Term-II

MICROBES IN HUMAN WELFARE

Syllabus

➢ *Microbes in food processing, industrial production, Antibiotic : production and judicious use, sewage treatment, energy generation and as biocontrol agents and biofertilizers.*

STAND ALONE MCQs (1 Mark each)

Q. 1. Which gases are produced in anaerobic sludge digesters ?

(A) Methane and CO_2 only

(B) Methane, hydrogen sulphide and CO_2

(C) Methane, hydrogen sulphide and O_2

(D) Hydrogen Sulphide and CO_2 R

Ans. Option (B) is correct.

> ***Explanation :*** In anaerobic sludge digesters, bacteria produce a mixture of gases like methane, hydrogen sulphide and CO_2.

Q. 2. Which of the following is used as clot-buster for removing clots from blood vessels of patients who have undergone myocardial infarction?

(A) Cyclosporin **(B)** Statins

(C) Streptokinase **(D)** Lipase R

Ans. Option (C) is correct.

> ***Explanation :*** Streptokinase produced by the bacterium Streptococcus and modified by genetic engineering is used as clot-buster.

Q. 3. Conversion of milk to curd improves its nutritional value by increasing the amount of :

(A) Vitamin D **(B)** Vitamin E

(C) Vitamin B_{12} **(D)** Vitamin A R

Ans. Option (C) is correct.

> ***Explanation :*** Lactic acid bacteria (LAB) grow in milk and convert it to curd thereby improving its nutritional quality by increasing vitamin B12.

Q. 4. Wastewater treatment generates a large quantity of sludge, which can be treated by

(A) digesters **(B)** activated sludge

(C) chemicals **(D)** oxidation pond R

Ans. Option (A) is correct.

> ***Explanation :*** Sludge is a thick, soft and muddy deposits which can be treated by anaerobic digesters. Anaerobic digesters are large heated tanks in which micro-organisms break down biodegradable material in the absence of oxygen. It is then sent to oxidation ponds where heterotrophic bacteria continue the breakdown of the organics and solar ultraviolet (UV) light destroys the harmful bacteria. Chemicals are not used in this treatment.

Q.5. Methanogenic bacteria are not found in

(A) rumen of cattle

(B) gobar gas plant

(C) bottom of water-logged paddy fields

(D) activated sludge R

Ans. Option (D) is correct.

> ***Explanation :*** Methanogenic bacteria are anaerobic microorganisms that grow in the presence of carbon dioxide and produce methane gas. These bacteria are not found in activated sludge. The microbes present in the activated sludge are aerobic bacteria that grow rapidly and form flocs.

Q.6. BOD of waste water is estimated by measuring the amount of

(A) total organic matter

(B) biodegradable organic matter

(C) oxygen evolution

(D) oxygen consumption [R]

Ans. Option (D) is correct.

> ***Explanation :*** Biochemical oxygen demand (BOD) is estimated by measuring the amount of oxygen consumption or is a measure of the organic pollution of water. It refers to the amount of dissolved oxygen required to decompose the organic matter in waste water. A high BOD indicates heavy pollution with little oxygen remaining for fish.

Q. 7. Big holes in Swiss cheese are made by

(A) a machine

(B) a bacterium that produces methane gas

(C) a bacterium producing a large amount of carbon dioxide

(D) a fungus that releases a lot of gases during its metabolic activities [R]

Ans. Option (C) is correct.

> ***Explanation :*** The large holes in 'Swiss cheese' are made due to production of a large amount of CO_2 by *Propionibacterium sharmanii.* It releases carbon dioxide when it consumes the lactic acid and forms bubbles. These bubbles form little air pockets, resulting in the holes of the Swiss cheese.

Q.8. The primary treatment of waste water involves the removal of

(A) dissolved impurities **(B)** stable particles

(C) toxic substances **(D)** harmful bacteria [R]

Ans. Option (B) is correct.

> ***Explanation :*** The primary treatment of waste water involves the physical removal of both larger and smaller particles (stable particles) from the sewage with the help of filtration and sedimentation. These removals occur in the following stages: (i) Initially, floating debris is removed by sequential filtration. (ii) After that grit (made of soil and small pebbles) are removed by sedimentation. All these solids particles that settled form the primary sludge and the supernatant forms the effluent. The effluent is taken for the secondary treatment. The primary treatment does not remove the dissolved impurities, toxic substances and harmful bacteria.

Q.9. The technology of biogas production from cow dung was developed in India largely due to the efforts of

(A) Gas Authority of India

(B) Oil and Natural Gas Commission

(C) Indian Agricultural Research Institute and Khadi and Village Industries Commission

(D) Indian Oil Corporation [R]

Ans. Option (C) is correct.

> ***Explanation :*** Biogas (commonly called gobar gas) is produced by using cattle dung. The technology of biogas production from cow dung was developed in India mainly due to the efforts of Indian Agricultural Research Institute (IARI) and Khadi and Village Industries Commission (KVIC).

Q. 10. What would happen if oxygen availability to activated sludge flocs is reduced?

(A) It will slow down the rate of degradation of organic matter.

(B) The centre of flocs will become anoxic, which would cause death of bacteria and eventually breakage of flocs.

(C) Flocs would increase in size as anaerobic bacteria would grow around flocs.

(D) Protozoa would grow in large numbers. [U]

Ans. Option (B) is correct.

> ***Explanation :*** Activated sludge micro-organisms need oxygen as they oxidise wastes to obtain energy for growth. Insufficient oxygen will slow down or kill off aerobic micro-organisms, make facultative organisms work less efficiently and ultimately lead to the breakage of flocs. It will also result in the production of the foul-smelling byproducts of anaerobic decomposition. So, sufficient oxygen must always be sustained in the aeration tank to ensure complete waste stabilisation.

Q. 11. Which one of the following microbes forms symbiotic association with plants and help them in their nutrition ?

(A) *Axotobacter* **(B)** *Aspetgillus*

(C) *Glomus* **(D)** *Trichodema* [R]

Ans. Option (C) is correct.

> ***Explanation :*** Glomus is a genus of arbuscular mycorrihizal fungi and, all species form symbiotic relationships with plant roots. They help the plant in the absorption of nutrients, especially phosphorus from soil.

Q. 12. A nitrogen-fixing microbe associated with Azolla in rice fields is :

(A) *Spirulina* **(B)** *Anabaena*

(C) *Frankia* **(D)** *Tolypothrix* [R]

Ans. Option (B) is correct.

> ***Explanation :*** The fern, *Azolla* and the bluegreen alga *Anabaena azollae* maintain a symbiotic relationship. The alga provides nitrogen to the fern, and the fern provides a habitat for the alga. This property of nitrogen fixation has made *Azolla* extremely important economically in the cultivation of rice.

Q. 13. Which one of the following is an example of carrying out biological control of pests/diseases using microbes ?

(A) *Trichoderma sp.* against certain plant pathogens

(B) Nucleoplyhedrovirus against white rust in Brassica.

(C) Bt-cotton to increase cotton field.

(D) Lady bird beetle against aphids in mustard. [R]

Ans. Option (C) is correct.

> ***Explanation :*** Bt-cotton is genetically modified organism cotton variety, which produces an insecticide to bollworms. It increases yield of cotton due to effective control of three types of bollworms viz, American spotted & pink bollworms.

Q.14. The free-living fungus *Trichoderma* can be used for

(A) killing insects

(B) biological control of plant diseases

(C) controlling butterfly caterpillars

(D) producing antibiotics R

Ans. Option (B) is correct.

> ***Explanation :*** Trichoderma is a free-living fungus which is common in soil and root eco-systems. It is an effective biocontrol agent and used extensively for soil-borne diseases. It has been also used successfully against many pathogenic fungi which belong to various genera, viz. Fusarium, Phytophthora and Scelerotia. It may suppress the growth of the disease-causing organisms in the rhizosphere through competition and thus reduce disease development. It produces anti-biotics and toxins, such as trichothecin and a sesquiterpine, and trichodermin, which have a direct effect on other organisms.

Q.15. Mycorrhiza does not help the host plant in

(A) enhancing its phosphorus uptake capacity.

(B) increasing its tolerance to drought.

(C) enhancing its resistance to root pathogens.

(D) increasing its resistance to insects. R

Ans. Option (D) is correct.

> ***Explanation :*** Fungi form symbiotic association with the roots of higher plants called mycorrhiza (VAM), for example, Glomus. The fungal hyphae symbiont in these associations, absorb phosphorus from soil and passes it to the plant. Plants having such associations show other benefits also, such as resistance to root borne pathogens, tolerance to salinity and draught, and an overall increase in plant growth and development. Mycorrhiza does not help the host plant in increasing its resistance to insects.

Q.16. Which one of the following is not a nitrogen-fixing organism?

(A) *Anabaena* **(B)** *Nostoc*

(C) *Azotobacter* **(D)** *Pseudomonas* R

Ans. Option (D) is correct.

> ***Explanation :*** *Pseudomonas* is a denitrifying bacterium, which converts ammonia and nitrates into free nitrogen. These bacteria are responsible to release free nitrogen in the environment through nitrogen cycle. *Anabaena, Nostoc* and *Azotobacter* are nitrogen fixing organisms. *Anabaena* and *Nostoc* are types of cyanobacteria which are widely distributed in aquatic and terrestrial environments and can fix atmospheric nitrogen. Azotobacter is free-living bacteria, which absorb free nitrogen from soil, air and convert it into salts of nitrogen like amino acids and enrich soil nutrients.

Q.17. *Bacillus thuringiensis* is widely used as :

(A) Insecticide **(B)** Weedicides

(C) Rodenticide **(D)** All of the above R

Ans. Option (A) is correct.

> ***Explanation :*** *Bacillus thuringiensis* is to control butterfly caterpillar. These are available in sachets as dried spores which are mixed with water and sprayed on to vulnerable plants such as brassica and fruit trees, where these are eaten by the insect larvae. In the gut of the larvae, the toxin is released and the larvae get killed.

Q.18. *Glomus* form a symbiotic relationship with plant .....

(A) leaves **(B)** stem

(C) root **(D)** stem and root R

Ans. Option (C) is correct.

> ***Explanation :*** *Glomus*, is a genus of arbuscular mycorrhizal fungi and all species form a symbiotic relationship with plant roots. They help the plant in the absorption of nutrients, especially phosphorus from soil.

Q.19. Which pigment gives a pinkish hue to rhizobium induced root nodules.

(A) Leghaemoglobin **(B)** Carotenoid

(C) Mauveine **(D)** None of the above R

Ans. Option (A) is correct.

> ***Explanation :*** Leghaemoglobin is a haem protein with structural and functional similarities to animal myoglobin, is found uniquely in legume root nodules, the sites of nitrogen fixation which form during symbiotic association between legumes and soil bacteria of the genus Rhizobium.

Q.20. Match the items in Column 'A' and Column 'B' and choose correct answer.

	Column A		**Column B**
a	Lady bird	(i)	Methanobacterium
b	Mycorrhiza	(ii)	*Trichoderma*
c	Biological control	(iii)	Aphids
d	Biogas	(vi)	*Glomus*

The correct answer is :

(A) a – (ii), b – (iv), c – (iii), d – (i)

(B) a – (iii), b – (iv), c – (ii), d – (i)

(C) a – (iv), b – (i), c – (ii), d – (iii)

(D) a – (iii), b – (ii), c – (i), d – (iv) U

Ans. Option (B) is correct.

Explanation :

Column A	Column B	Explanation
A	(iii)	Ladybird is the very familiar beetle with red and black marking, used to get rid of Aphids.
B	(iv)	Fungi form symbiotic association, with the roots of higher plants called mycorrhiza (e.g. Glomus)
C	(ii)	Trichorderma is a fungus and used as a fungicide. it acts a biological control agent for the treatment of plant disease.
D	(i)	Methanogens, particularly Methanobacterium, are found in cow dung. These bacteria grow anaerobically on cellulosic material and produce large amount of methane along with CO_2 and H_2.

ASSERTION AND REASON BASED MCQs (1 Mark each)

Directions : In the following questions a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

(A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(B) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(C) Assertion (A) is true but reason (R) is false.

(D) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion (A) : Bottled fruit juices bought from the market are clearer as compared to those made at home.

Reason (R) : They are clarified by pectinases and proteases.

Ans. Option (A) is correct.

> ***Explanation :*** The juice which is prepared at home is turbid, due to the presence of fibres, pectin, etc. The bottled fruit juices are clearer because they are clarified by pectinases and proteases.

Q. 2. Assertion (A) : An inoculum of curd is used for curdling of milk.

Reason (R) : It contains *Lactobacillus,* which improves nutritional quality by increasing Vitamin B_{12}.

Ans. Option (A) is correct.

> ***Explanation :*** The *lactobacillus,* produce acids which coagulate and partially digest the milk proteins. An inoculum of curd contains millions of LAB, which convert milk to curd.

Q. 3. Assertion (A) : Statin is produced by a yeast called *Trichoderma polysporum.*

Reason (R) : Its used lowers the blood cholesterol level in the body.

Ans. Option (D) is correct.

> ***Explanation :*** Statin is produced by a yeast called *Monascus purpureus* It is a blood cholesterol lowering agent.

Q. 4. Assertion (A) : Methanogens do not produce oxygen.

Reason (R) : Methanogens are obligate anaerobic micro-organisms.

Ans. Option (A) is correct.

> ***Explanation :*** Methanogens are obligate anaerobic micro-organisms which do not produce oxygen. In the digesters (during secondary treatment of waste water), hetero-trophic microbes (methanogens) anaerobically digest bacteria and fungi in sludge producing mixture of gases such as methane, hydrogen sulphide and CO_2 which form the biogas.

Q. 5. Assertion (A) : Activated sludge should have the ability to settle quickly.

Reason (R) : To absorb pathogenic bacteria present in waste water while sinking to the bottom of the settling tank.

Ans. Option (C) is correct.

> ***Explanation :*** Activated sludge should have the ability to settle quickly so that it can be rapidly pumped back from sedimentation tank to aeration tank.

Q. 6. Assertion (A) : Cyanobacteria increases the soil fertility and also add the organic matter to the soil.

Reason (R) : They can fix free nitrogen in the atmosphere.

Ans. Option (A) is correct.

> ***Explanation :*** Cyanobacteria are autotrophic microbes that can fix atmospheric nitrogen. They are also important biofertilizers that add organic matter to the soil.

Q. 7. Assertion (A) : Members of the genus *Glomus* from mycorrhiza.

Reason (R) : *Mycorrhiza* is an association of plants and fungi.

Ans. Option (A) is correct.

> ***Explanation :*** *Glomus* is a genus of arbuscular mycorrhizal and form a symbiotic association with plants.

Q. 8. Assertion (A) : *Rhizobium leguminosarum* is a symbiotic bacterium found in the root nodules of leguminous plants.

Reason (R) : They have the ability to fix atmospheric nitrogen.

Ans. Option (A) is correct.

> ***Explanation :*** *Rhizobium leguminosarum* is symbiotic bacterium that serves as a biofertilizers. These bacteria fix atmospheric nitrogen into organic forms, which is used by the plant as nutrient.

Q. 9. Assertion (A) : *Nucleopolyhedrovirus* are useful as they are good biocontrol agents.

Reason (R) : They are species-specific, narrow spectrum bioinsecticides.

Ans. Option (A) is correct.

> ***Explanation :*** *Nucleopolyhedrovirus* is from the genus of baculoviruses. They are useful as they are good biocontrol agents. They are species-specific, narrow spectrum bioinsecticides. They control only species specific pests, do not affect non target organisms / beneficial insects are conserved / they aid in IPM problems / no negative impact on plants or other animals.

Q. 10. Assertion (A) : Blue green algae are popular as biofertilisers.

Reason (R) : Blue green algae cause algal bloom in polluted water bodies.

Ans. Option (D) is correct.

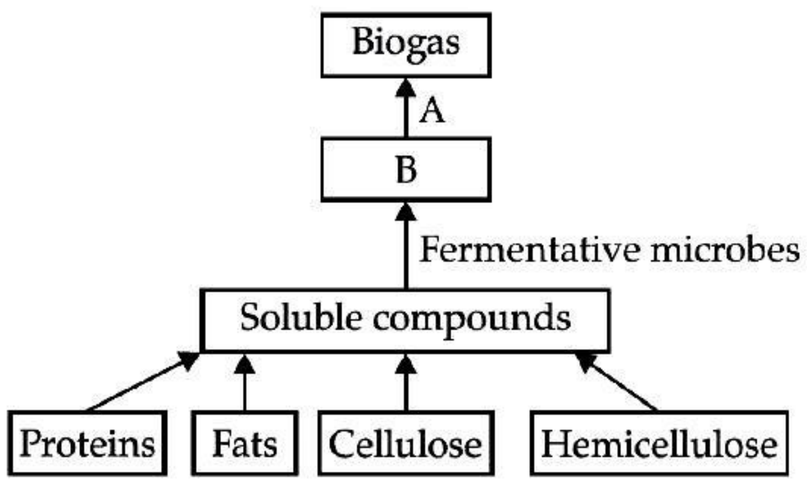
> ***Explanation :*** Blue-green algae are not popular as biofertilisers, besides adding organic matter to the soil and increasing its fertility because they cause algal bloom in polluted water bodies and have copious mucilage that makes the fields slippery.

CASE-BASED MCQs

Attempt any four sub-parts from each question. Each sub-part carries 1 mark.

I. Read the following and answer any four questions from Q.1 to Q.5 given below:

Villagers in a place near Chambur started planning to make power supply for agricultural purpose from cow dung. They have started a biogas plant for the purpose. Study the flow chart for biogas production given below and answer the following questions.



Q. 1. Biogas is composed of majorly:

(A) methane, CO_2 and O_2

(B) CO_2, H_2S, and H

(C) methane, CO_2

(D) H_2S, H and O_2

Ans. Option (C) is correct.

> ***Explanation :*** Biogas is composed of Methane(50-70%), CO_2(30-40%) with traces of hydrogen sulphide and hydrogen.

Q. 2. In the given flow chart, 'A' denotes :

(A) aerobic bacteria

(B) methanogenic bacteria

(C) cellulose degrading bacteria

(D) yeast and protozoa

Ans. Option (B) is correct.

> ***Explanation :*** The methanogenic bacteria are anaerobic organisms that convert CO_2 to methane via a sequence of reactions.

Q. 3. What is represented by 'B' in the flow chart?

(A) Carbohydrates **(B)** Protein polymers

(C) Organic acids **(D)** Fat globules

Ans. Option (C) is correct.

> ***Explanation :*** In the second stage of biogas production, the simple soluble compounds or monomers are acted upon by fermentation causing microbes and converted into organic acids especially acetic acid.

Q. 4. 'C' in the given flow chart represents:

(A) aerobic breakdown of complex organic compounds

(B) anaerobic digestion of complex organic compounds

(C) fermentation of organic compounds

(D) fermentation of monomers.

Ans. Option (B) is correct.

> ***Explanation :*** 'C' in the given flow chart represents anaerobic digestion of complex organic compounds.

Q. 5. If 'A' is not added in the procedure

(A) methane will not be formed

(B) CO_2 will not be formed

(C) organic compounds will not be converted to H_2S

(D) O_2 will not be formed

Ans. Option (A) is correct.

> ***Explanation :*** If methanogenic bacteria is not added in the procedure methane formation will not take place.

II. Read the following text and answer any four questions on the basis of the same :

Ecological Indicators :

The presence of dragonflies can reveal changes in the water ecosystems more quickly than studying other animals or plants. In fact, from the nymph to the adult stage, the dragonfly has a significant, positive ecological impact. Dragonfly eggs are laid and hatched in or near water, so their lives show on impact on both water and land ecosystems. Once hatched, dragonfly nymphs can breathe in the air or underwater which enables them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish. Adult dragonflies capture and eat adult mosquitoes. Community wide mosquito control programs that spray insecticides to kill adult mosquitoes also kill dragonflies.

Q. 1. The approach to biological control includes :

(A) Import and release of an insect pest to a new area to provide hosts for natural enemies.

(B) Import and release of natural enemies from the native home of an alien insect pest that has invaded a new area.

(C) Preservation of natural enemies (predators & parasites) that are already established in an area.

(D) Use of insecticides to reduce alien insect pests to establish new equilibrium position.

Ans. Option (A) is correct.

> ***Explanation :*** The approach to biological control includes Preservation of natural enemies(predators & parasites) that are already established in anarea.

Q. 2. Two diseases less likely to occur in a region with plenty of dragonflies are_____

(A) Yellow fever and amoebic dysentery

(B) Malaria and Yellow fever

(C) Anthrax and typhoid

(D) Cholera and typhoid

Ans. Option (B) is correct.

> ***Explanation :*** Two diseases less likely to occur in a region with plenty of dragonflies are Malaria and Yellow fever.

Q. 3. Dragonflies indicate positive ecological impact as :

(A) The presence of dragonflies indicates polluted water.

(B) Dragonfly nymphs selectively eat mosquito larvae.

(C) They help to decrease the probability of diseases spread by vectors.

(D) Dragonfly do not cause any harm to beneficial species.

Ans. Option (C) is correct.

> ***Explanation :*** Adult dragonflies are beneficial because the eat pest, flying insects, particularlymidges and mosquitoes and help to decrease the probability of diseases spread by vectors.

Q. 4. The most effective stages in the life cycle of dragonfly that eradicates mosquitoes area.

(A) Larvae and adult

(B) Caterpillar and adult

(C) Nymph and adult

(D) Pupa and adult

Ans. Option (C) is correct.

> ***Explanation :*** Dragonflies are large and heavy-bodied insects. The larvae (or Nymphs), which live in water, eat almost anything living that is smaller than themselves. The adult dragonfly larvae are even known to catch and eat small fish. Usually they eat bloodworms or other aquatic insect larvae. Dragonfly nymphs are such good hunters because they move really fast - by what looks like jet propulsion.
> One of the benefits of having dragonflies live nearby is that they eat many times their weight in mosquitoes every day. Dragonflies also eat many different kinds of flies. Using a basket-like arrangement of their legs, adult dragonflies can actually catch and eat other bugs while they are flying.

Q. 5. Assertion : Releasing dragonflies in areas where there is an outbreak of malarial diseases can be an environment friendly method of control.

Reason : Dragonflies are dominant species and will not allow mosquitoes to reproduce.

(A) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(B) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(C) Assertion is true but reason is false.

(D) Both assertion and reason are false.

Ans. Option (C) is correct.

> ***Explanation :*** Dragonflies have role in controlling the mosquitoes population and ultimately malarial disease as they are predators on them but they have no role to allow mosquitoes to reproduce.

III. Read the following text and answer the any four questions on the basis of the same:

Large quantities of sewage is generated every day in cities and towns, which is treated in Sewage Treatment Plants (STPs) to make it less polluted. Given below is the flow diagram of one of the stages of STP.

Observe the given flow diagram and answer the questions accordingly.

Primary effluent is passed into large aeration tank.

↓

Effluent passed into settling tank to form the sediment.

Q. 1. Primary effluent is passed into large aeration tanks:

(A) To allow bacterial flocs to settle down

(B) To allow fast growth of useful aerobic microbes into flocs

(C) To allow anaerobic sludge digestion

(D) None of these

Ans. Option (C) is correct.

> ***Explanation :*** The primary effluent is transferred into large aeration tanks where it is constantly agitated mechanically and the air having oxygen is pumped into it which allows fast growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh-like structures).

Q. 2. Technical term used for sedimentformed in sewage treatment is:

(A) Flocs

(B) Effluents

(C) Activated sludge

(D) Anerobic sludge

Ans. Option (B) is correct.

> ***Explanation :*** The effluent after primary treatment is passed into the settling tank where the bacterial 'flocs' are allowed to settle down and this sediment is called Activated sludge. A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum(starter).

Q. 3. The significance of the above sediment formed is that:

(A) It acts as inoculum

(B) It serves in formation of flocs

(C) It helps in formation of natural water bodies

(D) It helps in anerobic sludge digestion

Ans. Option (A) is correct.

> ***Explanation :*** The activated sludge is pumped back into the aeration tank to serve as the inoculum(starter).

Q. 4. Identify the correct set of gases produced during digestion of sludge:

(A) methane, hydrogen sulphide and carbon dioxide

(B) methane, sulphur and carbon dioxide

(C) carbon monooxide, methane, hydrogen sulphide

(D) methane, hydrogen sulphide and nitrogen

Ans. Option (A) is correct.

> ***Explanation :*** During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide, and carbon dioxide. These gases form biogas and can be used as a source of energy. The treated effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams.

Q. 5. The technology of biogas production from cow dung was developed in India largely due to the efforts of :

(A) Gas authority of India

(B) Oil and Natural Gas Commission

(C) Indian Agriculture Research Institute, Khadi and Village Industries Commission.

(D) Indian Oil Corporation

Ans. Option (C) is correct.