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MICROORGANISMS

INTRODUCTION

- The very small minute organism which can not be seen by the naked eyes are called **microorganism**.
- **Anton Von Leeuwenhoek** was the first to recognize the microorganism.
- These organisms are not visible by naked eyes. They can be seen only under the microscope or few (like fungus) can be seen with magnifying glass. There are more than 1,00,000 kinds of microbes existing on the earth.
- The major groups include **algae, fungi, bacteria, virus and protozoan**.
- The study of microbes is called **microbiology**.

OCCURRENCE OF MICROORGANISMS

- Microbes are the tiny creatures, which can be found everywhere like air, water, desert, extreme hot, extreme cold etc.
- They can survive under all type of environment and in extremely harsh environmental conditions like hot springs, desert soil, saline water, ice-cold water and marsh lands.
- They may exist in colonies (fungi and bacteria) or may be found isolated (Amoeba).
- They may be free living or may be symbiotic or parasitic.
- The micro organisms are also found on organic debris as the **saprophytes**. *E. coli* is a type of bacteria which lives in the small intestine of human beings.
- These are **cosmopolitan** in nature.

MAJOR GROUPS OF MICROORGANISMS

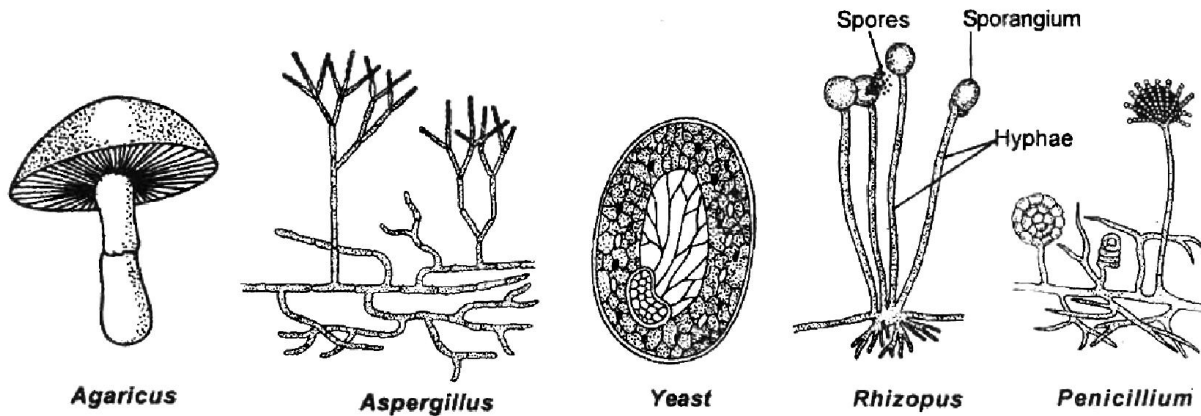
- There are five major group of microorganisms as bacterium, virus, protozoan, algae and fungus.

1. BACTERIA

- These are prokaryotic and unicellular organisms.
- These are single celled organisms, found in wide range of habitats ranging from glaciers to deserts and hot springs. **Eg.** *Lactobacillus*, *Rhizobium* etc.
- Bacteria occur in four main shapes spherical, rod-like spiral and (comma) vibrio.
 - (i) Spherical bacteria are called **cocci** (singular coccus).
 - (ii) Rod like bacteria are called **bacilli** (singular bacillus).
 - (iii) Spiral shaped bacilli are called **spirilla**.
 - (iv) Comma shaped bacteria are called **vibrio**.

2. FUNGI

- These are multicellular, heterotrophic organisms, non-green which lack chlorophyll and cannot synthesise their own food.
- Some of them, depend on dead and decomposed organic matter and are known as **saprophytes**.
- Fungi may be unicellular or multicellular. The outermost covering is cell wall which is made up of **chitin**.
Eg. *Penicillium*, *Aspergillus*, *Saccharomyces* (Yeast), *Agaricus* (Mushroom) etc.

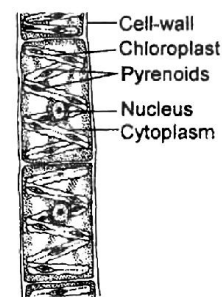


3. PROTOZOA

- Unicellular, eukaryotic microorganisms.
- Protozoa can be found in water, soil in free living form and as parasites also e.g. *Plasmodium*.
- A typical protozoan contains a well developed nucleus and membrane bounded cell organelles. **Eg.** *Amoeba*, *Paramecium* etc.

4. ALGAE

- These are unicellular or multicellular autotrophic organisms, contain chlorophyll pigment and carry out photosynthesis.
Eg. *Chlamydomonas*, *Spirogyra*, *Chlorella*, *Volvox* etc.



Chlamydomonas, *Volvox*, *Spirogyra*

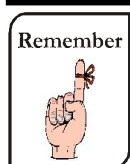
5. Virus :

- Virus is the smallest microorganisms that is visible only through electron microscope.
- Viruses are much smaller than bacteria.
- They do not show most of the characteristics of living things. For example, they do not respire, feed, grow, excrete or move on their own.
- They are just capable of other organisms like plant, animal and bacterial cells.
- As long as viruses are outside the living cells, they behave as non-living things but as soon as viruses enter the living cells of other organisms, they start behaving as living by carrying out the process of reproduction.
- Hence, viruses are said to be on the border line dividing the living things from non-living things.

Eg. Herpes virus, Polio virus etc.

MICROORGANISMS - FRIENDS AND FOE

- Most microorganisms are beneficial, for example, there are microorganisms in our large intestine that synthesize vitamins.
- However, some microorganisms are pathogens (disease causing agents) which are a threat to all life forms.



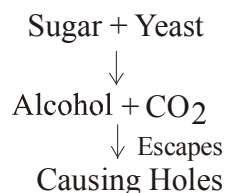
E.coli present in large intestine of humans helps in production of vitamin K, a important vitamin in blood clotting.

Microorganisms - As Friends

- Microorganisms are used for a number of purpose such as :
 - (1) Preparation of curd, bread, cake, idli, dosa, cheese.
 - (2) In industry – to produce alcohol, wine and vinegar.
 - (3) In agriculture – to increase soil fertility
 - (4) In medicines – to produce antibiotics and vaccines.
 - (5) Cleaning the environment.

1. Preparation of curd, bread, cake, idli, dosa and cheese

- (i) **Formation of curd (dahi) and bread:** Making of curd is a process in which the **lactose** (milk sugar) of the milk is converted into lactic acid by the action of certain bacteria (mainly *Lactobacillus*).

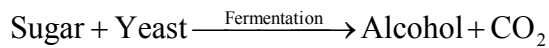


The unicellular fungi **yeast** is used for making Bread, Cakes and pastries. These food stuffs are produced by rising dough (Dough is rised by escaping CO₂ bubbles, which are produced by yeast and increases volume of the dough)

2. Commercial use of microbes : In Industry

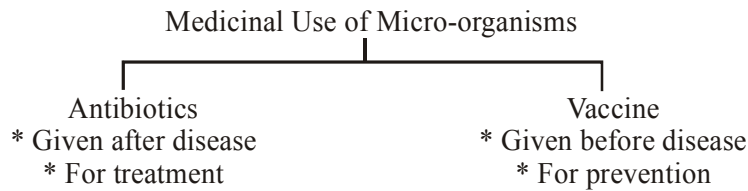
- Microorganisms are used for production of alcoholic drinks like wine, beer etc. on a large scale.
- Yeast is used in the production of alcoholic drinks and wine by the process of fermentation (Conversion of sugar into alcohol releasing heat).

- It converts natural sugar present in barley, wheat, rice, fruit juices etc as given:

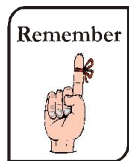


- Microbes like Acetobacter (Bacteria) are source of vinegar (Acetic acid).

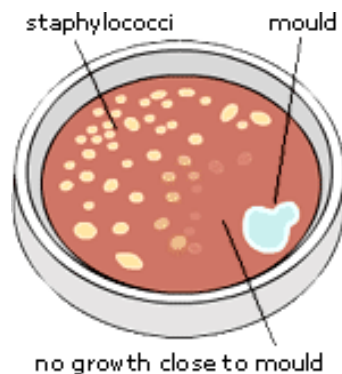
3. Medicinal use of microorganism



- The microorganisms are also used for making antibiotics for the cure of different microbial infections.
- Antibiotics are produced by one microorganism and kills/ reduce growth of other microorganism (Pathogen).
- Penicillin was the first antibiotic discovered in 1929 by **Alexander Flemming**.
- Flemming noticed that an agar plate inoculated with bacterium *Staphylococcus aureus* had become contaminated with a mould.
- He further noticed the presence of a clear zone in the agar plate in which breakdown of the bacterial cells had occurred. Detailed studies led to the isolation of an inhibitory substance from the mould. As the mould was identified as *Penicillium*, Flemming called the antibiotic penicillin. Soon other antibiotics were isolated.



Alexander Flemming was culturing bacteria on agar plate he observed no growth of bacteria near mould. The question in his mind was Why? Sort out his problem.



- Vaccines** are also prepared from the microorganisms or their fragments. These are given orally or injected to prevent the infants from harmful diseases like Cholera, Tuberculosis, Small pox and Hepatitis etc.
- Vaccine is killed/weakened microbe that when administered in body, evokes immune system and produces memory cell. **Edward Jenner** is **father of vaccination**.
- The outcome of whole errand is production of memory cell to safeguard against future infection. The life of memory cell is variable and may be even life long.

4. Microbes in increasing soil fertility

- The microorganisms like blue green algae (Cyanobacteria) and some nitrogen fixing bacteria (eg *Rhizobium* present in root nodules of Legumes) fix Nitrogen that means converts atmospheric nitrogen into nitrates or ammonia. Thus, they help in improving fertility of soil.

5. Microorganism in cleaning the environment

- The microorganisms feed on the dead organic matter and decompose it into simple substances. Because of this property they are also called as **natural scavengers**. They help in cleaning of environment and recycling of matter. Manure is formed by the same process mentioned above.

HARMFUL MICROORGANISMS

- Microorganisms are also harmful as they cause diseases in human beings, plants and animals. The disease causing microorganisms are called **pathogens**.

1. Disease causing Microorganisms

(A) In Humans

- In humans, the diseases are caused by those microbes which contaminate air, food and water.
- The diseases caused by these microbes are called the **communicable diseases**, which get spreads from person to person. Some of the disease caused by microbes are mentioned below:
 - Bacterial:** Cholera, diphtheria, anthrax, tuberculosis etc.
 - Virus:** Cold, Flu, Chickenpox, A.I.D.S.(Acquired Immuno Deficiency Syndrome), Swine flu etc.
 - Protozoan:** Amoebic dysentery, Malaria, African sleeping sickness, kala azar etc.

Human Diseases	Causative Microorganisms	Transmitting agents	Preventive Measures (General)
Tuberculosis	Bacteria	Air	(i) Isolation of the infected person. (ii) Vaccination at suitable age.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	
Cholera	Bacteria	Water / Food	(i) Maintaining personal hygiene. (ii) Consuming properly cooked food. (iii) Drinking boiled water. (iv) Vaccination helps in prevention.
Typhoid	Bacteria	Water	
Hepatitis B	Virus	Water	(i) Drinking boiled water. (ii) Vaccination helps in prevention.
Malaria	Protozoa	Mosquito	(i) Using mosquito nets or repellents. (ii) Spraying insecticides. (iii) Destroying breeding grounds of mosquitoes such as stagnant water.

- Vectors :** They are living organisms which spread their pathogens from an infected person to a healthy person. Usually, a part of life cycle of the pathogen is passed in the body of the vector.
- Some animals like housefly transfer the pathogen without taking them in their bodies. They are called carriers.
- Housefly is carrier of cholera, dysentery, typhoid, diarrhoea, etc.
- Female mosquitoes of many species are vectors of several diseases.

(B) In Animals

- The microbes also infect the animals and cause harmful diseases.

Common Animal Diseases

Microbes	Name of animal diseases
Viruses	Foot and mouth disease of cattle
Bacteria	Anthrax disease of cattle
Protozoa	Sleeping sickness (in cattle, pigs and horses)

(C) In Plants

There are several microbes causing diseases in plants.

Plant Diseases	Means of Transmission
Bacterial diseases	
Soft Rot / Red stripe of sugarcane	Air
Citrus Canker	Air / water / insects
Bacterial Blight of gram	Air
Viral diseases	
Tobacco mosaic disease	Wind / water
Yellow vein mosaic of bhindi	Insect
Tomato mosaic	Air
Fungal diseases	
Rust of wheat	Air / seeds
Late blight of potato	Rain / wind
Fungal blight of gram	Wind / water

2. Microbes causing food spoilage :

- Microorganisms grow on our food and spoil it. The eating of the spoiled food causes food poisoning.
- Microbes growing in food i.e. **Clostridium botulinum** can produce toxin that can cause food poisoning.
- Problem is more common in summer as microbial activity is usually more in warm temperature. Food poisoning is also known as **botulism**.
- The common symptom includes nausea, vomiting, abdominal cramping, diarrhoea and death in extreme case.

SOME IMPORTANT HUMAN DISEASE

1. Protozoan

(i) Malaria (Mal=Bad, Aria=Air)

- **Causative agent - Plasmodium** (Protozoa), infective stage is **sporozoites**.
- **Spread by** - Female Anopheles Mosquito.
- **Symptom** - Fever with chill (Cause by Lysis of RBC by Haemozoin).
- **Treatment by** - Quinine (obtain from bark of Cinchona tree).
- **Prevention** - Avoid contact between human and Mosquito (Net, Repellant) or by destroying breeding place of Mosquito (by Kerosene, Gambusia fish).

2. Bacteria

(i) Typhoid

- **Causative agent** - *Salmonella typhi*

- **Spread by** - Contaminated food and water, Flying insects feeding on faeces may occasionally transfer the bacteria through poor hygiene habits and public sanitation conditions.
- **Symptom** - Fever which rises in afternoon.
- **Prevention - Sanitation and hygiene**
- Typhoid can only spread in environments where human faeces or urine are able to come into contact with food or drinking water. **Careful food preparation and washing of hands** are crucial to preventing typhoid.

(ii) Tuberculosis

- **Causative agent** - *Mycobacterium tuberculosis*
- **Spread by** - When people suffering from active pulmonary TB, cough, sneeze, speak, or spit, they expel infectious aerosol droplets. A single sneeze can release up to 40,000 droplets. Each one of these droplets may transmit the disease.
- **Symptom** - Symptoms include chest pain, sputum with blood, and a productive, prolonged cough for more than three weeks.
- **Treatment** - Antibiotics to kill the bacteria. TB requires much longer periods of treatment (around 6 to 24 months) to entirely eliminate mycobacteria from the body.
- The **DOTS (Directly Observed Treatment Short-course)** is latest strategy to combat T.B
- **Prevention** Isolation of patient

(iii) Tetanus (Lock Jaw Disease)

- **Causative agent** - *Clostridium tetani*
- **Spread by:** Tetanus occurs when a wound becomes contaminated with bacterial spores. Infection follows when spores become activated and develop into gram-positive bacteria that multiply and produce a very powerful toxin (poison) that affects the muscles.
- **Symptom:** Tetanus results in severe, uncontrollable muscle spasms. The jaw is "locked" by muscle spasms, causing the disease to sometimes be called "lockjaw." In severe cases, the muscles used to breathe can spasm, causing a lack of oxygen to the brain and other organs that may possibly lead to death.
- **Treatment:** The wound must be cleaned. Dead and infected tissue should be removed. Passive immunization with ATS (Anti Tetanus Serum).

Prevention: Tetanus can be prevented by vaccination with DPT

(iv) Leprosy (Hansen's disease)

- **Causative agent:** bacteria ***Mycobacterium leprae***.
 - **Spread by:** Direct contact
 - **Symptom:** Skin lesions are the primary external sign. Left untreated, leprosy can be progressive, causing permanent damage to the skin, nerves, limbs and eyes. Note that leprosy does not cause body parts to fall off but they can become numb and/or diseased as a result of the disease.
- Complete treatment of Leprosy is possible using drugs like **Rifamicin**.



3. Viral Diseases

(i) Rabies (Hydrophobia)



Causative agent: rabies virus, present in the saliva of an infected animal

Spread by: Bite of rabid animal(dog,cat,horse etc).

- **Symptom:** light or partial paralysis, anxiety, abnormal behavior, terror and hallucinations.
- The production of large quantities of saliva and tears coupled with an inability to speak or swallow are typical during the later stages of the disease; this can result in **hydrophobia**, in which the patient has difficulty swallowing because the throat and jaw become slowly paralyzed, shows panic when presented with liquids to drink, and cannot quench his or her thirst.
- **Prevention:** Vaccine given after exposure to the virus. This unusual technique is successful because the rabies virus takes a comparatively long time to induce disease, a minimum of 10 days, and in rare cases, up to a year.
- The length of the incubation period apparently depends on both the location of the wound - the farther from the brain, the longer the incubation
- First and most valuable preventive measure is thorough cleaning of the site with soap and water, and immediate medical attention.

(ii) Polio (infantile paralysis)

- **Causative agent:** Polio virus
- **Spread by:** spread from person to person, primarily via the faecal-oral route
- **Symptom** moderate fever, stiff neck and back, fatigue and muscle pain, muscle weakness and spasms
- **Treatment by** There is no cure for polio. Supportive measures include antibiotics to prevent infections in weakened muscles, analgesics for pain, moderate exercise and a nutritious diet.
- **Prevention:** There are two type of vaccine - Sabin (weak Virus given orally) and Salk (Killed virus which is injected).



Figure: Polio Patient

Remember



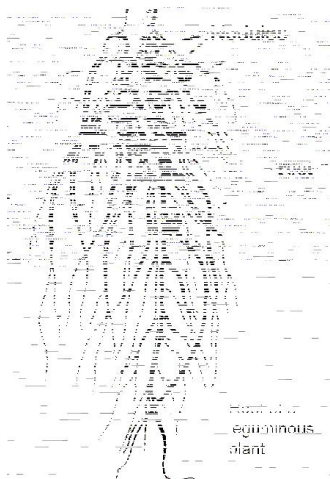
Salk is better vaccine for polio as Sabin contains weak virus which may revert.

FOOD PRESERVATION

- The process of storing of food by keeping it secure from the microbial action is called *preservation*.
 - The acids, sugars, salts, heat, cold treatment which helps in keeping the food stuffs free from spoilage for long duration are called the *preservative*. Commonly used preservatives are sodium benzoate and sodium metabisulphite.
 - **Methods for food preservation**
The process of treating and handling food with an aim to stop or slow down its spoilage while maintaining its nutritional value, texture and flavour.
1. **Heating :**
 - Heating food at high temperature kills microbes. For example, milk and water are boiled to kill microbes.
 - The milk stored in packets does not get spoiled as it has been pasteurised. The milk is made sterile by heating it at 70°C for about 15 to 30 seconds. Then the boiled milk is suddenly chilled and stored inside the packets. This process is known as **pasteurization**.
 - This method kills most of the bacteria without affecting the flavour.
 2. **Cold Treatment :**
 - Storing of food in refrigerator slows the bacterial action because of low temperature. All food and drinks like meat, fruits and vegetables and beverages are preserved by this method. However, once the food is taken out of freezer and warmed, microbes starts growing again.
 3. **Chemical preservatives :**
 - Certain chemical preservatives like sodium benzoate and sodium metabisulphite helps to control the microbial growth. These are used to preserve jams, squashes and ketch ups.
 4. **Presevation by common Salt :**
 - It checks the growth of bacteria by forcing microorganisms to lose water by process called **osmosis**. It is used to preserve meat, fish, pickles, chips etc.
 5. **Preservation by Sugar :**
 - It inhibits the growth of bacteria and therefore is used as preservative in jams, jellies and squashes. Sugar also makes microbes lose water by osmosis.
 6. **Preservation by Oil and Vinegar :**
 - Vinegar provides acidic medium to pickles and inhibits the growth of bacteria.
 - Use of oil and vinegar prevents spoilage of pickle because bacteria cannot live in this environment.
 7. **Drying :**
 - Drying is the oldest method of food preservation. It removes all the moisture from the food. As a result, there will be no bacterial growth. Cereals, pulses, spices and dry fruits are stored by drying method.
 8. **Canning :**
 - Canning store the food for a long time. It is a process where by you boil the food to kill the bacteria and then store it in a can with a seal.
 - Many canned food items are available in market.
 - However note that after breaking the seal of the can, any number of bacteria can enter and spoil the food. So it is advised to refrigerate the food contents as soon as the can is opened.

NITROGEN FIXATION

- The nitrogen cycle refers to the series of processes by which the element nitrogen (which makes up about 78% of the Earth's atmosphere) cycles between the atmosphere and the biosphere.
- The fixation of nitrogen refers to the process in which the gaseous form dinitrogen or N_2 is converted into forms usable by living organisms i.e. nitrate or ammonia. N_2 fixation occurs by:
 - Atmospheric processes** such as lightning
 - Symbiotic bacteria** Rhizobium is symbiont in root nodules of plants like legumes They fix N_2 for legumes.



- The plants then use the fixed nitrogen to produce vital cellular products such as proteins.
- The plants are then eaten by animals, which also need nitrogen to make amino acids and proteins. Decomposers acting on plant and animal materials and waste return nitrogen back to the soil. Nitrogen is returned back to the atmosphere by denitrifying bacteria (eg *Pseudomonas*), which convert nitrates to dinitrogen gas.

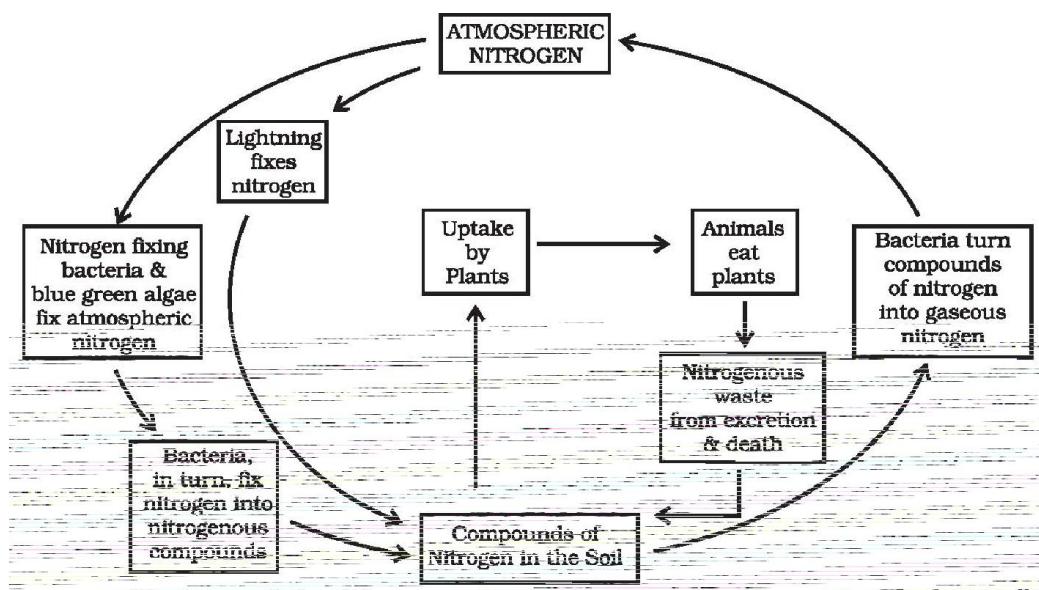
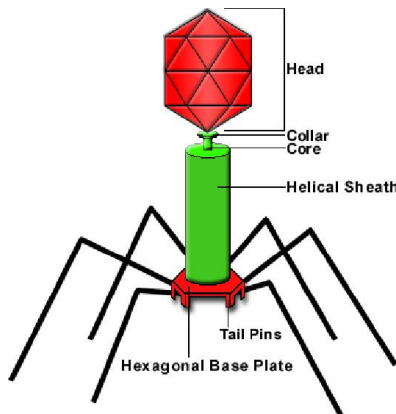


Figure: Nitrogen Cycle

TRY YOUR SELF

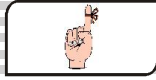
- Q.1 Microbes are:
(A) Friend (B) Foe (C) Both A and B (D) Visible by eyes
- Q.2 Disease causing microbes are called
(A) Insects (B) Protozoans (C) Vectors (D) Pathogens
- Q.3 Who discovered penicillin?
(A) Robert Hooke (B) D. Robert (C) Alexander Flemming (D) Edward Jenner
- Q.4 Bacteria used for the preparation of curd from milk is
(A) Mycobacterium (B) Salmonella (C) Lactobacillus (D) Any of the above
- Q.5 Vinegar contains
(A) Malic acid (B) Acetic acid (C) Citric acid (D) Sulphuric acid
- Q.6 Yeast is used for production of
(A) Sugar (B) Alcohol (C) HCl (D) Oxygen
- Q.7 Dough is formed due to
(A) Evolution of CO₂ by yeast (B) Absorption of CO₂ by yeast
(C) Both of these (D) None of these
- Q.8 Microbes were first recognised by :
(A) Robert Hook (B) Leeuwenhoek (C) Alexender (D) Robert brown
- Q.9 Plants take nitrogenous compounds from
(A) Air (B) Nitrogen fixing bacteria
(C) Soil (D) Roots of the water
- Q.10 Which of the following provide defence in our body?
(A) Antigens (B) Antibiotics (C) Antibodies (D) All of the above
- Q.11 Mushroom is the type of :
(A) Algae (B) Protista (C) Fungi (D) Bacteria
- Q.12 The vaccine for small pox was discovered by
(A) Louis pasteur (B) Edward Jenner (C) Alexander flemming (D) None of these
- Q.13 Which of the following is not a bacterial disease
(A) Typhoid (B) Measles (C) T.B. (D) Whooping Cough
- Q.14 Malaria is caused due to
(A) Contaminated air (B) Contaminated air and water
(C) Contaminated water (D) None

- Q.15 Which of the following is pathogen of malaria?
 (A) Plasmodium (B) Anopheles mosquito
 (C) Aedes (D) Trypanosoma
- Q.16 The bacterial disease dangerous to both animal and humans.
 (A) Dengue (B) Chickenpox (C) Anthrax (D) Aids
- Q.17 Malaria can be prevented by
 (A) Spraying of insecticides (B) Using mosquito net
 (C) Destroying breeding places (D) All of the above
- Q.18 The given figure is



- (A) Type of Virus (B) Bacteriophage (C) Both (A) and (B) (D) Bacteria
- Q.19 Hydrophobia is caused by
 (A) Plasmodium (B) Rhizobium (C) Virus (D) Trypanosoma
- Q.20 The polio drops given to children in pulse polio programme is
 (A) An antibiotic (B) A vaccine (C) A drug (D) An energy supplement
- Q.21 _____ helps in Nitrogen fixation
 (A) Ribosome (B) Rhizopus (C) Rhizobium (D) All
- Q.22 Blue green algae
 (A) Is actually an animal (B) Fixes nitrogen of the atmosphere
 (C) Enriches soil with sodium (D) All of the above
- Q.23 Food poisoning is caused by
 (A) Eating spicy food (B) Eating fast food
 (C) Eating spoiled food (D) None
- Q.24 Used as preservative
 (A) Sodium cyanide (B) Sodium benzoate (C) Both (A) and (B) (D) None of these

- Q.25 Strong heating of a substance at high temperature followed by immediate chilling is
(A) Pasteurization (B) Cryopreservation (C) Sterilization (D) Neutralization
- Q.26 Following pair contains only leguminous plants
(A) Wheat and rice (B) Rice and maize (C) Peas and beans (D) Wheat & maize
- Q.27 Blue green algae is used as biofertilizer because
(A) It can carry photosynthesis (B) It decompose organic matter
(C) It fixes nitrogen (D) It acts as insecticide
- Q.28 Nitrogen is one of essential component of
(A) Proteins (B) Nucleic acids (C) DNA (D) All of these



POINTS TO REMEMBER

- Microorganisms can be divided into five major groups-algae, bacteria, fungi, protozoans and viruses.
- Algae are simple, plant like organisms. All algae have chlorophyll, so they can do photosynthesis. They reproduce sexually and asexually.
- Green algae. e.g.. Chlamydomonas, Volvox and Spirogyra are mostly freshwater algae.
- Diatom are unicellular algae often called plankton. They have a cell wall of silica and their remains form siliceous earth.
- Seaweeds are usually brown algae. Red algae are mostly marine algae. Red and brown algae have additional pigments which mask the green colour of chlorophyll.
- Blue-green algae are more like bacteria, so they are now called cyanobacteria.
- Algin from seaweeds, is used to make ice creams, cosmetics and shaving cream. Agar is obtained from red algae, is used in the laboratory. Diatoms are used to make glass, ceramics, porcelain. toothpaste, polishes and filter.. Some algae are eaten. All algae provide food to other aquatic organisms.
- Bacteria come in four shapes-rod-shaped bacilli, spherical cocci, comma-shaped vibrios and spiral spirilla. They have a cell wall but do not have a nucleus. They reproduce by binary fission and can respire aerobically or anaerobically.
- The action of bacteria and yeast on carbohydrates is called fermentation. Bacteria are used to make alcohol, vinegar, cheese and yoghurt. They are used in the production of tea, coffee and tobacco, and in the leather and jute industries. Some bacteria are used to make antibiotics, some help in digestion, while some convert atmospheric nitrogen into nitrates. Bacteria also decompose waste and recycle nutrients.
- Some bacteria cause diseases, while others spoil food.
- Fungi are plantlike organisms without chlorophyll. Yeast is a unicellular fungus used to make alcohol bread and other fermentative food. It is also used to make B-complex vitamins.
- Moulds are multicellular fungi. They form a tangled mass of threadlike structures. The network is the mycelium, while the threadlike structures bearing sporangia are the hyphae.
- Some moulds are used to produce antibiotics and process cheese. Others spoil food.
- Some fungi cause plant and animal diseases.
- Protozoans are unicellular, animal-like organisms. Euglena can photosynthesis. Amoeba engulfs food with pseudopodia. Paramecium has cilia.
- Zooplankton feed other marine organisms. Protozoans are used for the treatment of sewage. Some live in the body of other organisms and help them.
- Some protozoans cause diseases.
- Viruses are acellular. When they enter a cell, they direct the cell to produce copies of themselves and thus destroy the cell. All viruses cause diseases and are parasites.
- Most ways of preserving food involve steps to create conditions that are unfavourable for the growth of microorganisms. Drying, freezing, heating, pasteurisation, canning, vacuum-packing and adding preservatives are some ways of preserving food.

CONCEPT APPLICATION LEVEL - I [NCERT Questions]

Q.1 What do you know about protozoa ?

Ans. Protozoa are single celled living cells. Amoeba, Paramecium, Euglena, Plasmodium are examples of protozoa. They are oval spherical and elongated in shape. They cause diseases like malaria and dengue. They decompose organic matters to convert them in useful soil nutrients.

Q.2 What do you understand by microorganism ? Describe their useful and harmful effects.

Ans. Microorganisms are very small organisms that are visible only under microscope. These are generally useful in many ways.

(i) In soil, these help in the fixation of atmospheric nitrogen.

(ii) They help us to prepare wine, pickles, vinegar, cheese, curd, aroma in tobacco and some antibiotics.

(iii) They help in the treatment of sewage materials.

Harmful effects :

They cause sickness, cold malaria, skin infections, influenza etc.

Q.3 Describe the main characteristics of viruses in brief.

Ans. Viruses are very small organisms and can be seen under an electron microscope. Ordinarily, their presence is felt by the effect they have on their hosts. They have no independent existence. It is a non-living particle when remains outside a living cell. They replicate only inside the living cells. They have no cellular structure. A virus has a small amount of a genetic material enclosed by a protective protein coat. They are parasitic in nature.

Q.4 How do you compare the number of microbes present in ponds and lakes with those present in water obtained from deep wells or hand pumps ?

Ans. Water of ponds and lakes are densely populated by microorganisms compare to water from hand pumps or deep wells.

Q.5 How do yeast make bread light and spongy ?

Ans. Due to the presence of sugar and warmth, the yeasts reproduce and releases CO₂. The bubbles of CO₂ rise in the bread loaf making the bread light and spongy.

Q.6 What is fermentation ?

Ans. Fermentation is a slow biochemical process in which sugar molecules in water are broken down due to some yeast in the absence of air. Thus, when sugar solution in water is kept with some yeast in a tumbler for a few days, alcohol is formed.

Q.7 What are antibiotics ? Who discovered Penicillin ?

Ans. Antibiotics are the substances that are produced by the microorganisms and are used to inhibit or control other microorganisms, e.g., penicillin. Penicillin was discovered by Alexander Fleming.

Q.8 How is milk converted into curd by bacterial activity ?

Ans. The curd has a mixture of microorganisms mainly bacteria like – Lactobacillus and Staphylococcus alongwith another microorganisms like Yeast. When we add a small amount of curd to the milk of warmth 37°C, the Lactobacillus start growing. This is an anaerobic bacteria, which reacts with non-fat components to give acidic products. Thus, the milk begins to thicken and curdle. Excess growth of these bacterial make the milk or curd sour.

Q.9 How is algae useful to us?

- Ans.**
1. Algae is useful source of oxygen on earth and it also provides good food for many aquatic animals.
 2. Algae and their products are used in commercial use like medicines, food and cosmetics.
 3. They are also used for paper manufacturing, fabric printing etc.
 4. The algae are also used to get various chemicals like iodine, potassium, silica etc.
 5. They are also used in making filters, glasses and porcelain.
 6. Some algae are also taken in as a human food or food products.

Q.10 How are protozoa useful to us?

- Ans.**
- (i) They feed on fungi and bacteria and help in decomposing organic matter.
 - (ii) They are important links in aquatic food chains.
 - (iii) They are used as research materials to study biological functions.
 - (iv) They sometimes provide habitat to other living organisms. Thus, they are symbiotic in existence.

Q.11 Name the commonly used vaccines with corresponding disease(s) in our country.

Ans.	Vaccine	Disease
	DPT	diphtheria, Pertussis (whooping cough), tetanus
	BCG	TB
	Polio	polio
	Typhoid	typhoid
	MMR	smallpox, rabies, measles

Q.12 State some beneficial effects of bacteria.**Ans. Beneficial effects of bacteria**

- (i) They convert fruit juices into vinegar and wine.
- (ii) Some bacteria convert atmospheric nitrogen into nitrates, i.e., help in fixation of nitrogen.
- (iii) They help in the digestion of food in our body.
- (iv) They decompose organic matter to give nutrients to plants.
- (v) They give us various milk products like curd and cheese.

Q.13 What are communicable diseases? Name a few.

Ans. The microbial diseases that are passed on from infected person to the healthy person through air, water, food or physical contact are known as communicable diseases, e.g., (i) cholera, (ii) flu, (iii) leprosy, etc.

Q.14 How does a housefly transmit diseases?

Ans. When the housefly sits on excreta or garbage it takes the microbes from there because these stick to his legs. When the same fly sits on our food, these pathogenic microbes are left on it. This way the diseases are transmitted by microorganisms.

Q.15 How are protozoa harmful to us?

Ans. Some protozoa cause diseases to us like fever, dysentery etc.
Entamoeba causes Amoebic dysentery.
Trypanosoma causes sleeping sickness.

Q.16 What are the ways through which microorganisms enter our body?

Ans. Microorganisms enter our body:

- (i) through air during breathing.
- (ii) through contaminated water.
- (iii) by contact with infected person.
- (iv) through our food or other edible things.

Q.17 Why do we use cold temperature like refrigerator or freeze to protect food products from decay?

Ans. We use cold temperature like refrigerator or freeze to protect our food products from decay because the growth of microorganisms declines at low temperature.

Q.18 Explain why pasteurized milk can be consumed without boiling.

Ans. Pasteurized milk can be consumed without boiling as it is free from microbes. The milk is heated to 70° C for 15 seconds and then suddenly chilled and stored. By doing so, it prevents the growth of microbes. This process was discovered by Louis Pasteur. It is called **pasteurization**.

Q.19 How can the spoilage in food be detected?

Ans. Following indicates spoilage in food:

- (A) **Odour:** Food gets spoiled due to bacteria, that gives our food odour or repulsive smell. It happens only when bacteria breaks the protein present in food items.
- (B) **Souring:** Certain bacteria act to produce acids which makes the food sour in taste. It happens in case of milk and gravies of vegetables if not preserved properly.
- (C) **Gas formation:** Sometimes gases like carbon dioxide are produced due to bacteria. It makes the food swell or spongy.

Q.20 Explain various methods that can be used for food preservation.

Ans. Important methods used for preserving food are :

Chemical Method : Salts and edible oils are the common chemicals generally used to check the growth of microorganisms. Therefore, they are called **preservatives**. We add salt or acids as preservatives to pickles to prevent the attack of microbes. Sodium benzoate and sodium metabisulphite are common preservatives. These are also used in the jams and squashes to check their spoilage.

Preservation by Salt : Common salt has been used to preserve meat and fish for ages. Meat and fish are covered with dry salt to check the growth of bacteria. Salting is also used to preserve amla, raw mangoes, tamarind, etc.

Preservation by Sugar : Jams, jellies and squashes are preserved by sugar. Sugar reduces the moisture content and inhibits the growth of food spoiling bacteria (microbes).

Preservation by Oil and Vinegar : Use of oil and vinegar prevents spoilage of pickles because bacteria cannot live in such an environment. Vegetables, fruits, fish and meat are often preserved by this method.

Q.21 What is nitrogen fixation?

Ans. The process of conversion of atmospheric nitrogen into its usable forms is called nitrogen fixation.

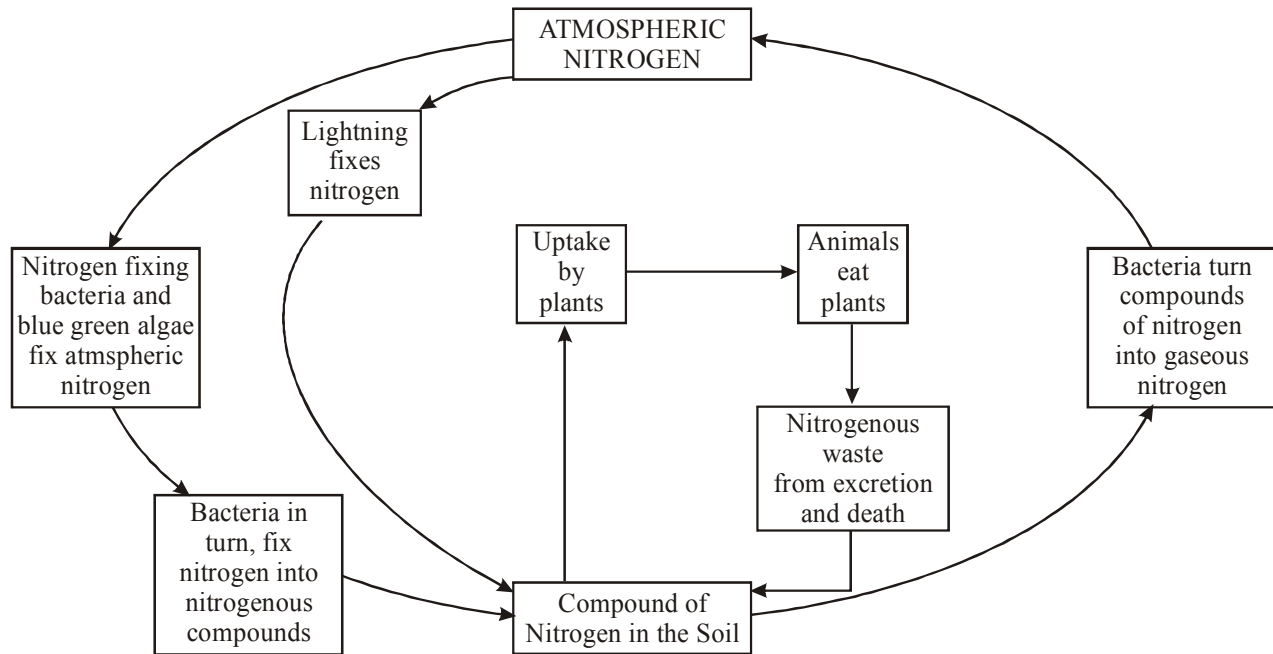
Q.22 Write one other way, how nitrogen is fixed.

Ans. Sometimes nitrogen gets fixed through the action of lightning.

Q.23 Describe nitrogen cycle in nature.

Ans. 78% of the total gases in the atmosphere is nitrogen but it cannot be used by plants and animals directly. The nitrogen-fixing bacteria and algae present in the soil fix nitrogen from the atmosphere and convert into nitrate forms. Once nitrogen is converted into these usable forms, it can be utilised by plants through their root system. This is the process of ‘fixing’ of nitrogen. Animals feeding on plants get proteins and other nitrogenous compounds.

When plants and animals die, bacteria and fungi present in the soil convert various nitrogenous compound into nitrates and nitrites. Certain specialized bacteria convert nitrates and nitrites into nitrogen gas. As a result, the percentage of nitrogen in the atmosphere remains more or less content.



Nitrogen Cycle

CONCEPT APPLICATION LEVEL - II

SECTION-A

• **FILL IN THE BLANKS :**

- Q.1 Microorganisms can be seen with the help of a _____.
- Q.2 Blue green algae fix _____ directly from air to enhance fertility of soil.
- Q.3 Alcohol is produced with the help of _____.
- Q.4 Cholera is caused by _____.
- Q.5 _____ spreads by the bite of female, *Anopheles* mosquito.
- Q.6 _____ accidentally discovered penicillin.
- Q.7 Bacteria such as _____ can fix atmospheric nitrogen and convert it into usable nitrogenous compounds.
- Q.8 Common cold is a/an _____ borne disease.
- Q.9 Raw mangoes and tamarind can be preserved by _____.

SECTION-B

• **MULTIPLE CHOICE QUESTIONS**

- Q.1 Which microbes is used to make curd from milk?
 (A) Bacteria (B) Virus (C) Fungi (D) Protozoan
- Q.2 The gas released during fermentation of sugar by yeast cells is –
 (A) Carbon dioxide (B) Carbon monoxide (C) Hydrogen (D) Oxygen
- Q.3 Which disease is caused by virus?
 (A) Tuberculosis (B) Common cold (C) Typhoid (D) Malaria
- Q.4 Bacteria can be seen only –
 (A) In light (B) In darkness
 (C) Under a microscope (D) Under a magnifying glass
- Q.5 Which of the following is a nitrifying bacteria?
 (A) *Nitrosomonas* and *Nitrobacter* (B) *Nitrosomonas* and *Pseudomonas*
 (C) *Nitrobacter* and *Pseudomonas* (D) *Nitrobacter* and *Lactobacillus*
- Q.6 Which microorganisms is smaller than bacteria?
 (A) Protozoan (B) Virus (C) Fungi (D) Algae
- Q.7 Microbes are an important part of the environment because they -
 (A) Break down waste products (B) Cause the water cycle
 (C) Protect the ozone layer (D) Block global warming
- Q.8 Infectious diseases can spread
 (A) From one person to another (B) By eating only frost fruit
 (C) From washing your hands (D) By Inheritance
- Q.9 What does you stomach use to kill microbes?
 (A) Acid (B) Water (C) Salt (D) Alkali

- Q.10 Which of the following correctly describes the size of fungi compared to the size of bacteria?
(A) Fungi are larger (B) Bacteria are larger
(C) They are about the same size (D) They are the same size but different shapes
- Q.11 Most bacteria can be killed by
(A) Cooking (B) Refrigeration (C) Freezing (D) Salting
- Q.12 When a person is made immune to a disease by an injection they have usually been
(A) Vaccinated (B) Infected (C) Infectious (D) Communicable
- Q.13 Penicillium is a
(A) Algae (B) Fungus (C) Bacteria (D) Yeast
- Q.14 Malaria is caused by
(A) Protozoa (B) Virus (C) Algae (D) Bacteria
- Q.15 Mushrooms belong to
(A) Algae (B) Virus (C) Fungi (D) None of these
- Q.16 Rhizobium bacteria
(A) help in digestion (B) help in nitrogen fixation
(C) cause various diseases (D) All of above
- Q.17 Coci are _____ shaped bacteria.
(A) Rod-shaped (B) Round-shaped (C) Spiral (D) Comma
- Q.18 Spirogyra is
(A) An algae (B) A fungi (C) A protozoa (D) A bacteria
- Q.19 Amount of nitrogen in atmosphere is
(A) 58% (B) 68% (C) 78% (D) 88%
- Q.20 Vaccine for small pox is discovered by
(A) Louis Pasteur (B) Alexander Fleming (C) Edward Jenner (D) John Mendal

SECTION-C

• **VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)**

Q.1 Give two examples of microorganisms.

Ans. Bacteria and Fungi.

Q.2 Name two habitats of microorganisms.

Ans. (i) Soil (ii) Water

Q.3 Write the names of some diseases caused by virus.

Ans. Influenza (Flu), Polio and Chicken Pox are some diseases caused by viruses.

Q.4 Mention some diseases caused by bacteria.

Ans. Typhoid and Tuberculosis (TB) are the bacterial diseases.

Q.5 Mention two groups of Microorganisms which live in colonies.

Ans. (i) Bacteria (ii) Fungi

Q.6 What are antibiotics?

Ans. The medicines which kill or stop the growth of the disease-causing microorganisms are called antibiotics.

Q.7 Who discovered the antibiotics?

Ans. Alexander Fleming in 1929.

Q.8 Name a popular vaccination programme.

Ans. Pulse Polio Programme.

Q.9 Name two communicable diseases.

Ans. Cholera and Chicken pox.

Q.10 Which is the carrier of dengue virus?

Ans. Female Aedes mosquito.

Q.11 Name a disease which is common in human and other animals.

Ans. Anthrax.

Q.12 Write the name of viral disease in cattles.

Ans. Foot and Mouth disease.

Q.13 Which microorganisms are called nitrogen fixing bacteria?

Ans. Rhizobium bacteria.

Q.14 Where do Rhizobium bacteria commonly live?

Ans. Rhizobium bacteria live in the root nodules of leguminous plants.

• **SHORT ANSWER TYPE QUESTIONS (2 MARKS)**

Q.1 What are microorganisms or microbes?

Ans. The organisms which are not seen with our naked eyes are called microorganisms.

Q.2 What are the four major groups of microorganisms?

Ans. (i) Bacteria (ii) Fungi (iii) Protozoa (iv) Algae

Q.3 What are viruses?

Ans. Very tiny microscopic organisms which reproduce only inside the cells of host organisms are called viruses.

Q.4 Name the microorganisms which promote the formation of curd.

Ans. Bacterium lactobacillus promotes the formation of curd.

Q.5 What is fermentation?

Ans. The process of conversion of sugar into alcohol is known as fermentation, in the absence of O₂.

Q.6 What do you mean by the antibodies?

Ans. When a disease carrying microbe enters in the body, the body produces a substance to fight the invader, these are called antibodies.

Q.7 What is vaccine?

Ans. The medicine used to protect the children from several diseases is called vaccine.

Q.8 What are pathogens?

Ans. The disease-causing microorganisms are called pathogens.

Q.9 What do you mean by food preservation?

Ans. Process to prevent food material from spoilage by the action of microbes is called preservation.

Q.10 What are preservatives?

Ans. The chemicals which are use to check the growth of microorganisms are called preservatives.

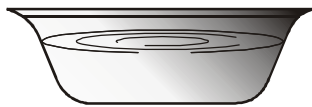
- **SHORT ANSWER TYPE QUESTIONS (3 MARKS EACH)**

Q.1 Explain the formation of curd from the milk.

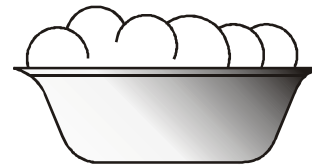
Ans. Curd contains several microorganisms. Of these, the *Lactobacillus bacterium* causes the formation of curd. It multiplies in milk and converts it into the curd. Curd is an important ingredient of rava idlis and bhaturas.

Q.2 What is the role of yeast in baking industry?

Ans. Yeast plays an important role in the baking industry. Yeast reproduces rapidly and produces carbon dioxide during respiration. Bubbles of the gas fill the dough and increase its volume. This is the basis of use of yeast in the baking industry for making breads, pastries and cakes.



Wheat flour (maida) with yeast powder



Dough formation of wheat flour

Q.3 How do microorganisms spoil food?

Ans. Microorganisms grow on the food materials and multiply rapidly. They release toxins in the food and make them unfit to consume. They break down the food molecules into amines and change the taste, texture and appearance of food.

Q.4 What are communicable diseases? Explain with examples.

Ans. The microbial diseases that can spread from an infected person to a healthy person through air, water, food or physical contact are called communicable diseases. Examples of such diseases include cholera, common cold, chicken pox and tuberculosis.

Q.5 What is pasteurization of milk?

Ans. Pasteurised milk can be consumed without boiling as it is free from harmful microbes. The milk is heated to about 70°C for 15 to 30 seconds and then suddenly chilled and stored. By doing so the milk is prevented by the growth of microbes.

This process was discovered by Louis Pasteur so it is called Pasteurization.

• LONG ANSWER TYPE QUESTIONS (5 MARKS)**Q.1 Explain the uses of Bacteria, Fungi and Algae.**

Ans. (A) Uses of Bacteria:

- (i) They are used to increase soil fertility by fixing nitrogen.
- (ii) Some bacteria are used to produce antibiotics.
- (iii) *Lactobacillus* bacteria converts milk into curd. It also helps in digestion of food.
- (iv) Some bacteria help in many functions of our body.

(B) Uses of Fungi:

- (i) Yeast is used to prepare alcohol and vinegar by fermentation.
- (ii) Yeast is used to produce breads, cheese, beer, wine etc.
- (iii) Mushrooms are eaten as food.
- (iv) Yeast is used to produce vitamin B.
- (v) Penicillin is an antibiotic formed by a fungus called *Penicillium*.

(C) Uses of Algae:

- (i) Algae are used to make jellies.
- (ii) They are used in soups, ice-creams, jellies and jams as thickening agent.
- (iii) *Chlorella* is used to obtain proteins.
- (iv) Silica from Diatoms are used in toothpastes.

Q.2 Explain some indications which help to detect the spoilage in food.

Ans. Indications to detect spoilage in food:

- (i) **Odour:** The unpleasant and foul smell indicates that food is spoiled.
- (ii) **Discolouration:** The presence of the microorganisms in the food results in discolouration of food black. Some fungus and moulds cause change in original colour.
- (iii) **Taste:** Sometimes the cooked food becomes sour. It is due to the production of acids by the action of certain bacteria.
- (iv) **Sliminess:** Sometimes the food becomes slimy. It is also due to action of certain bacteria, thread like sliminess also caused due to moulds.
- (v) **Gas formation:** Due to action of bacteria gases like carbon dioxide are produced. They also spoil the food by making it swell or become spongy.

CONCEPT APPLICATION LEVEL - III

SECTION-A

• **MULTIPLE CHOICE QUESTIONS (WITH ONE CORRECT ANSWER):**

- Q.1 Alcohol is produced with the help of –
(A) sodium chloride (B) yeast (C) nitrogen (D) carbon dioxide
- Q.2 The status of algae in the aquatic food chain is –
(A) consumers (B) producers (C) host (D) small in size
- Q.3 The rod shaped bacteria are called –
(A) Bacillus (B) Coccus (C) Vibrio (D) Spirillum
- Q.4 Bacteria present in root nodules of pea –
(A) Coli (B) Plasmodium (C) Rhizobium (D) Penicillin
- Q.5 The disease caused by protozoa is –
(A) tuberculosis (B) polio (C) typhoid (D) malaria
- Q.6 Which cannot fix atmospheric nitrogen in the soil?
(A) Rhizobium (B) Clostridium (C) Azotobacter (D) Penicillin
- Q.7 The disease which is not caused by virus is –
(A) measles (B) chicken pox (C) polio (D) Tetanus
- Q.8 Which bacteria helps in setting of curd?
(A) Rhizobium (B) Lactobacillus (C) Vibrio cholerae (D) Bacillus
- Q.9 Which microorganism causes AIDS?
(A) A protozoa (B) A bacteria (C) A virus (D) An algae
- Q.10 Which of the following is not used as food preservatives?
(A) Salt (B) Sugar (C) Vinegar (D) Methane
- Q.11 The process by which amount of nitrogen remains the same in the atmosphere is known as –
(A) fermentation (B) carbon cycle (C) nitrogen cycle (D) photosynthesis

SECTION-B

• **ASSERTION & REASON :**

Direction: Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (A) If both **Assertion** and **Reason** are correct and Reason is the **correct explanation** of Assertion.
(B) If both **Assertion** and **Reason** are correct and Reason is **not the correct explanation** of Assertion.
(C) If **Assertion** is **correct** but Reason is **incorrect**.
(D) If **Assertion** is **incorrect** but Reason is **correct**.

- Q.1 **Assertion :** Viruses can be seen with the help of electron microscope.
Reason : It is much smaller than bacteria.
- Q.2 **Assertion :** *Rhizobium* lives in the root nodules of leguminous plants.
Reason : It fixes nitrogen through a symbiotic relationship.
- Q.3 **Assertion :** Salt is added to chips and pickles.
Reason : Salting removes oxygen from the food item.

SECTION - C

- **MATCH THE FOLLOWING (ONE TO ONE)**
Column-I and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. Only One entries of column-I may have the matching with the some entries of column-II and one entry of column-II Only one matching with entries of column-I
- Q.1
- | Column I | Column II |
|-------------------|------------------|
| (A) Bacteriophage | (P) Protozoa |
| (B) Spirogyra | (Q) Virus |
| (C) Aspergillus | (R) Algae |
| (D) Paramecium | (S) Fungi |

SECTION - D

- **COMPREHENSION**
Most of the disease of human beings are caused due to contaminated food and water. These diseases spreads from person to person and are known as communicable diseases.
- Q.1 Name any two communicable diseases?
- Q.2 Give any two preventive measures for communicable diseases?
- Q.3 What are the two main causes of non communicable diseases?

SECTION - E

- **MATCH THE FOLLOWING (ONE TO MANY)**
Column-I and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. One or more than one entries of column-I may have the matching with the some entries of column-II and one entry of column-II may have one or more than one matching with entries of column-I
- Q.1
- | Column I | Column II |
|--------------------------|-----------------------|
| (A) Unicellular organism | (P) Nitrogen fixation |
| (B) Rhizobium | (Q) Protozoan |
| (C) Cyanobacteria | (R) Dysentery |
| (D) Amoeba | (S) Bacteria |

ANSWER KEY

TRY YOURSELF

Q.1	C	Q.2	D	Q.3	C	Q.4	C	Q.5	B	Q.6	B	Q.7	A
Q.8	B	Q.9	B	Q.10	C	Q.11	C	Q.12	B	Q.13	B	Q.14	D
Q.15	A	Q.16	C	Q.17	D	Q.18	C	Q.19	C	Q.20	B	Q.21	C
Q.22	B	Q.23	C	Q.24	B	Q.25	A	Q.26	C	Q.27	C	Q.28	D

CONCEPT APPLICATION LEVEL - II

SECTION-A

Q.1	microscope	Q.2	atmospheric nitrogen	Q.3	yeast
Q.4	bacteria	Q.5	Malaria	Q.6	Alexander Fleming
Q.7	<i>Rhizobium</i>	Q.8	Air	Q.9	Salt

SECTION-B

Q.1	A	Q.2	A	Q.3	B	Q.4	C	Q.5	A	Q.6	B	Q.7	A
Q.8	A	Q.9	A	Q.10	A	Q.11	A	Q.12	A	Q.13	B	Q.14	A
Q.15	C	Q.16	B	Q.17	B	Q.18	A	Q.19	C	Q.20	C		

CONCEPT APPLICATION LEVEL - III

SECTION-A

Q.1	B	Q.2	B	Q.3	A	Q.4	C	Q.5	D	Q.6	D	Q.7	D
Q.8	B	Q.9	C	Q.10	D	Q.11	C						

SECTION-B

Q.1	A	Q.2	A	Q.3	C
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SECTION - C

Q.1	(A)-(Q), (B)-(R), (C)-(S), (D)-(P)
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SECTION - D

Q.1	Tuberculosis, Typhoid
Q.2	(i) Isolation from the patient (ii) Vaccination
Q.3	Malnutrition and Hereditital transmission

SECTION - E

Q.1	(A)-(Q,S), (B)-(P,S), (C)-(P), (D)-(Q,R)
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