NEW BIOLOGY EXTRA FOR A'LEVEL. *This book has been built on an adage that "Biology setting keeps on evolving with time in different ways. Original questions come up or already existing ones are modified to suit the demands of the setters of that particular time".*

TOPIC: classification

EUBACTERIA/KINGDOM PROKARYOTAE/MONERA

INTRODUCTION TO KINGDOM PROKARYOTAE

Major Concept

To study the molecular and functional organization of prokaryotic organisms

Specific Objectives

1. To know importance of cell, and the types: Prokaryotic and eukaryotic cell.
2. Learn the essential differences of a prokaryotic cell and eukaryotic cell.
3. Draw a diagram of prokaryotic cell showing different cell organelles.
4. Study the following cellular organelles:

- DNA—its structure and functions.
- Mesosomes, the power house of a cell. Learn its structure and functions.

Describing the structure of bacterial cells

(1) What is meant by **microbiology? (3 marks)**

Refers to the study of micro-organisms✓ such as bacteria/fungi/viruses;✓ using microscopy and sterile/aseptic conditions;✓

2) Compare prokaryotes with eukaryotes (20marks)

Strategy

- This question requires both similarities and differences;
- For similarities use the word 'both';

Similarities

Start with "in both"

- Both have plasma membrane;✓
- Both have ribosomes;✓
- Both have cytoplasm;✓
- Both are composed of cells;✓
- Both have genetic material, DNA;✓
- Both have cilia and flagella;✓
- Both carry out life processes such as reproduction and photosynthesis;✓

Misconceptions by learners:

- Both prokaryotes and eukaryotes have cytoskeletons;*
- Both flagella of prokaryotes and eukaryotes operate in the same way;

Differences

- Often for differences we tabulate;
- OR we use words such as while/whilst/where as in a sentence.

Misconceptions by students:

- Eukaryotes have mitochondria while prokaryotes lack*(To make the difference right point out what prokaryotes have "Mesosomes"✓)
- Being too wordy (Be precise)

Prokaryotes	Eukaryotes
Extremely small in diameter;	Larger cells in diameter;✓
Cell division preceded by DNA replication;	Cell division preceded by mitosis or meiosis;✓

Nucleus absent/nuclear material not bound by a membrane;	Nucleus present (bound by perforated membrane);✓
Sexual reproduction in some prokaryotes involves transfer of some DNA from one cell to another;	Sexual system involves complete nuclear fusion between sex cells;✓
Cell walls contain mucopeptides;	Cell walls in plants and fungi do not contain mucopeptides;✓
Few organelles;	Many organelles;✓
Protein synthesis in smaller ribosomes; (70s type)	Protein synthesis in larger ribosomes;✓ (80s type)
Some cells have simple flagella;	Some cells have complex cilia and flagella;✓
Some can fix nitrogen for use in amino acid synthesis;	None has this ability;✓
No chloroplasts/photosynthesis takes place in membranes with no stacking;	Chloroplasts present;✓
Respiration occurs in mesosomes or cytoplasmic membranes;	Mitochondria for aerobic respiration;✓
No ER;	ER present to which ribosomes are attached;✓
Cytoskeletons absent;	Cytoskeletons present;✓
DNA is not associated with proteins;	DNA is associated with proteins;✓
No nucleolus;	Nucleolus present;✓
Have outer mucilage layer/capsule;	No capsule;✓
Plasmids/episomes present;	Lack plasmids/episomes;✓

3) Describe the **morphology** of **bacterial cells**.

Strategy

Morphology encompasses shape/size/arrangement;

Solution

Size

- Small in size/0.1 to 10 microns/μm;✓

Shape

- Cocci; spherical/oval; eg streptococcus pyogenes;✓
- Bacillus; rods; e.g. bacillus anthrancis;✓

- Filamentous; branched/thin filaments; eg actinomycetes;✓
- Spirillum; curved/spiral; single flagellum; eg treponoma pallidum✓
- Vibrios; comma shaped; eg vibrio cholerae;✓

Arrangement

Cocci

- Streptococci; chains of bacterial cells; eg Streptococcus pneumoniae;✓
- Staphylococci; bunches; eg staphylococcus aureus;✓
- Diplococci; pairs; eg diplococcus pneumoniae;✓
- Tetrad; packets of four; eg pediococcus;✓
- Sarcinae; packets of eight; eg sarcina ureae;✓

Bacillus

- Single bacillus; eg E.coli;✓
- Streptobacillus; chains; e.g. streptobacillus moniliform;✓
- Coccobacilli; short and ovoid; eg haemophilus influenza;✓

4) Explain the **adaptations** of the **bacteria** that enhances their survival

Answer plan

Misconceptions and Guidance to readers:

A structure does not "HELP, AID, ACT or ASSIST" (so dodge such words by using "FOR" eg long flagellum for locomotion;✓ NOT long flagellum helps/aids/assists in locomotion×)
Avoid combining two structural features for example long and segmented for movement
But say: elongated flagellum for generation of propulsive force; segmented body for flexibility;
Remember the question has not limited you so you can give structural and non-structural adaptations.
But if it's very specific to structural adaptations please adhere and mention only structural features

Adaptations are built on the following guide lines.

State the structure or component/subcomponent; its nature; and how the nature favors its efficiency.
Capsules and slimy layer/gummy secretions;✓ make them less susceptible to phagocytosis by white blood cells;✓
Cell wall✓ rigid due to peptidoglycan/murein for support;✓/ prevent osmotic shocks/ Gram negative bacteria have lipid-rich layer covering murein which confers resistance to antibiotics;
Flagellum;✓ long to propel the bacteria along;✓
Pili/Fimbriae;✓ for cell to surface attachment providing support/cell to cell attachment forming colonies;✓
Sex pilus;✓sexual reproduction/conjugation;✓
Mesosomes;✓in folding of the plasma membrane, housing enzymes for respiration/aid in the formation of the new cross wall/facilitates the separation of the two daughter molecules of DNA;✓
Photosynthetic sacs;✓ tubular/sheet-like containing photosynthetic pigments; for photosynthesis;✓
Circular DNA;✓containing genes which control the activities of the cell;
Ribosomes; sites for protein synthesis;✓
Production of large quantities of spores;✓ which results into rapid multiplications;✓
Endospores;✓thick walled extremely resistant to harsh condition;✓
Plasmid;✓extra- chromosomal DNA which confers ability to antibiotics resistance/ use of hydrocarbons/sexual reproduction/ conjugation;✓

Small in size;✓ decreases nutrient requirements/increasing surface area for diffusion of nutrients into the cell;✓

5) a) Explain the **criteria** based on when **classifying bacteria**

Morphology;✓ shapes/grouping of cells/size/Endospores/positions of endospores;✓
Staining reaction;✓gram positive stain purple/Gram negative stain pink with Gram stain;✓
Motility;✓ by means of a hanging drop technique;✓
Growth requirements;✓ varying conditions such as P^H/sugar/salts/temperature;✓
Colony characteristics;✓ shape of the colony eg amoeboid/ curled/ irregular;✓
Biochemical reactions;✓ some can ferment carbohydrate while others not/some produce hydrogen sulphide;✓
Disease in animals;✓ injecting an unknown bacteria in an organism, finding out disease(s)produced;✓

b) State why **bacterial staining** is **vital**

- **Observation of bacterial morphology, shape/size/arrangement;✓**
- **Determine the type of cell wall;✓**
- **To observe nuclear material;✓**
- **To determine whether capsule is present or absent;✓**
- **To determine the presence of spore✓ (Endospores and their positions)**
- **To determine presence of flagella✓**
- **To determine presence of fat globules;✓**

6) Describe the **structure** of bacterial **cell wall**

Answer plan

- **Structure refers to any "drawable" aspect of the organism.**

Words such as:

- **Rigid/rough/smooth/flabby/hard/flexible/membranous/big/small and negative responses e.g. "lack cell wall" are not/non-structural.**

Thick;✓ made up of murein/peptidoglycan;✓ which consists of polysaccharide chains;✓ running parallel;✓ cross-linked in a regular pattern;✓ by shorter peptide chains;

7) Describe how **sexual reproduction** occurs in **bacteria**.

- **Conjugation;✓ cells come into close contact;✓cells of two mating strains;✓donor (F^+) and recipient (F^-);✓ sex pilus;✓ forming a conjugation bridge;✓ transferring DNA;✓**
- **Transduction;✓ bacteriophages integrate their DNA with bacterial DNA;✓ small double stranded DNA transferred from donor to recipient by bacteriophage; ✓**
- **Transformation;✓ short pieces of DNA are released by the donor;✓ actively taken up by the recipient;✓ two strands of donor DNA separate✓; one donor DNA strand replaces similar but not identical strand of recipient DNA;✓ hybrid DNA replicates;✓**

8) Explain the **conditions** that favor **bacterial growth**

- **P^H;✓ favored by alkaline condition/ few tolerate extremely acidic conditions;✓**
- **Temperature;✓ range of 25^0c-45^0c favorable for most bacteria;✓/some can grow at very low temperatures/very high temperatures;**
- **Oxygen;✓ aerobes for respiration;✓**
- **Moisture/water;✓ for their metabolism;✓**
- **Nutrients;✓ metabolites such as carbon, hydrogen and sulphur;✓**

9) Explain the role of **R- plasmids** in **staphylococci**

R-plasmids confer resistance to antibiotics;✓ contains genes for the enzymes;✓ which break down antibiotics into harmless products;✓

b) Differentiate between **gram positive** and **gram negative bacteria**

Gram positive	Gram negative
Lack lipid layer along their murein;	Have lipid layer along their murein;✓
Affected by antibacterial enzymes/lysozyme;	Not affected by antibacterial enzymes;✓
High concentration of murein;	Low concentration of murein;✓
Stain purple with Gram stain/crystal violet solution;	Becomes pink on decolourisation with ethanol;✓
Cell wall is thicker;	Cell wall is thinner;✓

10) Explain the **importance** of **plasmids in bacteria**.

- R/resistance –plasmids;✓ which confers resistance to antibiotics;✓
- V/virulence –plasmids;✓ which confers the ability to cause diseases✓
- F-plasmid;✓ which codes for the production of the sex pili/conjugation pili;✓
- Col /colcinogenic -plasmids;✓ which codes for the production of colicin inhibiting growth of other strains of bacteria;✓
- D/degradative –plasmids;✓ confers ability to use hydrocarbon compounds such as petroleum✓

11) Explain the different **methods employed** in the controlling of **harmful bacteria**.

- Drying foods;✓ such as peas and meat, removes water preventing growth of bacteria;✓
- Salting food;✓ such as fish, which plasmolyses bacterial cells on food;✓
- Good hygiene;✓ washing hands/bathing/use of toilets, removes organic substances on which bacteria feed;✓
- Temperature treatment;✓ deep freezing suspends life/ boiling which kills most of the bacteria;✓
- Pasteurization of milk;✓ heating up to 77^0c cooling rapidly kills bacteria;✓
- Irradiation;✓ with ultra-violet light kills bacteria by damaging their DNA;✓
- Curing;✓ food hung over charcoal fire/smoke; formaldehyde in the smoke kills bacteria;✓
- Chemicals;✓ such as chlorine and fluorine kill bacteria;✓

12) **a) Differentiate** between **eubacteria** and **archaebacteria**

Eubacteria	Archea bacteria
Live under neutral conditions;	Live under extreme conditions;✓
Have murein/peptidoglycan;	Lack murein/peptidoglycan;✓
Found everywhere/ubiquitous;	Found in unusual places;✓

There are two types, gram positive and gram negative;	There are of three types, halophiles; methanogens; and thermoacidophils;✓

b) Compare photosynthesis in bacteria and **blue-green bacteria**

Similarities

- Both lack chloroplast/photosynthesis occurs in membranes;✓
- In both photosynthetic membranes do not show stacking;✓

Differences

Bacteria	Blue green bacteria
Photosynthetic membranes present as extension of the plasma membrane;	Photosynthetic membranes are present throughout the cytoplasm;✓
Photo system II absent;	Photo system II present;✓
No oxygen produced;	Oxygen produced;✓
Hydrogen donor variable;	Water acts as hydrogen donor;✓
Primary pigment is bacterio-chlorophyll;	Primary pigment is chlorophyll;✓
No phycobilins;	Contains phycobilins;✓
Smaller in size;	Larger in size;

C) ***(i)* Explain** how the **bacteria** that occur at the **bottom of the pond** obtain requirements for photosynthesis.

- Use hydrogen sulphide;✓ by-product of decay of organic matter;✓ by anaerobic bacteria;✓ as a source of hydrogen;✓ for reduction of carbon dioxide to carbohydrates;✓
- Light for photosynthesis;✓ absorbed by bacterio- chlorophyll;✓has slightly different absorption spectrum from plants;✓ hence absorb energy from light that pass through the aquatic plants;✓

(ii) Differentiate between photosynthesis in **higher plants** and **bacteria**

Higher plants	Bacteria
Chloroplasts present;	No chloroplasts;✓
Membranes present in the chloroplasts;	Membranes are extensions of the plasma membrane;✓
Photosynthetic membranes are stacked;	Photosynthetic membranes do not show stacking;✓

Photosystem II present;	Photosystem II absent;✓
Hydrogen donor is water;	Hydrogen donor variable;✓
Primary pigment is chlorophyll;	Primary pigment is bacterio- chlorophyll;✓

(iii) Describe **features** of different **groups of photosynthetic bacteria**.

- Green sulphur bacteria;✓ anoxygenic bacteria;✓ use hydrogen suphide and other sulphur containing compounds as a source hydrogen; found in deep sea; which has low light availability; e.g. prosthecochloris;✓
- Purple sulphur bacteria;✓ anoxygenic; red and brown pigments dominate bacterio-chlorophyll making it purple; e.g. chromatium;✓
- Purple non-sulphur bacteria;✓ bacteria using organic compound as a source of hydrogen to reduce carbon dioxide; or any organic source; eg Rhodospirillum;✓
- Blue green bacteria; ✓have Photosystem II; chlorophyll; phycobilins; and use water as a source of hydrogen eg anabaena✓

(iv) Describe **features** of different **groups of chemosynthetic** bacteria.

These synthesize complex organic compounds from inorganic substances, carbon dioxide and water using energy from chemical reactions they catalyze;

- Iron bacteria;✓ small/ rod shaped/occur in deep down in ore dumps; requires acidic medium for oxidation of iron; energy released is used to fix carbon dioxide and water to carbohydrate; metabolism of this bacteria is exploited in microbial mining; eg Thiobacillus ferro-oxidans;✓
- Nitrifying bacteria; ✓use energy from two exergonic reactions; in order to derive synthesis of carbohydrates; play key role in nutrient recycling; eg Thiobacillus;✓
- Colorless sulphur bacteria;✓ in anaerobic condition use nitrate as hydrogen acceptor; hence carrying out denitrification; play vital role in sulphur cycle; e.g. Thiobacillus;✓

18) Describe the **structure** of bacterial cells

Cellular structure is enclosed with a cell wall;✓made up of peptidoglycan/murein;✓ polysaccharide cross-linked by peptide molecules;✓cell wall enclosed by capsule;✓ which may have mucilage/slime layer✓; hair-like structure/rods;✓ pili;✓ made up of protein;✓ flagella;✓ long with protein flagellin;✓ cytoplasm with scattered 70s ribosomes;✓ glycogen and lipid droplets;✓ in folding of cell wall, mesosomes;✓photosynthetic bacteria have tubular/sac-like photosynthetic lamellae;✓with bacterio-chlorophyll;✓ scattered circular DNA;✓ and extra-chromosomal pieces of DNA; episomes/plasmids;✓

13) **Compare photosynthesis** and **chemosynthesis**

Similarities

- in both reactions carbon dioxide is reduced to carbohydrates;✓
- in both reactions energy/ATP is a requirement;✓
- Both occur in autotrophic bacteria;✓

Differences

Chemosynthesis	Photosynthesis
Occur only in colorless aerobic bacteria;	Occur in green plants and green bacteria;✓
Carbon dioxide is reduced into carbohydrates without light and chlorophyll;	Carbon dioxide and water are converted into carbohydrates in presence of light and chlorophyll;✓
Chemical energy is released during oxidation of inorganic substances;	Light energy is converted into chemical energy and stored in the carbohydrate;✓
No pigment molecule is involved in the process;	Several pigments are involved to absorb light energy to perform photochemical change;✓
Oxygen not evolved;	Oxygen is evolved as a by-product;✓
Photophosphorylation does not take place;	Photophosphorylation takes place;✓

13) **Differentiate between oxidative and Photophosphorylation**

Oxidative phosphorylation	Photophosphorylation
Occur during respiration;	Occur during photosynthesis;✓
Occurs in the mitochondria;	Occur within the chloroplast;✓
Occurs on the inner membrane of cristae;	Occurs in the thylakoid membrane;✓
Molecular oxygen is needed during terminal oxidation;	Molecular oxygen is not required;✓
Energy released during electron transfer due to oxidation-reduction reaction is used during ATP formation;	Source of energy for conversion of ATP from ADP and Pi is external;✓
Process takes place in electron transport system involving cytochromes;	Pigment system I and II are involved during the process;✓
ATP molecules are released in the cytoplasm available for different metabolic reactions;	The produced ATP molecules are used up for carbon dioxide assimilation in the dark reaction of photosynthesis;✓
Main hydrogen acceptor is NAD;	Main hydrogen acceptor is NADP;✓
Independent of light;	Dependent on the light;✓

14) a) Distinguish between bacterium and plant cell

Bacterium	Plant
No distinct nucleus;	A distinct nucleus;✓
No chromosomes;	Chromosomes are present;✓
No membrane bound organelles;	Membrane bound organelles are present;✓
No chloroplasts;	Chloroplasts present; ✓
Ribosomes are smaller;	Ribosomes are larger;✓
No mitosis and meiosis;	Mitosis and meiosis occurs;
Mesosomes are used in respiration	Mitochondria for respiration;✓
Cell wall contain murein;	Cell wall contain cellulose;✓

b) Explain the **ecological significance** of the **nutritional categories of bacteria**

Autotrophic bacteria;✓ make food by photosynthesis/chemosynthesis;✓ fed on by other organisms;✓ oxygen yielded as a by-product by photosynthetic bacteria is used in respiration by aerobic organisms;✓ nitrogen cycle/nitrifying bacteria converting nitrite into nitrates absorbed by plants;✓/nitrogen fixing bacteria fix nitrogen into the soil/denitrifying bacteria replenishes nitrogen into the atmosphere;✓ Heterotrophic bacteria; saprophytes bring about decay;✓ recycling nutrients/cleaning the environment;✓ normal flora in the gut/E.coli compete with parasitic bacteria for food/synthesizing vitamin B and K;✓

c) Explain how **leguminous plant** and the **bacterium in its nodule** benefit from the relationship.

Mutualistic relationship;✓ Leguminous plants provide shelter;✓ constant supply of food;✓ such as glucose/vitamins/aminocids;✓ warmth;✓ produces leghaemoglobin which absorbs oxygen to prevent oxygen poisoning of bacteria;✓ in return the bacteria convert gaseous nitrogen into nitrates;✓ absorbed by plants to make proteins forming tissues;✓

c) Describe the relationships between organisms forming **lichens.**

Mutualistic relationship;✓ between fungus and green protoctista;✓ fungus gain oxygen;✓ and carbohydrates;✓ while protoctistan obtains water;✓ carbon dioxide;✓ mineral salts✓ and protection from high/much light intensity by fungus;✓

d) Compare mutualism and **parasitism.**

Similarities

- In both species live within the same habitat;✓
- Both are types of symbiotic relationships;✓
- Both occur between organisms of different species;✓
- Both are metabolic relationships;✓
- Both occur in plants and animals;✓

Differences

Mutualism	Parasitism
Occur between non- parasitic species;	Occur between host and parasite;✓
Both participants benefit;	Host is harmed/damaged;✓
No death of members;	Host may be killed;
may be metabolic or non-metabolic benefits;	Often metabolic;✓
Organisms need each other;	Parasite need the host but the host doesn't need parasite;✓

Not very specific;	Specific relationship;✓

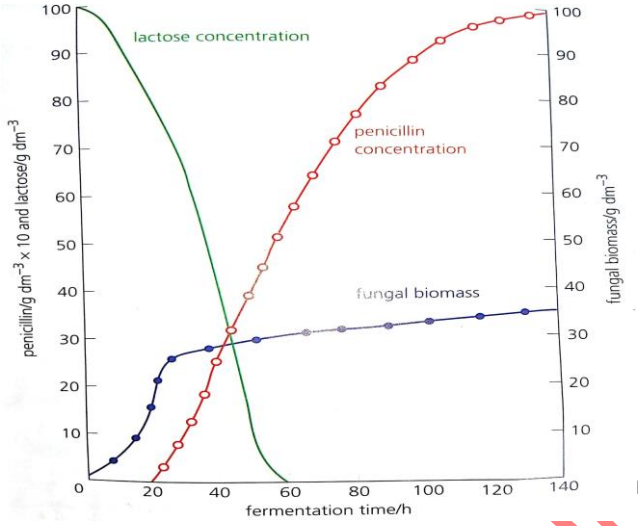
e) **State the economic importance** of **bacteria** in nature.

- Recycling nutrients (biogeochemical cycles) eg carbon/phosphorus and nitrogen;✓
- Decomposition of waste eg sewage;✓
- Production of yogurt and cheese;✓
- Industrial process eg tanning of leather and production of vitamins;✓
- Biotechnology and genetic engineering;✓
- Extraction of metals from minerals and solutions/biomining;✓
- Biogas and gasohol due to anaerobic activities of bacteria;✓
- Biological control of malaria eg Bacillus thuringiensis;✓
- Converting or fixing gaseous nitrogen into ammonium, nitrate and nitrite ions, plants use for synthesizing organic molecules such amino acids;✓
- Decaying or rotting food; eg salmonella;✓
- Causing illness; eg typhoid/cholera;✓
- Symbiotic relationship with other organisms eg bacteria in human gut synthesize vitamin B complex and others break down cellulose in the guts of herbivores;✓
- Source of antibiotics eg streptomycin;✓
- They are easily cultured and therefore used in research;✓

f) Explain how **nitrogen in the urea** of cattle in field of grass can become a component of protein in beef.

Urea is decomposed by saprophytic bacteria and fungi;✓ into ammonium compounds, ammonia or ammonium ions;✓oxidized to nitrites by nitrosomonas;✓to nitrates by nitrobacter;✓which are absorbed by plant root hairs;✓ later reduced to nitrites to ammonia by nitrite reductase;✓ammonia combined with organic acid alpha ketoglutarate✓ catalyzed by transaminase;✓forming amino acid glutamate;✓ used to make other aminocids by transferring other amino groups from other organic acids by transamination;✓amino acids obtained by feeding on the plant tissues are used to make proteins(protein synthesis) which are the components of beef;

15) The graph below shows the rate of utilization of carbon source in the penicillin production. Study it carefully and answer questions that follow.



a) How long does it take for the carbon source to be used up?

60 hours;✓

b) Describe the relationship between biomass increase and penicillin production

Penicillin production continues to increase rapidly; as biomass increases slows down;

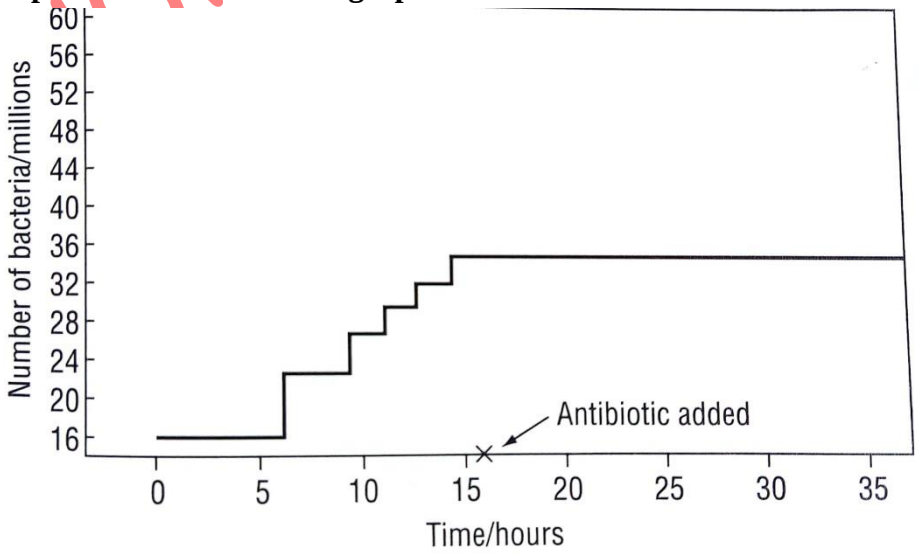
c) Why are additional substances added to the penicillin fermenters after 40 hours even though little further cell growth will occur

Additional nutrients increase the production phase of penicillin; by providing just sufficient nutrient to support growth without encouraging a big increase in fungal mass;

d) Explain why lactose concentration decreases during penicillin production

Lactose is used as a source of carbon required for the growth of the fungi; which produces penicillin;

16) Graph below illustrating the effect of bacteriostatic antibiotics. The antibiotics added at the point marked X on the graph



(i) Describe the effect of adding antibiotic on the bacterial population.

Number of bacteria does not change/Remains the same/constant;

(II) Suggest why bacteriostatic antibiotic are effective in treating bacterial infections even though they do not kill the bacterial

Prevents/stops bacteria from dividing/multiplying/reproducing; so population remains the same;

iii) Explain the classification of bacteria based on the energy source

Heterotrophic bacteria; obtain energy from oxidation of living or non-living organic matter; they are parasitic; saprotrophic; and mutualistic;

Chemoautotrophic bacteria; obtain energy from oxidation of inorganic materials and use this energy to synthesize their food; eg iron bacteria oxidize ferrous iron compounds to ferric hydroxide and release energy; nitrifying bacteria oxidize ammonia to nitrate and release energy; colourless sulphur bacteria oxidize hydrogen sulphide to sulphur and release;

Photoautrophic; bacteria use energy of sunlight for manufacture of food; eg green and purple bacteria contain bacterio-chlorophyll and photosynthesize using hydrogen sulphide as source of hydrogen

N.B heterotrophic bacteria may be anaerobic or aerobic; some may live in the environment eg clostridium tetani is a parasite in the absence of oxygen and saprophyte in its presence

Understand roles of parts of bacterium and the phyla under prokaryotae.

Cell wall	*Physical barrier which protects against mechanical damage and exudes certain substances;*
Capsule	*Protects bacterium from other cells eg white blood cells, also helps groups of bacteria to stick together for further protection;*
Cell surface membrane	*Differentially permeable layer which controls entry and exit of chemicals;*
Mesosomes	*Provide large surface area for attachment of respiratory enzymes;*
Flagellum	*For movement of bacterium because its rigid, corkscrew shape and rotating base helps the cell spin through fluids;*
Pili	*Cells to stick to one another or to other surfaces*
Circular DNA	*Possess genetic information for replication of bacterial cells;*
Plasmids	*Possess genes which aid the survival of bacteria in adverse conditions e.g. produce enzymes which break down antibiotics;*
Ribosomes	*70s type site for protein synthesis;*
Glycogen granules	*Stores carbohydrates for breakdown during respiration to provide energy;*
Lipid droplets	*Store lipids as a more concentrated, longer-term, store for conversion to carbohydrate and use in respiration;*
PHYLUM CYANOBACTERIA *Special rod shaped cells of unicellular structure; arranged in simple or branched multicellular filaments;*	***CHEMOHETEROTROPHS*** *These obtain their energy and carbon atoms from organic compounds;* *Heterotrophic bacteria may be:* *predators; eating other microorganisms;* *decomposers; breaking down dead organisms;* *parasites; infecting other organisms and causing diseases;*

Photosynthetic pigments, chlorophyll/phycoerythrin/phyco cyanin; certain species live mutualistically with fungi forming lichens; contain gas vacuoles and cells float at surface of water e.g. anabaena/chroococus;

PHYLUM EUBACTERIA

unicellular with grouped together cells; Have varied mode of nutrition, some autotrophic/ heterotrophic; Reproduction by binary fission and sexually by conjugation; mutualistic organisms; living in mutual harmony with others

PATHOGENIC BACTERIA

Corynebacterium diphtheria; gram (+); causes diphtheria; vaccine (toxoid)
Mycobacterium tuberculosis; rod shaped; cause tuberculosis; vaccine (BCG)
Clostridium tetani; rod shaped; causes tetanus; vaccine (toxoid)
Vibrio cholerae; comma shaped; causes cholera; treatment (antibiotics)
Salmonera typhi; rod shaped; causes typhoid; using TAB vaccine;

GENETIC RECOMBINATION IN BACTERIA AND OTHER ORGANISMS

Genetic recombination refers to the exchange of genetic materials from donor to recipient bacterium. The essential difference between sexual reproduction in bacteria and eukaryotes is that gametes and fusion of cells doesn't occur in bacteria! The DNA formed is called recombinant DNA. (contains genes from both parent cells)
Genetic recombination is a source of genetic variation; on which natural selection; operates to bring about evolution.
Factors affecting genetic recombination in eukaryotes
Frequency of crossing over at meiosis; position of chiasmata relative to the sequence of alleles
Amount of gene flow between populations; length of chromosome; type of breeding; frequency of crossing over at meiosis;

Check your self

This exercise should be done to make sure that you have mastered the biology concerning bacteria. Some of the answers are in the above spread so make sure you refer to them and also other relevant text books of biology.

1) Describe the different criteria based on when classifying bacteria (15 marks)
2) Differentiate between bacteria and blue green bacteria (6 marks)
3) Make a drawing showing a bacterial cell (6 marks)
4) Use endosymbiogenesis to explain the evolution of membrane bound organelles (6 marks)
5) Differentiate between cell wall and plasma membrane (5 marks)
6) Describe the structure of the following in a bacteria cell (20 marks)
   (i) Mesosomes
   (ii) Cell wall
   (III) Cell membrane
   (iv) Pili.
7) Explain the importance of plasmids in bacteria (6 marks)
8) Discuss ways how variation can arise in bacterial cells. (10 marks)
9) Differentiate between disinfection and sterilization (4 marks)
10) how are bacteria are adapted to their habitat (20 marks)
11) how do bacteria play a good role in human life (20marks)
12) how can you differentiate between gram positive and gram negative bacteria

(6 marks)

13) Describe the different nutritional categories of bacteria (9 marks)
14) How can you differentiate between bacteria and viruses (12 marks)
15) explain the different methods used to control bacteria (10 marks)
16) differentiate between bacteria and higher plants (6 marks)
17) differentiate between Eubacteria and archaebacteria (6 marks)
18) how do bacteria existing at the bottom of the water body are able to obtain requirements for photosynthesis (4 marks)
19) compare archaebacteria and eubacteria (5 marks)
20) compare fungi and bacteria (10 marks)
21) state diseases that are caused by bacteria (10 marks)
22) describe the different nutritional categories of bacteria (5 marks)
23) Describe the different forms of sexual reproduction in bacteria. (10 marks)
24) Explain the different roles played by plasmids.
25) Explain the different conditions that favor bacterial growth. (9 marks)
26) Explain why the continuous usage of the same antibiotic may result into resistance in bacterial cells. (10 marks)
27) Explain the importance of classification of bacteria (5 marks)
28) How can you determine growth in bacterial cells? (6 marks)

"Prokaryotes are the most primitive", substantiate. (20 marks)