

NCERT Solutions for Class-XII Biology

Chapter -8

NCERT Biology Class 12

1. Bacteria cannot be seen with the naked eyes, 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 under a microscope, which sample would you carry and why?
1. *Curd* can be used as a sample for the study of microbes. Curd contains numerous lactic acid bacteria (LAB) or *Lactobacillus*. These bacteria produce acids that coagulate and digest milk proteins. A small drop of curd contains millions of bacteria, which can be easily observed under a microscope.
2. Give examples to prove that microbes release gases during metabolism.
2. Fungi and bacteria can breakdown organic compounds using fermentation. They release CO₂ during this process. Common examples which show microbes release gases are:
 - Dough of idli and dosa gives puffed up appearance because of release of CO₂ during the process of fermentation by bacteria.
 - Dough of bread is puffed up because of fermentation by *Saccharomyces cerevisiae*.
 - The large holes in Swiss cheese are caused due to production of a large amount of CO₂ during fermentation by a bacterium named *Propionibacterium sharmanii*.
3. In which food would you find lactic acid bacteria? Mention some of their useful applications.
3. Lactic acid bacteria can be found in curd. It is this bacterium that promotes the formation of milk into curd. The bacterium multiplies and increases its number, which converts the milk into curd. They also increase the content of vitamin B₁₂ in curd. Lactic acid bacteria are also found in our stomach where it keeps a check on the disease-causing micro-organisms.
4. Name some traditional Indian foods made of wheat, rice and Bengal gram (or their products) which involve use of microbes.
4. Some of the traditional Indian fermented foods are:
 - Made from wheat: Filebi, Seera, Bhaturu, Kulcha, gulgule
 - Made from rice: Idli, dosa, chitrou, torani, aska, selroti
 - Made from bengal gram: dhokla, khaman

5. In which way have microbes played a major role in controlling diseases caused by harmful bacteria?
5. Several micro-organisms are used for preparing medicines. Antibiotics are medicines produced by certain micro-organisms to kill other disease-causing micro-organisms. These medicines are commonly obtained from bacteria and fungi. They either kill or stop the growth of disease-causing micro-organisms. Streptomycin, tetracycline, and penicillin are common antibiotics. Penicillium notatum produces chemical penicillin, which checks the growth of staphylococci bacteria in the body. Antibiotics are designed to destroy bacteria by weakening their cell walls. As a result of this weakening, certain immune cells such as the white blood cells enter the bacterial cell and cause cell lysis. Cell lysis is the process of destroying cells such as blood cells and bacteria.
6. Name any two species of fungus, which are used in the production of the antibiotics.
6. Many microbes are involved in production of antibiotics. Antibiotics are chemicals that are produced by some microbes (most commonly bacteria and fungi) that kill other microbes.
 - Penicillium chrysogenum- produces antibiotic penicillin which is effective against several bacterial infections by staphylococci and streptococci
 - Cephalosporium- produces cephalosporins hamper the formation of peptidoglycan layer in bacteria and hence, act as an antibiotic against them.
7. What is sewage? In which way can sewage be harmful to us?
7. Sewage is the municipal waste matter that is carried away in sewers and drains. It includes both liquid and solid wastes, rich in organic matter and microbes. Many of these microbes are pathogenic and can cause several water-borne diseases. Sewage water is a major cause of polluting drinking water. Hence, it is essential that sewage water is properly collected, treated, and disposed.
8. What is the key difference between primary and secondary sewage treatment?
8. Primary sewage treatment is to remove large and small solids through filtration and sedimentation while secondary treatment also known as biological treatment used microbes to consume organic matter. Primary treatment reduces BOD upto 20 to 30 percent. Secondary treatment reduces BOD upto 80 percent.
9. Do you think microbes can also be used as source of energy? If yes, how?
9. Yes, microbes can be used as a source of energy. Bacteria such as Methane bacterium is used for the generation of gobar gas or biogas. The generation of biogas is an anaerobic process in a biogas plant, which consists of a concrete tank (10–15 feet deep) with sufficient outlets and inlets. The dung is mixed with water to form the slurry and thrown

into the tank. The digester of the tank is filled with numerous anaerobic methane-producing bacteria, which produce biogas from the slurry. Biogas can be removed through the pipe which is then used as a source of energy, while the spent slurry is removed from the outlet and is used as a fertilizer.

10. Microbes can be used to decrease the use of chemical fertilisers and pesticides. Explain how this can be accomplished.
10. Various bacteria, fungi and cyanobacteria are used in organic farming instead of chemical fertilizers and pesticides. Biofertilizers are organisms that help in enriching the soil with nutrients.
- Rhizobium, Azospirillum and Azotobacter help in nitrogen fixation and hence, enrich the soil with nitrogen.
 - Fungi such as mycorrhiza form symbiotic relationship with plants and absorb phosphorus from soil and pass it to the plant.
 - Cyanobacteria help in nitrogen fixation and is an important biofertilizer.
 - Blue green algae adds organic matter to the soil.
 - Bio-pesticides such as Bacillus thuringiensis produce a toxin that kills insect pests.
 - Baculoviruses are bio-pesticides that are used as biological control agents against insects and other arthropods.

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?

11. Biological oxygen demand (BOD) is the method of determining the amount of oxygen required by micro-organisms to decompose the waste present in the water supply. If the quantity of organic wastes in the water supply is high, then the number of decomposing bacteria present in the water will also be high. As a result, the BOD value will increase. Therefore, it can be concluded that if the water supply is more polluted, then it will have a higher BOD value. Out of the above three samples, sample C is the most polluted since it has the maximum BOD value of 400 mg/L. After untreated sewage water, secondary effluent discharge from a sewage treatment plant is most polluted. Thus, sample A is secondary effluent discharge from a sewage treatment plant and has the BOD value of 20 mg/L, while sample B is river water and has the BOD value of 8 mg/L.

Hence, the correct label for each sample is:

Label	BOD value	Sample
A.	20 mg/L	Secondary effluent discharge from a sewage treatment plant
B.	8 mg/L	River water

C.	400 mg/L	Untreated sewage water
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12. Find out the name of the microbes from which Cyclosporin A (an immunosuppressive drug) and Statins (blood cholesterol lowering agents) are obtained.

12.

- Cyclosporin A is produced by *Trichoderma polysporum* and *Cylindrocarpum lucidum* which lowers the activity of T-cells of immune system.
- Statins are obtained from *Aspergillus terreus* and *Phoma* sp. which reduce production of Low Density Cholesterol in liver.

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

(a) Single cell protein (SCP)

(b) Soil

13. (a) Single cell protein (SCP)

A single cell protein is a protein obtained from certain microbes, which forms an alternate source of proteins in animal feeds. The microbes involved in the preparation of single cell proteins are algae, yeast, or bacteria. These microbes are grown on an industrial scale to obtain the desired protein. For example, *Spirulina* can be grown on waste materials obtained from molasses, sewage, and animal manures. It serves as a rich supplement of dietary nutrients such as proteins, carbohydrate, fats, minerals, and vitamins. Similarly, micro-organisms such as *Methylophilus* and *methylotrophus* have a large rate of biomass production. Their growth can produce a large amount of proteins.

(b) Soil

Microbes play an important role in maintaining soil fertility. They help in the formation of nutrient-rich humus by the process of decomposition. Many species of bacteria and cyanobacteria have the ability to fix atmospheric nitrogen into usable form. *Rhizobium* is a symbiotic bacteria found in the root nodules of leguminous plants. *Azospirillum* and *Azotobacter* are free living nitrogen-fixing bacteria, whereas *Anabena*, *Nostoc*, and *Oscillatoria* are examples of nitrogen-fixing cyanobacteria.

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

14. The importance of substances in decreasing order is

Penicillin, Biogas, Curd and Citric acid

Penicillin is an important antibiotic which helps in fighting against various bacteria; infections, hence, it is important for human welfare. Biogas is an eco friendly source of energy and helps in curbing pollution. Curd is a source of Vitamin B12 and it has several benefits as food. Citric acid is used as a preservative in food industry.

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

15. Bio-fertilizers are living organisms which help in increasing the fertility of soil. It involves the selection of beneficial micro-organisms that help in improving plant growth through the supply of plant nutrients. These are introduced to seeds, roots, or soil to mobilize the availability of nutrients by their biological activity. Thus, they are extremely beneficial in enriching the soil with organic nutrients. Many species of bacteria and cyanobacteria have the ability to fix free atmospheric nitrogen.

Rhizobium is a symbiotic bacteria found in the root nodules of leguminous plants.

Azospirillum and *Azotobacter* are free living nitrogen-fixing bacteria, whereas *Anabena*, *Nostoc*, and *Oscillatoria* are examples of nitrogen-fixing cyanobacteria. Biofertilizers are cost effective and eco-friendly.



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