



NCERT Class 12 Biology Exercise Solutions

Chapter 8 – Microbes in Human Welfare

1. Bacteria cannot be seen with the naked eye, but these can be seen with the help of a microscope. If you have to carry a sample from your home to your biology laboratory to demonstrate the presence of microbes with the help of a microscope, which sample would you carry and why?

Ans: Curd is a good choice for microbes to be observed under a microscope. Curd can be taken as a sample because it contains many Lactobacilli or Lactic Acid Bacteria. These bacteria make acids that coagulate and break down milk proteins. A single drop of curd contains millions of bacteria. They are easy to observe under a microscope.

2. Give examples to prove that microbes release gases during metabolism.

Ans: During metabolism, microbes release gases; some examples include: (a) Methano bacteria found in anaerobically treated sludge release large quantities of methane, hydrogen gas, and carbon dioxide. (b) In the fermentation of cheeses, doughs, and beverages, carbon dioxide is released. The following microbes are involved in the fermentation process: Propionibacterium Sharmaine, Lactic Acid Bacteria, Saccharomyces cerevisiae.

3. In which food would you find lactic acid bacteria? Mention some of their useful applications.

Ans: Lactic acid bacteria can be found in the curd. The following are some of the beneficial uses of Lactic acid bacteria:

- (a) increases the vitamin B12 content of the curd, increasing its nutritional value
- (b) can be used for fermentation or culture
- (c) improves gut health

4. Name some traditional Indian foods made of wheat, rice and Bengal gram (or their products) which involve use of microbes.

Ans: Various Indian dishes are prepared using ingredients such as wheat, rice, and Bengal gram. For instance, wheat-based dishes include Bread, Bhatara, and Cake. Rice-based dishes consist of Idli, Dosa, and Uttapam. Lastly, Bengal gram is used to make Dhokla and Khandvi.

5. In which way have microbes played a major role in controlling diseases caused by harmful bacteria?

Ans: Microbes play an important role in controlling diseases caused by harmful bacteria; some are given below:

- (i) Microbes are known to produce antibiotics which can be used to treat harmful diseases such as leprosy, diphtheria etc

- (ii) Microbes produce antitoxins or antisera, which act against a specific pathogen. Antisera is known to be widely used against lock jaw tetanus, diphtheria etc
- (iii) They produce antibodies which contain antitoxins and opsonins that check the occurrence of diseases, namely, cholera, typhoid, smallpox etc
- (iv) The design of antibiotics is such that they destroy bacteria by weakening their cell walls. This, in turn, weakens several immune cells (white blood cells) that enter the bacterial cell, causing cell lysis. The process of destructing cells such as blood cells by bacteria is known as cell lysis.
- (v) *Penicillium notatum*, a fungus, produces the chemical penicillin. It inhibits the growth of bacteria named Staphylococci in the body

6. Name any two species of fungus, which are used in the production of the antibiotics.

Ans: Several microbes produce antibiotics, that kill other microbes which cause diseases. These antibiotics are typically acquired from fungi and bacteria. Two species of fungus that are used in the production of antibiotics are:

- (i) Penicillin – the fungal source is *Penicillium notatum*
- (ii) Cephalosporin – the fungal source is *Cephalosporium acremonium*

7. What is sewage? In which way can sewage be harmful to us?

Ans: The term sewage refers to the municipal waste material which is carried away in drains and sewers. Sewage includes both solid and liquid wastes that are rich in microbes and organic matter. Most of these microbes are pathogenic, i.e., they are capable of causing diseases such as water-borne diseases. This sewage water is one of the major causes of contaminating drinking water. Therefore, it is vital to treat sewage water by collecting and disposing of it.

8. What is the key difference between primary and secondary sewage treatment?

Ans: The key differences are as follows:

Primary sewage treatment	Secondary sewage treatment
It is the mechanical or physical removal of small and large substances from sewage	It includes the removal of organic matter by microbes
The process deployed is through sedimentation and filtration	The process used is the biological digestion of wastes
Less complicated and relatively low-priced method of treatment	It is a complicated process and is expensive.

9. Do you think microbes can also be used as source of energy? If yes, how?

Ans: Yes, microbes can certainly be a source of energy. Some bacteria, such as the Methane bacterium, can be used to generate biogas or gobar gas. In a biogas plant, under anaerobic conditions, biogas can be generated. The biogas plant consists of a concrete tank with a depth of nearly 10-15 feet, comprising of adequate outlets and inlets. The gathered dung is mixed with water for the formation of slurry and flung

into the tank. The tank consists of a digester, which is filled with plenty of anaerobic methane-producing bacteria. This produces biogas from the slurry. Biogas can be extracted through a pipe which can be used as a source of energy. The slurry that is used is removed from the outlet and used as a fertilizer.

10. Microbes can be used to decrease the use of chemical fertilisers and pesticides. Explain how this can be accomplished.

Ans: Organic farming is carried out without the use of any pesticides and chemical fertilizers. Microbes play a major role in organic farming. Bio-fertilizers involve picking advantageous microbes to help improve plant growth by supplying nutrients. Bio-fertilizers are living entities that are known to increase soil fertility. These are introduced into roots, seeds and soil in order to make nutrients available, thus enriching the soil with organic nutrients. Many species of cyanobacteria and bacteria have the potential to fix free atmospheric nitrogen.

A symbiotic bacteria, Rhizobium, is found in the root nodules of leguminous plants. Some free-living nitrogen-fixing bacteria are Azotobacter and Azospirillum, while Nostoc, Oscillatoria, and Anabaena are examples of nitrogen-fixing cyanobacteria. These biofertilizers are eco-friendly and cost-effective.

On the other hand, microbes can also serve as bio-pesticides to check insect pests in plants. The Bacillus thuringiensis, a bio-pesticide, produces a toxin which kills insect pests.

Withered bacterial spores are mixed with water and sprinkled in fields. These spores enter the gut of the larvae to release toxins when larvae of various insects feed on the crops. Likewise, the free-living fungi, Trichoderma, are found in the roots of higher plants, safeguarding them from pathogens. Another bio-pesticide, Baculovirus, is used as a biological control agent against other arthropods and insects.

11. Three water samples namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant were subjected to BOD test. The samples were labelled A, B and C; but the laboratory attendant did not note which was which. The BOD values of the three samples A, B and C were recorded as 20mg/L, 8mg/L and 400mg/L, respectively. Which sample of the water is most polluted? Can you assign the correct label to each assuming the river water is relatively clean?

Ans: BOD or biochemical oxygen demand refers to the amount of oxygen which would be consumed if all the organic matter in one litre of water were to be oxidized by bacteria. This BOD test measures the rate of uptake of oxygen by microbes in a sample of water; hence BOD is said to be a measure of the organic matter found in water. Therefore, the greater the BOD of wastewater, the greater the polluting potential. Sample A with BOD 20mg/L can be assigned as the secondary effluent discharged from a sewage treatment plant.

Sample B with BOD 8mg/L can be assigned as river water

Sample C with BOD 400mg/L can be assigned as untreated sewage water.

This assignment is on the basis that the highest BOD value is the sample carrying the most polluted water.

12. Find out the name of the microbes from which Cyclosporin A (an immunosuppressive drug) and Statins (blood cholesterol lowering agents) are obtained.

Ans: Cyclosporin A, an immunosuppressive drug, is obtained from the fungus *Trichoderma polysporum*. Statins, a blood cholesterol-lowering agent, is obtained from the yeast *Monascus purpureus*.

13. Find out the role of microbes in the following and discuss it with your teacher.

(a) Single cell protein (SCP)

(b) Soil

Ans: The functions of microbes in the following areas are as follows:

(a) Single cell protein (SCP)

- (i) SCP refers to the utilization of harmless microbial cells as a substitute for high-quality proteins.
- (ii) Certain types of microbial cells can be consumed as a food source that is rich in minerals, proteins, fats, vitamins, and carbohydrates. For example, athletes consume yeast as a protein source, and mushrooms are consumed in a similar manner.
- (iii) *Methylophilus methylotrophus* and *Spirulina* are cultivated on a large scale using materials such as starch-like wastewater from potato processing plants, molasses, straw, animal manure, and sewage.

(b) Soil

- (i) Microbes play a crucial role in maintaining soil fertility.
- (ii) They aid in the formation of nutrient-rich humus through the process of decomposition.
- (iii) Several species of bacteria and cyanobacteria have the ability to convert atmospheric nitrogen into a form that can be utilized by plants.
- (iv) *Rhizobium*, a symbiotic bacteria, is present in the root nodules of leguminous plants.
- (v) Various nitrogen-fixing bacteria, such as *Azotobacter* and *Azospirillum*, as well as nitrogen-fixing cyanobacteria like *Nostoc*, *Oscillatoria*, and *Anabaena*, can be found in the soil.

14. Arrange the following in the decreasing order (most important first) of their importance, for the welfare of human society. Give reasons for your answer. Biogas, Citric acid, Penicillin and Curd.

Ans: The order of importance, arranged in decreasing order for the welfare of human society, is as follows: Penicillin, Biogas, Curd, and Citric acid.

- Penicillin takes the top spot due to its ability to eliminate harmful pathogens that cause diseases and infections, ultimately saving lives. Its role as an antibiotic makes it the most crucial in this list.
- Following Penicillin is Biogas, which serves as a clean and non-polluting fuel. It is produced as a byproduct of sewage treatment and can be utilized for cooking and lighting homes in remote areas.
- Curd comes next in line, offering high nutritional value and supplying vitamin B12. It plays a significant role in maintaining gut health and replacing harmful bacteria with beneficial ones in the stomach.
- Lastly, we have citric acid, which is used primarily as a food preservative. While it serves a purpose in food preservation, it holds the least importance compared to the other items on the list.

15. How do biofertilizers enrich the fertility of the soil?

Ans: Bio-fertilizers consist of beneficial microbes that aid in enhancing plant growth by providing essential nutrients. They are living organisms that can enhance soil fertility. These microbes are applied to roots, seeds, and soil to ensure the availability of nutrients, thereby enriching the soil with organic elements. Various species of cyanobacteria and bacteria have the ability to convert atmospheric nitrogen into a usable form. For instance, the symbiotic bacterium *Rhizobium* resides in the root nodules of leguminous plants. Examples of free-living nitrogen-fixing bacteria include *Azotobacter* and *Azospirillum*, while nitrogen-fixing cyanobacteria such as *Nostoc*, *Oscillatoria*, and *Anabaena* also play a crucial role. These biofertilizers are both environmentally friendly and cost-effective.

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