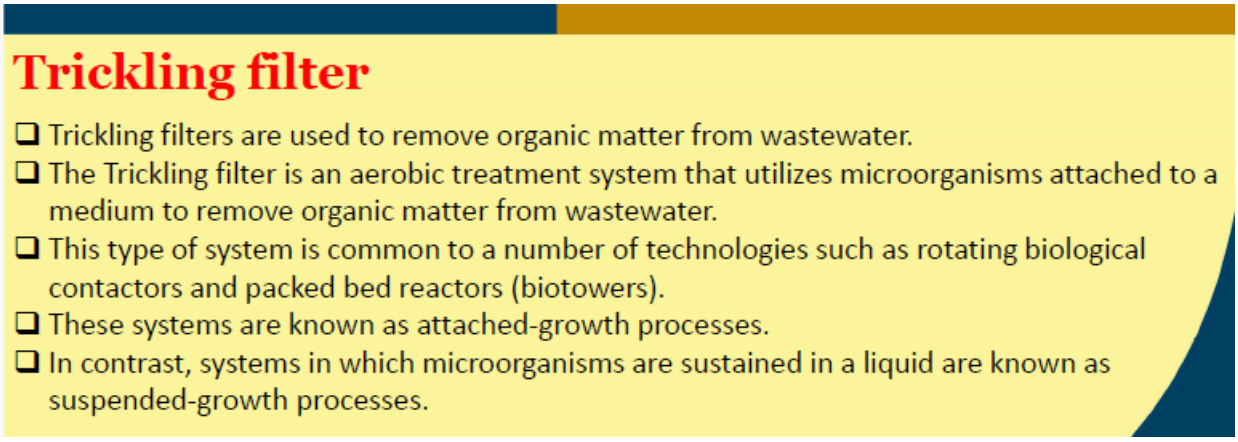
QUESTION 14:

Identify the correct statement regarding Trickling filter from the following.

a. Tricling filters are used to remove inorganic particles from wastewater
b. The Trickling filter is an anaerobic treatment system that utilizes microorganisms attached to a medium to remove organic matter from wastewater.
c. In these systems, the microorganisms are sustained in a liquid, known as suspended-growth processes.
d. Trickling filter follows attached-growth processes

Correct Answer: d

Detailed Solution:



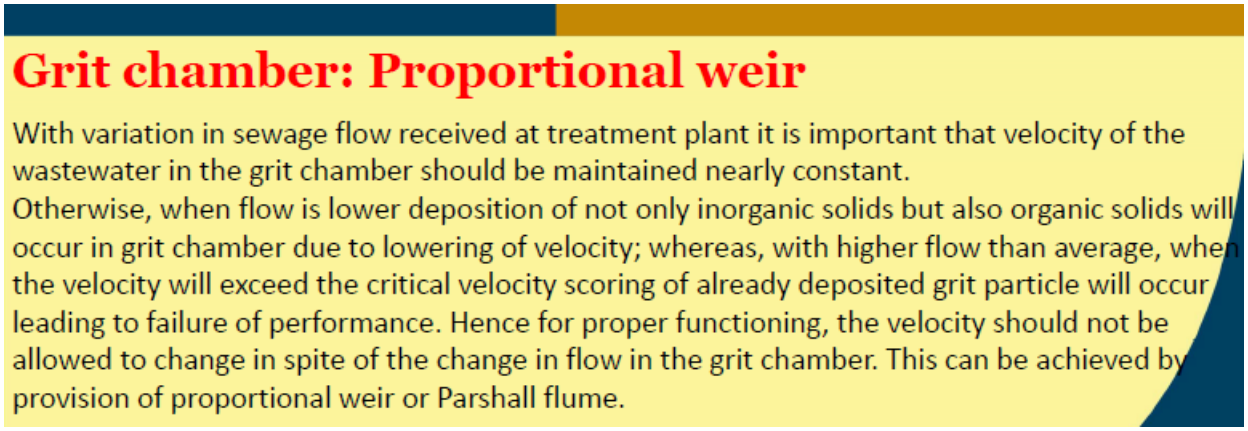
QUESTION 15:

Which is the structure designed for maintaining a constant flow velocity in grit chambers?

a. Spiral aerator
b. Equalization basin
c. Parshall flume
d. Screens

Correct Answer: c

Detailed Solution:



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NPTEL Online Certification Courses

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Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 10

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 **Total Marks 15 x 2 = 30**

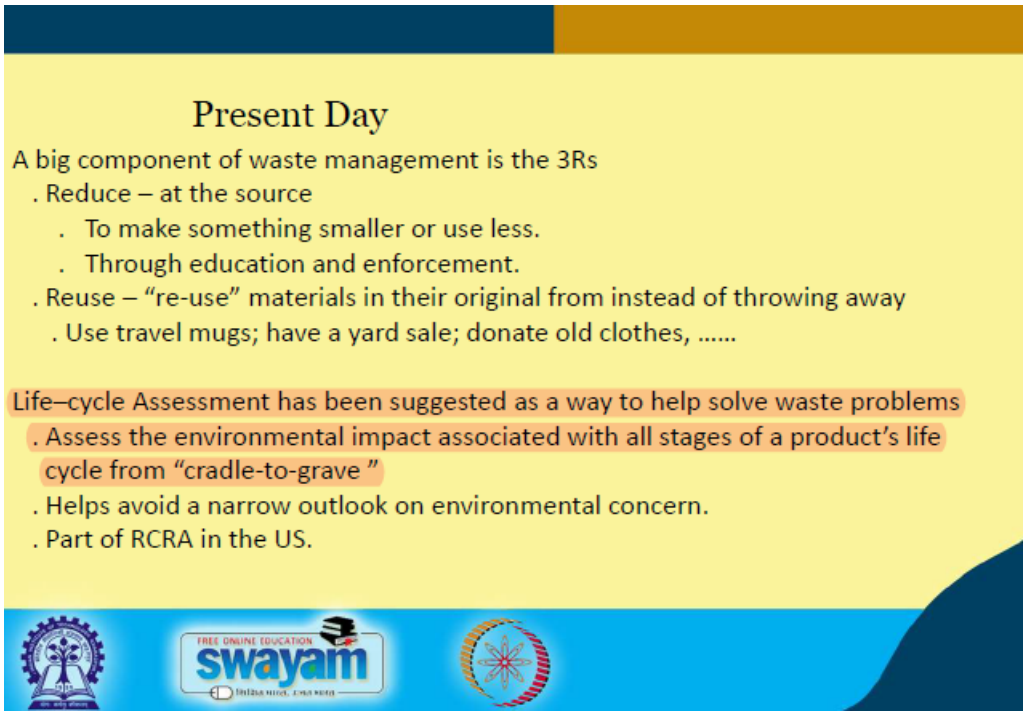
QUESTION 1:

Which methodology is used to assess the environmental impact associated with all stages of a product's life cycle?

a. Material flow analysis
b. Life cycle assessment
c. Sensitivity analysis
d. Risk assessment

Correct Answer: b

Detailed Solution:



QUESTION 2:

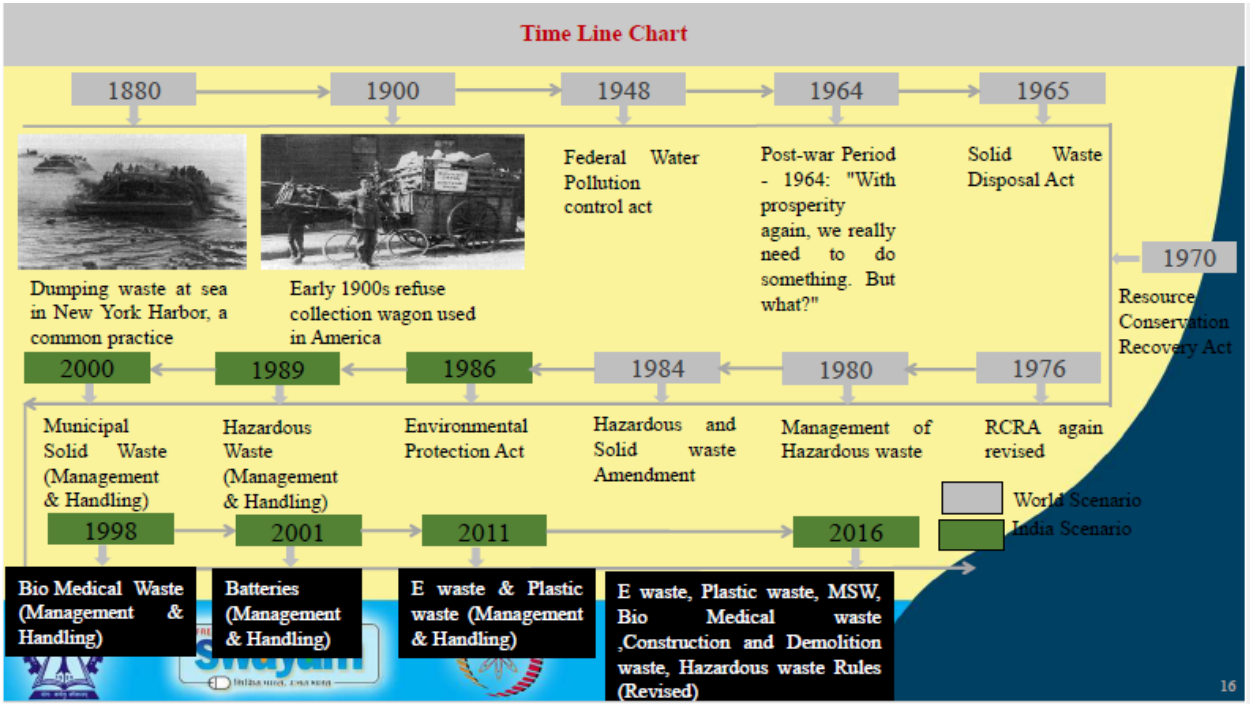
Match the following;

A.	Solid Waste Disposal Act	i.	1970
B.	Resource Conservation Recovery Act	ii.	1986
C.	Environmental Protection Act	iii.	1965
D.	Bio-Medical Waste (Management & Handling)	iv.	1998

a. A-i, B-ii, C-iii, D-iv
b. A-iv, B-iii, C-ii, D-i
c. A-iii, B-i, C-ii, D-iv
d. A-iii, B-ii, C-i, D-iv

Correct Answer: c

Detailed Solution:



QUESTION 3:

Which is the correct order of waste management strategies from the most favored to least favored option?

a. Reduce – Reuse – Recycle – Energy recovery – Disposal
b. Reuse – Reduce – Recycle – Energy recovery – Disposal
c. Reduce – Reuse – Energy recovery – Disposal – Recycle
d. Energy recovery – Disposal – Reduce – Reuse – Recycle

Correct Answer: a

Detailed Solution:

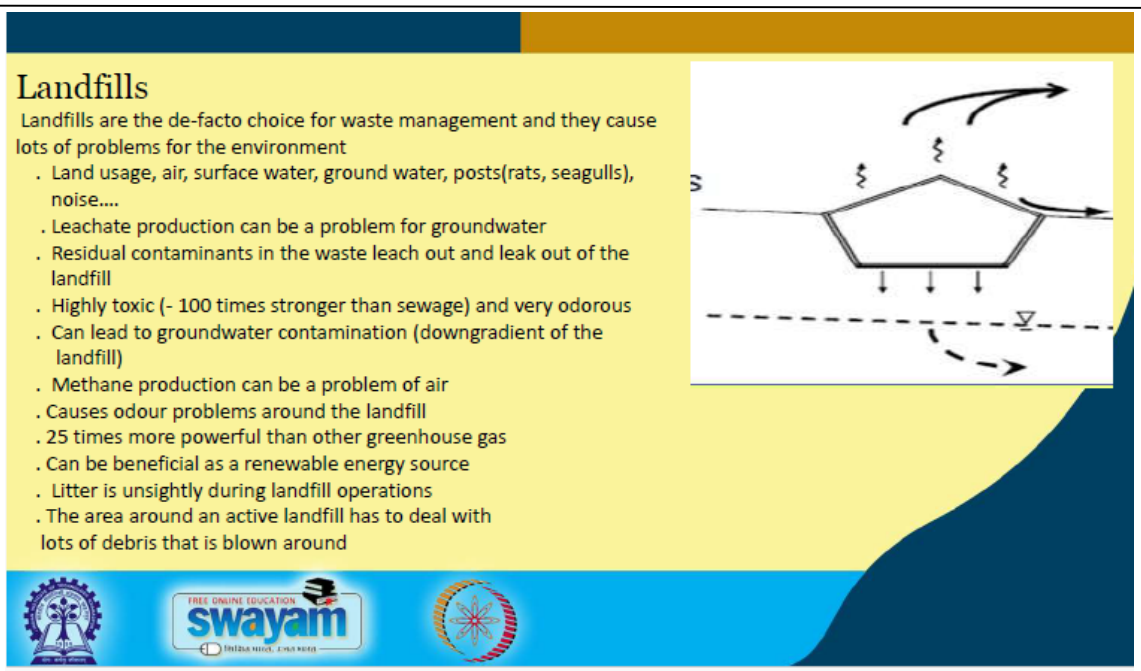
QUESTION 4:

Identify the correct statement(s) regarding landfills from the following;

a. They are the de-facto choice for waste management and they cause lots of problems for the environment.
b. Leachate production can be a problem for groundwater.
c. Methane production causes odour problems around the landfill.
d. All the above

Correct Answer: d

Detailed Solution:



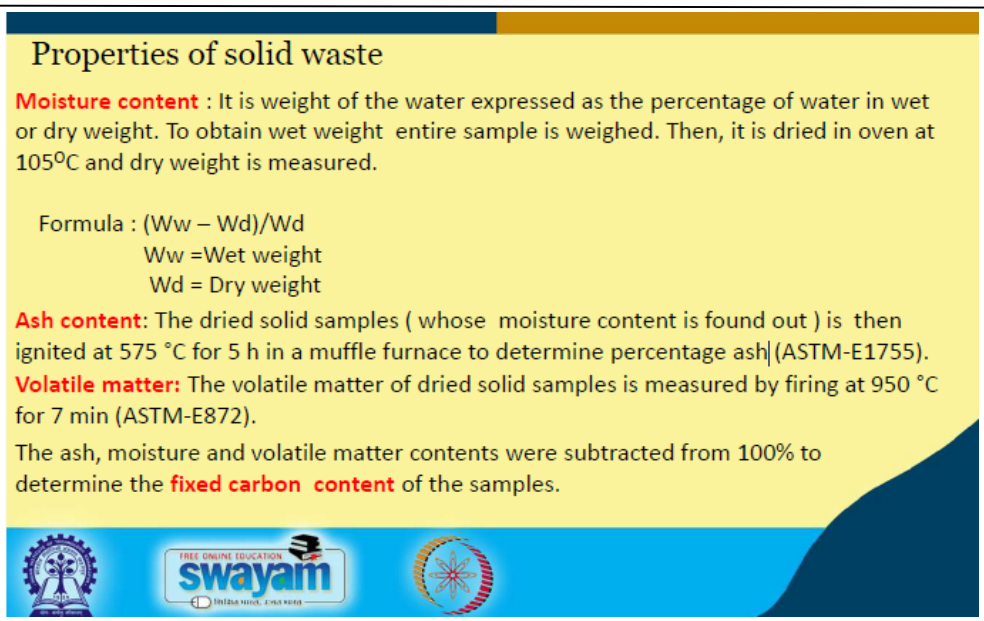
QUESTION 5:

The dried solid samples (whose moisture content is found out), when ignited at 575 °C for 5 h in a muffle furnace, give _____.

a. Total solids
b. Volatile matter
c. Fixed carbon content
d. Ash content

Correct Answer: d

Detailed Solution:



QUESTION 6:

How can the net calorific value of a waste sample be determined?

a. Gas chromatography
b. Bomb calorimeter
c. Dulong formula
d. Both b & c

Correct Answer: d

Detailed Solution:

Net caloric value: It is defined at the heat produced by unit quantity of waste at constant volume and at constant pressure. It is measure using bomb calorimeter or using formula (using elemental value, Ex: Dulong formula).

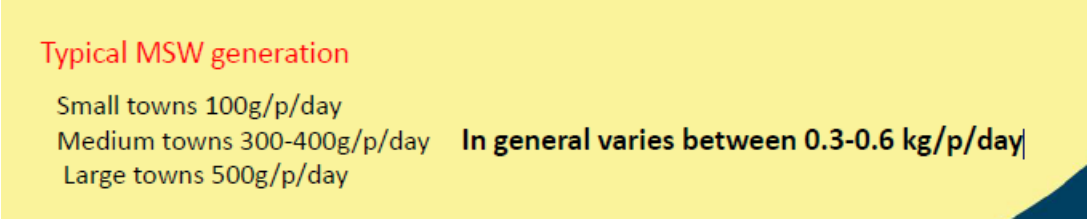
QUESTION 7:

Typical solid waste generation in India varies between _____.

a. 0.5-0.9 kg/p/day
b. 0.3-0.6 kg/p/day
c. 1.5-1.8 kg/p/day
d. 0.1-0.2 kg/p/day

Correct Answer: b

Detailed Solution:



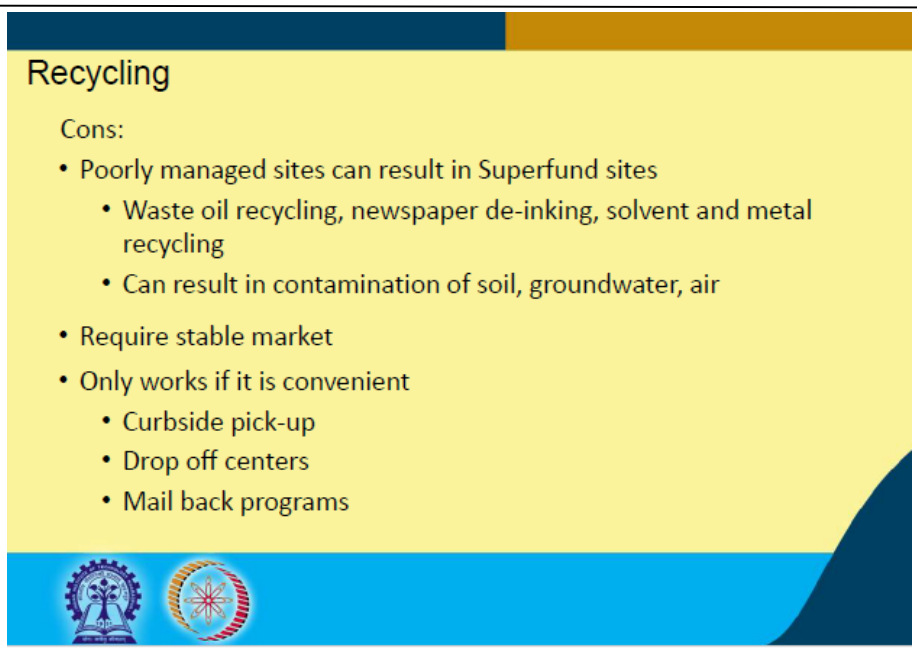
QUESTION 8:

Identify the advantages of municipal solid waste recycling from the following;

a. Require stable market
b. Save precious resources
c. Poorly managed sites can result in Superfund sites
d. Improve the efficiency of incinerators and composting facilities

Correct Answer: b & d

Detailed Solution:



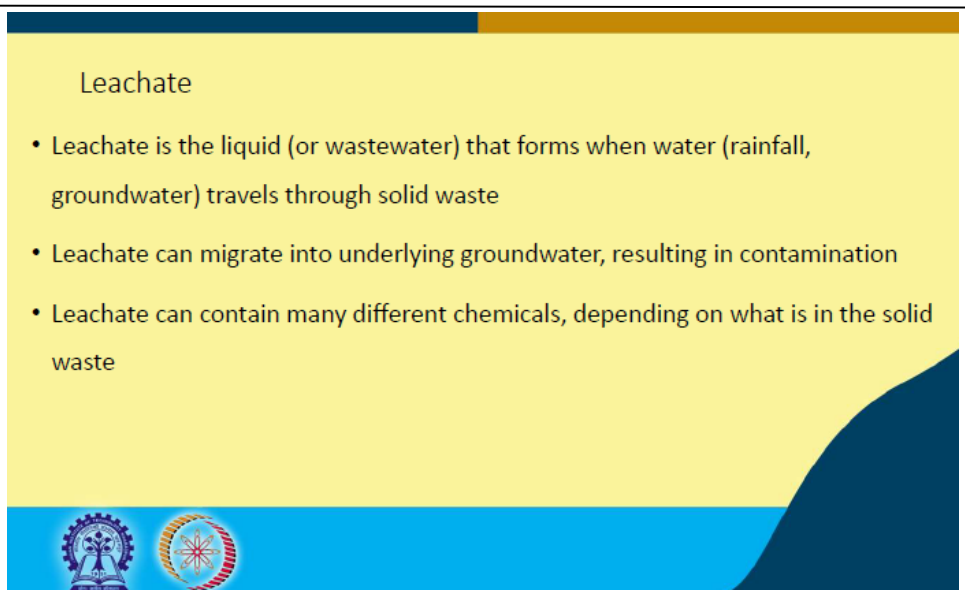
QUESTION 9:

The liquid formed from the degradation of organic fraction of municipal solid waste in the landfill is termed as _____.

a. Leachate
b. Hydrolysate
c. Digestate
d. Condensate

Correct Answer: a

Detailed Solution:



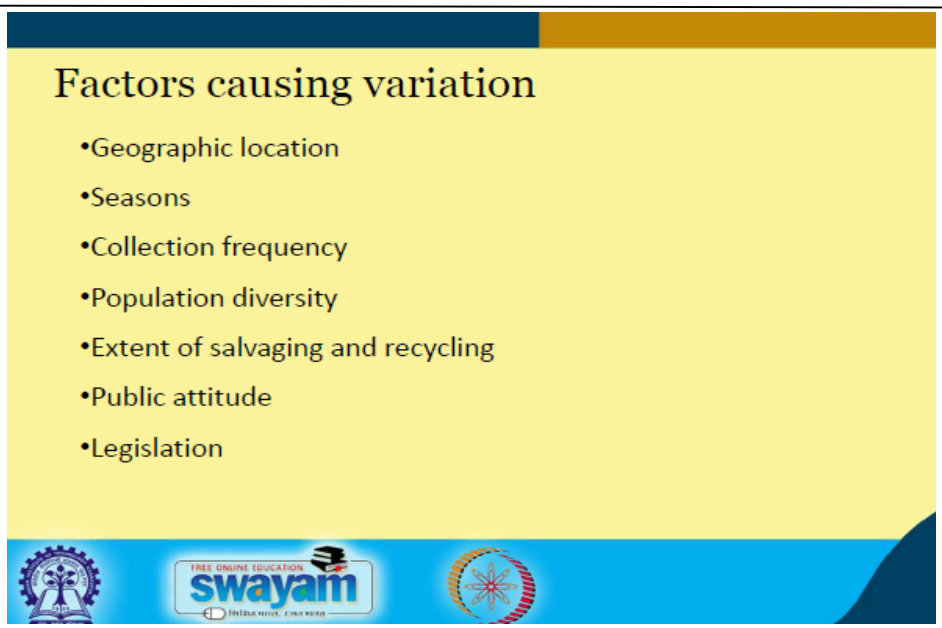
QUESTION 10:

Which among the following factors affects the solid waste composition of a region?

a. Geographic location
b. Collection frequency
c. Public attitude
d. All the above

Correct Answer: d

Detailed Solution:



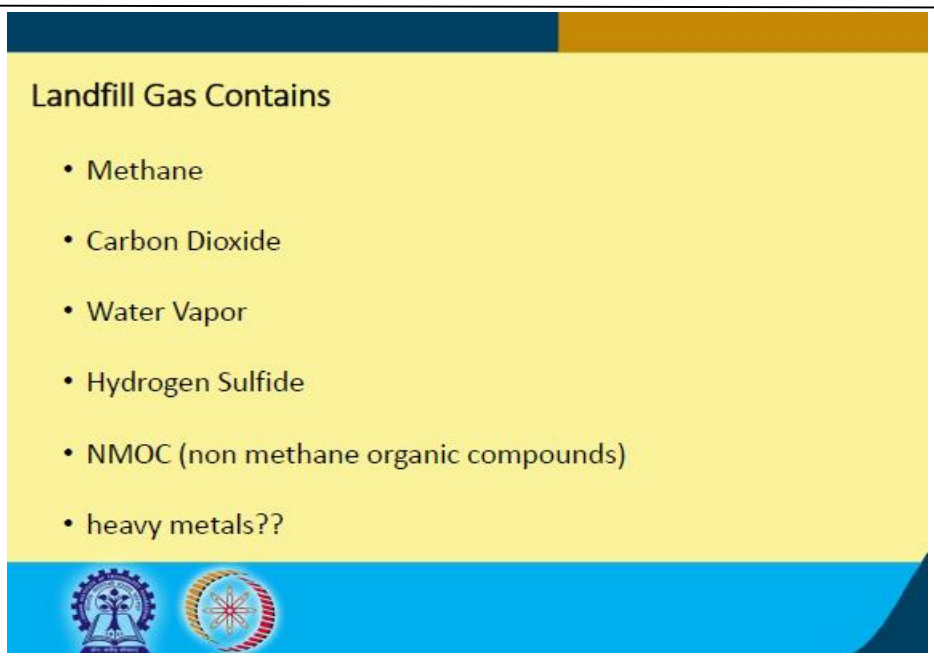
QUESTION 11:

Which of the following gases is not typically found in the composition of landfill gas?

a. Methane
b. Carbon dioxide
c. Hydrogen
d. Hydrogen sulfide

Correct Answer: c

Detailed Solution:



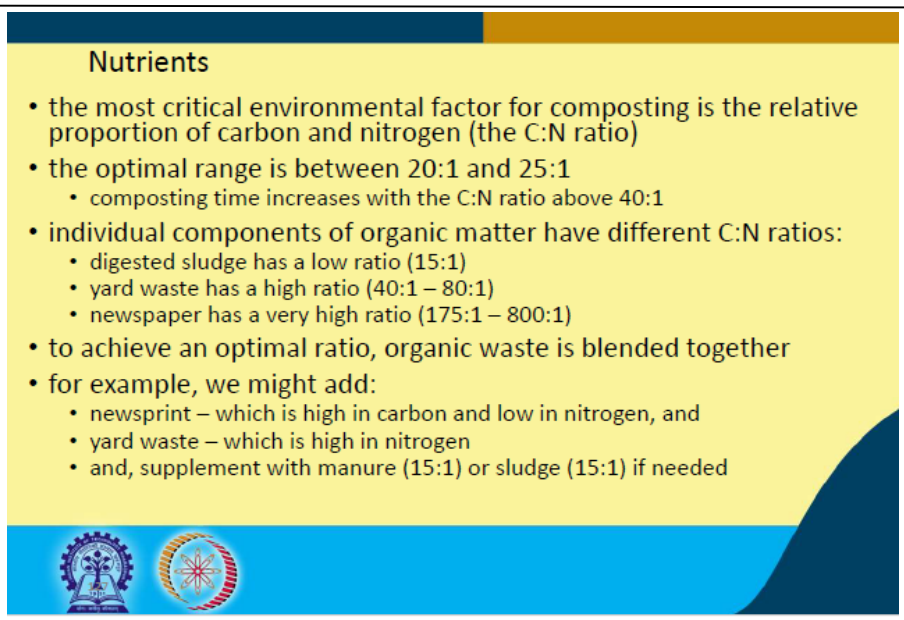
QUESTION 12:

What is the optimal range of C:N ratio for composting?

a. 10:1 to 15:1
b. 15:1 to 20:1
c. 20:1 to 25:1
d. 25:1 to 30:1

Correct Answer: c

Detailed Solution:



QUESTION 13:

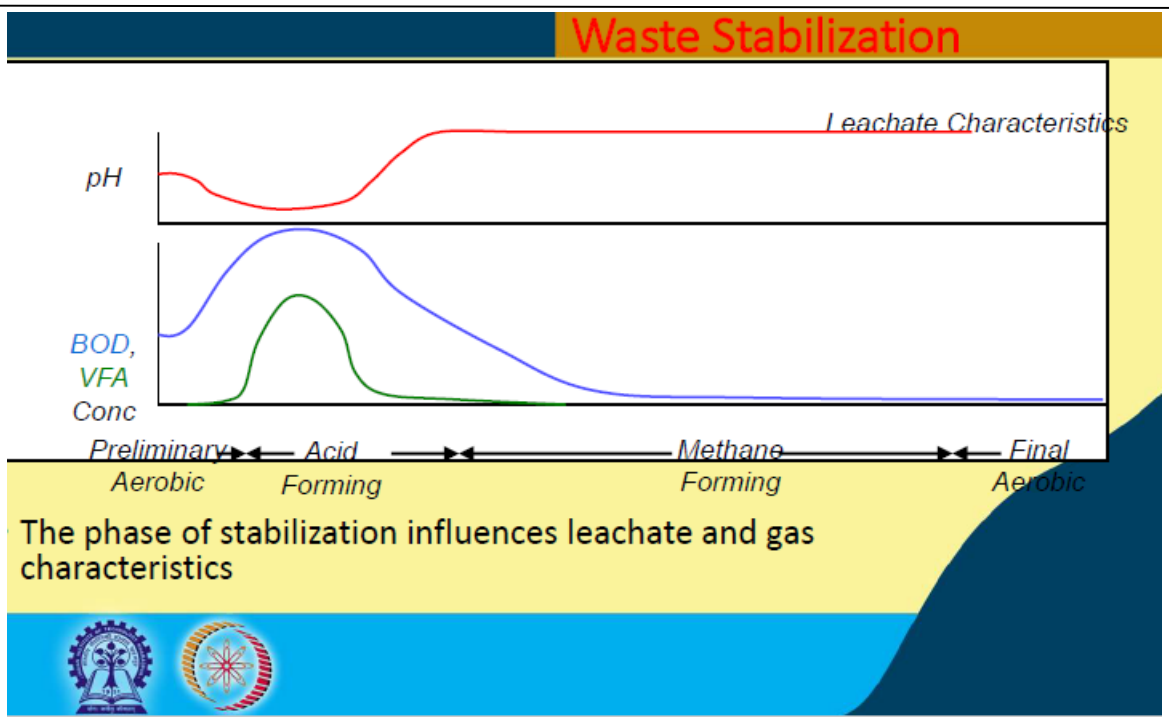
State whether the following statement is True/False.

'During the acid-forming phase of waste in landfills, the production of volatile fatty acids (VFAs) results in low pH conditions."

a. True
b. False

Correct Answer: a

Detailed Solution:



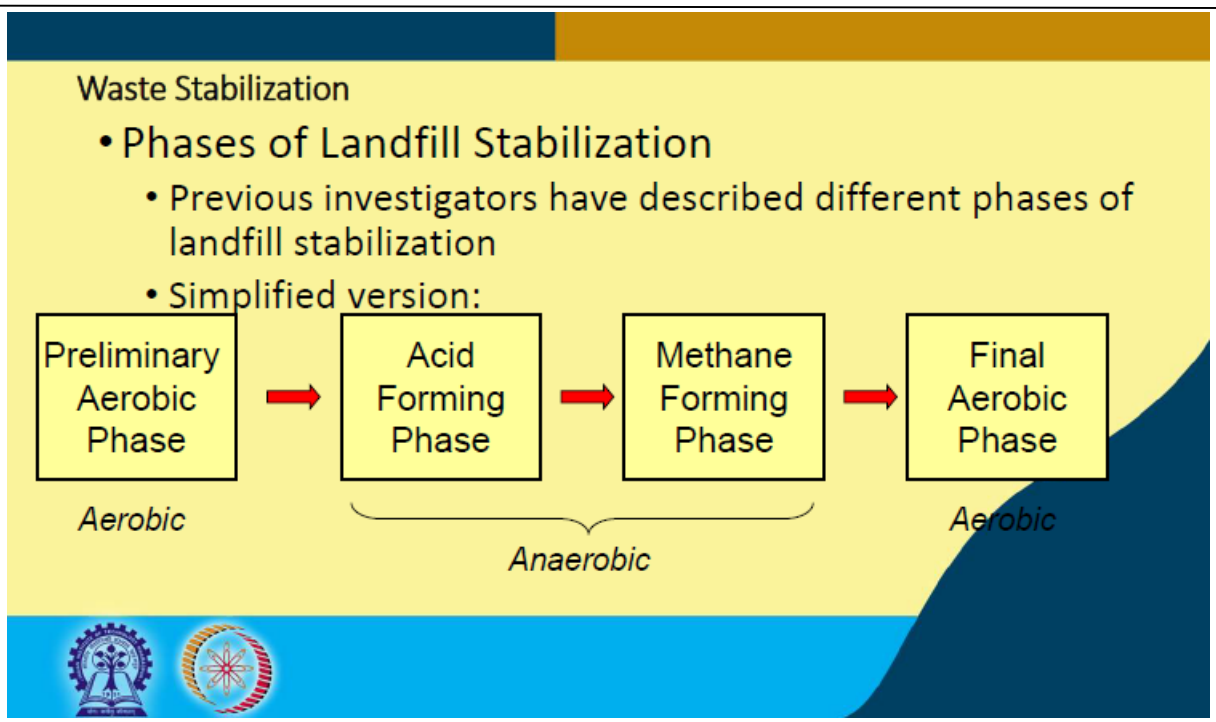
QUESTION 14:

Identify the correct order for the stabilization of landfill waste from the following.

a. Preliminary aerobic phase – Acid forming phase – Methane forming phase – Final aerobic phase
b. Preliminary anaerobic phase – Acid forming phase – Methane forming phase – Final anaerobic phase
c. Preliminary aerobic phase – Methane forming phase – Acid forming phase – Final aerobic phase
d. Preliminary anaerobic phase – Methane forming phase – Acid forming phase –Final anaerobic phase

Correct Answer: a

Detailed Solution:



QUESTION 15:

What materials can be used to make the liner of a sanitary landfill?

a. Compacted clay
b. Sand
c. Composite of compacted clay and geomembrane
d. None of the above

Correct Answer: a, c

Detailed Solution:


Typical Regulatory Requirements
• Liners -- Low permeability barrier layers
• Compacted soil (clay)
• Geomembranes (plastic)
• Composites of both
• Liner keep leachate from migrating out of the landfill
• Leachate must be collected and removed

**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 11

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 **Total Marks 15 x 2 = 30**

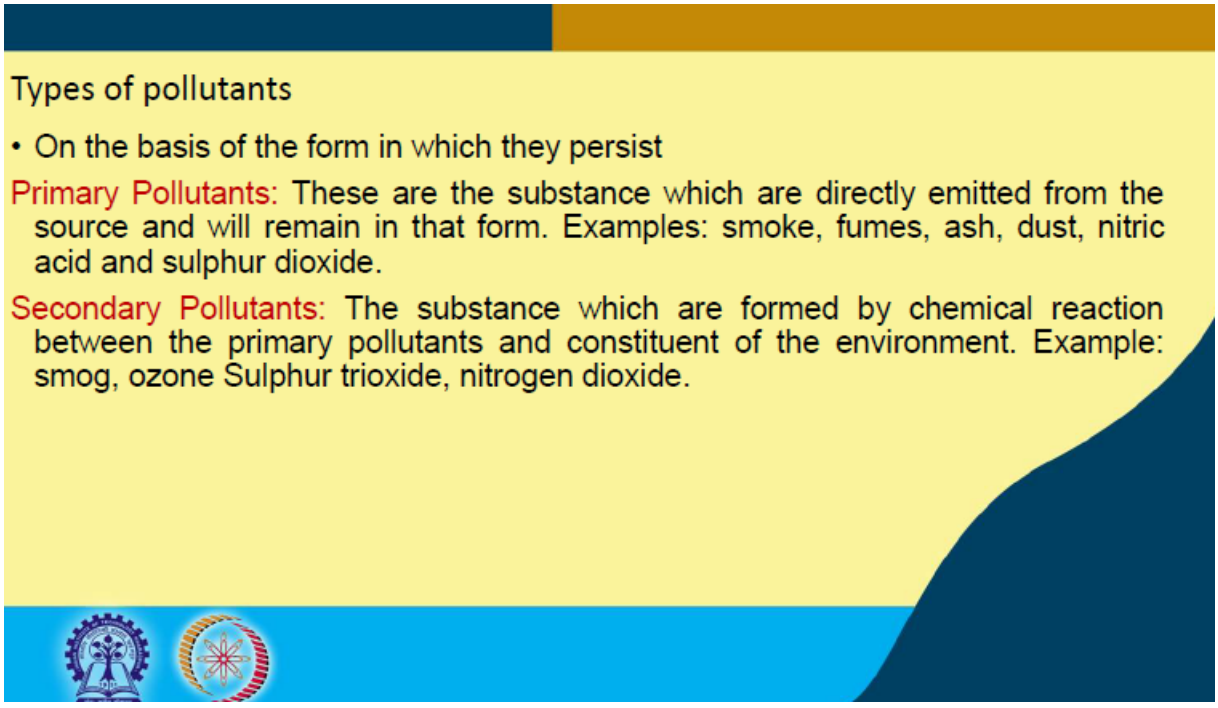
QUESTION 1:

Which among the following is a secondary air pollutant?

a. Smoke
b. Smog
c. Dust
d. Ash

Correct Answer: b

Detailed Solution:



QUESTION 2:

What is the possible ozone (O_3) generation source from the following?

a. Fuel combustion
b. Emissions from unpaved roads

c. Volcanoes
d. Chemical reaction between VOCs and nitrogen oxides (NO_χ) in presence of sunlight.

Correct Answer: d

Detailed Solution:

Sources, Health Effects, and Other Information Associated with Criteria Air Pollutants (adapted from EPA, 2012a).

Ozone (O_3)	Only criteria pollutant that has no direct sources. This secondary pollutants is typically formed by chemical reaction of VOCs and nitrogen oxides (NO_χ) in the presence of sunlight.	Decreases lung function and causes respiratory symptoms, such as coughing and shortness of breath. Aggravates asthma and other lung diseases leading to increased medication use, hospital admissions, emergency room visits, and premature mortality.	Can damage sensitive plants, reducing crop yields and forest productivity. Reduces visibility, causing haze in the atmosphere.

QUESTION 3:

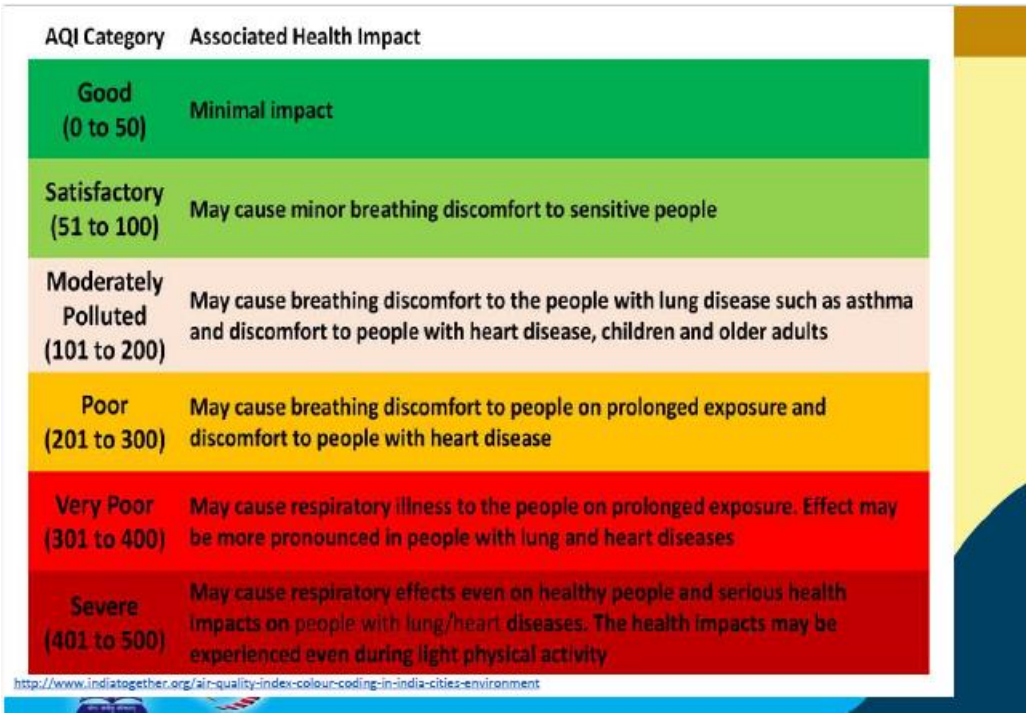
Match the following AQI categories with their associated health impacts.

AQI Category		Health impacts
A. 0 – 50	i.	May cause minor breathing discomfort to sensitive people
B. 51 - 100	ii.	Minimal impact
C. 101 - 200	iii.	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
D. 201-300	iv.	May cause breathing discomfort to people with lung diseases such as asthma and discomfort to people with heart disease, children, and older adults

a. A-ii, B-i, C-iv, D-iii
b. A-i, B-ii, C-iv, D-iii
c. A-ii, B-i, C-iii, D-iv
d. A-i, B-ii, C-iii, D-iv

Correct Answer: a

Detailed Solution:



AQI Category	Associated Health Impact
Good (0 to 50)	Minimal impact
Satisfactory (51 to 100)	May cause minor breathing discomfort to sensitive people
Moderately Polluted (101 to 200)	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
Poor (201 to 300)	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
Very Poor (301 to 400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases
Severe (401 to 500)	May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced even during light physical activity

http://www.indiatogether.org/air-quality-index-colour-coding-in-india-cities-environment

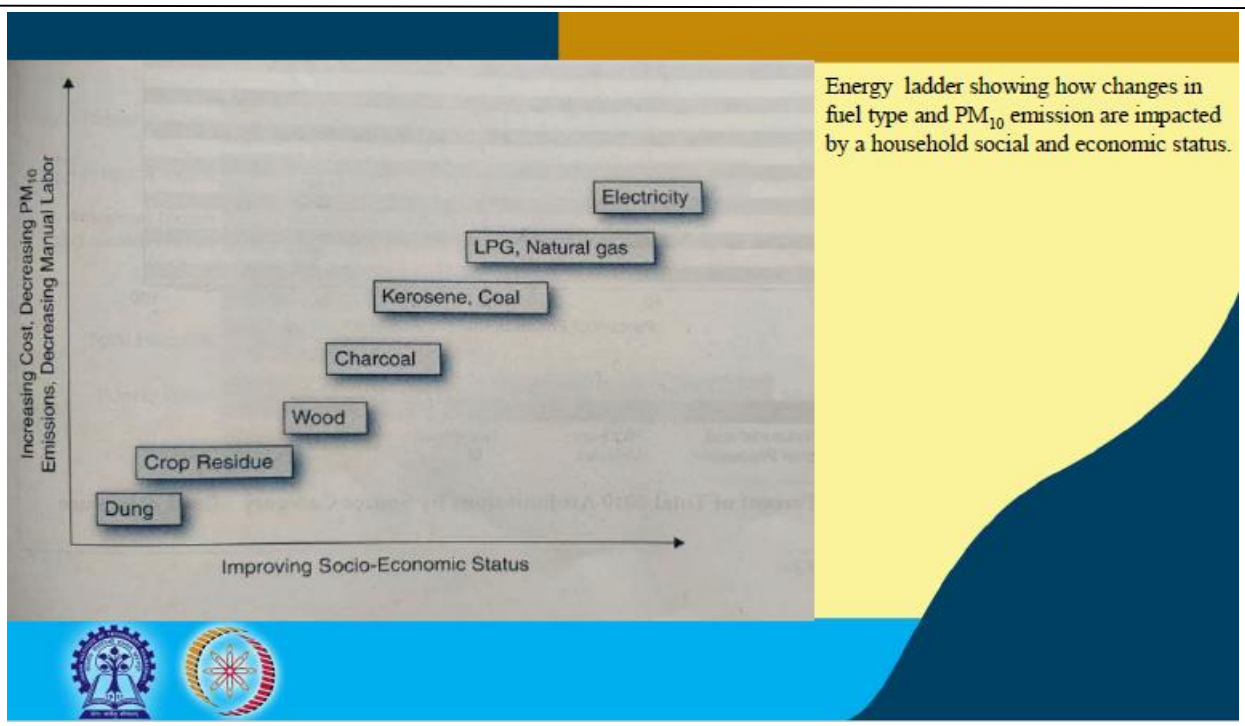
QUESTION 4:

Identify the correct order in which the fuels are arranged in decreasing PM_{10} emissions.

a. Crop residue – Wood – Coal – Natural gas – Electricity
b. Electricity – Natural gas – Coal – Wood – Crop residue
c. Crop residue– Coal – Wood – Natural gas – Electricity
d. Wood – Crop residue – Coal – Natural gas – Electricity

Correct Answer: a

Detailed Solution:



Energy ladder showing how changes in fuel type and PM_{10} emission are impacted by a household social and economic status.

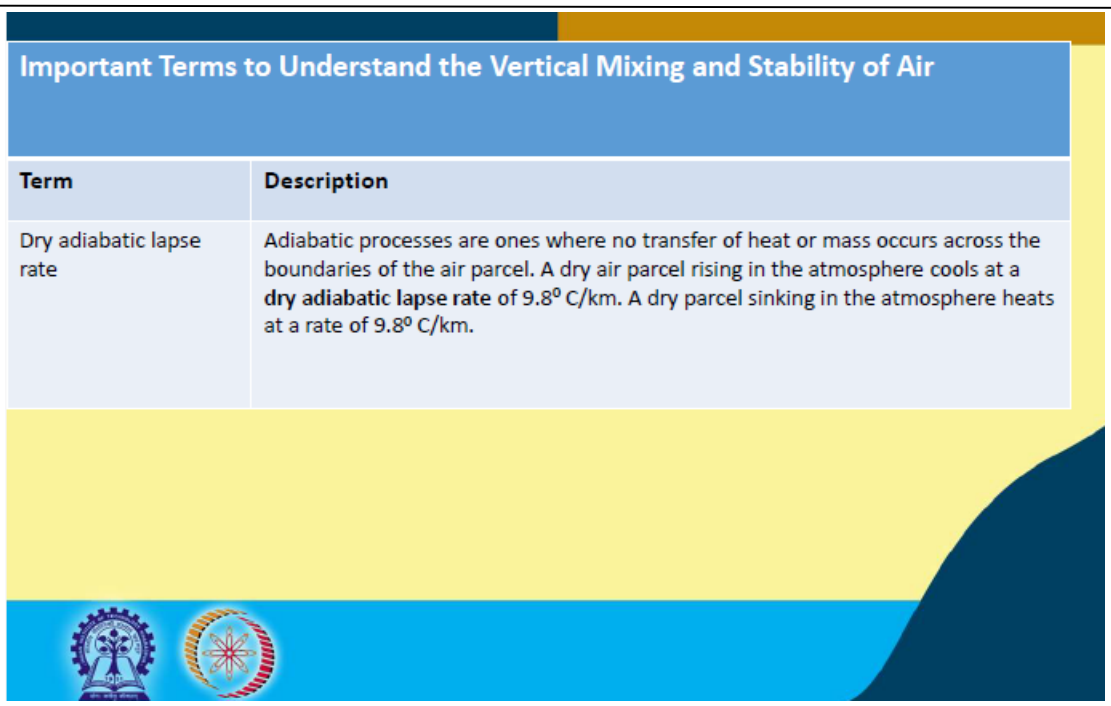
QUESTION 5:

A dry air parcel rising in the atmosphere cools at a dry adiabatic lapse rate of _____.

a. 4.5 °C/km
b. 6.9 °C/km
c. 7.6 °C/km
d. 9.8 °C/km

Correct Answer: d

Detailed Solution:



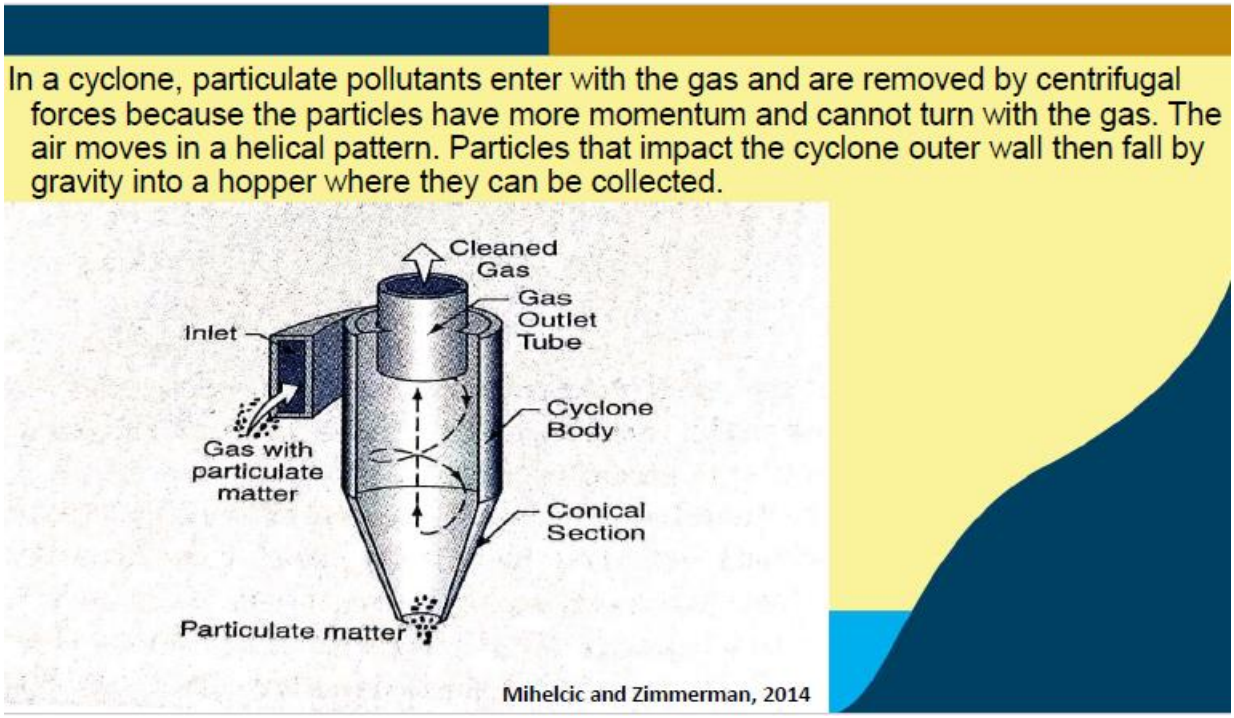
QUESTION 6:

Which air pollution control technology utilizes centrifugal forces to remove particulate pollutants?

a. Electrostatic precipitator
b. Venturi scrubber
c. Biofilter
d. Cyclone separator

Correct Answer: d

Detailed Solution:



QUESTION 7:

Which air pollutant is generated as a result of incomplete combustion of fuels?

a. Particulate matter
b. Carbon monoxide
c. Nitrogen oxides
d. Sulfur dioxide

Correct Answer: b

Detailed Solution:

Sources, Health Effects, and Other Information Associated with Criteria Air Pollutants (adapted from EPA, 2012a).

Pollutant	Sources	Health Effects	Other
Carbon monoxide (CO)	Fuel combustion (especially from vehicles)	Short-term exposures can aggravate heart or lung disease leading to respiratory symptoms, increased use of medication, hospital admission, emergency room visits, and premature mortality.	Produced from incomplete combustion of fuels, usually arising from an insufficient amount of air for the amount of fuel. Inadequate air-to-fuel ratio can be due to poorly operated or maintained equipment, airflow limitations, or low temperatures. While high levels are rarely encountered in the ambient atmosphere , asphyxiation can occur in indoor environments, often through a combination of poorly functioning heating systems and inadequate ventilation.

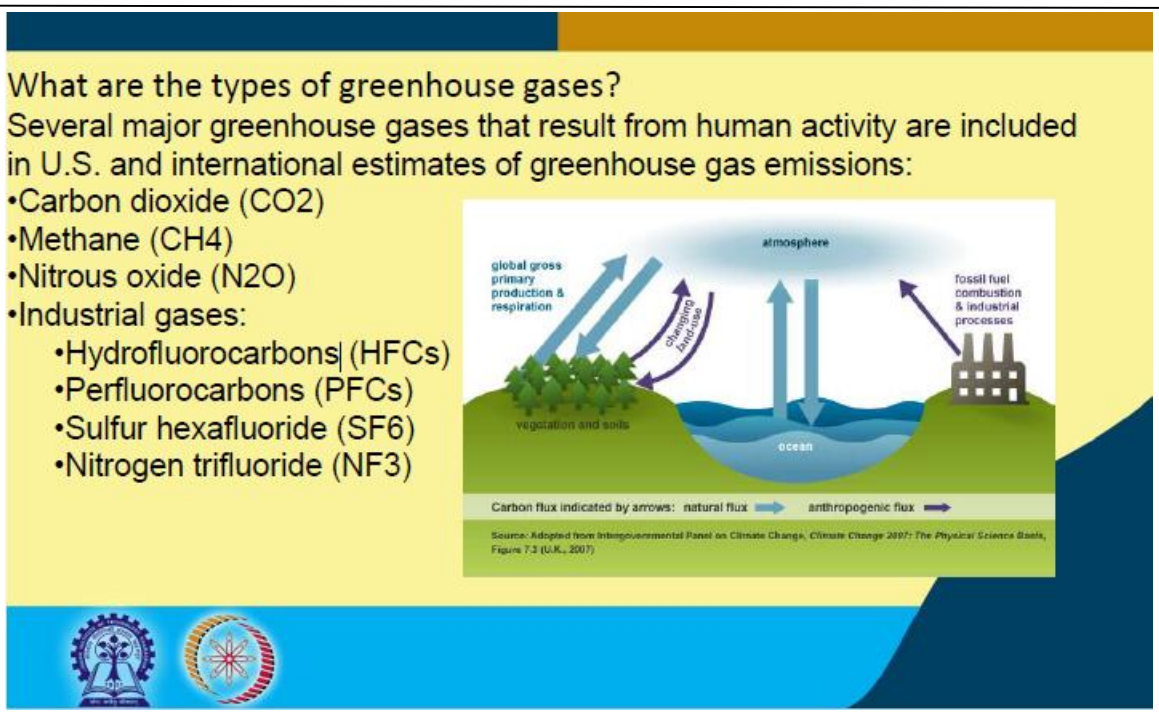
QUESTION 8:

Which of the following is not a greenhouse gas?

a. Methane
b. Hydrogen
c. Carbon dioxide
d. Hydrofluorocarbons

Correct Answer: b

Detailed Solution:



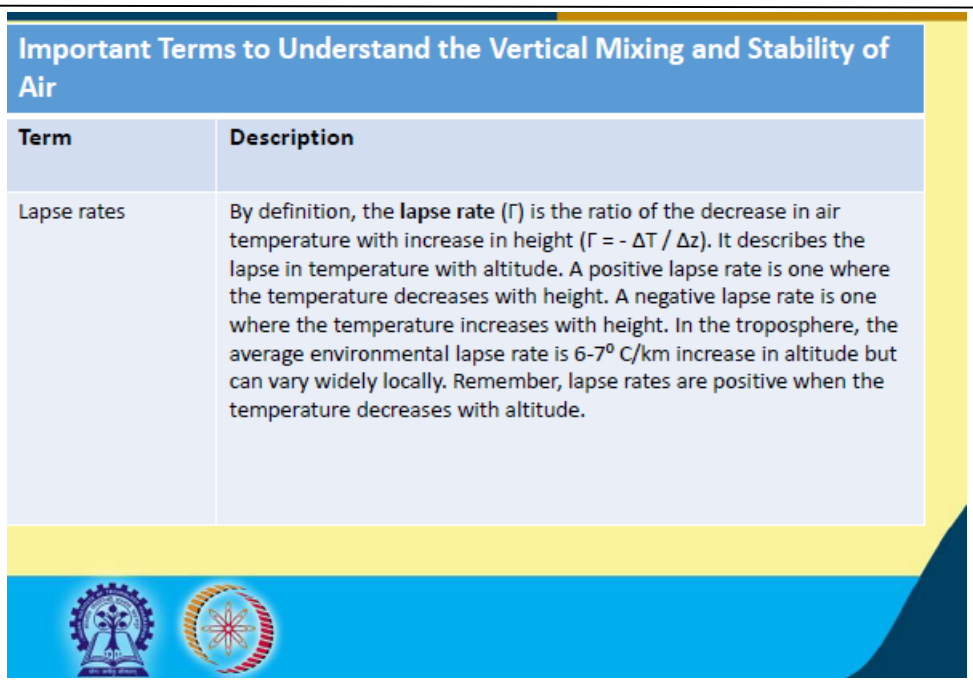
QUESTION 9:

What is the range of average environmental lapse rate in the troposphere?

a. 3 – 4 °C/km
b. 6 – 7 °C/km
c. 9 – 8 °C/km
d. 2 – 3 °C/km

Correct Answer: b

Detailed Solution:



Important Terms to Understand the Vertical Mixing and Stability of Air

Term	Description
Lapse rates	By definition, the **lapse rate** (Γ) is the ratio of the decrease in air temperature with increase in height ($\Gamma = -\Delta T / \Delta z$). It describes the lapse in temperature with altitude. A positive lapse rate is one where the temperature decreases with height. A negative lapse rate is one where the temperature increases with height. In the troposphere, the average environmental lapse rate is 6-7^0 C/km increase in altitude but can vary widely locally. Remember, lapse rates are positive when the temperature decreases with altitude.

QUESTION 10:

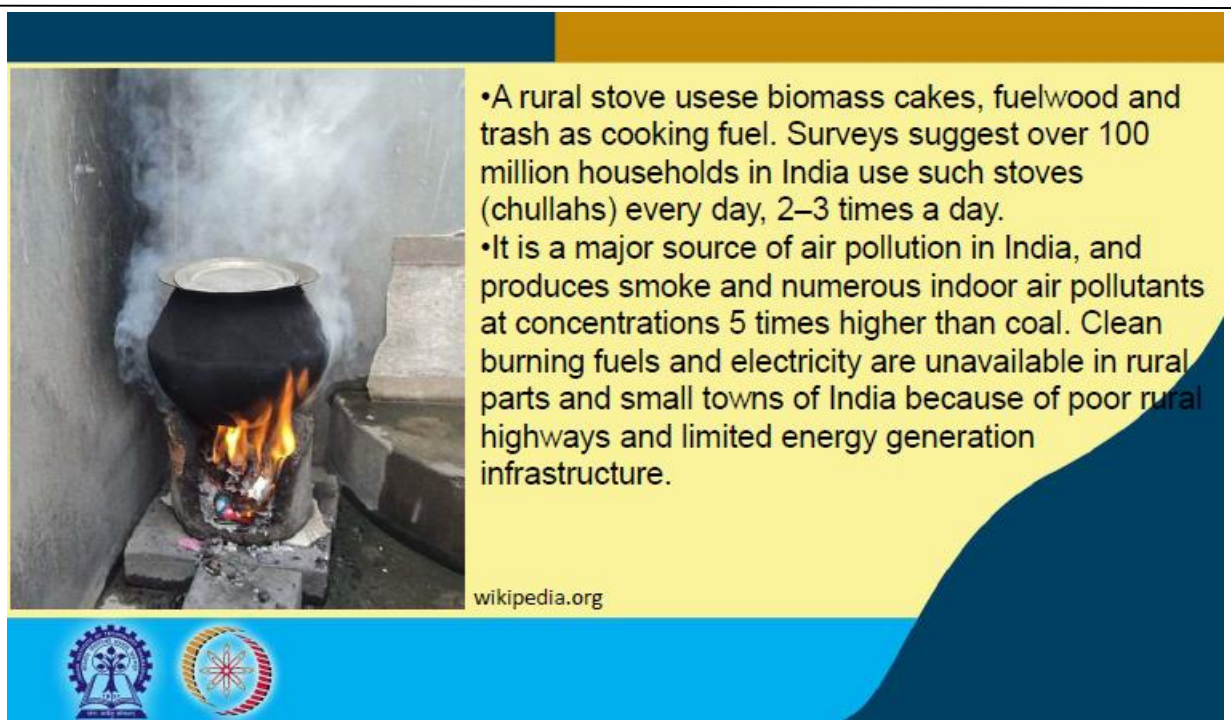
State whether the following statement is True/False.

"Rural stoves that use biomass cakes, fuelwood, and trash as cooking fuel are major sources of air pollution in India since they produce smoke and numerous indoor air pollutants at concentrations five times higher than coal."

a. True
b. False

Correct Answer: a

Detailed Solution:



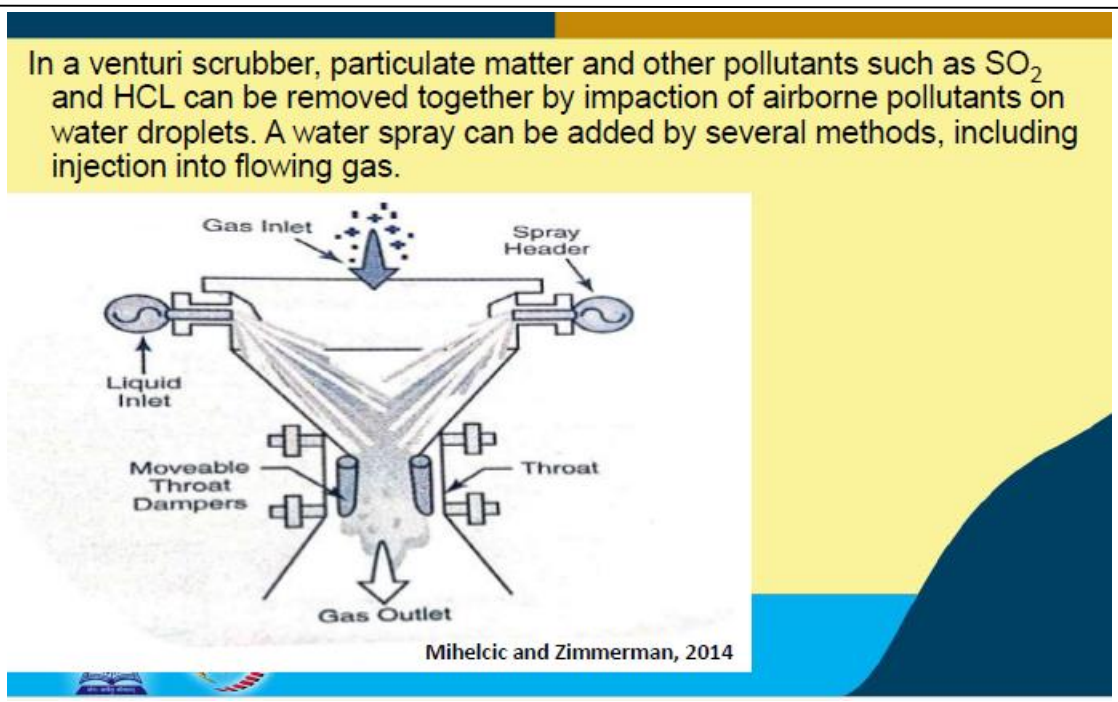
QUESTION 11:

Which of the following air pollutants can be removed by a venturi scrubber?

a. Particulate matter
b. SO_2
c. HCl
d. All the above

Correct Answer: d

Detailed Solution:



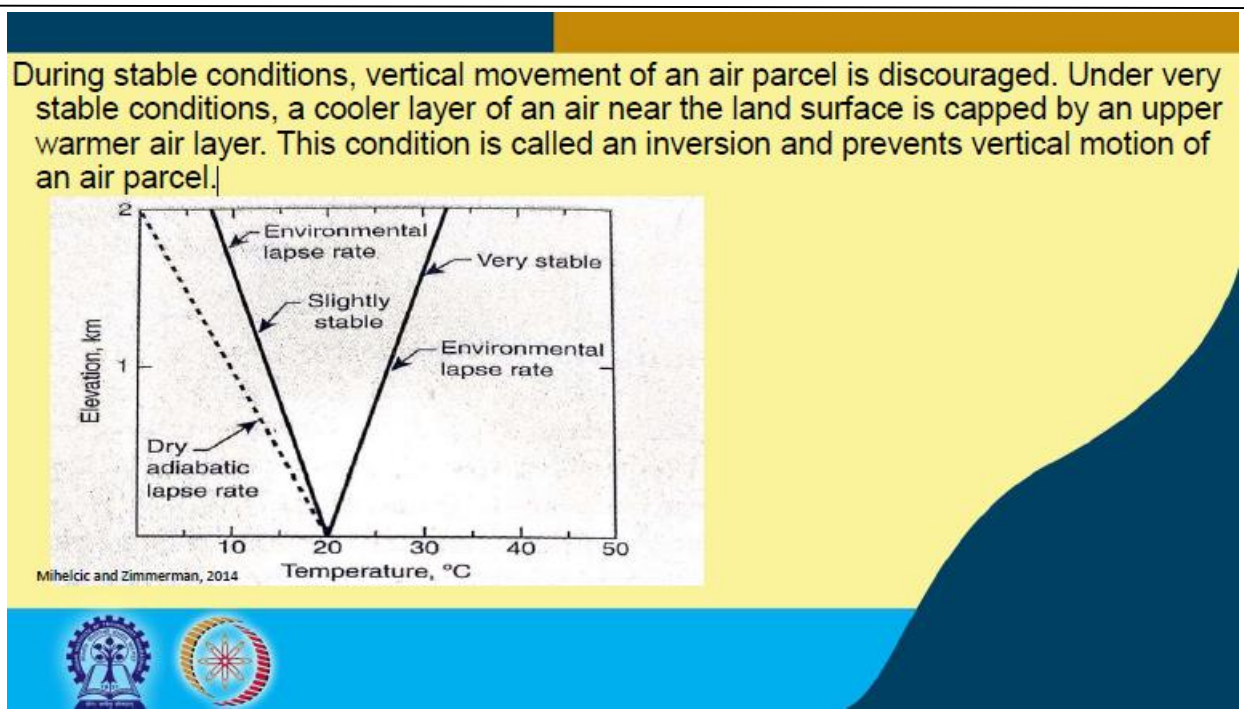
QUESTION 12:

Which atmospheric condition occurs when the environmental lapse rate is the same as the dry adiabatic lapse rate?

a. Stable condition
b. Unstable condition
c. Neutral stability
d. None of the above

Correct Answer: c

Detailed Solution:



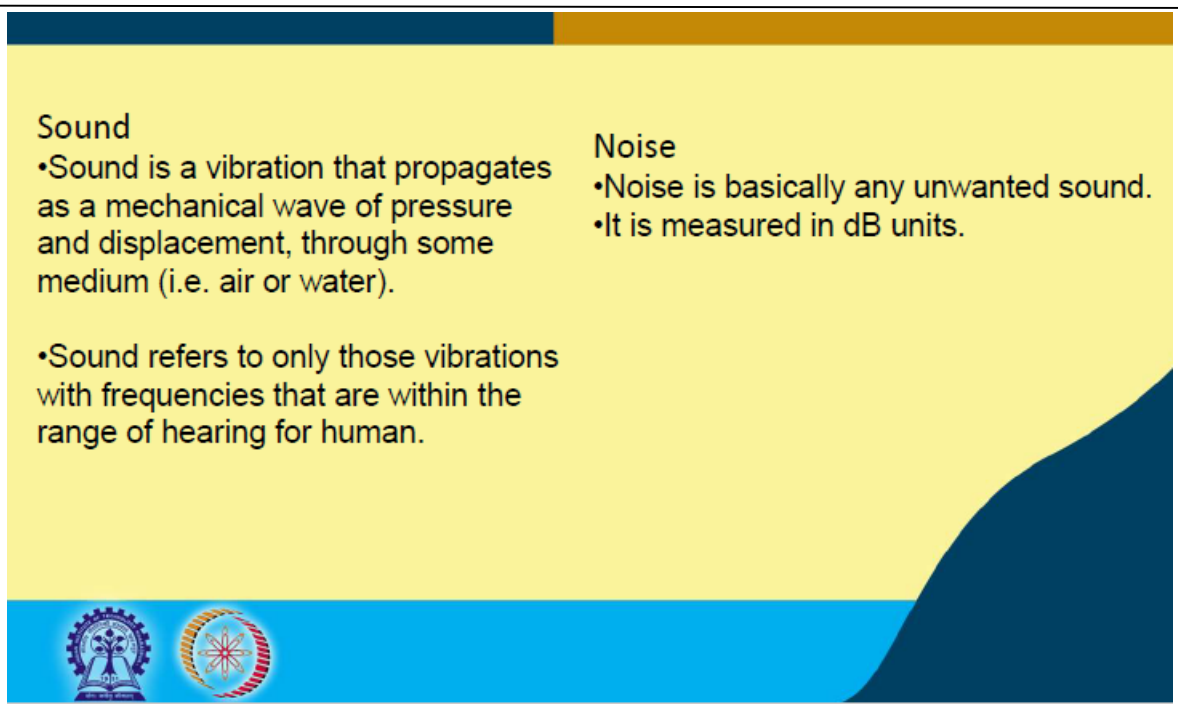
QUESTION 13:

Noise is measured in _____ units.

a. Pascal
b. Siemen
c. Decibel
d. Ampere

Correct Answer: c

Detailed Solution:



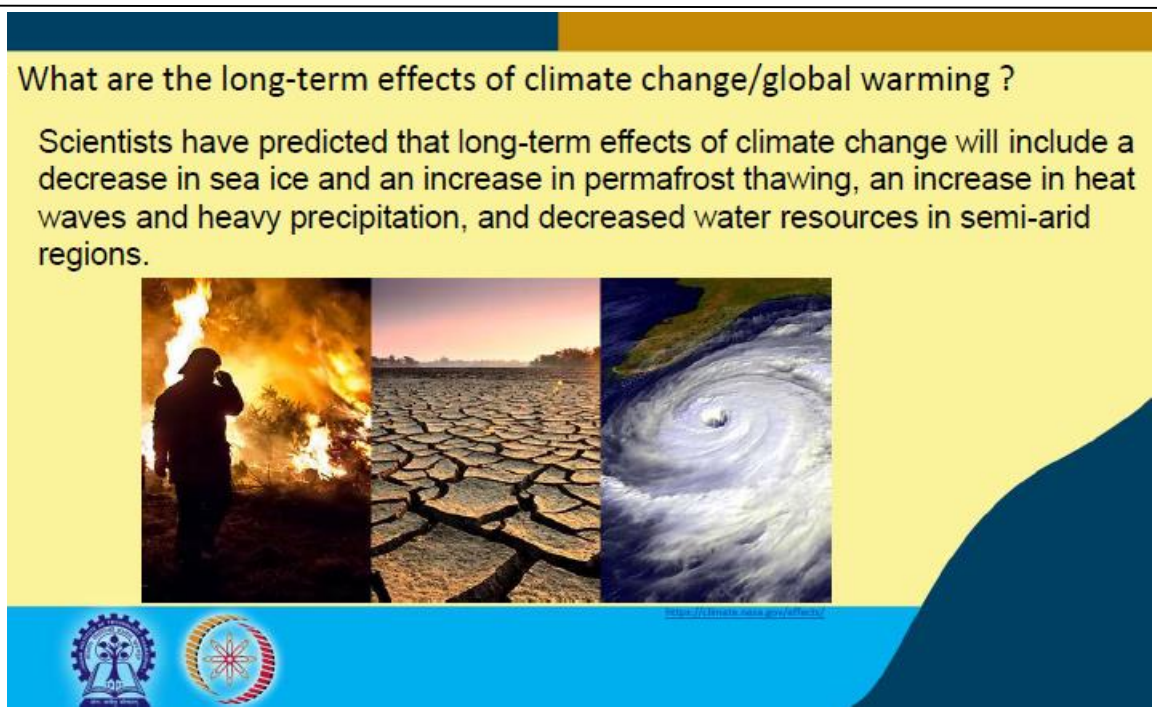
QUESTION 14:

What are the long-term effects of climate change/global warming?

a. Decrease in sea ice and an increase in permafrost thawing
b. Increase in heat waves and heavy precipitation
c. Decreased water resources in semi-arid regions
d. All the above

Correct Answer: d

Detailed Solution:



QUESTION 15:

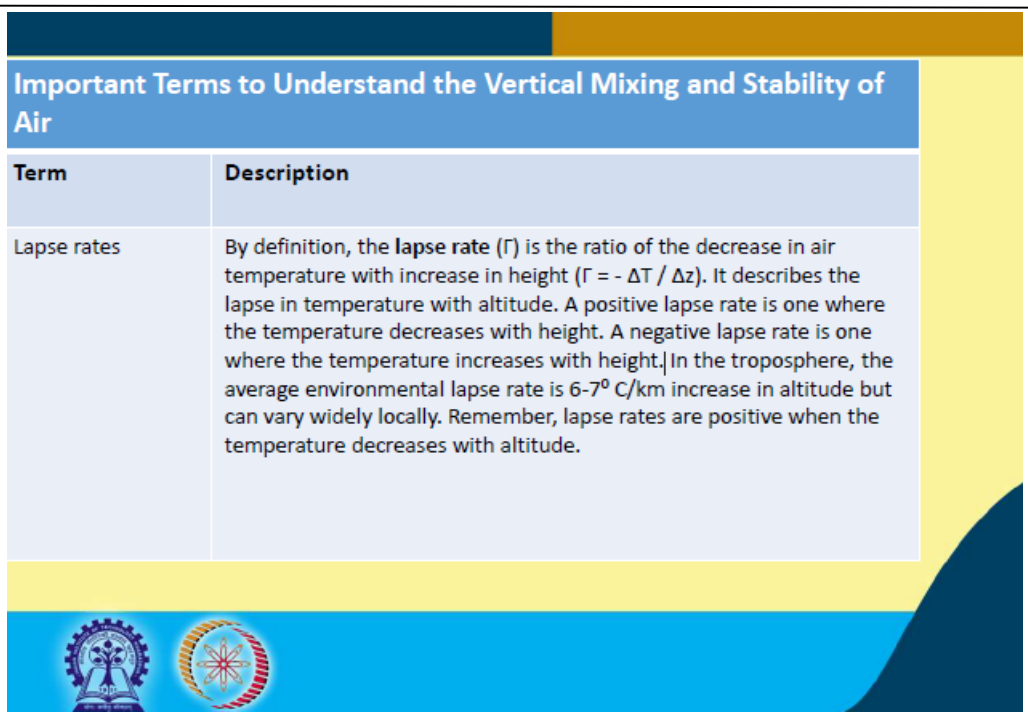
State whether the following statement is True/False.

"A positive lapse rate is one where the temperature increases with height, whereas a negative lapse rate is one where the temperature decreases with height."

a. True
b. False

Correct Answer: b

Detailed Solution:



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**********END*******

Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concepts

Assignment- 12

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 15 **Total Marks 15 x 2 = 30**

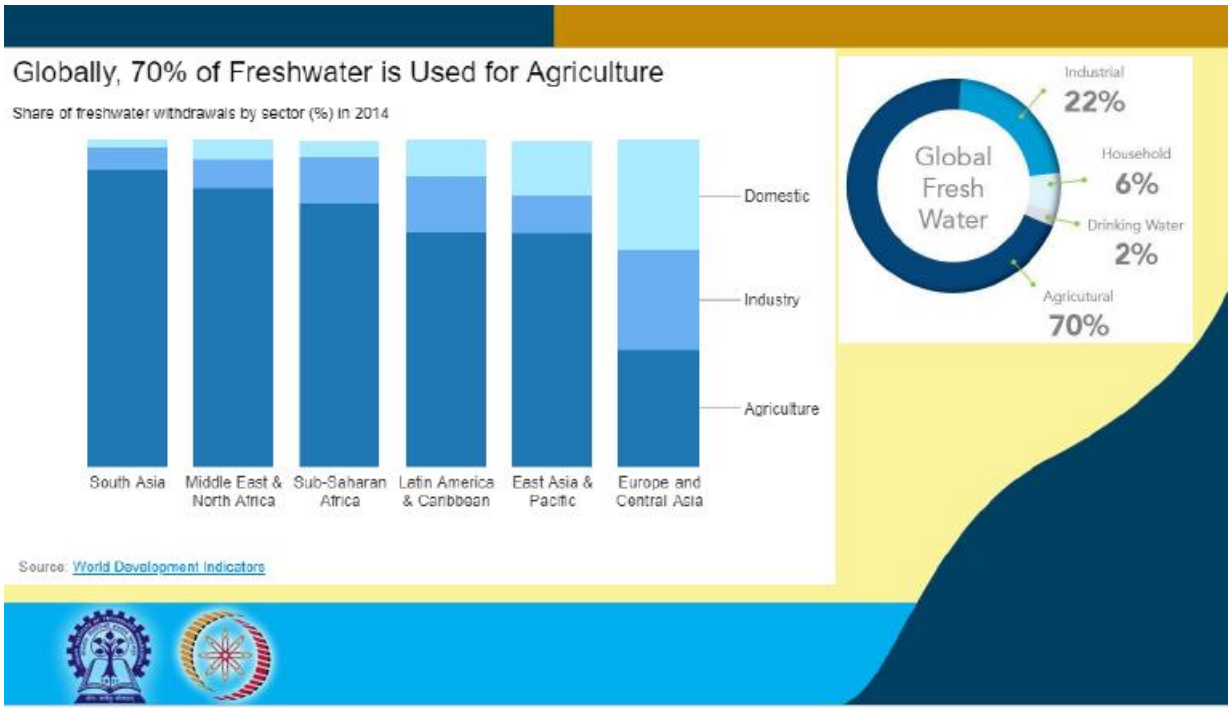
QUESTION 1:

Which sector has the highest share of freshwater withdrawals globally as per World Development Indicators (2014)?

a. Household
b. Industry
c. Agriculture
d. Household

Correct Answer: c

Detailed Solution:



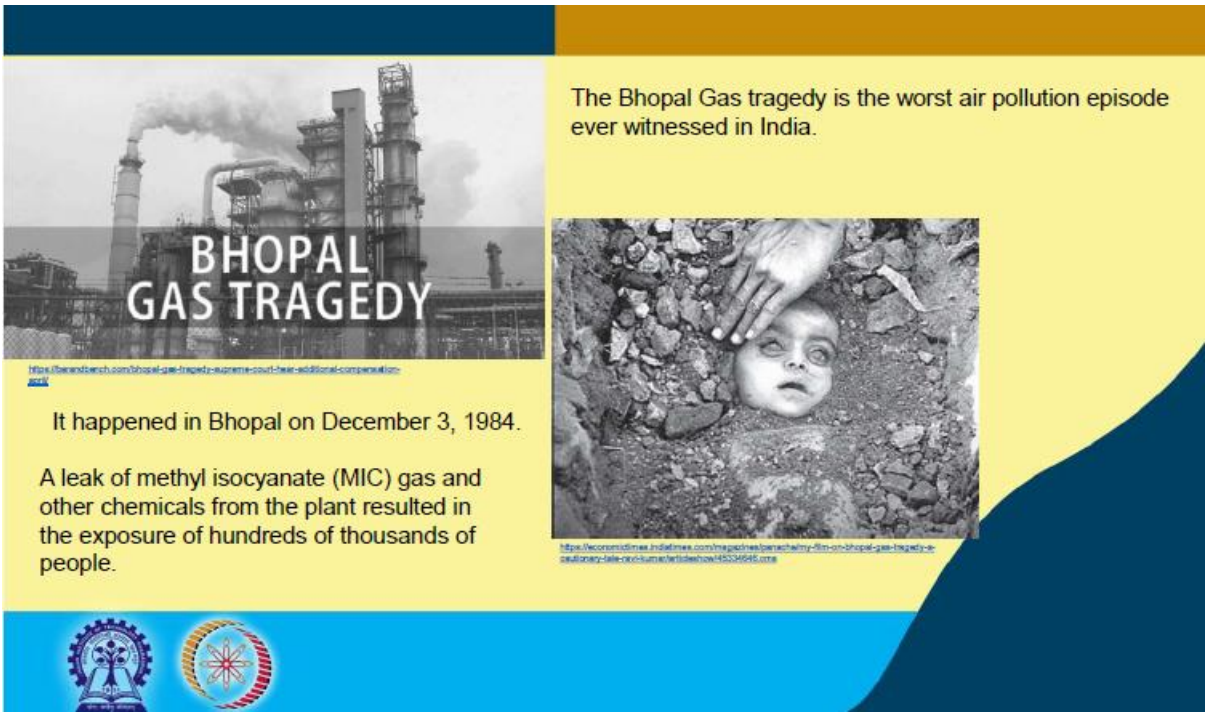
QUESTION 2:

The leakage of which gas caused the Bhopal Gas Tragedy in 1984?

a. Methyl cyanate
b. Methyl isocyanate
c. Methyl cyanide
d. Methyl isocyanide

Correct Answer: b

Detailed Solution:



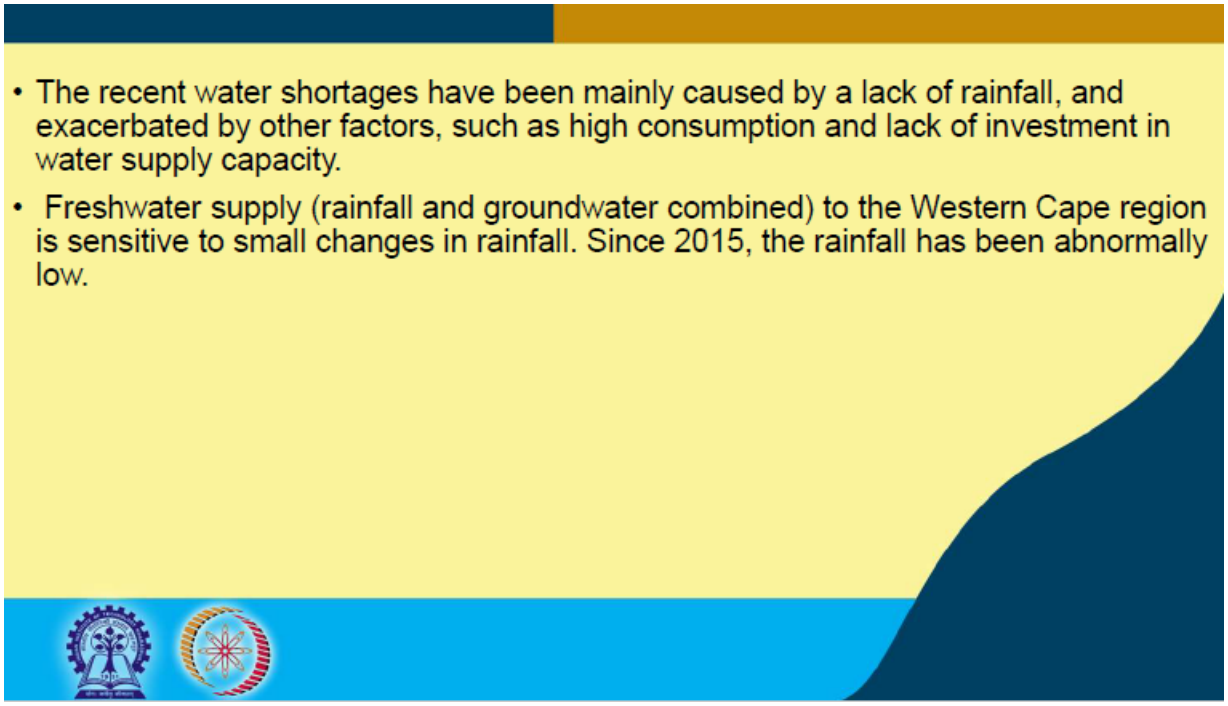
QUESTION 3:

Which of the following is/are the main reason(s) for the water shortage experienced in Cape town during 2017-2018?

a. Lack of rainfall
b. High water consumption
c. Lack of investment in water supply capacity
d. All the above

Correct Answer: d

Detailed Solution:



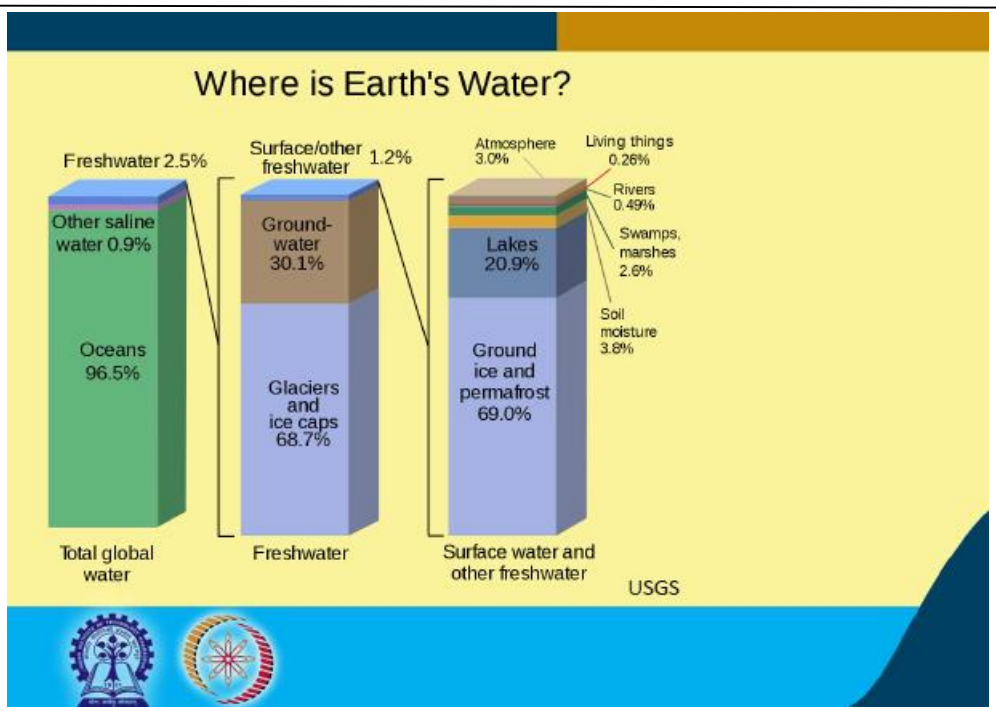
QUESTION 4:

What percentage of the total global water is fresh water?

a. 96.5 %
b. 2.5 %
c. 0.9 %
d. 30.1 %

Correct Answer: b

Detailed Solution:



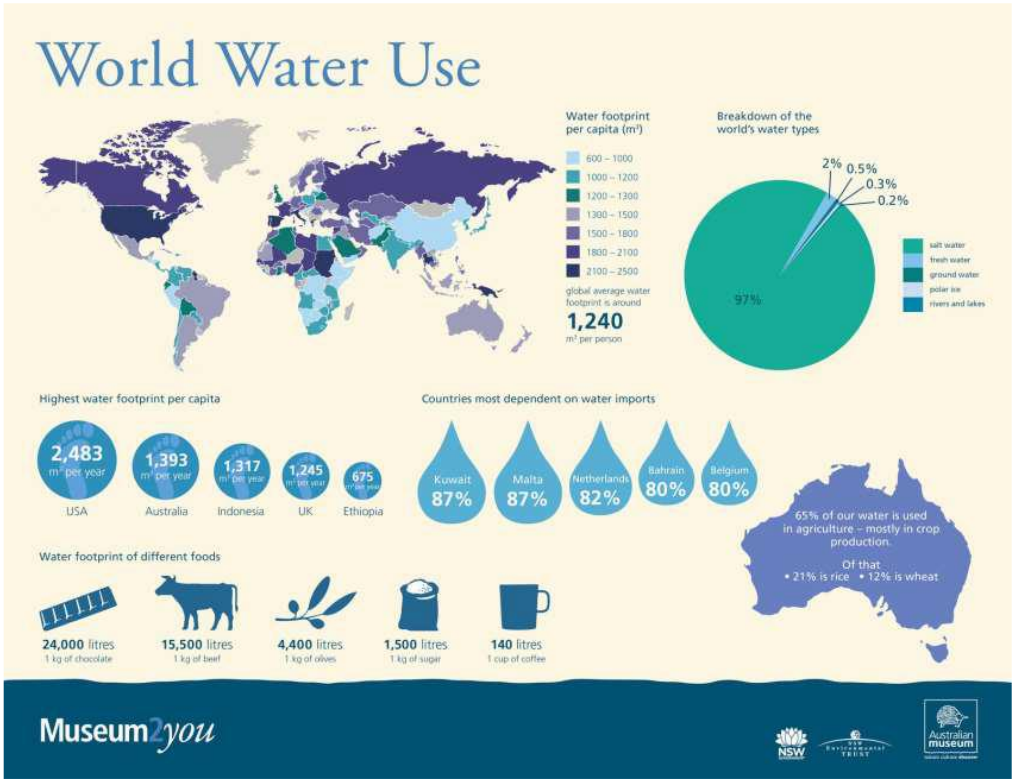
QUESTION 5:

Identify the correct arrangement of countries from higher to lower water footprint per capita as per the report of the Australian Museum.

a. Indonesia – UK – USA – Australia
b. USA – Indonesia – UK – Australia
c. USA – Australia – Indonesia – UK
d. USA – Indonesia – UK – Australia

Correct Answer: c

Detailed Solution:



QUESTION 6:

1 gallon of water equals _____.

a. 1.7 liters
b. 2.7 liters
c. 3.7 liters
d. 4.5 liters

Correct Answer: c

Detailed Solution:

Fundamental unit of Volume

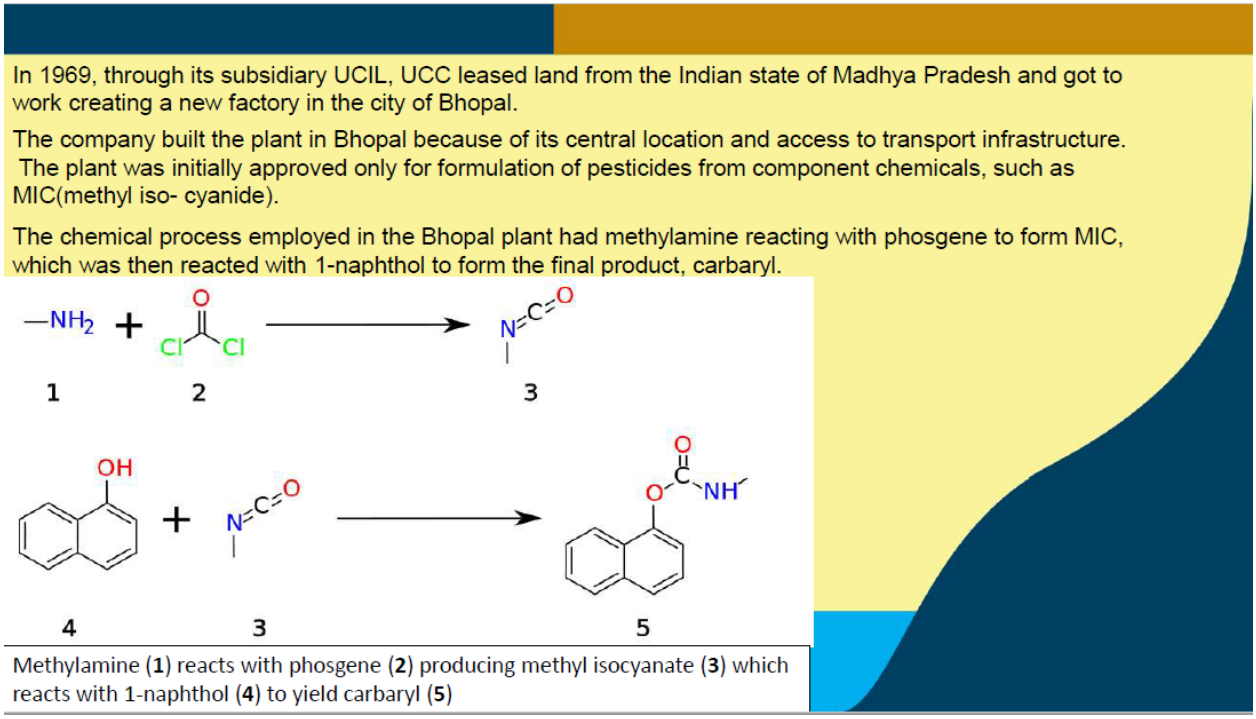
QUESTION 7:

Which pesticide was the final product from the Union Carbide plant of Bhopal?

a. Methylamine
b. Phosgene
c. 1- naphthol
d. Carbaryl

Correct Answer: d

Detailed Solution:



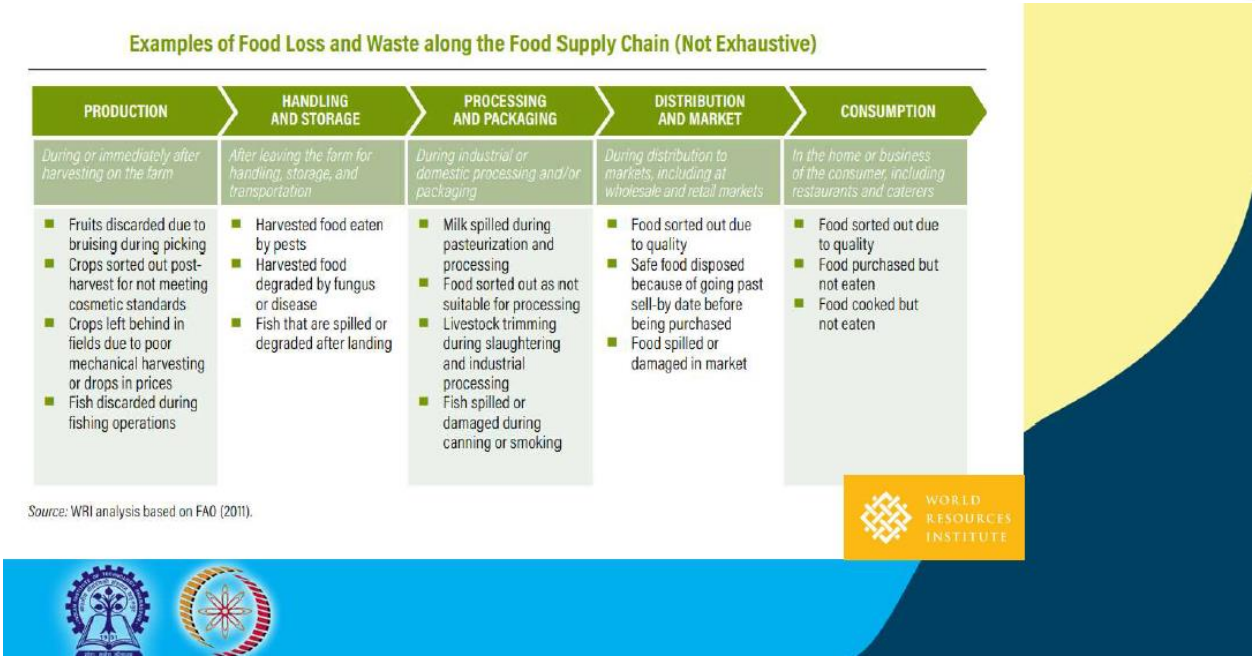
QUESTION 8:

Harvested food eaten by pests is an example of food loss and waste in _____ process of Food Supply Chain.

a. Production
b. Handling and storage
c. Processing and packaging
d. Consumption

Correct Answer: b

Detailed Solution:



QUESTION 9:

Which of the following is/are the initiative(s) taken by Cape Town to manage increasing water demand?

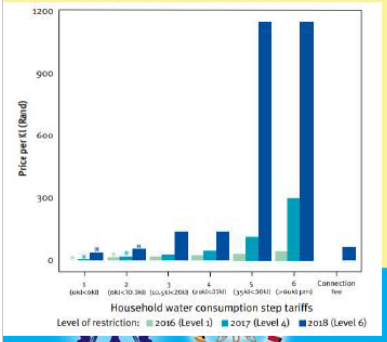
a. Strict water restrictions over the period of the crisis.
b. Revision of water tariffs
c. Installation of Water Management Devices
d. All the above

Correct Answer: d

Detailed Solution:

1. Water restrictions

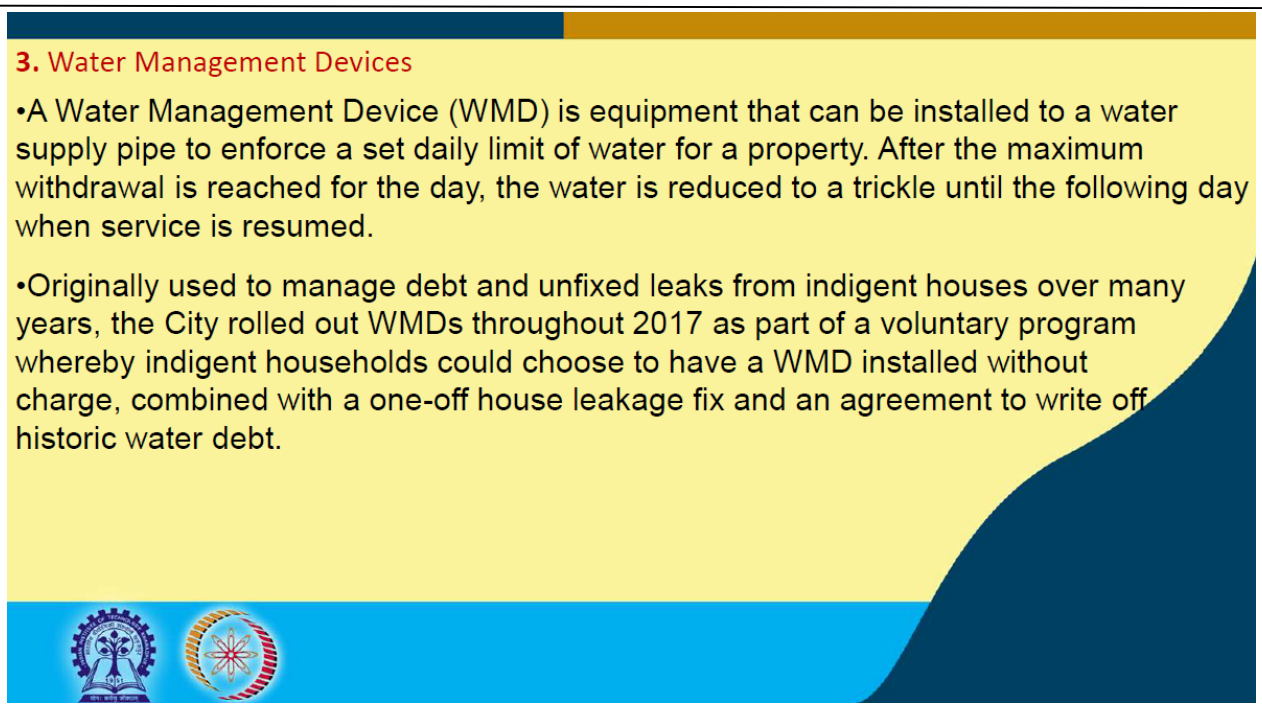
•The city introduced increasingly strict water restrictions over the period of the crisis, which evolved and developed over time as the water shortage became progressively more acute .
•Fines of between R1,000 ($70) and R10,000 ($700) were used as punishment for transgressive behavior and high consumption households.
•Water restrictions defined limits on how water could be used, in what quantities and for which purposes. At the most extreme level of restriction implemented, Level 6B, residents were restricted to a maximum of 50 litres (13.2 gallons) of water per person per day.



•Restrictions were revised on an ad-hoc basis by the city, with some revisions taking place within a month of the previous restriction. Under normal circumstances, further restrictions would have to be sanctioned by the Council of the city.

2. Tariffs

•The city operates on a step tariff payment system for water, in existence before the current water crisis.
•In the system, each additional unit of water becomes more expensive as greater volumes are used.
• Different rates are applied based on the level of water restrictions currently active, and households are also subject to a sanitation charge, calculated as a percentage of their water consumption for the month.
•Under normal circumstances, the city is limited to a single adjustment of tariffs per year as part of their budget review, which comes into effect annually in July.
• In response to the water crisis, tariffs were increased significantly from 2016 until late 2018 in order to reduce water demand.
Tariffs were not downgraded again until 1 October 2018.



QUESTION 10:

As per WRI analysis based on FAO (2007 data), which of the following regions has the highest share in global food loss and waste?

a. Industrialized Asia
b. Europe
c. Latin America
d. Sub- Saharan Africa

Correct Answer: a

Detailed Solution:

QUESTION 11:

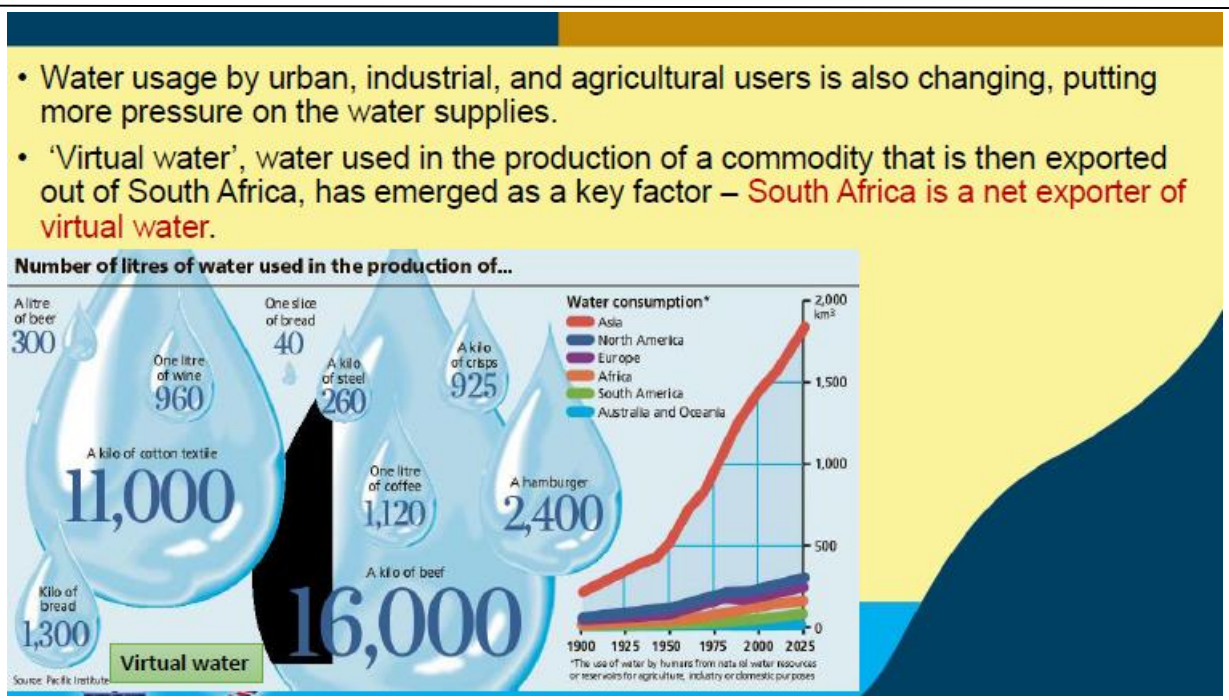
State whether the following statement is True/False.

"Water that is consumed during the production of a commodity is termed as virtual water."

a. True
b. False

Correct Answer: a

Detailed Solution:



QUESTION 12:

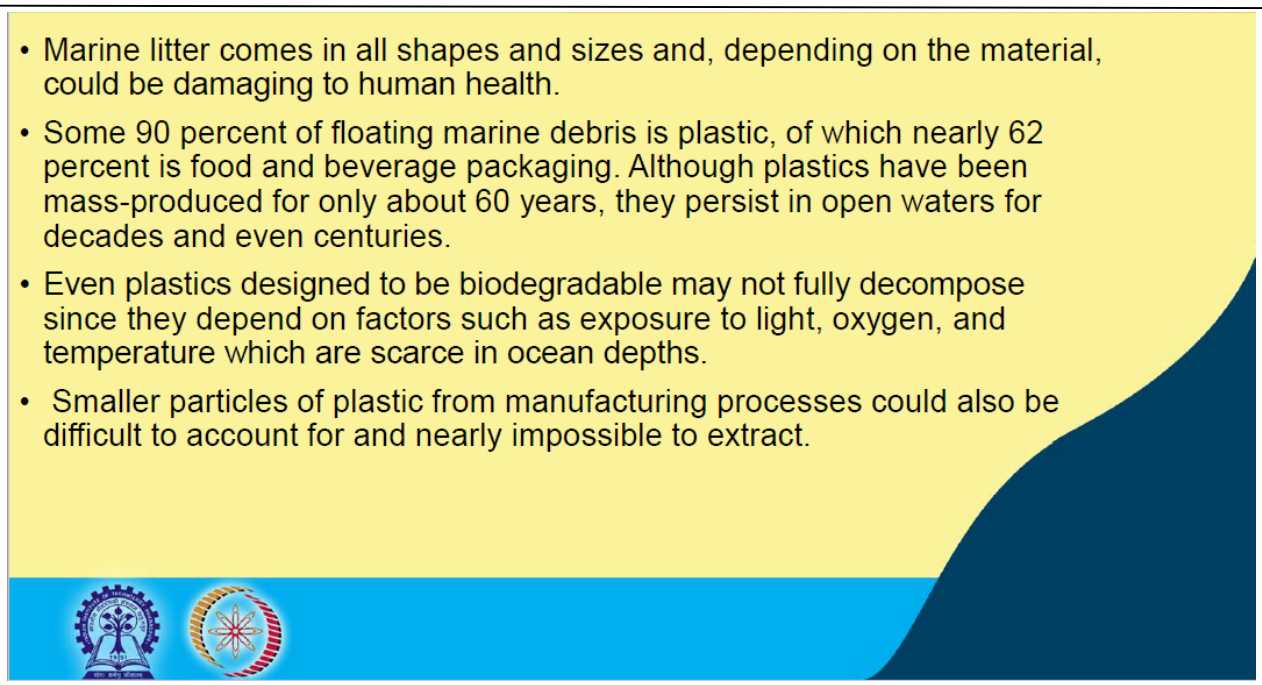
State whether the following statement is True/False.

"Approximately 90% of the floating marine debris consists of plastic, with nearly 62% of this plastic comprising food and beverage packaging."

a. True
b. False

Correct Answer: a

Detailed Solution:



QUESTION 13:

Match the following waste collection bins to their corresponding waste material based on the source separation scheme adopted by Panaji, India.

A. Green bins	i. Non-recyclables
B. Pink bins	ii. Plastics
C. Orange bins	iii. Paper and cartons
D. White bins	iv. Wet waste

a. A-i, B-ii, C-iii, D-iv
b. A-iv, B-iii, C-ii, D-i
c. A-i, B-ii, C-iv, D-iii
d. A-iv, B-ii, C-i, D-iii

Correct Answer: b

Detailed Solution:

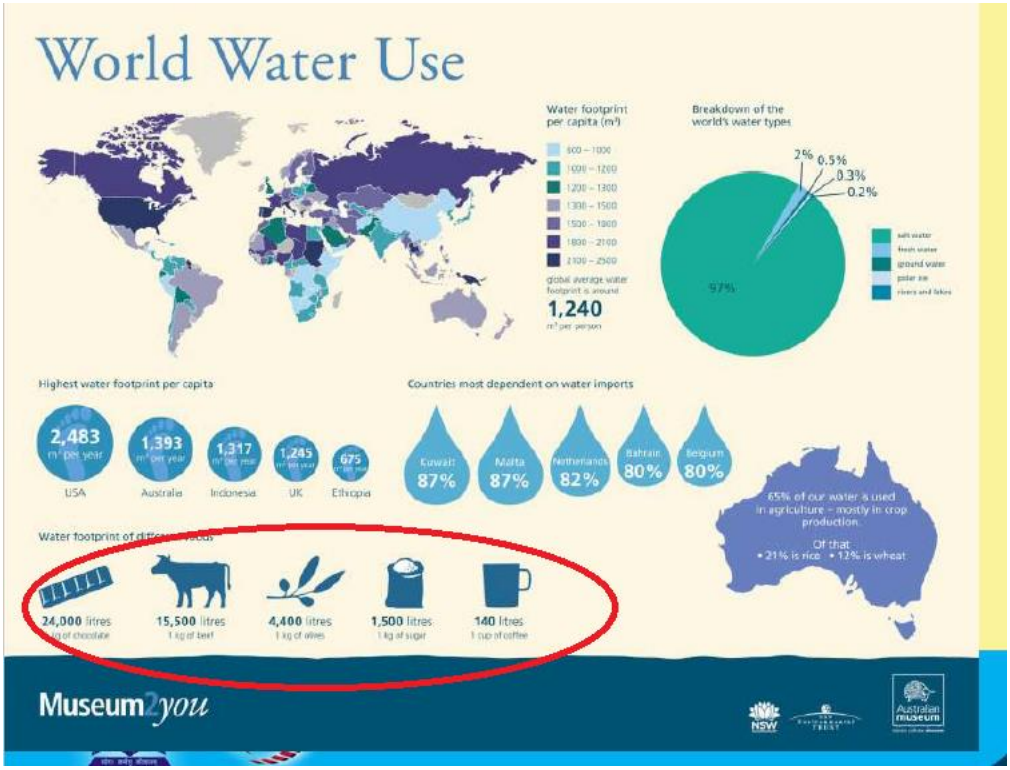
QUESTION 14:

Which of the following food items has the lowest water footprint?

a. 1 kg of chocolate
b. 1 kg of beef
c. 1 kg of sugar
d. 1 cup of coffee

Correct Answer: d

Detailed Solution:



QUESTION 15:

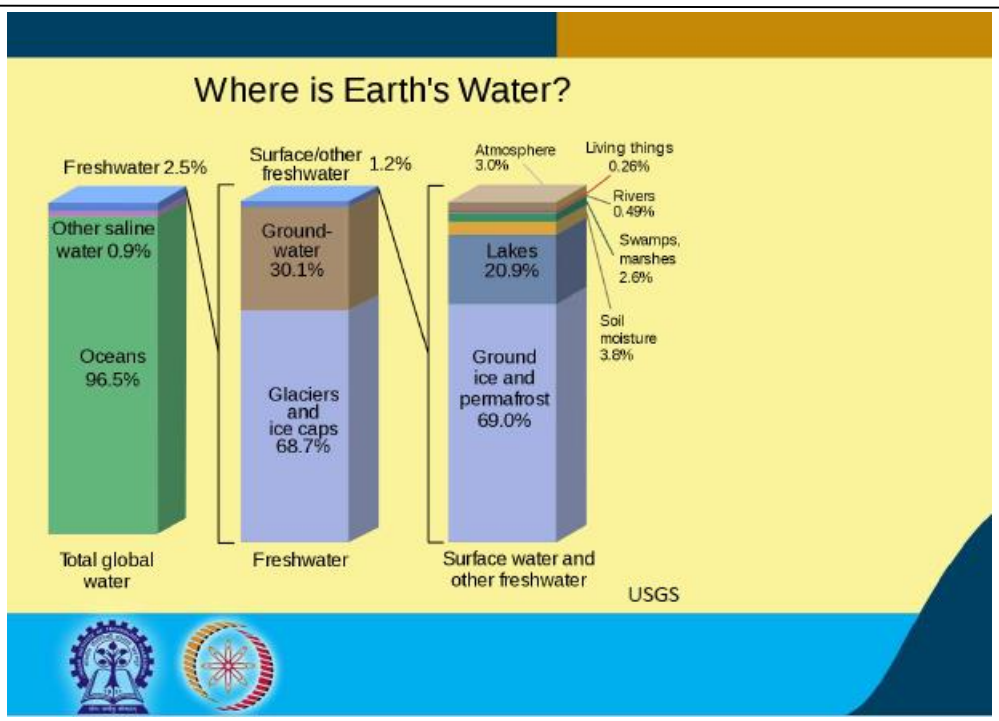
State whether the following statement is True/False.

"Groundwater accounts for a major portion of the freshwater reserve."

a. True
b. False

Correct Answer: b

Detailed Solution:


Where is Earth's Water?
Freshwater 2.5%
Other saline water 0.9%
Oceans 96.5%
Total global water
Surface/other freshwater 1.2%
Ground-water 30.1%
Glaciers and ice caps 68.7%
Freshwater
Atmosphere 3.0%
Living things 0.26%
Rivers 0.49%
Swamps, marshes 2.6%
Lakes 20.9%
Soil moisture 3.8%
Ground ice and permafrost 69.0%
Surface water and other freshwater
USGS

**********END*******