Exam: F.Y.BSc Semester – I
Subject: Life Science Paper – I
Date of Exam: 3rd December 2018
Question Paper code: 55223

Q. 1

A) Fill in the blanks: (07)

1. _____ is a molecule or ion having separate positively and negatively charged groups.

Ans. Zwitterions

2. _____ , a solution which resists changes in pH when acid or alkali is added to it.

Ans. Buffer

3. Glucose and Fructose molecules are linked together by _____bonds to form sucrose.

Ans. Glycosidic bond

4. Phenylalanine, tyrosine and tryptophan are _____ amino acids.

Ans. Aromatic

5. Proline reacts with Ninhydrin to give _____ colour.

Ans. Yellow

6. Glucose and Galactose are _____of each other as they differ in only the position of hydroxyl group at C_4.

Ans. Epimers

7. 1, fluoro – 2,4- dinitrobenzene reagent is used in _____ reaction.

Ans. Sanger's

B. Match the Column (07)

a.---v
b.---iv
c.---vi
d.---i
e.---ii
f.---vii
g.---iii

C) Define/Explain the following terms (07)

1. Euchromatin- The condensed chromatin in the nucleus, which is darkly stained.
2, Sarcomere- The functional unit of striated muscle fibre which is from one Z-line to another Z-line.
3. Chitin- The component of fungal cell wall.
4. Karyotheca- Nuclear double membrane is also termed as Karyotheca.
5. Nucleolus- The darkly stained, spherical body within the nucleus.
6. Cilium- The small hair like appendage of cells, which have lashing movement.

Q.2. A) Describe <u>any one</u> of the following: (10)

1. The structural classification of amino acids.

Classification of Amino Acids

Amino Acid can be classified ***based on their structure*** and the structure of their side chains i.e. the R chains. Now two basic subcategories are

1] Non-Polar Amino Acids

These are also known as Hydrophobic. The R group can be either of Alkyl groups (with an alkyl chain) or Aromatic groups. The acids falling in this group are stated below. Numbers one to seven are Alkyl and the last two are aromatic

i. Glycine (H)
ii. Alanine (CH3)
iii. Valine (CH (CH3)2)
iv. Methionine (CH2CH2SCH3)
v. Leucine (CH2CH(CH3)2)
vi. Isoleucine (-CH(CH3)CH2CH3)
vii. Proline (special structure)
viii. Phenylalanine
ix. Tryptophan

2] Polar Amino Acids

If the side chains of amino acid contain different polar groups like amines, alcohols or acids they are polar in nature. These are also known as Hydrophilic Acids. These are further divided into three further categories.

a) Acidic: If the side chain contains an extra element of carboxylic acid component these are acid-polar amino acids. They tend to donate their hydrogen atom. These are:

i. Aspartic Acid (CH2COOH)
ii. Glutamic Acid (CH2CH2COOH)

b) Basic: These have an extra nitrogen group that tend to attract a hydrogen atom. The three basic polar amino acids are

i. Histidine

ii. Lysine (CH2(CH2)2NH2)

iii. Arginine

c) Neutral: These are neither acidic nor basic. They have an equal number of amino and carboxyl groups. Also, they have at least one hydrogen component connected to electronegative atoms. Some of these neutral acids are

i. Serine (CH2OH)

ii. Threonine (CH(OH)CH3)

iii. Asparagine (CH2OHNH2)

iv. Glutamine (CH2CH2CONH2)

v. Cysteine (CH2SH)

vi. Tyrosine

Amino acid can also be classified on the basis of their need to the human body and their ***availability in the human body***

1] Essential Amino Acids

These are the acids that cannot be synthesized in our bodies. We must rely on food sources to obtain these amino acids. They are

- Leucine
- Isoleucine
- Lysine
- Theorine
- Methionine

- Phenylalanine
- Valine
- Tryptophan
- Histidine (conditionally essential)

2] Non-Essential

These acids are synthesized in our bodies itself and we need not rely on outside sources for them. They are either produced in our bodies or obtained from protein breakdowns.

2. Disaccharides. Explain the physical and chemical properties of disaccharides with help of examples.

Disaccharides

Disaccharides are sugars (carbohydrate molecules) that form when two simple sugars i.e. monosaccharides combine to form a disaccharide.

Cyclic monosaccharides react with alcohols to form acetals and ketals. Sometimes this alcohol is actually a carbohydrate since they function very similarly to alcohols. So when this happens individual monosaccharides link together to make an acetal. This linkage is known as *glycosidic linkage.*

This linkage is an oxide linkage formed by the loss of a water molecule. When two monosaccharides are linked together by glycosidic linkage the resulting product is a disaccharide.

1.Sucrose:This is the most important disaccharide. It is popularly known as *table sugar*. Sucrose is found in all photosynthetic plants. It is commercially obtained from sugarcane and sugar beets via an industrial process. Let us take a look at some chemical properties of sucrose

- The molecular formula of sucrose is $\mathbf{C_{12}H_{22}O_{11}}$**.**
- If sucrose goes through acid catalysed hydrolysis it will give one mole of D-Glucose and one mole of D-Fructose.

- The chemical structure of sucrose comprises of α form of glucose and β form of fructose
- The glycosidic linkage is α linkage because the molecule formation is in α orientation
- Sucrose is a non-reducing sugar. As you can see from the structure it is combined (linked) at the hemiacetal oxygen and does not have a free hemiacetal hydroxide
- Since has no free hemiacetal hydroxide it does not show mutarotation (α to β conversion). Sucrose also does not form osazones for the same reason.
- We can prove the structural formula of sucrose by hydrolysing it with α-glycosidase enzymes which only hydrolyses α glucose. This test is positive for sucrose.

2.Maltose is another disaccharide commonly found. It has two monosaccharide glucose molecules bound together, The link is between the first carbon atom of glucose and the fourth carbon of another glucose molecule. This, as you know, is the one-four glycosidic linkage. Let us look at a few of its properties.

On acid catalysed hydrolysis one mole of maltose gives two moles of D-glucose.

- Maltose has a free hemiacetal hydroxide, hence it undergoes mutarotation. It exists as both α-Maltose and also β-Maltose
- For the same reasons it also gives a positive test with Benedicts and Tollens reagent.

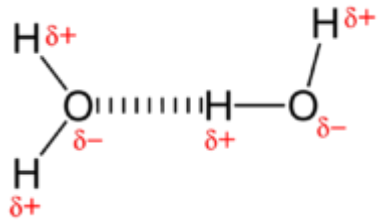
Q. 2. B) Answer <u>any two</u> of the following: (10)

1. Ionic interactions of water.

Ionic interactions involve the attraction of ions or molecules with full permanent charges of opposite signs. For example, sodium fluoride involves the attraction of the positive charge on sodium (Na^+) with the negative charge on fluoride (F^-).[9] These bonds are harder to break than covalent bonds because there is a strong electrostatic interaction between oppositely charged ions. However, this particular interaction is easily broken upon addition to water, or other highly polar solvents. In water ion pairing is mostly entropy driven; a single salt bridge usually amounts to an attraction value of about ΔG =5 kJ/mol at an intermediate ion strenght I, at I close to zero the value increases to about 8 kJ/mol. The ΔG values are usually additive and largely independent of the nature of the participating ions, except for transition metal ions etc.

These interactions can also be seen in molecules with a localized charge on a particular atom. For example, the full negative charge associated with ethoxide, the conjugate base of ethanol, is most commonly accompanied by the positive charge of an alkali metal salt such as the sodium cation (Na^+).

Hydrogen bonding



A hydrogen bond (H-bond), is a specific type of interaction that involves dipole-dipole attraction between a partially positive hydrogen atom and a highly electronegative, partially negative oxygen, nitrogen, sulfur, or fluorine atom (not covalently bound to said hydrogen atom). It is not a covalent bond, but instead is classified as a strong non-covalent interaction. It is responsible for why water is a liquid at room temperature and not a gas (given water's low molecular weight). Most commonly, the strength of hydrogen bonds lies between 0 - 4 kcal/mol, but can sometimes be as strong as 40 kcal/mo.l In solvents such as chloroform or carbontetrachloride one observes e.g. for the interaction between amides additive values of about 5 kJ/mol. According to L. Pauling the strength of a hydrogen bond is essentially determined by the electrostatic charges. Measurements of thousands complexes in chloroform or carbontetrachloride have led to additive free energy increments for all kind of donor-acceptor combinations.

2. List of buffers present in the human body.

A buffer is a chemical substance that helps maintain a relatively constant pH in a solution, even in the face of addition of acids or bases. Buffering is important in living systems as a means of maintaining a fairly constant internal environment, also known as homeostasis. Small molecules such as bicarbonate and phosphate provide buffering capacity as do other substances, such as hemoglobin and other proteins.

Bicarbonate Buffer

The maintenance of blood pH is regulated via the bicarbonate buffer. This system consists of carbonic acid and bicarbonate ions. When the blood pH drops into the acidic range, this buffer acts to form carbon dioxide gas. The lungs expel this gas out of the body during the process of respiration. During alkaline conditions, this buffer brings pH back to neutral by causing excretion of the bicarbonate ions through the urine.

Phosphate Buffer

The phosphate buffer system acts in a manner similar to the bicarbonate buffer, but has much stronger action. The internal environment of all cells contains this buffer comprising hydrogen phosphate ions and dihydrogen phosphate ions. Under conditions when excess hydrogen enters the cell, it reacts with the hydrogen phosphate ions, which accepts them. Under alkaline conditions, the dihydrogen phosphate ions accept the excess hydroxide ions that enter the cell.

Protein Buffer

Proteins consist of amino acids held together by peptide bonds. The amino acids possess an amino group and a carboxylic acid group. At physiological pH, the carboxylic acid exists as the carboxylate ion (COO^-) with a negative charge and the amino group exists as the NH^{3+} ion. When the pH becomes acidic, the carboxyl group takes up excess hydrogen ions to return back to

the carboxylic acid form. If the blood pH becomes alkaline, there is a release of a proton from the NH^{3+} ion, which takes the NH_2 form.

Hemoglobin Buffer

The respiratory pigment present in blood, hemoglobin, also has buffering action within tissues. It has an ability to bind with either protons or oxygen at a given point of time. Binding of one releases the other. In hemoglobin, the binding of protons occurs in the globin portion whereas oxygen binding occurs at the iron of the heme portion. At the time of exercise, protons are generated in excess. Hemoglobin helps in the buffering action by binding these protons, and simultaneously releasing molecular oxygen.

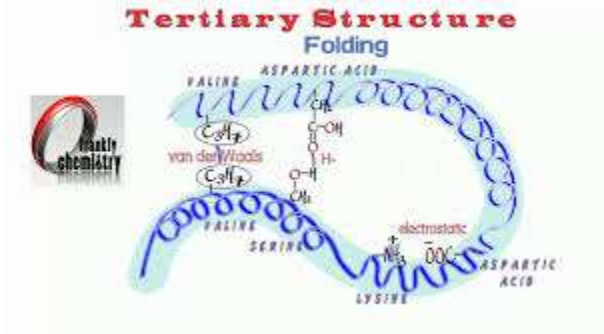
3. The forces that contribute to the tertiary structure of a protein.

Tertiary Structure

The overall three-dimensional shape of an entire protein molecule is the *tertiary structure*. The protein molecule will bend and twist in such a way as to achieve maximum stability or lowest energy state. Although the three-dimensional shape of a protein may seem irregular and random, it is fashioned by many stabilizing forces due to bonding interactions between the side-chain groups of the amino acids.

Under physiologic conditions, the hydrophobic side-chains of neutral, non-polar amino acids such as phenylalanine or isoleucine tend to be buried on the interior of the protein molecule thereby shielding them from the aqueous medium. The alkyl groups of alanine, valine, leucine and isoleucine often form hydrophobic interactions between one-another, while aromatic groups such as those of phenylalanine and tryosine often stack together. Acidic or basic amino acid side-chains will generally be exposed on the surface of the protein as they are hydrophilic.

The formation of disulfide bridges by oxidation of the sulfhydryl groups on cysteine is an important aspect of the stabilization of protein tertiary structure, allowing different parts of the protein chain to be held together covalently. Additionally, hydrogen bonds may form between different side-chain groups. As with *disulfide bridges*, these hydrogen bonds can bring together two parts of a chain that are some distance away in terms of sequence. *Salt bridges*, ionic interactions between positively and negatively charged sites on amino acid side chains, also help to stabilize the tertiary structure of a protein.



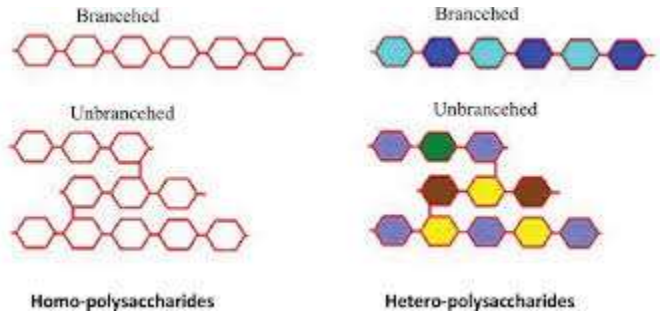
4. Differentiating points between homo and hetero polysaccharides.

HOMOPOLYSACCHARIDES

VERSUS

HETEROPOLYSACCHARIDES

HOMOPOLYSACCHARIDES	HETEROPOLYSACCHARIDES
Homopolysaccharides are chemical compounds that are composed of a single type of monomer	Heteropolysaccharides are polysaccharides made out of two or more different monosaccharides
Composed of the same repeating unit	Composed of different repeating units
Single type of monosaccharide is involved in the formation	Different types of monosaccharides are involved in the formation
Have simple structures when compared to heteropolysaccharides	Have complex structures



Q. 3 A. Describe any one of the following: (10)

1. Two Methods of Isolation of Microorganism

Isolation of Microorganisms:

Microorganisms occur in natural environment like soil. They are mixed with several other forms of life. Many microbes are pathogenic. They cause a number of diseases with a variety of symptoms, depending on how they interact with the patient. The isolation and growth of suspected microbe in pure culture is essential for the identification and control the infectious agent.

The primary culture from natural source will normally be a mixed culture containing microbes of different kinds. But in laboratory, the various species may be isolated from one another. A culture which contains just one species of microorganism is called a pure culture. The process of obtaining a pure culture by separating one species of microbe from a mixture of other species, is known as isolation of the organisms.

Methods of Isolation:

There are special techniques employed to obtain pure cultures of microorganisms. In few cases it is possible to secure pure culture by direct isolation or direct transfer. This can be done only in those situations in which pure culture occurs naturally. Kinds of specimens taken for culturing will depend on the nature and habitat of microbes.

Different pathogens can be isolated from body tissues and fluids such as blood, urine, sputum, pus, faces, spinal fluid, bile, pleural fluids, stomach fluids etc. In the blood stream of a patient suffering with typhoid fever, the bacteria Salmonella typhosa may be present.

A pure culture of this bacterium may be obtained by drawing blood sample using a sterilized hypodermic syringe and treating the blood with anticoagulant such as heparin and potassium oxalate. The presence of the anticoagulant prevents the pathogenic microbe from entrapping in fibrin clot. The sample of the blood may be inoculated into a suitable medium.

Following isolation methods are employed to isolate microbes from mixed cultures:

Streaking

2. Plating

3. Dilution

4. Enriched procedure, and

5. Single cell technique.

Streaking:
This is most widely used method of isolation. The technique consists of pouring a suitable sterile medium into sterile petriplate and allowing the medium to solidify. By means of a sterile loope or straight needle or a sterile bent glass-rod a small amount of growth preferably from a broth culture or bacterial suspension is streaked back and forth across the surface of agar until about one third of the diameter of the plate has been covered.

The needle is then flamed and streaking in done at right angles to and across the first streak. This serves to drag bacteria out in a long line from the initial streak. When this streaking is completed the needle is again flamed and streaking is done at right angles to the second streak and parallel to the first.

It includes diluting of a mixture of microorganisms until only a few hundred bacteria are left in each millilitre of the suspension. A very small amount of the dilution is then placed in a sterile petriplateby means of a sterile loop or pipette. The melted agar medium is cooled to about 45°C and is poured into plate. The microorganism and agar are well mixed. When the agar is solidified the individual bacterium will be held in place and will grow to a visible colony.

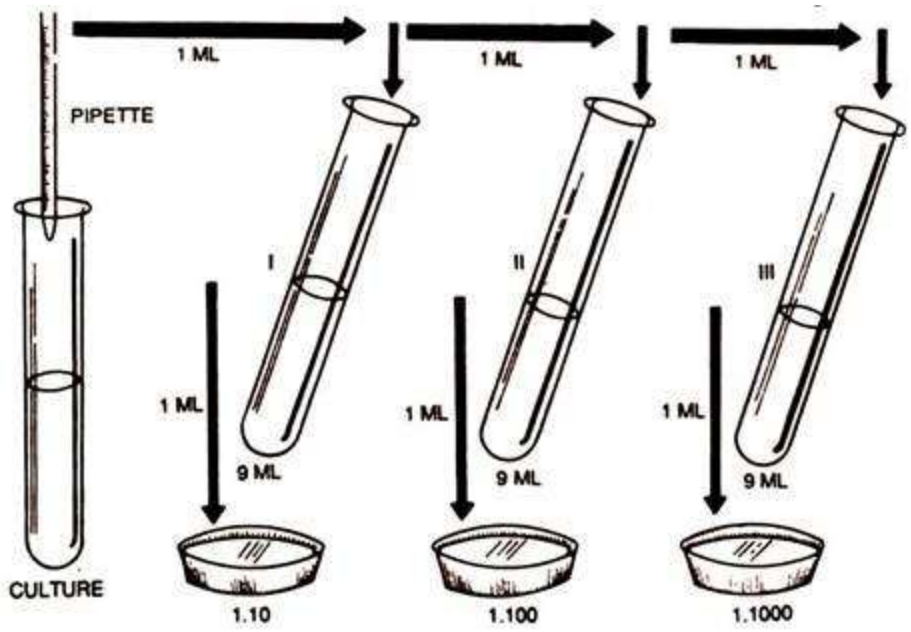


Fig. 2.2 Dilution method of isolation.

3. Dilution:

This method is used for the microorganisms which cannot be easily isolated by streaking or plating method. Sometimes when several organisms are present in a mixture, with one organism predominating, the predominating form may be isolated by this method. For example, when raw milk is allowed to sour at room temperature it will, at the time of curding, have a mixture of microorganisms with high percentage of Streptococcus lactis.

If 1 ml of the sour milk is taken into a tube containing 9 ml. of sterile milk (in which no organisms are present) then 1 ml. of this mixture is transferred with a sterile pipette into a second tube of sterile milk and the procedure is repeated i.e. from second to third tube, third to fourth tube until a series of about 10 tubes are inoculated. By this serial dilution, the chances are that a pure culture of S. lactis will be obtained.

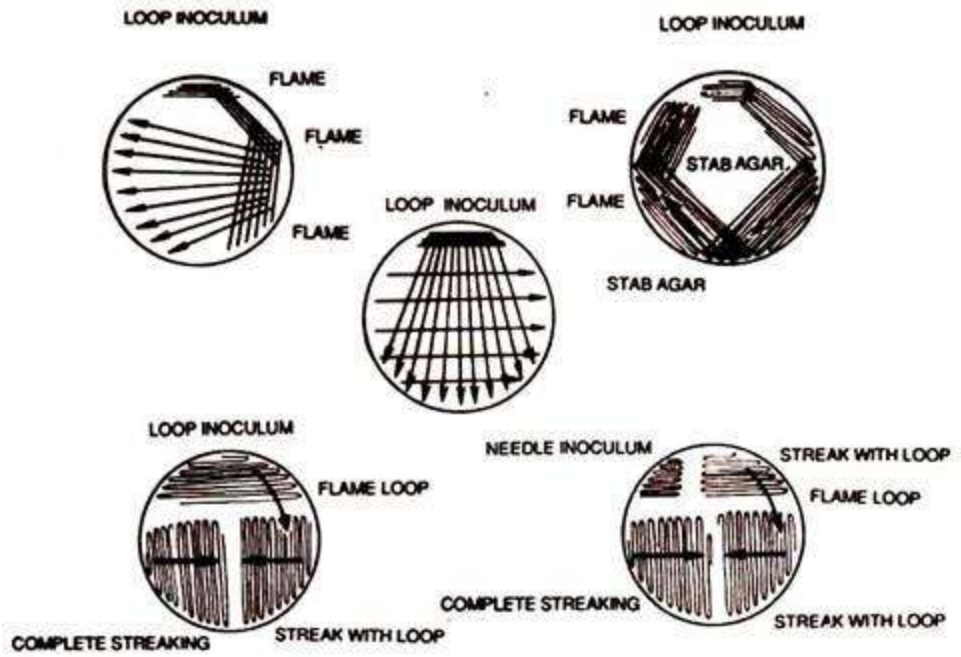
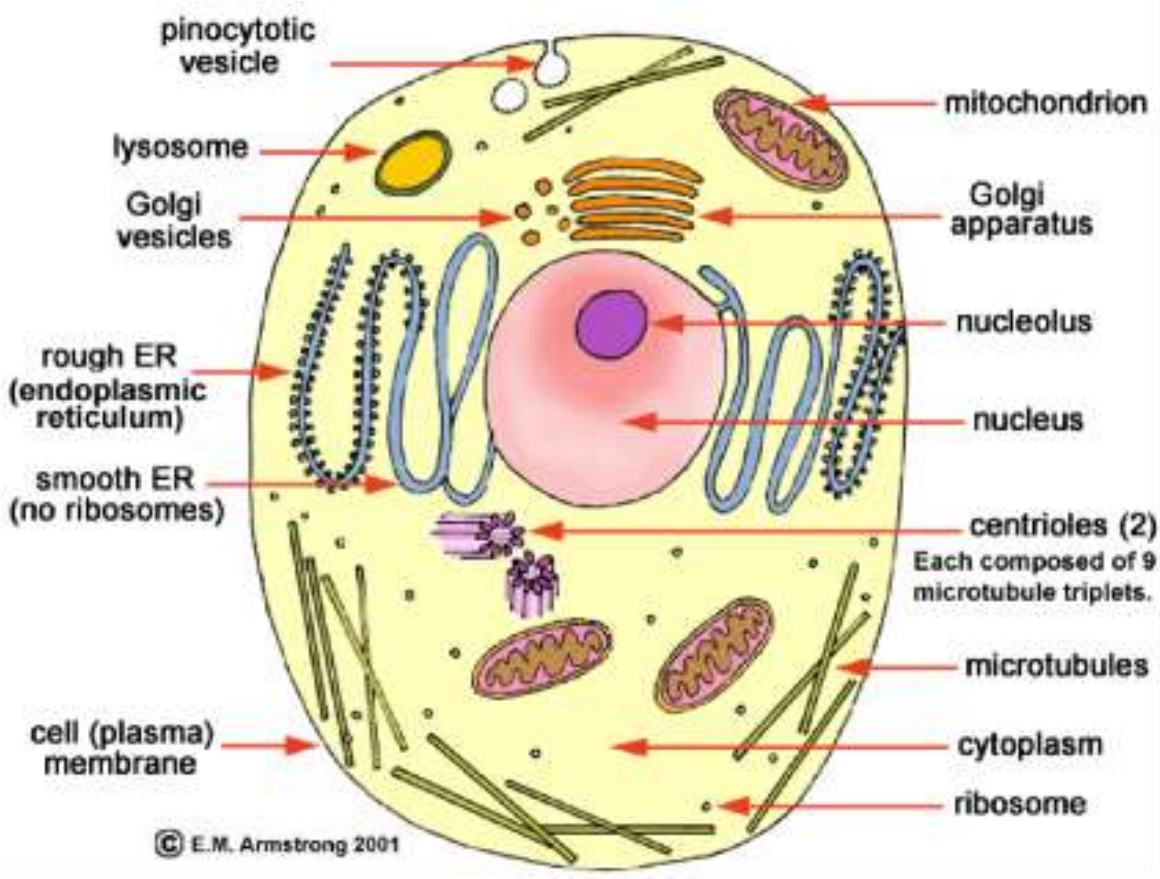


Fig. 2.1 Different patterns used for obtaining pure culture by streaking.

2. Ultra structure of Eukaryotic cell with its cell organelles and function of each organelle

Organelle	**Function**
Nucleus	The “brains” of the cell, the nucleus directs cell activities and contains genetic material called chromosomes made of DNA.
Mitochondria	Make energy out of food
Ribosomes	Make protein
Golgi Apparatus	Make, process and package proteins
Lysosome	Contains digestive enzymes to help break food down
Endoplasmic Reticulum	Called the "intracellular highway" because it is for transporting all sorts of items around the cell.
Vacuole	Used for storage, vacuoles usually contain water or food. (Are you are thirsty? Perhaps your vacuoles need some water!)
Plant cells also have:	
Chloroplasts	Use sunlight to create food by photosynthesis
Cell Wall	For support



2. Parts and Working of Compound Microscope:

A compound microscope is an indispensable instrument in any biological laboratory. It is used for passive observation of structural details of a cell, tissue or organ in sections.

Q. 3 B. Explain any two of the following: (10 mks)

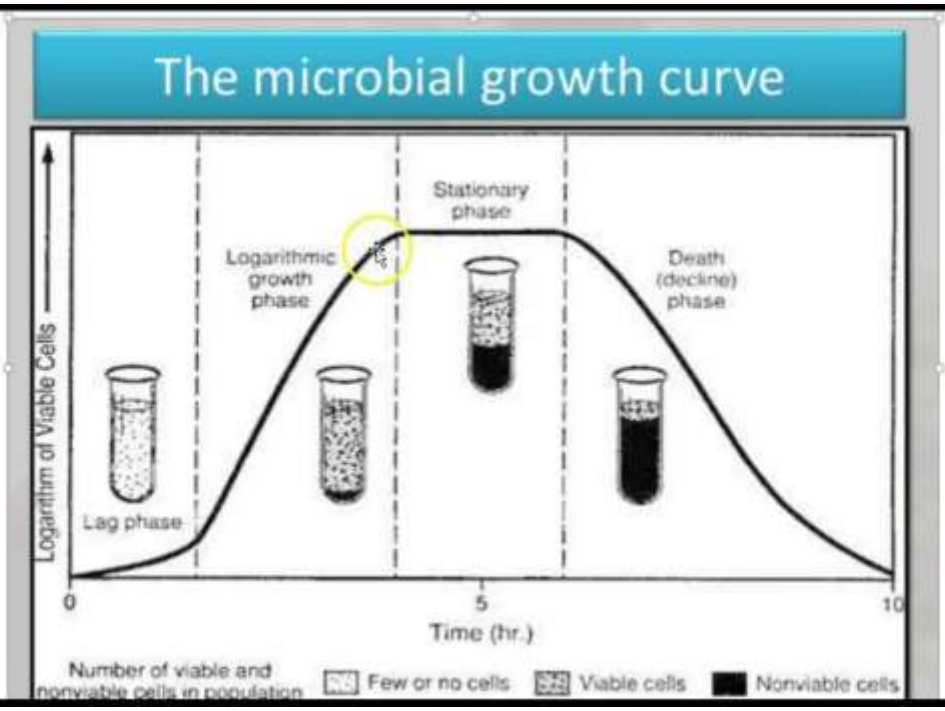
Stages in Bacterial growth curve:

Bacterial growth is the asexual reproduction, or cell division, of a bacterium into two daughter cells, in a process called binary fission. Providing no mutational event occurs, the resulting daughter cells are genetically identical to the original cell. Hence, bacterial growth occurs. Both daughter cells from the division do not necessarily survive. However, if the number surviving exceeds unity on average, the bacterial population undergoes exponential growth. The measurement of an exponential bacterial growth curve in batch culture was traditionally a part of the training of all microbiologists; the basic means requires bacterial enumeration (cell counting) by direct and individual (microscopic, flow cytometry), direct and bulk (biomass), indirect and

individual (colony counting), or indirect and bulk (most probable number, turbidity, nutrient uptake) methods. Models reconcile theory with the measurements.

Four different phases: **lag phase** (A), **log phase** or **exponential phase** (B), **stationary phase** (C), and **death phase**(D).

1. During **lag phase**, bacteria adapt themselves to growth conditions. It is the period where the individual bacteria are maturing and not yet able to divide. During the lag phase of the bacterial growth cycle, synthesis of RNA, enzymes and other molecules occurs. During the lag phase cells change very little because the cells do not immediately reproduce in a new medium. This period of little to no cell division is called the lag phase and can last for 1 hour to several days. During this phase cells are not dormant.[4]
2. The **log phase** (sometimes called the logarithmic phase or the *exponential phase*) is a period characterized by cell doubling.[5]The number of new bacteria appearing per unit time is proportional to the present population. If growth is not limited, doubling will continue at a constant rate so both the number of cells and the rate of population increase doubles with each consecutive time period. For this type of exponential growth, plotting the natural logarithm of cell number against time produces a straight line. The slope of this line is the specific growth rate of the organism, which is a measure of the number of divisions per cell per unit time. The actual rate of this growth (i.e. the slope of the line in the figure) depends upon the growth conditions, which affect the frequency of cell division events and the probability of both daughter cells surviving. Under controlled conditions, cyanobacteria can double their population four times a day and then they can triple their population.[6] Exponential growth cannot continue indefinitely, however, because the medium is soon depleted of nutrients and enriched with wastes.
3. The **stationary phase** is often due to a growth-limiting factor such as the depletion of an essential nutrient, and/or the formation of an inhibitory product such as an organic acid. Stationary phase results from a situation in which growth rate and death rate are equal. The number of new cells created is limited by the growth factor and as a result the rate of cell growth matches the rate of cell death. The result is a "smooth," horizontal linear part of the curve during the stationary phase. Mutations can occur during stationary phase. Bridges et al. (2001) presented evidence that DNA damage is responsible for many of the mutations arising in the genomes of stationary phase or starving bacteria. Endogenously generated reactive oxygen species appear to be a major source of such damages.
4. At **death phase** (decline phase), bacteria die. This could be caused by lack of nutrients, environmental temperature above or below the tolerance band for the species, or other injurious conditions.



2. Principal of Electron Microscope:

Working Principle:

An electron microscope uses an 'electron beam' to produce the image of the object and magnification is obtained by 'electromagnetic fields'; unlike light or optical microscopes, in which 'light waves' are used to produce the image and magnification is obtained by a system of 'optical lenses'.

It has already been discussed that, the smaller is the wavelength of light, the greater is its resolving power. The wavelength of green light (=0.55µ) is 1, 10,000 times longer than that of electron beam (=0.000005µ or 0.05 Å; 1µ = 10,000 Å).

That is why, despite its smaller numerical aperture, an electron microscope can resolve objects as small as 0.001µ (=10 Å), as compared to 0.2µ by a light microscope. Thus, the resolving power of an electron microscope is 200 times greater than that of a light microscope. It produces useful magnification up to X 400,000, as compared to X 2000 in a light microscope. Thus, the useful magnification is 200 times greater in an electron microscope than that in a light microscope.

There are three types of electron microscopes as described below:

(1) Transmission Electron Microscope (TEM):

In this microscope, an electron beam from an electron gun is transmitted through an ultra-thin section of the microscopic object and the image is magnified by the electromagnetic fields. It is used to observe finer details of internal structures of microscopic objects like bacteria and other cells. The specimen to be examined is prepared as an extremely thin dry film or as an ultra-thin section on a small screen and is introduced into the microscope at a point between the magnetic condenser and the magnetic objective. The point is comparable to the stage of a light microscope. The magnified image may be viewed on a fluorescent screen through an airtight window or recorded on a photographic plate by an in-built camera. Modern variants have facility to record the photograph by digital camera.

(2) Scanning Electron Microscope (SEM):

In a scanning electron microscope, the specimen is exposed to a narrow electron beam from an electron gun, which rapidly moves over or scans the surface of the specimen. This causes the release of a shower of secondary electrons and other types of radiations from the specimen surface.The intensity of these secondary electrons depends upon the shape and the chemical composition of the irradiated object. These electrons are collected by a detector, which generates electronic signals. These signals are scanned in the manner of a television system to produce an image on a cathode ray tube (CRT). The image is recorded by capturing it from the CRT. Modern variants have facility to record the photograph by digital camera. This microscope is used to observe the surface structure of microscopic objects.

(3) Scanning and Transmission Electron Microscope (STEM):

It has both transmission and scanning electron microscope functions.

Limitations of Electron Microscopes:

The limitations of electron microscopes are as follows:

(a) Live specimen cannot be observed.

(b) As the penetration power of electron beam is very low, the object should be ultra-thin. For this, the specimen is dried and cut into ultra-thin sections before observation.

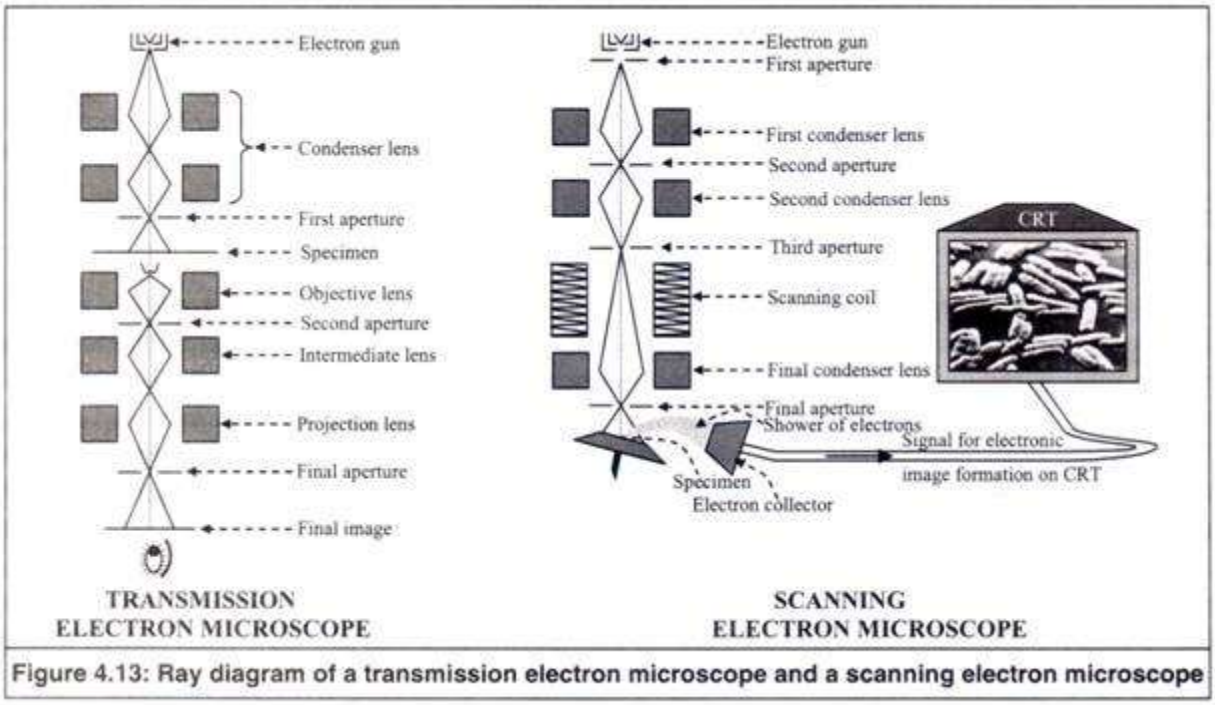


Figure 4.13: Ray diagram of a transmission electron microscope and a scanning electron microscope

3. Animal viruses and the disease caused by them

Animal viruses are viruses that infect animals. Viruses infect all cellular life and although viruses infect every animal, plant and protist species, each has its own specific range of viruses that often infect only that species.

The viruses of vertebrates are informally distinguished between those that primarily cause infections of humans and those that infect other animals. The two fields of study are called medical (or clinical) virology and veterinary virology respectively. Although not the first viruses to be discovered and characterised, those that cause infections of humans are the most studied. Different viruses can infect all the organs and tissues of the body and the outcomes range from mild or no symptoms, to life-threatening diseases. Humans cannot be infected by plant or insect viruses, but they are susceptible to infections with viruses from other vertebrates. These are called viral zoonoses or zoonotic infections. Examples include, rabies, yellow fever and pappataci fever.

The viruses that infect other vertebrates are related to those of humans and most families of viruses that cause human diseases are represented. They are important pathogens of livestock and cause diseases such as foot-and-mouth disease and bluetongue. Jersey and Guernsey breeds of cattle are particularly susceptible to pox viruses, with symptoms characterised by widespread, unsightly skin lesions. And most people have heard of myxomatosis, which is a fatal pox virus infection of rabbits: once infected they die within twelve days. The virus was deliberately released in Australia in 1950, in an attempt to control the exponentially growing rabbit population. Rabbits had been brought to the continent in 1859 for sport, and having no natural predators, bred at an extraordinary rate. The infection killed 99.8 percent of rabbits, but by the late 1950s, Australian rabbits started to become immune to the virus and the population of rabbits increased, but never to the vast numbers seen before 1950.

Companion animals such as cats, dogs, and horses, if not vaccinated, can catch serious viral infections. Canine parvovirus 2 is caused by a small DNA virus, and infections are often fatal in pups. The emergence of the parvovirus in the 1970s was the most significant in the history of infectious diseases. The disease spread rapidly across the world, and thousands of dogs died from the infection. The virus originated in cats, the vector of feline panleukopenia, but a mutation that changed just two amino acids in the viral capsid protein VP2 allowed it to cross the species barrier, and dogs, unlike cats, had no resistance to the disease. Canine distemper virus is closely related to measles virus and is the most important viral disease of dogs. The disease (which was first described in 1760, by Edward Jenner, the pioneer of smallpox vaccination, is highly contagious, but is well controlled by vaccination. In the 1990s, thousands of African lions died from the infection, which they contracted from feral dogs and hyenas.

Marine mammals are susceptible to viral infections. In 1988 and 2002, thousands of harbor seals were killed in Europe by the measles-like phocine distemper virus. Large outbreaks of the disease were recorded among the seal populations of Lake Baikal and along the shores of the Baltic and North Sea. The infection resembled canine distemper; the animals died within two weeks of respiratory distress and many aborted pups were seen. Many other viruses, including caliciviruses, herpesviruses, adenoviruses and parvoviruses, circulate in marine mammal populations.

Fish too have their viruses. They are particularly prone to infections with rhabdoviruses, which are distinct from, but related to rabies virus. At least nine types of rhabdovirus cause economically important diseases in species including salmon, pike, perch, sea bass, carp and cod. The symptoms include anaemia, bleeding, lethargy and a mortality rate that is affected by the temperature of the water. In hatcheries the diseases are often controlled by increasing the temperature to 15–18 °C. Like all vertebrates, fish suffer from herpes viruses. These ancient viruses have co-evolved with their hosts and are highly species-specific. In fish, they cause cancerous tumours and non-cancerous growths called hyperplasia.

4. Methods of Preservation of Microorganism:

(1) Periodic transfer to fresh media:Bacteria can be maintained by periodically preparing a fresh stock culture from the previous culture. The culture medium, the storage temperature, and the time interval at which the transfers are made vary from one bacteria to another. The temperature and the typr of media chosen should support a slow rather than a rapid growth rate so that the time interval between transfers can be as long as possible.

(2) Preservation by overlaying cultures with Mineral Oil: Many bacteria are successfully preserved by covering the growth on an agar slant with sterile mineral oil. The oil should cover the slant completely. To ensure this, the oil should be about half an inch above the tip of the slant.

(3) Preservation by Lyophilization: Most bacteria die if cultures are allowed to become dry. However, freeze-drying can preserve many kinds of bacteria that would be killed by ordinary preservation techniques.

(i) Equipment used for Lyophilization: A lyophilizer consists of:

- A vacuum chamber that contains shelves.
- A vacuum pump.
- A refrigeration unit.

(ii) Procedure:

- The first step in the lyophilization process is to freeze a product to solidify all of its water molecules.
- Once frozen, the product is placed in a vacuum and gradually heated without melting the product.
- This process, called sublimation, transforms the ice directly into water vapor, without first passing through the liquid state.
- The water vapor given off by the product in the sublimation phase condenses as ice in a condenser, within the lyophilizer's vacuum chamber.
- The vials are now sealed off under vacuum and stored in a refrigerator.

Q.4.A) Describe **any one** of the following:

1. The chromatin structure and packaging in nucleus.
Structure of chromatin thread, nucleosome, solenoid model, packing in chromatid and chromosome.
Diagram is expected.
2. Polytene chromosome and lampbrush chromosome.
What are giant chromosomes? Description of both the chromosomes.
Diagram is expected.

Q. 4. B) Answer **any two** of the following:

1. Enlist the functions of nuclear membrane.

Any five functions.

2. What is cytoskeleton?Write briefly about cytoskeletal elements.

Definition of cytoskeleton. Brief description and location or function of them.

3. Sketch and label Interphase nucleus.

Sketch with important labels- nuclear membrane, nuclear pore, nucleolus, euchromatin, heteochromatin, perinulcear space, and more.

4. Differentiate between bacterial cell wall and plant cell wall.

Points	Bacterial cell wall	Plant cell wall
Major constituent	peptidoglycan	Cellulose
layers	2-3 layers	2-3 layers, primary,secondary, tertiary
casule	May be present	absent
Peptide x linkage	present	absent
Other consttuents	Teichoic acid, teichuronic acid	Hemicelluloses, pectin, lignin
Wall	Single cell wall,	Cell walls have middle lamella

		between adjoining cells
Composition	Based on composition Gram positive And Gram negative distinction	No such distinction. Different types of cell have different composition

Consider any other relevant point

Q. 5 Write short notes on : (10mks)

1. Edman's reaction

Protein sequencing via Edman degradation works by using phenylisothiocyanate (PITC) for sequential removal of the amino acids from the N-terminus of a polypeptide chain. PITC reacts with the N-terminal amino group of a polypeptide and creates a phenylthiocarbamyl-peptide derivative. The terminal derivative is then cleaved using trifluoroacetic acid, creating a thiazolinone derivative.

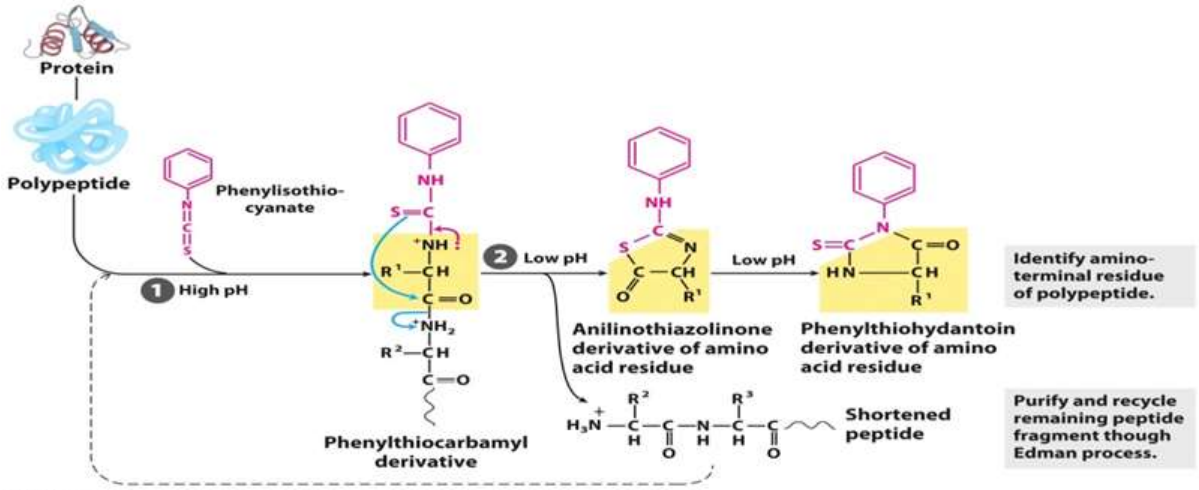


Figure 3-27
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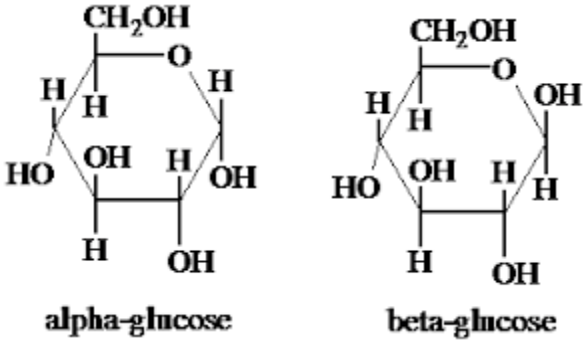
2. Distinguish between α-glucose and β-glucose

Alpha and Beta

The difference between alpha and beta glucose is nothing more than the position of one of the four -OH groups. The carbon to the right of the oxygen atom in the hexagonal ring is called the anomeric carbon. If the -OH group attached to it is below the ring, the molecule is alpha glucose. If the -OH group is above the ring, the molecule is beta glucose. Since the linear and cyclic forms of glucose inter-convert with each other, alpha glucose can turn into beta glucose and vice versa. If you take a sample of pure alpha glucose and put it into water, you'll end up with a sample that is part alpha and part beta glucose.



3. Stages of Cell Cycle:

Interphase

During interphase, the cell undergoes normal growth processes while also preparing for cell division. In order for a cell to move from interphase into the mitotic phase, many internal and external conditions must be met. The three stages of interphase are called G_1, S, and G_2.

G_1 Phase (First Gap)

The first stage of interphase is called the G_1 phase (first gap) because, from a microscopic aspect, little change is visible. However, during the G_1 stage, the cell is quite active at the biochemical level. The cell is accumulating the building blocks of chromosomal DNA and the associated proteins as well as accumulating sufficient energy reserves to complete the task of replicating each chromosome in the nucleus.

S Phase (Synthesis of DNA)

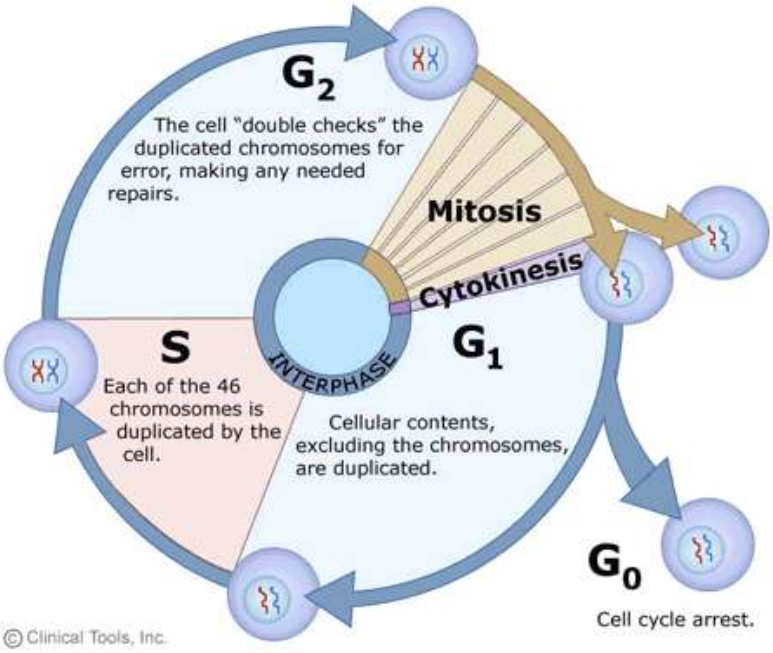
Throughout interphase, nuclear DNA remains in a semi-condensed chromatin configuration. In the S phase, DNA replication can proceed through the mechanisms that result in the formation of identical pairs of DNA molecules—sister chromatids—that are firmly attached to the centromeric region. The centrosome is duplicated during the S phase. The two centrosomes will give rise to the mitotic spindle, the apparatus that orchestrates the movement of chromosomes during mitosis. At the center of each animal cell, the centrosomes of animal cells are associated with a pair of rod-like objects, the centrioles, which are at right angles to each other. Centrioles help organize cell division. Centrioles are not present in the centrosomes of other eukaryotic species, such as plants and most fungi.

G_2 Phase (Second Gap)

In the G_2 phase, the cell replenishes its energy stores and synthesizes proteins necessary for chromosome manipulation. Some cell organelles are duplicated, and the cytoskeleton is dismantled to provide resources for the mitotic phase. There may be additional cell growth during G_2. The final preparations for the mitotic phase must be completed before the cell is able to enter the first stage of mitosis.

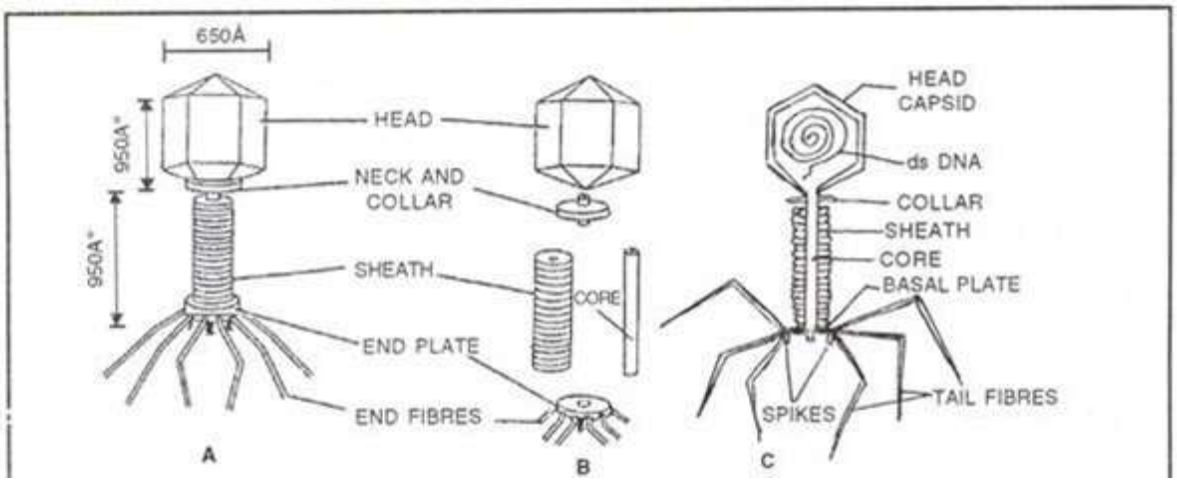
The Mitotic Phase

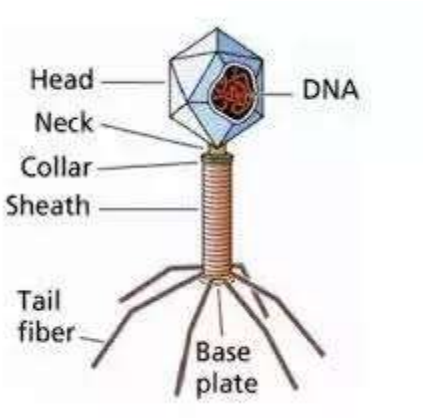
The mitotic phase is a multistep process during which the duplicated chromosomes are aligned, separated, and move into two new, identical daughter cells. The first portion of the mitotic phase is called karyokinesis, or nuclear division. The second portion of the mitotic phase, called cytokinesis, is the physical separation of the cytoplasmic components into the two daughter cells.



4. Structure of Bacteriophage:

The virion of T-even phage is binal or tadpole like structure with a polyhedral head connected to a helical tail through a short collar. The head composed of about 2000 capsomeres arid encloses a tightly packed dsDNA (50 nm long). The tail has an inner hollow tube called core, surrounded by a contractile sheath which consists of 24 annular rings. The distal end of the tube is connected to a hexagonal basal plate with spike or tail spin at each corner. Six long, flexible tail fibers also arise from the basal plate which helps in adsorption to bacteria**.**





5. Nucleosome

dimension, detailed structure description.
Diagram is expected.

6. Internal structure of flagellum

Structure of axoneme with the cytoskeletal elements (9+2)
T.S. of flagellum diagram is expected.
