ZS SERIES

BIOLOGY NOTES

MCQs & Short Questions

For F.Sc Part - II

Salient Feature

- Solved MCQs & Short Questions From Past Papers (9 BISE of Punjab & Federal Board Islamabad)
- Helpful for MDCAT,PPSC,FPSC & NTS

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SALIENT FEATURES OF Z-S SERIES:

- Questions in these notes are all selected from **PAST PAPERS** with number of times are repeated (highlighted with star sign).
- **Exercises** of all chapters are also covered.
- There are **1097 MCQs**, **572 SHORT QUESTIONS** and **132 LONG QUESTIONS**.
- These notes are composed according to **9 BISE of Punjab & AJK.**
- These notes are also preferred for competitive exams like **PPSC, FPSC, NTS** etc.
- **Simple, Easy and Concise** notes with heading
- Some **Additional and Valuable points** only for brilliant students have also been added.
- **95% SUCCESS RATIO** in all BISE.
- Study plan for Students also included. Where students can select any plan according to their ability and can cover syllabus.
- **Z-S SERIES NOTES OF BIOLOGY FOR 9th, 10th, 11th AND 12th CLASSES.**
- **Upcoming projects:**
  - **Video lecture** on youtube channel Irtisam Bio.
  - **One liner Biology** for 9th, 10th, 11th & 12th classes (Based on concepts for extraordinary preparation). Also valid for competitive examination related to Biology i.e **NTS, PPSC & FPSC (Lecturer).**

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CONTENTS

CH # 15: HOMEOSTASIS

SHORT QUESTIONS (SELECTED FROM PAST PAPERS)

Sentence which is under lines in these notes means that they are also a part of MCQ.

For Example:

Elimination of nitrogenous waste from body.

(a) Osmoregulation (b) thermoregulation (c) excretion.

In notes it is written as

Elimination of nitrogenous waste from body called **excretion.**

1. **Define homeostasis. Write its role.**

➢ **Homeostasis:** The protection of internal environment from harm of fluctuation of external environment called **homeostasis.**

- **Role:** It protect organism from external environment by osmoregulation, excretion & thermoregulation.
- **Example:** Control of body temperature (Human 37^0C).

2. **Difference b/w osmoregulation & thermoregulation.**

Osmoregulation	Thermoregulation
Control the amount of water & salt in body called osmoregulation.	Control of internal temperature within a tolerable range called thermoregulation.
Organ: Kidney, lungs and skin involve in osmoregulation.	**Organ:** Skin, brain and circulatory system (vasodilation) involve in thermoregulation.
Example: Kidney produces dilute urine in abundant supply of water.	**Example:** Control of body temperature (Human 37^0C).

3. **Define excretion.**

➢ **Excretion:** Elimination of nitrogenous waste from body called **excretion**.

- **Organ:** Kidney involve in excretion.
- **Example:** Excretion of ammonia, urea & uric acid.

4. **Difference b/w hypotonic & hypertonic environment.** ★★★★

Hypotonic environment	Hypertonic environment
A dilute solution as compared to cell concentration called **hypotonic environment**.	A concentrated solution as compared to cell concentration called **hypertonic solution**.
Water enters into cell & Cell become turgid.	Water release from cell & cell shrinks.
Example: Fresh water.	**Example:** Marine water.

5. **What are xerophytes & hydrophytes. Write their adaptation.** ★★★

➢ **Xerophytes:** Plants living in dry terrestrial condition called xerophytes.

❖ **Adaptation;**

- They have thick & waxy cuticle to reduce transpiration.
- **Xerophytes** have small & thick leaves to reduce transpiration.
- **Xerophytes** have stomata (sunken) present in lower epidermis.

- Cacti shed their leaves during dry season.

❖ **Example:** Cacti (ii) *Aloe vera*

➢ **Hydrophytes:** Aquatic plants are called hydrophytes.

❖ **Adaptation:**

- They have large surface area for more transpiration.
- **Hydrophyte's** stomata present on upper epidermis.
- Hydrophytes possess **large leaves.**

❖ **Example:** Water lily (ii) Lotus

6. What is mesophytes. ★★★

➢ **Mesophytes:** Plants living in moderate water availability called **mesophytes.**

❖ **Adaptation:**

- When there is sufficient supply of water, they open their stomata.
- When there is less supply of water, they close their stomata.

❖ **Example: Brassica, rose & mango.**

7. Difference b/w osmoconformers & osmoregulators. ★★★★★★★

Osmoconformers	Osmoregulator
Osmoconformer does not require to adjusts their internal osmotic state.	They adjust their internal osmotic state according to external environment.
They keep their body fluid isotonic to external environment.	Their body fluid does not isotonic to external environment.
Example: Hag fishes (ii) Marine invertebrates	**Example:** Bony fishes (ii) Cartilaginous fishes

8. How are osmoregulators adapted in fresh and marine environment / Give four adaptation of marine fish for its survival / How do bony fish osmoregulate in marine water.

➢ **Marine water:**

- Most cartilaginous fishes excrete salts through gills and also possess salt excreting organs such as rectal glands.
- Some fishes retaining urea in adequate concentration or retain Trimethyl amine oxide (less toxic than urea).
- Bony fishes drink large amount of seas water and excrete concentrated urine.

➢ **Fresh water:**

- Fresh water protozoa (Amoeba and Paramecium) pump out excess water by contractile vacuoles.
- Fresh water animals (flatworms) and fishes remove excess water by producing large volumes of **dilute urine**.

9. What is role of contractile vacuole.

➢ **Function of contractile vacuole:** Contractile vacoule is present in **fresh water organism**. Fresh water organism pump out excess water by **contractile vacuole.**

- **Example:** Amoeba (ii) Paramecium

10. What is anhydrobiosis.

➢ **Anhydrobiosis:** Terrestrial animal tolerate **dehydration** called **anhydrobiosis.**

- **Example: Kangaroo rat** survives without drinking water.

11. Why leaves are called excretophore. ★★★★

➢ **Excretophore:** Plants stored their waste in leaves. During autumn, plants fall yellow leaves to excrete their waste. That's why **leaves** are called excretophore.

- **Advantage:** Plants get rid from their organic/inorganic waste through leaves.

12. Define ebony.

➢ **Ebony:** Some trees store strange chemicals (waste material) in dead xylem (non-conducting) of stem and branches. The color of wood change to dark black in that parts of plant called ebony (Dark/ Black wood). These strange chemicals are regarded as waste material of plants.

- **Example:** Gaboon and Ceylon trees show ebony.

13. Write nitrogenous waste of purine & pyrimidine.

➢ **Nitrogenous waste of pyrimidine:** Ammonia, urea, xanthine & hypoxanthine.

➢ **Nitrogenous waste of purine:** Uric acid.

14. Why ammonia is more toxic than other nitrogenous waste.

➢ **Toxicity of ammonia: Ammonia** is most toxic nitrogenous waste & dissolves quickly in body fluid.

- A large/maximum amount of water is needed to release **ammonia.**
- About **500ml** of water is needed to release 1 g of ammonia.

15. What is ammonotelic, ureotelic &uricotelicanimals. ★★★★

➢ **Ammonotelic:** Ammonia (excretory product) excreting animals called **ammonotelic.**

- **Example:** Fresh water animals like fishes.

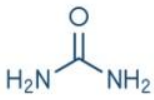
➢ **Ureotelic:** Urea (excretory product) excreting animals called ureotelic.

- **Example:** Terrestrial animals like humans.

➢ **Uricotelic:** Uric acid (excretory product) excreting animals called uricotelic.

- **Example:** Birds & reptiles.

16. Write formula of urea & uric acid. ★★★

➢ **Urea:** 

Uric acid: 

17. What is flame cell. Why it is called so. ★★

➢ **Flame cell:** Flame cell is part of excretory system of **planarian**.

- **Function:** Cilia of flame cells propel interstitial fluid into excretory duct for removal from body.
- **Name:** It has tuft of cilia. Beating of cilia looks like flickering flame. That's why it is called flame cell.

18. What is protonephredium & metanephredium.★★

➢ **Protonephredium:** Excretory system of flat worms (**planarian**) called **protonephrium**. **Protonephrium** is a network of closed tubules without internal openings. This system spread throughout the body and branches are capped by flame cells.

- **Example:** It is found in planarian.

➢ **Metanephridium:** Excretory system of earthworm called **metanephridium.**
Each segment of earth worm has pair of metanephridium. It has internal ciliated opening called nephrostome. It collects coelomic fluid. Useful material reabsorbs by capillaries. Waste material excretes from body through nephridopore.

- **Example:** It is found in earth worm.

19. Write function of malpighian tubule. ★★★

➢ **Malpighian tubules:** Excretory system of insects (cockroach) called **malpihgian tubule**.

Malphigian tubules are suspended in sinuses. Malpighian tubules collect excretory product from **hemolymh**. Malpighian tubule opens into hind gut. Fluid then pass from hind gut to rectum. **Rectum** reabsorbs water and salt. **Cock roach** excrete their waste in form of **uric acid.**

- **Example:** Arthropods.

20. Write metabolic waste of man.

Metabolic waste of man: Urea, uric acid, toxins, billirubin, creatinine & metabolites.

21. Skin does not come within definition of excretory organ. Comment.

➢ **Skin: Skin** has sweat glands & sebaceous gland.

- **Sweat gland:** Sweat gland secretes salt & water for thermoregulation.
- **Sebaceous gland:** Sebaceous gland secretes sebum for **protection**.

So skin does not come within definition of excretory organ.

22. Write two function of liver in homeostasis.

➢ **Function of liver:**

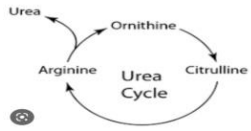
- Liver detoxify drugs.
- Liver secretes **bile** juice that emulsifies fats.
- They form fibrinogen (blood clotting protein).
- Liver produce **urea.**
- Major homeostatic function of liver is **glycogen** (Energy reserves) storage.
- **Plasma protein:** Prothrombin & fibrinogen (blood clotting) and Albumin (maintain osmotic balance of blood).
- **Storage function:** Liver act as store house of **Iron** (Oxygenation of tissues as constituent of hemoglobin).

23. What is bile.

➢ **Bile: Bile** is secreted by liver.

- **Function: Bile** emulsifies (large fat molecule converted into small molecules) fats in small intestine.

24. What is urea cycle. Draw urea cycle. ★★★



➢ **Urea cycle:** Urea is excretory product of man formed in liver.

Two molecule of ammonia & one molecule of CO_2 combine to form urea during urea cycle. Ammonia combines with CO_2 & ornithine to form citrulline. 2nd ammonia molecule combine with citrulline to form arginine. Arginine split by arginase to form urea & ornithine.

25. Difference between ureter and urethra.

Ureter	Urethra
Ureters of both kidneys drain urine into urinary bladder.	Urine leaves the body/urinary bladder, during urination through **urethra.**
There are two ureters in human body.	There is only one urethra in human body.

26. Difference b/w cortical & juxtamedullary nephron. ★★★★

Cortical nephron	Juxtamedullary nephron
Nephrons of cortex called cortical nephron.	These nephron form deep loop in inner medulla.
Function; It produces dilute urine.	**Function: Juxtamedularry nephron** involve in production of concentrated urine.
It is 85% of total nephron of kidney.	It is 85% of total nephron of kidney.
They have reduces Vasa recta.	They have well developed vasa recta.

27. Difference b/w afferent & efferent arterioles.

Afferent arteriole	Efferent arteriole
Blood enters into glomerulus through afferent arteriole.	Blood leaves the glomerulus through efferent arteriole.
Afferent has high diameter.	Efferent has less diameter.

28. What is vasa recta?

- **Vasa Recta:** Additional capillaries in juxtamedullary nephron extend to form loop around loop of Henle. These capillaries called **vasa recta.**
- **Function:** Vasa recta involve in production of concentrated urine (increase reabsorbtion).

29. What is glomerular filtrate?

- **Glomerular filtrate:** Filtrate coming from glomerulus due to pressure filtration called **glomerular filtrate.**
- **Composition:** Glomerular filtrate consists of glucose, amino acid & salts etc.

30. What is counter current multiplier.

- **Counter current multiplier:** The opposite flow of adjacent fluid (nephron and vasa recta) that maximize transfer rate called counter current multiplier.
- **Function:** Counter current multiplier produce concentrated urine.

31. Name two hormones working in nephron. ★★★

- **Aldosterone:** Secreted from adrenal cortex.
- **Function: Aldosterone** promote active uptake of **Na ion** in **collecting duct**.
- **ADH: ADH/vasopressin** is secreted from pituitary gland (posterior lobe).
- **Function:** It promotes reabsorption of water in collecting tubule.

32. Difference b/w hypercalcemia & hyperoxaluria.

Hypercalcemia	Hyperoxaluria
High level of calcium in blood called **hypercalcemia.**	High level of oxalate in blood called hyperoxaluria.
Effect: It causes calcium stone.	**Effect;** It causes oxalate stone.
Percentage: Hypercalcemia forms **15%** of total kidney stone.	**Percentage:** Hyperoxaluria forms **70%** of total kidney stone.

33. What is lithotripsy & renal failure? ★★★

- **Lithotripsy:** Non-surgical removal of kidney stone called **lithotripsy**. In lithotripsy, non electrical shock waves (X-rays) are applied over kidney stone that break stone into sand.
- **Uses:** It is used to remove kidney, ureter & gall bladder stone.
- **Renal failure:** Complete or partial failure of kidney called renal failure.
- **Causes:** Different pathological & chemical factors (Diabetes and hypertension) cause renal failure.
- **Effects:** Nitrogenous & plasma level of urea increase due to **renal failure.**

34. What is dialysis. ★★★

- **Dialysis:** Removal of urea from blood called dialysis. Dialysis is done by dialyzer machine. Dialyzer machine works on principle of kidney. It removes water & nitrogenous waste from blood.

❖ **Types:** There are two types of dialysis.

- Peritoneal dialysis
- Hemodialysis
-

35. Difference b/w hemodialysis & peritoneal dialysis. ★★★

- **Hemodialysis:** Cleaning of blood called hemodialysis. Blood is passed from dialyzer machine. It has two spaces which are separated by thin membrane. Blood passed from dialyzer fluid & waste material of blood absorb in dialysis fluid.
- **Peritoneal dialysis:** Cleaning of blood in peritoneal cavity called peritoneal dialysis. Peritoneal cavity present in abdomen has lined by thin epithelium called **peritonium**. Peritoneal cavity filled with dialysis fluid by catheter. Waste of blood enters into dialysis fluid.

36. What do you know about kidney transplant.

- **Kidney transplant:** Donor kidney, transplant into patient called kidney transplant.
- **Reason:** Higher degree of renal failure called **uremia**. In uremia, dialysis done continuously until new kidney transplant. Kidney transplantation is only permanent treatment of uremia.

37. Write two adaptation of plant in low & high temperature.

- **Adaptation in high temperature:**
  - Plants cool their body temperature by transpiration.
  - Plants synthesize special protein called heat shock protein that covers enzymes & protein.
- **Adaptation in low temperature:**
  - Plants increase unsaturated fatty acid of membrane.
  - Plant change **solute composition** that cause cytosol to super cool without ice formation.

38. What is heat shock protein.

- **Heat shock protein:** Some plants synthesize special type of protein in response to heat stress called heat shock protein. They cover enzyme & protein.
- **Function:** They prevents enzyme from denaturation.
- **Example:** Chaperones.

39. Difference b/w poikilotherms & homeotherms. ★★★

Poikilotherms	Homeotherms
Their body temperature change according to environmental temperature.	Their body temperature does not change according to environmental temperature. / They maintain their body temperature constant in changing environmental temperature.
They get heat from environment.	They generate their own body heat.
Example: Amphibians (ii) Reptiles	**Example:** Birds (ii) Mammals

40. Define heterotherms. ★★

- **Heterotherms:** They produce endothermic heat but generally do not regulate their body temperature called **heterotherms**.
- **Example: Bats** (ii) **Humming birds.**

41. Difference b/w endotherms & ectotherms. ★★★

Endotherms	Ectotherms
Endotherms produce their own body heat during metabolism as by product.	They produce metabolic heat at low level & absorb heat from environment.
Endotherms are also called cold blooded animals.	Ectotherms are also called warm blooded animals.
Example: Mammals (ii) **Birds**	**Example: Amphibians, fishes, invertebrates & reptiles.**

42. Define panting.

- **Panting:** Evaporative cooling in respiratory tract is called **panting.**

- **Organs:** Sweat gland (ii) Lungs
- **Example:** Dogs

43. Difference b/w shivering & non-shivering thermogenesis. ★★★★

Shivering thermogenesis	Non-shivering thermogenesis
Production of heat by contraction & shivering of muscle called **shivering thermogenesis.**	Production of heat by hormones called non-shivering.
Skeletal muscle involved.	ATPase enzyme and thyroxin involve.
Example: Heat produce by skeletal muscles.	**Example:** Heat produce by thyroxin hormone (secreted by Thyroid gland).

44. Write functions of brown fat.

- **Brown fat:** Some mammals possess brown fat.
- **Function:** Brown fat is specialized for rapid heat production.

45. How marine mammals regulate their body temperature.

- **Marine mammals:** Marine mammals have insulating fat called blubber. Blubber present under skin (act as insulator). So these mammals survive in colder environment due to blubber.
- **Example:** Whales (ii) Seals

46. Difference b/w pyrogens & pyrexia.

Pyrogens	Pyrexia
Pathogens & blood cell (leukocytes/**WBC**) produce chemicals called pyrogens.	Pyrogens increase normal body temperate above 37^0C. This condition called **pyrexia**/ temperature in fever.
Function: Pyrogens increase normal body temperate above 37^0C.	**Function:** It is defensive mechanism of body.
Example: Endotoxin.	**Example:** Fever

Exercise Short Questions

1) **Difference b/w osmoconformers & osmoregulators.**
   See question number: 7
2) **What is anhydrobiosis.**
   See question number: 10
3) **Why does filtration take place only at glomerular part of nephron.**
   Glomerular part: Walls of glomerulus are porous. So material of blood easily passes thorough these pores. While rest of blood vessels are without pores.
4) **Mention two metabolic altered states generally cause kidney stone.**
   Hypercalcemia and hyperoxaluria.
5) **What is renal failure.**
   See question number: 33
6) **Write one each adaptation of plants in low and high temperature.**
   See question number: 37

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Trimethylamine oxide produced in = **Marine fishes**
2) Ammonia kept as excretory product in animals living in = **Hypotonic organism**

3) Excretory product that is secreted with minimum amount of water= **Uric acid**

4) Excretory product that is secreted with less amount of water = **Urea**

5) ____ has structural & functional relationship b/w nutritive & excretory system = **Insects**

6) In urea cycle, detoxified form of ammonia is = **Urea**

7) Arginine is split by arginase to form urea & = **Ornithine**

8) Kidney receive blood with each cardiac cycle is = **20%**

9) Urine leaves kidney through = **Ureter**

10) Structural & function unit of kidney is = **Nephron**

11) All collecting tubules open into = **Pelvis**

12) Mammalian kidney conserve water by reabsorption of glomerolus filtrate= **99.5%**

13) Lizards basks in sun to gain = **Heat**

14) Land mammals respond to cold by rising their = **Fur**

15) Homeostatic thermostat is present in = **Hypothalamus**

16) Shark excrete = **Ammonia**

17) Uric acid produced from = **Nucleic acid**

18) Lease toxic N_2 waste = **Uric acid**

19) Which organ is central Station for metabolism/ metabolic clearing center = **Liver**

20) End product of hemoglobin breakdown = **Bilirubin**

21) Blood enter glomerulus through = **Afferent arteriole**

22) Incidence of Calcium oxalate stone = **70**

23) Incidence of calcium phosphate stone = **15**

24) Incidence of uric acid stone = **10**

25) Which is structural adaptation of animals for thermoregulation = **Pelage**

26) Chief nitrogenous waste in birds and reptiles = **Uric acid**

27) Fresh water flat worms excrete = **Dilute urine**

28) ___ not synthesize in liver = **Urine**

29) Lack of vasopressin = **Diabetes insipidous**

30) Saliva and urine is used for evaporating cooling in = **Bats**

31) ___ adapted to remove flooding of water = **Hydrophytes**

32) ____ take part in urea cycle = **Citruline**

33) ____ nitrogenous base has high molecular weight = **Guanine**

34) ____ animals inhabiting environment with acute shortage of water secrete = **Uric acid**

35) Liver has numerous crucial function of = **Homeostasis**

36) Liver has pivotal role in = **Homeostasis**

37) Inner end of Nephron form a cup shape structure = **Bowman capsule**

38) ___ vessel supply blood to Bowman capsule = **Afferenet arteriole**

39) Blood passing through the glomerulus filtered in = **Bowman capsule**
40) Secretion of ADH is inhibited when body fluid is = **Hypotonic**

Exercise MCQs

1) The protection of internal environment from harm of fluctuation of external environment called = **Homeostasis**
2) ____ have small & thick leaves = **Xerophytes**
3) Environment where animal produce large volume of dilute urine = **Hypotonic**
4) _____ are called excretophore = **Leaves**
5) Excretory product that is secreted with minimum amount of water = **Uric acid**
6) ___ has structural & functional relationship b/w nutritive & excretory system = **Insects**
7) ____ drain urine from kidney into urinary bladder = **Ureters**
8) Metabolic waste that are ingested into body and must be removed **= All**
9) Which of the following are not endotherm = **Amphibians**
10) Shivering thermogenesis is ____ type of adaptation = **Physiological**

LONG QUESTIONS
(SELECTED FROM PAST PAPERS)

1. Discuss osmoregulation in plants & animals. ★★★
2. Describe osmoregulation in marine & terrestrial environment. ★★
3. Describe excretion in plants. ★★
4. Discuss excretion in planaria, earthworm & cockroach. ★★
5. Discuss homeostatic & excretory function of liver. ★★★★★★★
6. Discuss urinary system of human. Write a detail note on structure & function of nephron. Draw labeled diagram.
7. Discuss kidney problems & cures. ★★
8. Write a note on renal failure & its treatment. ★★
9. Explain adaptation of plants at low & high temperature.
10. Explain thermoregulation in mammals. ★★
11. Explain thermostat function of hypothalamus in human thermoregulation. Draw diagram. ★★
12. Explain nephron in detail. ★★★

CH # 16: SUPPORT & MOVEMENT

Short questions (Selected from past papers)

1. **What is turgor pressure & osmotic pressure?** ★★★★★

➢ **Turgor pressure:** Pressure due to water within plant cell called **turgor** pressure.

- **Importance:** It keeps the plant rigid & prevents the plant from bending.

➢ **Osmotic pressure**: Pressure due to solute within plant cell called osmotic pressure.

- **Importance**: Water follows solute. That's why water enters in cell due to solute & involve in turgidity of cell.

2. **What is tonoplast. Write its function.**

➢ **Tonoplast:** Membrane of vacuole called **tonoplast.**

- **Role:** It has many active transport systems, which transport ions into vacuole that provide turgidity to plant cell.

3. **Difference b/w sclerenchyma & collenchyma.** ★★★★★

Sclerenchyma	Collenchymas
They have secondary cell wall.	**Collenchyma** lacks secondary cell wall.
They are non-living.	They are living.
Location: They are present in xylem.	**Location:** They are present in cortex.
Function: They provide support to plant.	**Function:** They provide support to young plant.

4. **What are fibers & sclerides.**

Fibers	Sclerides
They are long.	They are short.
Location: They are present in xylem or bundle caps.	**Location: Sclerides** are present in nut shells & seed coat.
Function: They provide support.	**Function:** They provide protection.

5. **Define secondary growth. Give its importance.**

➢ **Secondary growth:** Plant girth increase due to vascular cambium called **secondary growth.**

- **Cause:** It is caused by vascular and cork cambium.
- **Importance:** It is important to determine the age of plants. They increase the thickness of plant.

6. **Difference b/w vascular & cork cambium.** ★★

Vascular cambium	Cork cambium
They involve in secondary growth of plant.	They provide protection to plant.
Vascular cambium present in vascular bundle.	Cork cambium is present in cortex.
They give rise to secondary xylem & phloem.	They give rise to cork.

7. **Which tissue arises from vascular cambium.**

➢ **Vascular cambium:** Vascular tissue gives rise to two type of tissue.

- **Tissue:** Secondary xylem & secondary phloem.

8. **Difference b/w sap wood & heart wood.** ★★

Sap wood	Heart wood
Active & conducting wood called **sap wood.**	Inactive & non-conducting wood called **heart wood.**
It is also called alburnum.	It is also called duramen.

Function: They provide food and water to all parts of plant.	**Function: Heart wood** provides resistance to decay & insect attack.
Sap wood is light in color.	Heart wood is dark in color.
Sap wood present peripheral to plant.	Heart wood present in center of plant.
Example: Living xylem and phloem.	**Example:** Dead xylem.

9. Write function of callus. ★★★★★★

- **Callus:** Newly formed tissue over wound called callus.
- **Function:**
  - It unites the branching during budding & grafting.
  - It fills the wound.

10. Difference b/w autonomic & paratonic movements.

Autonomic movement	Paratonic movements
Spontaneous movements due to internal cause called **autonomic movements.**	Movement due to external cause called **paratonic movements.**
Types: Tactic, turgor and growth movements.	**Types:** Nastic and tropic movemts.
Example: Movement of fern's sperm toward archegonium.	**Example:** Movement of stem toward light.

11. Define tactic & phototropic movements. ★★★

- **Phototropic:** Movement of plant part in response to light stimulus.
  - **Example:** Movement of stem toward light.
- **Tactic movements:** Movement of entire organism/cell in response to internal stimui.
  - **Example:** Movement of fern's sperm toward archegonium.

12. What is the difference of plant & animal movement.

Animal movement	Plant movement
Animals change their location in response to stimuli.	Plant changes their growth pattern in response to external stimuli.
Animals show movement & locomotion.	Plants only show movement.
Example: Walking, swimming and flight.	**Example:** Movement of stem toward light.

13. Difference b/w phototactic & chemotactic movement. ★★★

Phototactic movement	Chemotactic movements
Movement in response to stimulus of light called phototactic.	Movement in response to stimulus of chemical called chemotactic.
Example: Movement of chloroplast toward light.	**Example:** Sperm of fern move toward archegonium is **chemotactic**.

14. Define pulvinus. ★★★

- **Pulvinus: Pulvinus** is swollen portion of petiole.
  - **Function:** Pulvinus rise & lower the leaves.

15. What is rapid movements of leaflets.

- **Rapid movement of leaflets:** Mimosa (Touch me not) plant has very sensitive leaves. When leaves of Mimosa plant are touched, their leaflets fold rapidly due to exosmosis in pulvinus due to potassium ion. K ion decrease the osmotic potential of cell and cell lose water by exosmosis. Plant takes 10 min to regain turgidity of leaves.

16. Difference b/w epinasty, nutation & hyponasty/three type of growth movement. ★★★

- **Epinasty:** In epinasty, epidermis of leave show more growth than hypodermis in bud condition.

- **Epinasty** leads to opening of bud.

➢ **Hyponasty:** In hyponasty, hypodermis of leave show more growth than epidermis in bud condition.

- Thus bud remains closed.

➢ **Nutation:** Growing tip of stem move in zigzag due to growth on opposite side of apex called **nutation.**

- **Example:** Sunflower seedling.

17. List different types of tropism.

➢ **Types:** Phototropism (ii) Thigmotropism
(iii) Chemotropism (iv) Hydrotropism (v) Geotropism.

18. Difference b/w geotropism & hydrotropism.

Geotropism	Hydrotropism
Movement of plant part in response to gravity called geotropism.	Movement of plant part in response to water called hydrotropism.
Allow plant to search water.	Allow plant to search nutrients.
Stem show negative geotropism.	Root show positive geotropism.
Example: Movement of roots.	**Example:** Movement of roots.

19. Difference b/w nyctinasty & haptonasty.

➢ **Nyctinasty:** Movement of organ in response to turgor & growth change called nyctinasty.

- **Example:** Opening of flower is example of **nyctinasty.**

➢ **Hyptonasty:** Movement in response to contact called **hyptonasty**.

- **Example:** Action of venus fly trap is example of **hyptonasty**.

20. Difference b/w photonasty & thermonasty.

Photonasty	Thermonasty
Movement of plant part in response to photoperiod called photonasty.	Movement of plant part in response to temperature called thermonasty.
Example: Opening & closing of flower due to light intensity.	**Example:** Leaves of Tulipa.

21. What is hydroskeleton.

➢ **Hydroskeleton:** Skeleton with fluid filled cavity called hydroskeleton.

- **Example:** Cnidarians & annelids etc. These animals has hydrostatic skeleton.

22. Difference b/w exoskeleton & endoskeleton. ★★★

Exoskeleton	Endoskeleton
Skeleton present outside the muscle called exoskeleton.	Skeleton present inside the muscle called endoskeleton.
It is inert & non-living.	It is moveable & living.
Function: Exoskeleton in arthropods protects the animals against their enemies and rough environment. It also protects them from drying.	**Function:** Endoskeleton involves in protection, movement and support.
Example: Skeleton of arthropods & mollusks.	**Example:** Skeleton of human.

23. Difference b/w epicuticle & procuticle.

Epicuticle	Procuticle
Outer layer of exoskeleton called epicuticle.	It is present below the epicuticle.
Composition: It is made of waxy lipoproteins.	**Composition:** It is made of chitin.
Function: Act as barrier for microorganism &	**Function:** It protects organism.

insects.	

24. Write composition of exoskeleton in mollusks & arthropods.

- **Exoskeleton of mollusks:** Shell of snail (mollusks) made of calcium carbonate.
- **Exoskeleton of arthropods:** Exoskeleton of arthropods composed of wax and chitin & further hardened by calcium carbonate.

25. Write different adaptation of exoskeleton in arthropods.

- **Adaptation:**

- Ridges & bars for attachment of muscle.
- Formation of joint in arthropods.
- Formation of sansilla & lenses.
- Modifications for exchange of gases.

26. Define ecdysis. Write its stages. ★★★★★

- **Ecdysis:** Shedding of old skeleton & secretion of new skeleton called ecdysis.
- **Stages:**
  - Digestion of old endocuticle by enzymes.
  - Formation of new procuticle & epicuticle.
  - Old skeleton splits & finally removed.
  - New skeleton is hardened by $CaCO_3$.

  All these changes of moulting are controlled by Nervous system & hormone called **ecdysone.**

27. Write disadvantage of exoskeleton.

- **Disadvantage of exoskeleton:**

- It restricts growth of animal.
- It is non-living.
- They replaced periodically by new skeleton.

28. Write function of skeletal system in mineral homeostasis & blood cells production.

- **Mineral homeostasis:** Bones act as store house of minerals (Ca, P, Na & K). Bones release or take up minerals by feedback mechanism.
- **Blood cells production:** Red & white blood cells are produced in bone marrow.

29. Difference b/w bone & cartilage. ★★★

Bone	Cartilage
Bones are hardest connective tissue.	Cartilages are soft connective tissue.
Bones have three types of cells (osteocyte, osteoblast & osteoclast).	They have only one type of cells (chondrocyte).
Blood vessels are present in bone.	Cartilage lack blood vessels.
Types: Spongy and compact bone.	**Types:** Hyaline and fibro cartilage.
Example: Skull and ribs	**Example:** Epiglottis and Larynx

30. Difference b/w compact & spongy bone.

Spongy bone	Compact bone
Inner part of bone is spongy.	Outer part of bone is compact.
Structure: Spongy bone is light, rich in blood vessels & highly porous.	**Structure:** Compact bones are dense & strong.
Function: Spongy bone involve in blood cell production.	**Function: Compact bone** provide attachment site for muscle.

31. Which kind of cells responsible for bone formation.

- **Osteoblast: Osteoblasts** are bone forming cells.

32. Difference b/w hyaline & fibro cartilage. ★★★

Hyaline	Fibro
It is most abundant cartilage.	It is less abundant cartilage.
It is composed of more collagen fibers.	It is composed of less collagen fibers.
It is weakest type of cartilage.	It is strongest type of cartilage.
Location: It is present at moveable joints.	**Location:** It is present in intervertebral disc.

33. Difference b/w axial & appendicular skeleton.

Axial skeleton	Appendicular skeleton
Axial skeleton consists of **skull**, vertebrae, ribs & sternum.	Appendicular skeleton consist of pelvic girdle with appendages & pectoral girdle with appendages.
Bones: Axial skeleton has 80 bones.	**Bones:** It has 126 bones.
Function: It is not involve in locomotion of organism.	**Function:** It involve in locomotion of organism.

34. Write names of two cranium bones.

- **Cranium bones:** Frontal & temporal bone.

35. Write names of paired & unpaired facial bones.

- **Paired facial bones:** Maxilla, **nasal**, zygomatic & palatine etc.
- **Unpaired facial bones:** Mandible & vomer.

36. Write classification of vertebral column.

- **Classification of vertebral column:** Vertebral column has **33** vertebrae & four regions.
- **Cervical region**: Cervical region has **7** vertebrae in nick.
- **Thoracic region**: Thoracic region has **12** vertebrae in chest cavity.
- **Lumber region**: Lumbar region has **5** vertebrae in abdomen.
- **Pelvic region**: It has 9 vertebrae in pelvic.

37. Describe pelvic girdle & hind limb in human. ★★

- **Pelvic girdle:** Pelvic girdle consists of two coxal bone that formed by fusion of ilium, ischium & pubis.
- **Function:** It attaches hind limb to vertebral column & support the pelvic region.
- **Hind limb: Hind limb** consist of femur, tibia, fibula, tarsals, meta-tarsal & appendages.

38. Write the bones of pectoral girdle, pelvic girdle & hind limb.

- **Bones of pectoral girdle:** Pectoral girdle composed of scapula, supra scapula& clavicle.
- **Bones of pelvic girdle:** Pelvic girdle composed of ilium, ischium & pubis.
- **Bones of hind limb: Hind limb** composed of femur, tibia & fabula, tarsal, metatarsal & phalanges.

39. What are synovial joints.

- **Synovial joints**: These joints contain a cavity filled with fluid and are adapted to reduce friction among the moving joints. The joint is surrounded by a layer of connective tissue called "fibrous capsule" and their inner layer the synovial membrane.
- **Example:** Hinge joint (ii) Ball and socket joint.

40. Difference b/w hinge & ball & socket joint. ★★★★★

Hinge joint	Ball & socket joint
Hinge joints allow the movement in two direction.	**Ball & socket** joint allow movement in several directions.

It has single pair of muscle	It has many pair of muscle.
They are more abundant.	They are less abundant.
Example: Elbow & knee joint.	**Example:** Hip& shoulder joint.

41. **What is cleft palate.**

- **Cleft palate**: In **cleft palate,** in which palatine processes of maxilla and palatine bone fail to fuse. The persistent opening between the oral and nasal cavity interferes with sucking.
- **Effect:** It can lead to inhalation of food into the lungs causing aspiration pneumonia.

42. What is microcephaly & osteoporosis.

- **Microcephaly:** Small size skull called **microcephaly**.
- **Cause:** It is caused by genetic defect.
- **Osteoporosis:** In osteoporosis, bone deposition is more than bone deposits. It is group of disease.
- **Cause:** It is caused by decreased estrogen level, smoking, less exercise & low calcium & protein in diet.
- **Treatment:** It is treated by estrogen replacement therapy (ERT).

43. What is rickets. How it is produced. ★★★★

- **Rickets:** It is disease of children. In rickets, children have deformed legs & **pelvis**.
- **Cause:** It is caused by deficiency of **vitamin D** & calcium.

44. What is herniation.

- **Herniation:** Severe physical trauma to spines causes herniation. It causes severe pain.
- **Cause:** Bending forward while lifting heavy object.
- **Treatment:** It is treated by bed rest, pulling & pain killer.

45. What is spondylosis & sciatica.

- **Spondylosis: Spondylosis** causes immobility & fusion of vertebral joint.
- **Sciatica:** Pain over **sciatica nerve** called sciatica.
- **Cause:** Injury & improper administration of injection into buttock.

46. What is soft callus & hematoma formation. ★★★★

- **Hematoma formation:** Clotted blood on injured site called hematoma.
- **Formation:** Blood vessels torn when bones breaks. As a result hematoma is formed.
- **Soft callus:** Soft callus formed within 3-4 weeks. Capillaries grow into hematoma & clear the debris. Then new bones are formed.

47. Compare three type of muscle. ★★★★★

Smooth muscle	Skeletal muscle	Cardiac muscle
Smooth muscles are non-striated muscle.	They are striated muscle.	They are striated muscle.
They have one nucleus.	They have many nuclei.	They have one nucleus.
They are involuntary muscle.	They are voluntary muscle.	They are involuntary muscle.
Found in internal organs.	They are attached with bones.	**Cardiac** muscles are found in heart.

48. What is rigor mortis. ★★

- **Rigor mortis:** Stiffening of body after death called rigor mortis.

- **Cause:** Bridge b/w myosin & actin is not break due to **low ATP** in body. ATP is required to break these bridges. Amount of ATP falls after death. So bridge remains bound.

49. Write two difference between sarcoplasm and Cytoplasm.

➢ **Sarcoplasm:** Sarcoplasm of the muscle fibre is similar to the cytoplasm of other cells but it contains usually large amount of stored glycogen and oxygen bonding protein myoglobin (a red pigment that stores oxygen).

50. **Write composition of thin filament**.

➢ **Thin filament**: Thin filaments are 7 - 8 nm thick and are composed chiefly of actin molecule, tropomyosin (**two** chains) and troponin (three polypeptide).

51. What are sources of energy for muscle contraction.

➢ **Sources:**

- Energy for muscle contraction comes from the ATP. Supply of ATP is maintained by the aerobic breakdown of glucose in muscle cell.
- When more energy is required due to high metabolism, it is provided by another energy storing substance called creatine phosphate.

52. Write effect of exercise on muscle.

➢ **Effect of exercise:**

- Exercise increase the muscle size & made more efficient.
- Aerobic exercise increase mitochondria & capillaries that surround muscle.

53. What is muscle fatigue. Write two cause.

➢ **Muscle fatigue:** Physiological inability of muscle to contract called muscle fatigue.

❖ **Cause:**

- Deficiency of ATP.
- Muscle fatigue is also caused by excess accumulation of **lactic acid** in muscle.

54. Difference b/w tetanus & muscle tetany.

➢ **Tetany:** Continuous contraction of muscle called tetany.

- **Cause: Tetany** is caused by low calcium level in blood.
- **Symptoms:** Muscle twitches & convulsion. If it remains untreated it causes even death.

➢ **Tetanus:** It is infectious disease caused by ***Clostridium tetani*** **(Bacteria).**

- **Symptoms:** Spasm of jaws & neck muscle. It causes lock-jaw. Spasm of trunk & limb muscle.
- Tetanus is major cause of death where mortality rate is **40%.**

55. What is cramp. Write its cause.

➢ **Cramp:** It is also called **tetanic contraction** of entire muscle.
Cramp lasts for few seconds to many hours.

- **Cause:** Low sugar level, deficiency of water & electrolyte.

56. Define origin & insertion.

➢ **Origin:** End of muscle that remains fixed during contraction of muscle called **origin**.

➢ **Insertion:** End of muscle that moves the bone during contraction of muscle called insertion.

57. Difference b/w tendon & ligament. ★★

Ligament	Tendon
Ligament attaches bone to bone.	**Tendon** attaches skeletal muscle to bone.
It is elastic.	Tendon is **non-elastic**.
Example: Coronary ligament	**Example:** Bicep tendon

58. What is antagonistic action of muscle.

- **Antagonistic muscle:** The relationship in which two muscles work against each other called antagonistic action of muscle.
- **Example:** Bicep and Tricep muscle.

59. What is brachialis & brachioradilus.

- **Brachialis:** Brachialis inserted in ulna.
- **Brachioradilus:** Brachioradilus inserted in radius.

60. Difference b/w effective & recovery stroke.

- **Effective stroke:** Five out of nine (5/9) double fibril contract & cilium bend called effective stroke.
- **Recovery stroke:** Four out of nine (4/9) double fibril contract & cilium straight called recovery stroke.

61. Write function of cilia in movement of paramecium.

- **Function of cilia:** Paramecium swim against water due to effective & recovery stroke of cilia. ATP provides energy to cilia for movement. All cilia beat together & propels animal.

62. What is jet propulsion.

- **Jet propulsion:** Jelly fish has umbrella like body called **bell**. Water enters into bell. Bell contract & force the water out like jet. Then animal moves forward. **Jelly fish** moves by jet propulsion.

63. Difference b/w active & passive flight. ★★★

Passive flight	Active flight
Birds fly passively by gliding.	Birds fly actively by flapping their wings.
Passive flight utilizes air currents.	Active flight utilizes muscle power.
No use of ATP.	ATP used.
Example: Flight of Bald eagle.	**Example:** Flight of Crow

64. What is aerofoils.

- **Aerofoils:** Wings act as aerofoil during gliding. Aerofoil is smooth surface which move through the air at an angle to air stream.

65. Difference b/w digitigrades, plantigrade & unguligrade. ★★★★

Digitigrade	Plantigrade	Unguligrade
Digitigrades walk on their digits only.	Plantigrade walk on their soles.	**Unguligrade** walk on their toes. Their toes modified into hoof.
They run faster than plantigrade.	When they walk, their sole touch the ground	It is swiftest type of locomotion.
Example: Rabbits & rodents.	**Example:** Human & **monkey**.	**Example: Deer** & goat etc.

66. What is formen triosseum.

- **Formen triosseum:** In birds, lifting action is possible because tendon of supra-coracoid passes through foramen triosseum.
  Location: It is present b/w scapula coracoids & clavicle bones.

Exercise Short Questions

1) **What is cramp. Write its cause.**
   See question number: 55
2) **Difference b/w tetanus & muscle tetany.**

See question number: 54

3) **What is ligament.**
   See question number: 57
4) **What is nutation.**
   See question number: 16
5) **How many ribs not attach with sternum.**
   Ribs: Last two pairs of ribs (called floating ribs) are not attached to sternum.
6) **How rickets are produce.**
   See question number: 43
7) **What is cause of tetanus.**
   See question number: 54
8) **How muscle fatigue is produce.**
   See question number: 53

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Bundle cap in sunflower is formed of ___ = **Sclerenchyma**

2) Loss of water due to ex-osmosis that cause plant to___ = **Wilt**

3) Turgor pressure generated by high osmotic pressure on___ = **Vacuole**

4) Secondary wall of sclerenchyma impregnated with ___= **Lignin**

5) ___ has three type of cells = **Sclerenchyma**

6) Sleep movements are due to ___= **Turgor pressure**

7) ___ types of growth movements are = **Three**

8) Movement in response to touch___ = **Thigmotropism**

9) Movement of hyphae of fungi is ___ = **Chemotropism**

10) Collagen fibers of bone hardened by deposition of ___ = **Calcium phosphate**

11) Bone dissolving cells called___ = **Osteoclast**

12) Living cells of cartilage called___ **= Chondrocytes**

13) ___ formed by fusion of four posterior vertebrae = **Coccys**

14) ___ connects scapula with sternum = **Clavicle**

15) ___joints held together by short fibers embedded in connective tissue = **Fibrous**

16) Fibrous joint present in___ = **Skull**

17) Acute form of arthritis caused by____ = **Bacteria**

18) Skeletal muscle called striated because____ = **Light & dark bands**

19) Diameter of skeletal muscle fiber is____ = **10-100um**

20) Thick filament is composed of ____ = **Myosin**

21) Elbow joint is straightens by____ = **Triceps**

22) Roots in Plants and skeleton in animals support them on land against___ = **Gravity**

23) In terrestrial plants, major mechanical stress imposed by ___ = **Wind**

24) Fibers, sclereids and vessels are example of ___= **Sclerenchyma**

25) _____ long cylindrical and exist as bundle caps = **Tracheids**

26) Leaflet of mimosa plant regain their turgidy after ___ min = **10**

27) Leaves go to sleep position due to low turgor in___ = **Pulvinus**

28) Hyponasty is cause by___ = Gibberellins

29) Hydroskeleton found in ____= **Jelly fish**

30) Inner semi fluid present in disc = **Nucleus pulposis**

31) ___Earliest form of muscle = **Smooth**

32) ___ Protein filament bind to Ca = **Troponin**

33) ____Unit of structure of myofibrils = **Sarcomere**

34) Most efficient way of supporting body is seen in ___ = **Mammals**

35) ____ cells have angular thickening in primary wall = **Collenchyma**

36) Positive geotropism of root is due to ___ = **Auxin**

37) Mature bone cell ___= Osteocyte

38) Tropic is Greek word derived from tropos which mean___ = **Turn**

39) ____ has hydrostatic skeleton = **Sea anemone**

40) ___ not a joint disease = **Sciatica**

41) Osteoarthritis is degenerative joint disease also caused by___ = **Genetic defect**

42) ____Inflammatory disease that damage joints = **Arthritis**

43) Humerus, radius and ulna are part of___ = **Fore limb**

44) Dark band is polarizing / an isotropic called ___ = **A band**

45) Euglena moves with help of ___= **Flagella**

46) Diameter of cillia is___ = **0.1 - 0.5 um**

47) _____ bird has long narrow wings = **Gull**

48) The supercoracoid muscle provide power for ___ = **Upward stroke**

49) Collenchyma and sclerenchyma are highly lignified cells of = **Cortex and xylem**

50) Internal hydrostatic pressure in plants = **Turgor**

51) Cells of bones and cartilage embedded in matrix of = **Collagen**

52) Lower two pairs of ribs called = **Floating ribs**

53) Vertebral column extend from skull to = **Pelvis**

54) Saccrum is formed by fusion of ___bones = **Five**

55) Clavicle connects scapula with = **Sternum**

56) In osteomalacia, bones receive ___ inadequate = **Minerals**

57) Diameter of thick filament = **16 nm**

58) Thick filament made of = **Myosin**

59) Beginning of bone formation starts after injury = **3-4 weeks**

60) In reptiles, ___ is modified for rotational movement = **Axis**

61) Skeletal muscle called striped because = **Alternating light and dark band**

62) Complete immobilization of muscle leads to = **Atrophy**

63) ___ straightness the elbow = **Tricep**

64) ___ common in Thigh and hip muscle = **Cramp**

Exercise MCQs

1) Which is direct source of energy = **ATP and creatine phosphate**
2) When muscle contract = **Myosin slide past actin**
3) ____ occur when muscle contract = **A band shorten**
4) Thin filaments are composed chiefly = **actin molecule, tropomyosin and troponin**
5) Contraction of muscle is initiated by release of energy in presence of = **Ca**
6) In mammal, synovial joint present between = **Humerus and ulna**
7) Which bone present in axial skeleton = **Rib**
8) Vertebral column include = **All (sacrum, coccyx, cervical, thoracic and lumbar**)
9) ___ cervical vertebrae in mammals = **7**
10) Brain is protected by = **Cranium**
11) ___ example of plantigrade = **Monkey**
12) Brachioradialis uplift is caused by **= Radius**
13) Moulting occur in arthropods at ___ stage = **Mature**
14) Muscle fatigue is caused by = **Lactic acid accumulation**
15) Cardiac muscle are = **Involuntary**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Describe significance of secondary growth. ★★
2. Write a detail note on autonomic & paratonic movement. ★★★
3. Explain growth movement.
4. Explain hydrostatic skeleton. ★★
5. Explain endoskeleton. Also discuss bone & cartilage.
6. Write major function of skeletal system. ★★★
7. Explain bones of human skull with diagram.
8. Discuss appendicular skeleton.
9. What is joint. Explain its types.
10. Explain four phase of repair process of fractured bones.
11. Explain ultra structure of myofilaments of skeletal muscle fibers. ★★★★★★
12. Explain sliding filament model. ★★★★
13. Describe locomotion in earthworm and paramecium. ★★

CH # 17: COORDINATION & CONTROL

Short questions (Selected from past papers)

1) Difference b/w etiolation & chlorosis. ★★★★

Etiolation	Chlorosis
Plants without chlorophyll called **etiolation.**	Plant with less **chlorophyll** called chlorosis.
Cause: Etiolation is caused when plants are grown without **light.**	**Causes:** It is caused due to mineral deficiency.
Chlorophyll not formed in these plants.	Chlorophyll formed but not enough for plant.

2) Difference b/w callus & galls.

Calluses	Galls
If plants are wounded, they develop amorphous mass. This undifferentiated mass of plant called calluses.	Galls are growth on plant. Highly organized galls are tumors.
Cause: Injury, cut or wound	**Causes:** Galls are caused by **parasite** like bacteria.
Callus is like regeneration.	Gall is like a tumor.

3) Define biorhythms. ★★★★

➢ **Biorhythms:** Behavior activities occur at regular intervals in living things called **biorhythms.**

- **Types:** Circadian & circannual are types of biorhythms.

4) Define circadian &circanual rhythms. ★★★

➢ **Circadian rhythms:** If biorhythms are about 24 hours called circadian rhythms.
Circadian is Latin word which means circa=about & dies=day.

- **Example:** Opening & closing of stomata.

➢ **Circannual rhythms:** If biorhythms are about 365 days called circannual rhythms.
Circannual is Latin word which means about year (circa=about & annual=year).

- **Example:** Migration of birds, hibernation of squirrels & moulting of ungulates.

5) Write commercial applications of auxins, gibberellins, ethene&cytokinins. ★★★★

Auxin	NAA cause parthenocarpy.	NAA stimulate fruiting.	2,4 D act as weed killer.
Gibberellins	GA used in brewing industry.	Delay ripening of Banana.	Increase size of grape & seedless grape production.
Cytokinins	Break dormancy of seed.	Keep flower fresh.	Delay senescence in cabbage.
Abscisic acid	Regulate fruit drop at end of season.	Promote flowering in short day plants .	Promote seed dormancy.
Ethane	Induce flowering in pineapple.	Stimulate flow of latex.	Stimulate ripening of fruit.

6) Name synthetic auxin used as weed killer.

➢ **Synthetic auxin: 2,4D** is synthetic auxin used as weed killer.

7) What is receptor. Name their types.

➢ **Receptor:** Cells/organs that detect stimuli in environment called **receptors.**

- **Types:** Chemoreceptor, mechanoreceptor, photoreceptor, thermoreceptor & nociceptor

8) Difference b/w chemo, nociceptor & mechanoreceptor.

➢ **Chemoreceptor:** These receptors are used for smell, taste and for blood (O_2, CO_2, glucose & amino acid) in hypothalamus.

- **Example:** Taste buds.

➢ **Nociceptor:** Nociceptor produces sensation of **pain.**

- **Example:** Cutaneous nociceptors.

➢ **Mechanoreceptor:** These receptors detect touch, pressure, hearing & equilibrium.

- **Example:** Meissners corpuscle.

9) Difference b/w meissner's&pacinian corpuscle.

Meissner's corpuscle	Pacinian corpuscle
Meissner lie in papillae.	**Pacinian** lie deep in body.
They have encapsulated endings.	They have encapsulated endings.
Meissner's are **touch** receptors.	They receive pressure stimulus.

10) Mention relative abundance of receptor in human skin.

➢ **Abundance of receptor:** Receptors are not distributed equally over surface of body.

- Pain receptors are 27 times more than cold receptor.
- Cold receptor is **10** times more than heat receptor.

11) What is neuroglia &Nissal'sgranules.

➢ **Neuroglia:** Nervous system contains neuron & neuroglia cells.

- **Role:** They involve in nutrition of neuron & form myelin sheath over neuron.

➢ **Nissl's granules:** Group of **ribosome** associated with rough ER & Golgi apparatus called Nissl's granules.

- **Role:** They synthesized proteins for neurons.

12) Define sensory, motor & associative neuron.

➢ **Sensory neuron:** They carry nerve impulse from receptor to CNS (brain/spinal cord).

- They are present in sense organs (eye, skin, nose, ear and tongue).
- **Composition:** They have only one axon & one dendron.

➢ **Motor neuron:** They carry nerve impulse from CNS to effectors.

- They are present in effectors (muscles and glands).
- **Composition: Motor** neurons have long axons & branch dendrites.

➢ **Associative neurons: Associative** neurons present in CNS (brain & spinal cord).

- They receive information from sensory neuron and send information to motor neuron.
- **Composition:** They have highly branched dendrites that looks like tree.

13) Define Dendron, dendrites & axon. ★★★★

➢ **Dendron:** Single large fiber which carries nerve impulse toward cell body called Dendron.

- **Example:** Dendron present in sensory neuron.

➢ **Dendrites:** Many smaller fibers which carry nerve impulse toward cell body called dendrites.

- **Example:** Dendrites present in motor and inter neurons.

➢ **Axon:** Process which carries nerve impulse away from cell body called **axon.**

- **Example:** Axon present in all neurons.

14) Define effector. ★★★★

➢ **Effector: Effector** produces response stimulated by nerve impulse coming via motor neuron.

❖ **Example:**

- Glands (secrete hormone) involve in chemical coordination.
- Muscle (by contract and relax) involve in Nervous coordination.

15) Define reflex arc & reflex action. ★★

➢ **Reflex arc:** Pathway of nerve impulse during reflex action.

- Reflex arc is type of pathway.

➢ **Reflex action:** It is an involuntary type of action.

- Reflex action is type of response.
- It involves receptors, CNS & effectors.

16) Difference b/w nerve impulse & salutatory impulse.

Nerve impulse	Salutatory impulse
Electrochemical change along length of neuron involving chemical reactions & movement of ions across cell membrane called nerve impulse.	In myelinated neurons, impulse jumps from node to node called **salutatory impulse.**
Its speed is slow.	Its speed is fast.
It transmits message in non mylinated neuron.	It transmits message in mylinated neuron.

17) What is sodium & potassium pump.

➢ **Sodium & potassium pump:** All neurons have Na & K pump located on membrane.

❖ **Function:**

- They use ATP for transport of Na out & K in, against concentration gradient.
- They involve in conduction of nerve impulse.

18) Define threshold stimulus.

➢ **Threshold stimulus:** Minimum stimulus which produces nerve impulse called threshold stimulus.

- **Function:** It convert resting membrane potential to active membrane potential.

19) Difference b/w resting & active membrane potential. ★★★★

Resting membrane potential	Active membrane potential
Net difference of charge in non-conducting neuron with more positive charge outside than inside the cell membrane called RMP.	Conducting neuron with less positive charge outside than inside the cell membrane called AMP.
It remains for long time.	It remains for short time (millisecond).
Resting membrane potential of neuron is **-70mV**.	Active membrane potential is 50mV.

20) Define synapse. ★★

➢ **Synapse:** Consecutive neurons are arranged by connecting axon & dendrite. There is no cytoplasmic connection but microscopic gap are left between them. Contact point b/w these two neurons called synapse. /

➢ Microscopic gap b/w two neurons called **synapse**.

21) What is neurotransmitter. ★★★★★

➢ **Neurotransmitter:** Chemicals released at axon endings/post synaptic membrane for transmit of message at synapse called **neurotransmitters**.

- **Function:** They involve in coordination.
- **Example: Acetylcholine** (lie outside the body), adrenaline & dopamine etc.

22) Difference b/w diffused & centralized nervous system.

Diffused nervous system	Central nervous system
Diffused nervous system consists of neuron only.	Central nervous system consists of brain & spinal cord.
They Lack CNS.	They have CNS.
Example: Cnidarians (**hydra** & jelly fish etc).	**Example:** It is present in human.

23) How brain is protected.

- **Protection of brain:**
- **Cranium** (bone) protects the brain.
- Three layers of **meninges** inside cranium protect brain/spinal cord.
- Cerebrospinal fluid in meninges protects brain.

24) What is cerebrospinal fluid.

- **Cerebrospinal fluid:** Cerebrospinal fluid is similar to **blood plasma.**
- **Function:**
  - It protects brain & spinal cord against bumps & jolts.
  - It baths the neuron of CNS.

25) Difference b/w CNS & PNS.

Central nervous system	Peripheral nervous system
CNS of human consists of brain & spinal cord.	PNS of human consist of nerves (Bundle of cell bodies)& ganglia (Bundle of axon/dendrite).
CNS is protected by bones & meninges.	PNS is protected by fatty layers.
They are consists of neurons.	PNS of human consist of nerves & ganglia.
Function: CNS control body functions.	**Function:** PNS transfer message between body & CNS.

26) Write components and functions of limbic system.

- **Components of limbic system:** Limbic system consists of hypothalamus, amygdale & hippocampus.
- **Function:** Emotions, drives, and behaviors, including fear, rage, tranquility, hunger, thirst, pleasure and sexual responses. Portion of limbic system is also important in the formation of memories.

27) Write function hypothalamus and amygdala.

- **Hypothalamus:** The hypothalamus through its hormone production and neural connections acts as a major co-ordination centre.
- It controls **body temperature, hunger,** menstrual cycle, water balance & sleep-wake cycle.
- **Amygdala:** Produce sensation of pleasure, punishment or sexual arousal when stimulated.
- It is also involved in the feelings of fear and rage.

28) Write role of Hind brain.

- **Hind brain:** Hind brain consists of **medulla**, **pons** & **cerebellum.**
- **Function:** It controls involuntary actions, maintain body position, sleep & wakefulness, learning & memory storage.

29) Difference b/w Grey & White matter.

Grey matter	White matter
Inner part of spinal cord called grey matter.	Outer part of spinal cord called white matter.
Grey matter is also present in cortex of brain.	White matter is also present on surface of brain.
Composition: It consists of cell bodies & non-myelinated nerve fiber.	**Composition:** It consists of myelinated nerve fibers.

Cell bodies present in grey matter.	White matter lack cell bodies.
It is 40% of brain.	It is 60% of brain .

30) Difference b/w nerves & ganglia.

Ganglia	Nerves
Ganglia are bundle of cell bodies of neurons bound by connective tissue.	Nerves are bundle of axon/dendrites bound by connective tissue.
Function: They are present in peripheral nervous system.	**Function:** They are present in peripheral nervous system.
Example: Dorsal root & autonomic ganglia.	**Example:** Sensory, motor & mixed nerves.

31) Difference b/w sympathetic & parasympathetic system.

Sympathetic system	Parasympathetic system
This system is important during emergency.	It over comes sympathetic system.
Function: It accelerate heart beat, dilate blood vessels & inhibit digestion.	**Function:** Retard heart beats, contraction of pupil & promote digestion.
Noradrenaline is released at effector site.	Acetylcholine is released at effector site.
Generates excitatory effects.	Generates inhibitory effects.

32) Difference between autonomic and somatic nervous system.

Somatic Nervous System	Autonomic Nervous system
Motor neurons form somatic nervous system, which controls voluntary movements (under the conscious control of the body).	Motor neurons also form autonomic nervous system, which controls involuntary responses (not under the conscious control of the body).
It affects skeletal muscles.	It affects glands and smooth muscles.
Also called voluntary nervous system.	Also called involuntary nervous system.

33) What is Parkinson, Alzheimer disease &Epilepsy. ★★★

Parkinson	Epilepsy	Alzheimer
Symptoms: Involuntary tremor, diminish motor powers & rigidity.	**Symptoms:** Frequent unconscious. Psychic nature.	**Symptoms:** Decline brain function. Symptoms like dementia
Cause: Head trauma	**Cause:** Tumor & emotional disturbance.	**Cause:** Genetic, high Aluminium level, lack brain function
Treatment: L-dopa & GDNF (glial cell-line derived neurotrophic factor).	**Treatment:** Anticonvulsant & avoid alcohol.	**Treatment:** Tacrine drug

34) Write action of nicotine on coordination. ★★

- **Action of nicotine:**
  - **Nervous system:** Stimulate nerve impulse. Nicotine Increase heart beat & blood pressure.
  - **Digestive system:** Nicotine Induces vomiting & diarrhea.

35) Define hormone. Write their nature.

- **Hormone: Hormones** are Organic compounds produced by glands, transported by blood & affect the function of target cells.

- **Example:** Insulin, glucagon and oxytocin etc.

❖ **Nature:**

- Protein (insulin & glucagon). Amino acid derivatives (epinephrine & non-epinephrine).
- **Polypeptides** (ADH & oxytocin).
- Steroids **(Cortisone,** estrogen & testosterone).

36) Write down role of hypothalamus in chemical coordination.

➢ **Role of hypothalamus:** It is part of fore brain.
Many sensory stimuli of nervous system converted into hormonal response.

❖ **Function:**

- It is believed that oxytocin & antidiuretic hormone produced in hypothalamus.
- Hypothalamus release many inhibiting and releasing factor that control the secretion of glands.

37) Anterior lobe of pituitary gland is master gland comment.

➢ **Master gland:** Anterior lobe of pituitary gland called master gland because they secrete their own hormones & tropic hormones (that control the secretions of other glands).

38) What is acromegaly.

➢ **Acromegaly:** Excess production of **somatotrophin/**growth hormone during late age cause acromegaly.

- **Symptoms:** It causes abnormal development of hands, feet & jaw.

39) What is luteinizing hormone (LH).

➢ **Luteinizing hormone:** It work with FSH & stimulate the secretion of estrogen. It ruptures follicles to release egg. It causes luteinizing of follicles. Ruptured follicles change to corpus luteum. Corpus luteum secretes progesterone.

40) Write name of hormone secreted by posterior lobe of pituitary gland.

➢ **Hormones of posterior lobe:**

- Anti-diuretic hormone/vasopressin
- Oxytocin.

41) Write function of oxytocin & anti-diuretic hormone.

➢ **Oxytocin:**

- Distension of cervix
- Decrease progesterone level
- Cause milk ejection
- Contraction of uterus muscle during child birth.

➢ **Anti-diuretic hormone:** ADH produces as result of decrease in blood pressure, osmotic pressure & blood volume of blood.

❖ **Effect:**

- High level of ADH increases the reabsorption of water in kidney.
- Low level of ADH decreases the reabsorption of water.

42) What is cretinism.

➢ **Cretinism:** Congenital deficiency of thyroxin causes cretinism.

- **Symptoms:** Small coarse scanty hairs, thick yellowish skin & mental retardation.

43) Write function of parathyroid hormone.

➢ **Parathyroid hormone:** Parathyroid produce parathormone.

- Parathormone controls the concentration of blood Ca level.
- Low level of blood Ca increase parathormone production & vice versa.

44) What are effects of low & high concentration of parathormone in body.

- **Low conc. of parathormone:** Low concentration of parathormone, cause low blood Ca that causes muscular Tetany.
- **High conc. of parathormone:** High concentration of parathormone, cause high blood Ca level that cause rickets & kidney stones.

45) Write name of hormones secreted by islet of Langerhans.

- **Islet of Langerhans:** Islet of Langerhans secretes insulin & glucagon hormone.

46) What is insulin & glucagon.

- **Insulin:** Insulin is secreted by β cells of pancreas.
- **Function:** It decreases glucose level by conversion of glucose into glycogen, lipids & protein.
- **Effect:** Lack of insulin production causes **diabetes mellitus.**
- **Glucagon: Glucagon** is produced by α cells of pancreas.
- **Function: Glucagon** increases the level of glucose in blood by breaking glycogen into glucose. It also breaks fats.

47) Name the hormones of adrenal gland.

- **Hormones of adrenal gland:** Adrenal gland present on **kidney**. It produces following hormones.
- **Adrenal medulla:** It produce adrenaline & nor-adrenaline hormone.
- **Adrenal Cortex:** It produce cortico-steroids (like cortisol, aldosterone) & androgenic hormones.

48) What do you know about Cushing disease.

- **Cushing disease:** It is reverse of Addison disease.
- **Cause:** Too much cortical hormone production, cause excess protein breakdown.
- **Symptoms:** Muscle & bone weakness. High level of blood sugar.

49) What are androgens.

- **Androgens:** Small amount of androgens are secreted by adrenal glands in male & females.
- **Example:** Testosterone
- **Effect:** They cause development of secondary male characteristics (hair on face).

50) Name the hormone of gut. ★★

- **Gastrin:** Gastrin is secreted by **stomach (Pyloric region).**
- **Function:** Stimulate stomach to secrete gastric juice.
- **Secretin:** Secretin is secreted by duodenum (due to acid food).
- **Fuction:** Stimulate pancrease to secrete pancreatic juice & liver to secrete bile.
- Gastrin and secretin released from **Gut**.

51) Write function of estrogen and testosterone.

- **Estrogen:** Estrogens involve in development of the secondary sex characters (enlargement of breast) in the female.
- It cause thickening of the uterine wall.
- They also aid in healing and repair of uterine wall after menstruation.
- **Testosterone:** It initiates the development of the sex organs.
- At puberty it brings about development of the male secondary characteristics (beard) and promotes the sex drive.

52) Why progesterone a constituent of birth control pills.

- **Birth control pills: Progesterone** suppresses ovulation (release of egg). That's why progesterone called birth control pills.

53) Define feedback mechanism.

- **Feedback mechanism:** It is interaction in which a controlling mechanism is controlled by its own products.
- **Example:** Low body temperature stimulates the production of TSH. TSH stimulates the production of thyroxin. Thyroxin breaks food to increase body temperature. High level of thyroxin and heat inhibit TSH production.

54) Write similarities & difference of nervous & chemical coordination.

- **Differences.**

Nervous coordination	Chemical coordination
Neuron is basic unit of nervous coordination.	Gland is basic unit of chemical coordination.
They have immediate effect.	They have prolonged effect except insulin.
Transmit signal through neuron/nerves.	Transmit message through blood.
They use neurotransmitters/nerve impulse for coordination.	They use chemicals for coordination.

- **Similarities:**

- Both nervous and chemical coordination synthesize chemical messengers.
- Both nervous and chemical coordination help in coordination of body.
- Both nervous and chemical coordination are homeostatic in function.

55) Difference b/w innate & learning behavior.

Innate behavior	Learning behavior
It is collection of response that is predetermined by inheritance of specific nerve in organism.	Process which shows adaptive change in individual behavior as a result of experience.
Innate behavior cannot be altered.	Learning behavior can be altered.
Example: All plant behavior is innate.	**Example:** Cat learns to press the lever to open the cage.

56) Name types of innate behavior.

- **Types of innate behavior:**

- Orientation.
- Reflexes & instincts.

57) What is kinases & taxes.

- **Kineses:** Random movement of organism which help them to survive in environment.
- **Example:** Movement of pill pug towards moist area.
- **Taxes:** Directed movement towards (positive taxis) or away (negative taxis) from a stimulus.
- Taxis are opposite to kinesis.

58) What is imprinting &habituation. ★★★

- **Imprinting:** The process in which animal forms association with another animal/object in environment during sensitive period of development called imprinting.
- **Example:** Birds imprint moving things in absence of parents.
- **Habituation: Habituation** is simple learning character.
- **Habituation** means less response to harmless & repeated stimuli.
- **Example**: Rodents respond to alarm calls by others in their group is **habituation.**

59) Difference b/w conditioned reflex type I & II.

Conditioned reflex type I	Conditioned reflex type II
Pairing of irrelevant stimulus with a natural stimulus that arise automatic response.	Under natural condition, achievement of goal is reward that directs random activities into behavior pattern.
It is also called conditioning.	It is also called trial & error learning.
Example: Dogs learn to salivate on ringing bell alone.	**Example:** Cat learns to press the lever to open the cage.

60) What is latent & insight learning.

- **Latent learning:** Association of neutral stimuli without patent reward.
- **Example:** We put a rat in maze & rat accidently get food. If we put rat in same maze, rat directly reaches to food.
- **Insight learning:** Insight learning is extreme case of behavior modification involving application of insight.
- **Kohler** performed many experiment on **insight learning**.
- **Example:** A chimpanzee is placed in cage in which fruit hangs from ceiling & with many boxes. After some time, chimpanzee moves towards boxes & piles them forget fruit.

Exercise Short Questions

1) **Define circadian rhythms.**
   See question number: 4
2) **Write difference between CNS & PNS.**
   See question number: 25
3) **What are the functions of parathyroid gland**.
   See question number: 43
4) **Define hormone.**
   See question number: 35
5) **What are the commercial applications of Auxin**.
   See question number: 5
6) **Write a note on Alzheimer disease.**
   See question number: 33

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Indole acetic acid is also called = **Auxin**
2) Which promote cell enlargement in region behind apex = **Auxin**
3) Which inhibit growth of lateral buds = **Auxin**
4) Gibberellins are obtained from = **Fungi**
5) Hormone promote bolting of some rosette = **Gibberellins**
6) Hormone delay ripening & improve storage life of fruits = **Gibberellins**
7) Hormone promote stomatal opening = **Cytokinins**
8) Abscisic acid promote closing of stomata under = **Water stress**
9) ABA sprayed on tress to regulate = **Fruit drop**
10) Hormone applied on rubber plant to stimulate flow of latex = **Ethene**

11) Ethane induce flowering in = **Pineapple**
12) Flow of impulse through nervous system, receptor, neuron & effector = **Simple reflex action**
13) During non-conducting state, neuron is permeable to efflux = **Potassium**
14) Normal speed of nerve impulse in human is = **100 m/s**
15) Which is largest part of brain = **Cerebrum**
16) Mid brain in human is = **Reduced**
17) Which act as relay centre in brain = **Mid brain**
18) Which is not related to medulla oblongata = **Large term memory**
19) How many pairs of spinal nerves present = **31 pairs**
20) Onset of epilepsy is usually before age = **30**
21) Alzheimer's disease is related to = **Mental illness**
22) Alzheimer is characterized by decline in function = **Brain**
23) Lack of ADH cause = **Diabetes insipidus**
24) Hormone inhibits root growth = **ABA**
25) Parthenocarpy is development of fruit without = **Fertilization**
26) Hormone absent in developing seed = **ABA**
27) ___ Delays ripening and improve storage life of fruits = **Gibberellins**
28) Which neuron has long axon = **Motor**
29) Maximum speed of nerve impulse = **120m/s**
30) Main neurotransmitter in brain = **Serotonin**
31) ____ Receive information from skin = **Thalamus**
32) Human has __ pair of cranial nerves = **12**
33) Onset of Parkinson disease at age of __ years = **50-60**
34) ___ Stimulate interstitial cell to secrete testosterone = **ICSH**
35) Lutenizing hormone induce = **Ovulation**
36) __ known as prolactin **= LTH**
37) Diabetics patient unable to metabolize = **Glucose**
38) Development of secondary sex character in female control by = **Estrogen**
39) ____ types of receptor present in skin = **5**
40) _____ necessary for fruit set = **Auxin**
41) EEG is used to study for **= Epilepsy**
42) ____ hormone induce labor pain = **Oxytocin**
43) Unicellular organism responed to = **All (temperature, light, chemicals)**
44) Receptor of planaria are sensitive to = **Light, pressure, touch and chemicals**
45) ___ control breathing, heart beat and swallowing = **Medulla**
46) ___ best developed in birds = **Cerebellum**
47) ___ caused by destruction of adrenal gland = **Addison**
48) Thalamua carry impulse from ___to limbic system = **Cerebrum**
49) ACTH is secreted from = **Pituitary gland**
50) During pregnancy, LTH & placental lactogen stimulate mammary gland for = **Lactation**

Exercise MCQs

1) Neuron net of hydra lack = **Connection**
2) A nerve is = **Bundle of axon / dendrites covered with connective tissue**
3) Thyroid gland produce = **Thyroxin, calcitonin, T3 and T4**
4) Number of cranial and spinal nerve in human = **12 and 31**
5) ____ not related to others = **Diabetes**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Write a detail note on biological clock. ★★
2. Explain role & commercial application of auxin. ★★★★
3. What is receptor. Explain its types. ★★★★
4. Discuss working of sensory receptor with reference to skin.
5. Define neuron. Explain its types.
6. Define reflex arc. Describe flow of information through nervous system. ★★
7. Define nerve impulse. How it is transmitted from one neuron to other.
8. What is resting membrane potential. How it is maintained. ★★★
9. Define synapse. How neurotransmitter help in passage of nerve impulse from one neuron to other. ★★
10. Compare nervous system of hydra & planaria. ★★
11. Write function of different parts of brain. ★★
12. Explain posterior lobe of pituitary gland. ★★
13. Write a detail note on thyroid gland & adrenal gland. ★★
14. Describe role of pancreas as an endocrine gland.
15. Explain four different types of learning behavior.
16. Explain conditioned reflex type 1. ★★★
17. Discuss latent & insight learning.

CH # 18: REPRODUCTION

Short questions (Selected from past papers)

1. **Define reproduction. Write its importance.**

➢ **Reproduction:** Production of new generation & maintain a species population called reproduction.

- **Importance:** Reproduction is important for survival of **species/population**.
- **Types:** Asexual reproduction (ii) Sexual reproduction.

2. **Difference b/w sexual & asexual reproduction.**

Asexual reproduction	Sexual reproduction
Reproduction without production & fusion of gamete	Reproduction with production & fusion of gamete
It involve only single parent.	It usually involves both parents.
Offspring produced by mitosis.	Offspring produced by meiosis.
Example: Bacteria reproduce asexually.	**Example:** Human reproduce sexually.

3. **Difference b/w isomorphic & heteromorphic generation.**

Isomorphic generation	Heteromorphic generation
When two generations (sporophyte & gametophyte) are vegetatively similar called isomorphic generation.	When two generations (sporophyte & gametophyte) are vegetatively dissimilar called heteromorphic generation.
Example: It is present in Alage.	**Example:** It is present in seed plants.

4. **What is diplohaplontic life cycle.**

➢ **Diplohaplontic:** In sexual reproduction, plants have diplohaplontic life cycle with alternating diploid sporophyte and haploid gametophyte generations.

- **Example:** Angiosperm and Gymnosperm.

5. **Why seed plant are dominant all around us.**

➢ **Dominant plants:** Seed plants are dominant around us due to following reasons.

❖ **Reasons:** Formation of flower & fruit

- Seed protection
- Seed dormancy
- Food storage for embryo.

6. **What are spermatophytes.**

➢ **Spermatophytes:** Seed plants are called spermatophytes. They are dominant around us. They are most abundant plants.

- **Example:** Wheat (ii) Corn (iii) Maize

❖ **Types:**

- Gymnosperms
- Angiosperms.

7. **Write importance of pollen tube.**

➢ **Importance of pollen tube:**

- **Pollen tube** act as vehicle for safe transport of male gametes (sperm) to female gamete (egg) in ovule in land plants.
- It is land adaptation by plants. Evolution of pollen tube is parallel to evolution of seed.

8. **How seed is formed. Write function of seed.**

➢ **Formation of seed:** Seed is formed from ovule.

- **Function:** Seed helps in dispersion of plant in terrestrial environment.

9. **Define parthenocarpy & seed dormancy.** ★★★★

➢ **Parthenocarpy:** In **parthenocarpy,** development of fruit without fertilization & seed formation.

- **Example:** Banana & Pineapples.
- **Artificial induction:** It is artificial induced by adding **auxin** as in tomato & pepper.

➢ **Seed dormancy:** Seed become inactive during unfavorable conditions (water scarcity and low temperature etc) called **dormancy**. It is special condition of rest.

❖ **Function:**

- It help embryo to survive the long periods of unfavorable conditions.
- Pass warm spell in winter that could be fatal for embryo.

10. **What is climacteric.** ★★

➢ **Climacteric:** Respiratory activity starts rapidly during fruit ripening called **climacteric.**

- **Cause:** Climacteric is associated with ethene production (involve in fruit ripening).

11. **What is meant by fruit set & fruit.**

➢ **Fruit set:** Formation of fruit from ovary wall after fertilization called fruit set.

➢ **Fruit:** Ripened ovary called fruit.

12. **Define photoperiodism.** ★★

➢ **Photoperiodism:** Response of plant to 24 hours day night cycle called photoperiodism.

- Photoperiodism was first studied by **Garner & Allard** in **1920** in tobacco**.**
- **Affects:** Photoperiodism affects flowering, fruit & seed production.

13. **Difference b/w short day plants & long day plants.** ★★★★★

Short day plants	Long day plants
Flowering is induced when dark period is longer than critical length.	Flowering is induced when dark period is shorter than critical length.
Under natural conditions, days are shorter than critical length.	Under natural conditions, days are longer than critical length.
Example: tobacco & strawberry.	**Example:** wheat, **cabbage**, **Henbane** & ***Hyoscyamus niger.***

14. **Write role of light on plant growth.**

➢ **Role of light:** Flowering is influenced by quality of light.

➢ **Quality of light:** Cocklebur is short day plant. It will not flower if its long night interrupted.

➢ **Quantity of light:** Red light prevent flowering while far red light induce flowering.

15. **What is phytochromes. Which form is more during night.**

➢ **Phytochromes:** Red light sensitive proteins pigment called **phytochromes**.

- **Functions**: Induce flowering in many plants.
- **Forms**: It exists in two forms P-660 & P-730.
- **During night:** P-730 is converted into P-660 during **dark**. So P-660 is more during night.

16. Write role of P-730 phytochrome in flowering.

P-730: Long day plants produce flower in presence of P-730.

17. What is vernalisation. Write is significance & cause. ★★★★★★★

➢ **Vernalisation:** Flowering is stimulated by low temperature treatment (received by shoot apex or embryo) called **vernalisation**.

- **Duration**: 4 days to 3 month. $4^{o}C$ is very effective temperature for vernalisation.
- **Cause:** Vernalisation is caused by vernalin hormone (actually gibberellins).

❖ **Importance:**

- They ensure flowering of same species at same time.
- They encourage cross pollination.

- **Example:** Vernalization done in Biennials and perennials plants

18. Name any two type of asexual reproduction in animals.

➢ **Asexual reproduction:** Parthenogenesis & cloning is method of asexual reproduction in animals.

19. Define parthenogenesis.

➢ **Parthenogenesis:** Development of egg without fertilization called **parthenogenesis.**

- **Example:** Honey bees & ants

20. Difference b/w haploid & diploid parthenogenesis. ★★★★★

Haploid parthenogenesis	Diploid parthenogenesis
Haploid egg develops into haploid offspring.	Diploid egg develops into diploid offspring.
Fertilization does not occur.	Fertilization does not occur.
Normal meiosis occurs.	Modified meiosis occurs.
Example: Honey bees.	**Example: Aphids**

21. Define apomixis. ★★★★★★

➢ **Apomixes:** Diploid cell of ovule develop into embryo in absence of male gamete. Rest of embryo develops into seed & ovary into fruit. Apomixes is type of parthenogenesis.

- **Example:** Flowering plants.

22. What is cloning. Give their advantage & disadvantage.

➢ **Cloning:** Production of genetically identical organism by asexual reproduction called cloning.

- **Clone:** Organism produced by cloning called clones.

❖ **Advantages:**

- Desirable animals like race horses can be cloned.
- Useful varieties of plants can be cloned.

❖ **Disadvantage:**

- Organism produce by cloning have no genetic recombinations. All organisms will not show resistant to disease, if disease outbreak all organisms die.
- Cloning of human beings is immoral.

23. What is tissue culturing.

➢ **Tissue culturing:** Culturing of tissue for production of identical organism called tissue culture. In this technique, tissue of cambium excised and cultured. That tissue develops into new plant in culture medium.

❖ **Use:**

- It used for production of identical organism.
- It is used for rapid propagation.

❖ **Types:**

- Tissue culturing of plants
- Tissue culturing of Animals

24. Difference b/w identical & fraternal twins/triplets. ★★★★★★★

Identical twins	Fraternal twins/Triplets
When embryo is at 2 celled stage, two blastomeres separate & develop into 2 individual.	Female produce more than one egg. Each egg is fertilized by sperm.
There are also called monozygotic twins.	There are also called dizygotic twins.
Share same placenta.	Twins have different placenta.
Have same blood group.	May have different blood group.
Both offspring are identical.	Both offspring are not identical.
They produced asexually.	They produced sexually.

25. Define fertilization.

➢ **Fertilization:** Process which leads to union of gametes (sperm & egg) called **fertilization.**

❖ **Types:**

- Internal fertilization (fertilization takes place inside the body)
- External fertilization (fertilization take place in aquatic environment)

26. Difference b/w external & internal fertilization.

External fertilization	Internal fertilization
It occurs outside body.	It occurs inside the body.
External fertilization occurs in **aquatic** conditions.	It occurs in terrestrial conditions.
Development is external.	Development may be internal or external.
Large number of gametes are produce.	Less number of gametes are produce.
Example: fishes & frogs.	**Example**: birds & mammals.

27. Define oviparous, viviparous & ovoviviparous. ★★★★★★★

➢ **Oviparous: Oviparous** lays **shelled eggs**. Shell protects developing embryo from harsh condition.

- **Example: Birds & reptiles.**

➢ **Viviparous:** Development of embryo takes place inside the body. Female give birth to baby.

- **Example:** Mammals (human).

- **Ovoviviparous:** Development of embryo is internal within shelled egg. After completion of development, shelled egg laid & offspring come out.
- **Example: Duckbill platypus.**

28. Name different parts of male reproductive system.

- **Parts of male reproductive system:** Testes, sperm ducts (seminiferous tubule, vas deferens, epididymis) & penis.

29. Write function of interstitial cells &sertoli cells. ★★

- **Sertoli cell:** Sertoli cells present in **testes**. They secrete fluid.
- **Function:** This fluid of sertoli cells provides liquid medium, protection & nourishment to **sperms**.
- **Interstitial cells:** These cells are present b/w seminiferous tubule & produce **testosterone.**
- **Function: Interstitial cells** produce testosterone hormone. **Testosterone** involve in production of sperms & development of male secondary sexual character (beard).

30. What is ovulation.

- **Ovulation:** Discharge of egg from ovary called **ovulation**.
- **Example:** In human, only **one ovum** is discharge from ovary at same time.

31. Difference b/w spermatogenesis & oogenesis. ★★

Spermatogenesis	Oogenesis
Spermatogenesis is continuous process in male.	Oogenesis is not a continuous process in female.
Millions of haploid sperms are produced by meiosis through spermatogenesis.	Single haploid egg is produced by meiosis through oogenesis.
It takes place in testes.	It takes place in ovary.
Produce motile sperm.	Produce non motile egg.

32. What changes occur in ovulation & menstruation during pregnancy.

- **Change during pregnancy:** Ovulation& menstruation stops during pregnancy.

33. What is follicle atresia.

- **Follicle atresia:** At start of puberty, pituitary gland release follicle stimulating hormone (FSH). FSH stimulates many primary follicles. Only one follicle grow & other follicles break down by degenerative process called follicle atresia.

34. What is corpus luteum. Write its function. ★★

- **Corpus luteum: Corpus luteum** is yellowish glandular structure formed from follicle cell.
- **Function:** Corpus luteum secrete **progesterone** hormone. It develops endometrium & than placenta.

35. Write function of placenta & oxytocin.

- **Placenta:** A structure formed between uterine and foetus for exchange of materials called placenta.
- **Function of placenta:** Placenta help in exchange of O_2, CO_2, wastes, nutrients & other materials b/w mother & foetus.
- **Function of oxytocin:**
- **Oxytocin** cause labour pain (contraction of uterine wall).
- They provide force to expel fetus from uterus. It is also involve in ejection of milk.

36. Difference b/w menstrual cycle & menopause. At what age menopause starts.

- **Menstrual cycle:** Changes in structure & function of whole reproductive system in human females called menstrual cycle. It is completed in approximately 28 days.
- **Age:** It starts at the age of 14 years.
- **Menopause:** Complete stopping of menstrual cycle called **menopause**.

- Female stops producing egg after menopause.
- **Age**: It starts at age of 45 to 50 years.

37. What is menstruation.

➢ **Menstruation:** Discharge of blood & cell debris from vagina called **menstruation**.

- **Duration:** Menstruation lasts for 3-7 days.

38. What is oestrouscycle. ★★

➢ **Oestrous cycle:** In this cycle, estrogen prepares uterus for conception partly & also stimulate follicle to develop ova. She exhibits desire for mating (for ovulation) & said to be on heat.

- **Example:** It is found in all female mammals except **human female**.

39. What is gestation & lactation. ★★

➢ **Gestation:** Pregnancy period called gestation. In human gestation period is **280 days**.

➢ **Lactation:** Mammary glands produce milk called lactation. It is induce by oxytocin and prolactin.

40. Write hormones of placenta.

➢ **Hormones of placenta:** Progesterone maintains pregnancy.

- Human placental lactogen cause development of mammary gland.

41. Name hormones that stimulate mammary gland for lactation.

➢ **Hormone:** Luteotrophic hormone (from pituitary gland) & placental lactogen (from placenta) stimulate mammary gland for lactation.

42. What is labor pain.

➢ **Labor pain:** Contraction of uterus wall cause pain called labour pain.

- **Cause:** Labor pain is caused by **oxytocin hormone** secreted by pituitary gland.

43. What is after birth.

➢ **After birth:** Within 10-45 minutes after birth, placenta separate from uterus & than pass out from vagina. This is called after birth.

44. What is test tube babies.

➢ **Test tube babies:** Parents with abnormalities are unable to enjoy the normal process of fertilization & birth of their baby. Such parents are benefited by test tube babies. In TTB, fertilization is in vitro & zygote is implanted back to mother uterus. This leads to normal birth.

45. What are syphilis, gonorrhea & genital herpes. ★★★

Gonorrhea	Syphilis	Genital herpes
Causitive Agent: ***Neisseria gonorrlzoeae*** **(Gram +ve).**	**Causitive Agent:** Spirochete i.e ***T. pallidum.***	**Causitive Agent:** *Herpes simplex type 2*
Affects: Mucous membrane of urinogenetal. Eye infection in infants.	**Affects:** Reproductive organs, eyes, joints, CNS, heart & skin.	**Affects:** Infection in genitalia. affect eye & CNS in infant
Cause: Sexual contact.	**Cause:** Sexual contact	**Cause:** Sexual contact.

46. What is AIDS. ★★★

➢ **AIDS:** Abbreviation of AIDS is acquired immune deficiency syndrome.

- **Affects**: It affects immune system.
- **Cause:** It is caused by HIV virus.
- **Spread:** It is spread through sexual contact.

Exercise Short Question

1) **What changes occur during ovulation and menstruation.**
   Changes: Both ovulation and menstruation stops.
2) **Write difference between oogenesis and spermatogenesis.**
   See question number: 31
3) **How a seed formed.**
   See question number: 8
4) **What is importance of seed during plant life cycle.**
   Seed: Seed is important structure for dispersion of plant.

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Sporophyte is completely dependent upon gametophyte = **Bryophyte**

2) Germinating pollen grain is rich source of = **Auxin**

3) Which help in ripening of fruit = **Ethane**

4) Photoperiod affects flowering when shoot produce = **Floral bud**

5) Example of long day plant is = **Cucumber & Tomato**

6) P-660 absorbs = **Red light**

7) Long day plant produce flower **= P-730**

8) Floreign hormone travel through phloem & produce in **= Leaves**

9) Which temperature is more effective in vernalisation = **4^oC**

10) Duration of low temperature required for = **4 days- 3 months**

11) In honey bees males are haploid & produce sperms by = **Mitosis**

12) During oogenesis, total non-disjunction of chromosome occur in = **Aphids**

13) Which lie outside the body in sac like scrotum = **Testes**

14) Vas deferens form highly convoluted = **Epididymis**

15) Germ cells of ovary produce many = **Oogonia**

16) Uterine tube open into = **Uterus**

17) Decrease of FSH cause pituitary gland to secrete = **Luteinizing hormone**

18) Luteinizing hormone induce = **Ovulation**

19) Human embryo remained enclosed in = **Amniotic sac**

20) From beginning of 3^{rd} month of pregnancy, embryo called = **Fetus**

21) Major organs formed after = **12^{th} weeks**

22) Average loss of blood during delivery = **350 cm^3**

23) Tobacco plant produce flower in = **Autumn**

24) Example of day neutral plant = **Tomato & cotton**

25) Short day plant with critical length 8.5 hours = **Cocklebur**

26) ___ substitute of red light **= Auxin**

27) A long day plant with critical length 11 hours = **Henbane**

28) Unhooking of plumule is promoted by = **Red light**

29) 1st convulated part of Vasa deferens = **Epididmyis**

30) Example of haploid cell = **Secondary oocyte**

31) Sensitive part of External genitalia in female = **Clitoris**

32) High level of estrogen stimulate the ___ secretion = **LH**

33) Rapid aging and low environmental resistance are result of = **Cloning**

34) Sperms are formed in ____ tubules = **Seminiferous**

35) Reduction in progesterone, stimulate production of ____ hormone at end of pregnancy = **Oxytocin**

36) Oviduct also called = **Uterine tube/fallopian tube**

37) Development of secondary sex character in female is due to = **Estrogen**

38) ____ hormone suppress ovulation = **Progesterone**

39) Reproduction in which organism divide into two organism = **Binary fission**

40) Blue light sensitive protein found in plants = **Phytochrome**

41) Leaf unrolling is promoted by red light in = **Monocots**

42) P660 is converted into P730 during = **Red light**

43) P730 is converted into P660 during = **Dark**

44) Light that prevent flowering in cocklebur = **Far red**

45) Light promote germination of fern spore = **Red**

46) ___ differentiate into sperm = **Spermatid**

47) Estrogen inhibits secretion of = **FSH**

48) Inner soft wall of uterus called = **Endometrium**

Exercise MCQs

1) Reproduction is important for survival of = **Population**.
2) In Plants photoperiod and temperature affects = **All (flowering, bud and seed dormancy, fruit and seed development)**
3) Developing seeds are rich source of = **Auxin**
4) Common method of asexual reproduction = **All (tissue culture, cloning, identical twins**)
5) Photoperiod affects flowering when shoot Meristem produce = **Floral bud**

LONG QUESTIONS
(SELECTED FROM PAST PAPERS)

1. Define photoperiodism. Write classification of plants according to photoperiodism. ★★
2. Write role of phytochrome in flowering & regulate photoperiodism. ★★

3. Discuss parthenogenesis. Discuss its types. ★★★★
4. Describe apomixes & cloning.
5. Discuss identical twins & test tube babies.
6. Discuss various method of sexual reproduction in animals.
7. Compare asexual reproduction with sexual reproduction.
8. Discuss male reproductive system. ★★★★★★
9. Discuss female reproductive system.
10. Discuss female menstrual cycle. ★★★
11. Discuss child birth in human. ★★★★★★
12. Discuss hormones secreted by ovary.
13. Discuss sexually transmitted disease. ★★★

CH # 19: GROWTH & DEVELOPMENT

Short questions (Selected from past papers)

1. **Difference b/w growth & development.** ★★★★★

Growth	Development
Permanent& irreversible increase in size of an organism as organism mature called growth.	Progressive changes occurring within organism before adult called development.
Growth is quantitative.	Development is both quantitative and qualitative.
Growth stops at maturity.	Development never stops.

2. **What is open growth & meristem.**

➢ **Open growth:** Addition of new organs like branches, leaves & roots throughout life called open growth. Plants show open growth.

➢ **Meristems:** Group of cells/tissues that has ability to **divide** called **meristems.**

- They involve in growth of plant.
- **Example:** Apical and lateral meristem.

3. **Difference b/w apical & intercalary meristem.** ★★★★

Apical meristems	Intercalary meristems
Apical meristems present at the **tips of roots & shoots**.	Intercalary meristems present at the **base of internodes**.
Function: They play important role in primary growth.	**Function:** They play important role in production of flowers & leaves.

4. **Difference b/w determinant & indeterminant growth.**

Determinate	Indeterminate
Some parts of plant grow to certain size & than stop. So their growth is determinate.	Stem grow by meristem & continuously grow. So their growth is indeterminate.
Example: Growth of leaves, flower & fruits.	**Example:** Root & stem.

5. **Difference b/w primary & secondary growth.** ★★★

Primary growth	Secondary growth
In primary growth, **apical meristems** added primary tissues.	In secondary growth, intercalary/lateral meristems added secondary tissues.
Function: It increases the length of plant.	**Function:** It increases the width/thickness of plant.
Occurs in all plants.	Occurs only in spermatophytes.
Increase the plant in longitudinal axis.	Increase the plant in radial axis.

6. **Write effects of temperature & light on growth.**

➢ **Effect of temperature:** Temperature influence rate of growth.

- Growth is maximums at optimum temperature **25-30^{0}C.**
- Growth is minimums at low temperature 5-10^{0}C.
- Growth stops at very high temperature 35-40^{0}C.

➢ **Effect of light:** Intensity of light increase the cell division.

- **Red light** increase cell elongation while **blue light** retards cell elongation.

7. Write function of vitamins in growth.

➢ **Vitamins:** Vitamins are organic compounds produced in plants. Vitamins produced in presence of **light.**

❖ **Functions:** Vitamins are essential for metabolism. Vitamins are act as co-factor. Vitamins are important for growth.

8. What is differentiation & correlation.

➢ **Differentiation:** Formation of specialized tissue from similar cells called differentiation.

- Meristems form all cells of adult plant.

➢ **Correlations:** Reciprocal relationship of growth b/w different parts of plants in which one part affect the growth of other part called growth correlation.

- **Example:** Apical dominance.

9. Define apical dominance.

➢ **Apical dominance:** In many plants, only apical bud grows while growth is suppressed in lower axillary buds. **Auxin** (terminal bud) is responsible for inhibiting the growth of lateral buds.

- **Cause:** It is affected by auxin (promote apical dominance) & Cytokinins (inhibit apical dominance)
- **Role/Application:** It plays an important role in tap root development
  (ii) Inhibition of sprouting of lateral buds.

10. What is inhibitory & compensatory effect.

➢ **Inhibitory effect:** Terminal bud produced auxin that diffuses to lateral bud.

- Auxin inhibits the growth of lateral bud called inhibitory effects.

➢ **Compensatory effect:** Removal of terminal bud that restores the growth of lateral bud called **compensatory effects.**

- Cytokinesis promotes compensatory effect.

11. Define cleavage & discoidal cleavage.

➢ **Cleavage:** Series of mitotic division in egg after fertilization called **cleavage.**

- **Example:** It takes place in zygote.

➢ **Discoidal cleavage:** Process of cell division is confined to small disc of protoplasm. This disc lies on surface of yolk at animal pole.

- **Example:** It is present in bird egg.

12. Define morula & blastoderm.

➢ **Morula:** Rounded closely packed mass of blastomeres called **morula.**

➢ **Blastoderm:** Discoidal cap of cells above blastocoel is called **blastoderm.**

13. Define gastrulation.

➢ **Gastrulation:** Movements & rearrangements of cells into germ layers within embryo called **gastrulation.**

- **Germ layers:** Endoderm (ii) Ectoderm (iii) Mesoderm

14. Difference b/w epiblast & hypoblast. ★★

Epiblast	Hypoblast
Upper layer of blastoderm cells called epiblast.	Lower layer of blastoderm cells called hypoblast.
Epiblast develops into embryo.	Hypoblast develops into yolk sac.
Function: Epiblast forms **ectoderm & mesoderm**	**Function:** Hypoblast forms **endoderm.**

15. How area opaca differs from area pellucid. ★★★

➢ **Area pellucida:** Fluid rises at central cells of blastoderm & separates them from yolk. This gives translucent appearance called area pellucida.

- **Area opaca:** Peripheral part of blastoderm that is attached with yolk called **area opaca**. It is white area.

16. How primitive streak formed. ★★

- **Formation of primitive streak:** Mesodermal cells migrate to centre from both sides. They create thick mid line called **primitive streak.** More and more mesodermal cells move towards center.
- **Function:** They change the shape of blastoderm from circular to pear shaped.

17. What is Hensennode.

- **Hensen node:** At the cephalic end of primitive streak, closely packed cells form a local thickening known as **Hensen's node.**
- The Hensen's node is some of special type of invagination.

18. Define coelom. Name layers of lateral plate of mesoderm.

- **Coelom:** Cavity formed b/w somatic & splanchnic mesoderm called **coelom.**
- **Layers of lateral plate:** Lateral plate of mesoderm split into somatic mesoderm & splanchnic mesoderm.

19. How neural plate formed.

- **Formation of neural plate:** Over notochord, neural ectoderm present in form of band. As gastrula elongates, band thickens to form neural plate. After 18 hours in chicks, neural plate is present as flat.

20. Define neurula & neuroceol.

- **Neurula:** Folding of neural plate is clearly visible after 24 hour embryo.
- Embryo in this stage called **neurula**.
- **Neuroceol:** Cavity enclosed in nervous system called neuroceol.

21. What is Grey crescent? Write its importance. ★★

- **Grey crescent:** Pigment free area appears during fertilization called **grey crescent**.
- **Importance:** Development depends upon position of grey crescent.

22. Write role of cytoplasm in development.

- **Role of cytoplasm:**
- **Clear cytoplasm**: Clear cytoplasm produces larval **epidermis**.
- **Yellow cytoplasm**: Yellow cytoplasm produce **muscle cells**.
- **Grey vegetal cytoplasm:** Grey vegetal cytoplasm produces **gut**.

23. What is embryonic induction. ★★★★★

- **Embryonic induction:** Capacity of some cells in embryo affects the development of other cells called embryonic induction.
- **Experiment:** H. Spemann & H. Mangold in 1924 perform experiment on salamander for embryonic induction
- **Example:** Dorsal lip of blastopore.

24. What is primary organizer/ induction.

- **Primary organizer:** Dorsal lip of blastopore is only tissue that inducing the development of secondary embryo in host. That's why they are called primary organizer. This phenomenon called primary induction.

25. What is aging. Write symptoms. How aging slow down. ★★★★★

- **Aging:** The negative physiological changes that weaken our body called **aging**.
- **Symptoms:** Loss of hair pigment (ii) Poor vision & forgetfulness
  (iii) Weakens the body (iv) Degeneration of organs.

- **Slow down:** Better nutritional & improved living conditions.
  (ii) Maintaining body weight. (iii) Avoid from smoking.

26. Define gerontology. Write its goal.

➢ **Gerontology:** Study of **aging** called **gerontology**.

- **Goal:** Present goal of gerontology is to increase life span not health span.

27. What is regeneration. ★★★★

➢ **Regeneration:** The ability to recover lost part of body called regeneration.

❖ **Example:**

- **Human:** Healing of wound in human.
- **Lobster:** If Lobster losses its claw, it regenerates new claw.
- **Star fish:** Star fish regenerates its loss arm.

28. What are neoblast. How regeneration occur in planarian.

➢ **Neoblast:** Unspecialized cells which are mobile and migrate to amputation site, where differentiate into specialized cells. Such cells called **neoblast. Neoblast** are present in some organism like flat worms & planaria.

➢ **Regeneration in planarian:** Planarian has neoblast. Neoblast mobilized & migrate to injured site. Where they differentiate into specialized cells.

29. Define teratogens & teratology. ★★

➢ **Teratogens:** Environmental factor that cause abnormal development in living organism called **teratogens**.

- **Example:** Ionizing radiations & mutagens etc.

➢ **Teratology: Teratology** is study of abnormal development & their cause.

- These abnormalities are due to genes (defective gene on X chromosome cause haemophilia) or environmental factor (radiations, chemicals, mutagens and drugs) etc.

30. What is metabolic defects. Give examples.

➢ **Metabolic defects:** Metabolic defects cause structural deviations from normal body during organogenesis.

- **Effect:** Formation of abnormal organ.
- **Example: Microcephaly** (individual is born with small skull) & cleft palate.

Exercise Short Questions

1) **What is organizer and inducer.**
   See question number: 24
2) **What is differentiation.**
   See question number: 8
3) **Define embryonic induction.**
   See question number: 23
4) **Differentiate between growth and development.**
   See question number: 1
5) **What is meristem.**
   See question number: 2

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) During cell elongation, cell volume increase upto = **150 fold**

2) Apical dominance is caused by = **Auxin**
3) Shell is secreted as egg passes through = **Shell gland/Uterus**
4) Which is formed & organized into somites = **Dorsal mesoderm**
5) Cork cambium is example of = **Lateral Meristem**
6) Increase in plant girth due to vascular cambium = **Secondary growth**
7) Light that enhance cell division **= Blue**
8) Cambium is formed at ___ stage = **4**
9) Hatching period of chick = **21**
10) Blastomere are formed during = **Cleavage**
11) Acetaularia is example of = **Algae**
12) In ____ upper lip fold / harelip = **Cleft palate**
13) ___ release lateral bud from apical dominance = **Cytokinin**
14) Little distance from root and shoot apex ___ zone lies = **Elongation**
15) ___ internal factor of growth = **Hormones**
16) Final size of cell attained = **Maturation**
17) Secondary growth leads to increase in diameter of = **Root and stem**
18) ___ represents dorsal and lateral lips of blastopore = **Primitive streak**
19) Egg is fertilized as it passes from ___ in chick = **Shell gland**
20) Somites are formed and organized by = **Mesoderm**
21) __ structure found after 18 of chick embryo = **Notochord**
22) Acetabullaria attached to ground by = **Rhizoids**
23) Human life span judged to be maximum = **120 years**
24) ___ is inevitable process = **Aging**
25) Headcap can be regenerated by = **Earthworm**
26) Individual born with a normal organ = **Malformed**
27) ___ interfair with normal process of development = **Abnormalities**

Exercise MCQs

1) Growth rate is influenced by = **Hormones**
2) Neurula is stage at which embryo has = **Neural tube**
3) Mesodermal cells do not invaginates caudally or medially from sides and create mid line thickening called = **Primitive streak**
4) Negative physiological change occurring in body = **Aging**

LONG QUESTIONS
(SELECTED FROM PAST PAPERS)

1. Discuss types of growth. Also write about phases of growth. ★
2. Discuss quality of light on photoperiodism.
3. Describe internal factor that affect rate of growth of plant.
4. Write a note on growth correlation & embryonic induction. ★★★★★
5. Write role of cytoplasm in development.
6. Discuss role of nucleus in development with reference to Acetabularia. ★★★★★★★
7. Define aging. Explain its process. ★★★
8. Explain regeneration in animals.
9. Describe abnormal development. ★★

CH # 20: CHROMOSOME & DNA

Short questions (Selected from past papers)

1. **Write number of chromosome in sugarcane,mosquito& mouse.**

➢ **Chromosome in sugar cane:** There are 80 chromosomes in sugar cane.

➢ **Chromosome in mouse:** There are **40** chromosomes in mouse.

➢ **Chromosome in Mosquito:** There are **6** chromosomes in mouse.

2. **Write different types of chromosome.** ★★★

➢ **Telocentric:** Centromere is present at the ends of chromatids.

- **Shape:** They are i shaped chromosome.

➢ **Acrocentric:** Centromere is present near the ends of chromatids.

- **Shape:** They are i shaped chromosome.

➢ **Sub metacentric:** Centromere is present near the middle of chromatids.

- **Shape:** They are L shaped chromosome.

➢ **Metacentric:** Centromere is present at middle of chromatids.

- **Shape:** They are v shaped chromosome.

3. **Define karyotype. Give significance.** ★★★★★

➢ **Karyotype:** Arrangement of chromosome in an individual called its **karyotype.**

- **Significance:** Karyotype show difference among species & even individual of same species. Different species have different karyotype.

4. **Define nucleosome.** ★★★★★★

➢ **Nucleosome:** Double stranded DNA (-ve charge) is coiled around **eight** histone proteins (**+ve charge)** after every **200** nucleotides called **nucleosome**. It resembles a string of beads.

- **Function**: Nucleosome is basic structure of chromatin folding that further fold to form chromosome.

5. **How does histone & DNA interact with each other/importance of +ve charge of histone.**

➢ **Interaction of DNA & histone:** Histones have abundance of basic amino acids (**arginine & lysine**) that is positively charged. Thus histone is attracted to negatively charged phosphate group of DNA.

6. **Difference b/w heterochromatin & euchromatin.** ★★★★★★

Heterochromatin	Euchromatin
Heterochromatin is highly condensed portion & remains condensed permanently.	The non-condensed portion that condensed during cell division only called **euchromatin.**
Their DNA never expressed.	Their DNA expressed.
Heterochromatin is darkly stained.	Euchromatin is lightly stained.
Found only in eukaryotes.	Found in both prokaryotes and eukaryotes.

7. **Define chromosomal theory of inheritance.** ★★★

➢ **Chromosomal theory of inheritance:** Genes& chromosomes show parallel behavior. Genes are located on chromosome.

- **Formulation:** This theory was formulated by **Walter Sutton and Bovri** in 1902.
- **Postulate:** Gene and chromosome are present in pairs. Both separate during gamete formation. Again unite during zygote formation.

8. Define transformation. ★★

➢ **Transformation:** Transfer of genetic material from one cell to another & can alter genetic makeup of recipient cell called **transformation**.

- **Example:** Bacteria.
- **Discovery:** Transformation was 1st observed by F. Griffith in bacteria.

9. What is S and R form of bacteria.

➢ **S form:** The normal pathogenic form (S form) of *Streptococcus pneumonia* is referred to as the S form because it forms smooth colonies on a culture dish.

➢ **R form:** The mutant forms (R form), which lacks an enzyme needed to manufacture the polysaccharide coat, is called the R form because it forms rough colonies.

10. Draw structural formula of adenine, guanine & thymine.

➢ **Adenine:** Adenine has double ring.

➢ **Thymine:** Thymine has single ring.

➢ **Guanine:** Guanine has double ring.

11. Difference b/w purines & pyrimidines.

Purines:	**Pyrimidines:**
Purines are double ring structure.	Pyrimidines are single ring structure.
Has high melting and boiling points.	Has low melting and boiling points.
Catabolism produces uric acid.	Catabolism produces ammonia & CO_2.
Example: (i) Adenine (ii) Guanine.	**Example:** (i) Cytosine (ii) Thymine (iii) Uracil

12. Define nucleotide.

➢ **Nucleotide: Nucleotides** are building block/repeating units of nucleic acid.

- **Composition:** Nucleotide consists of pentose sugar, nitrogenous base & phosphate group.
- **Example:** ATP, GTP, TTP & CTP.

13. How phosphodiester bond formed. Draw its structure. ★★★★

➢ **Phosphodiester bond:** Phosphate group is linked through two sugars by pair of ester bond. Thus linkage b/w two nucleotides called phosphodiester bond.

14. Write work of Erwin chargaff.

➢ **Erwin chargaff:** He proved that amount of adenine is equal to thymine & amount of guanine is equal to cytosine. There is always equal proportion of purine (A+G) & pyrimidine (C+T).

15. What is Meselson-Stahl experiment.

➢ **Meselson- Stahl experiment:** Meselson & Stahl performed experiment at California institute of technology in 1958 to test three hypothesis of DNA replication. They proved that semi-conservative model is true. They grew bacteria in medium of N^{15}, which incorporate with DNA. Then transferred the bacteria from N^{15} to N^{14} and collected DNA at various intervals. And proved DNA replication is semi-conservative.

16. What is conservative, semi conservative & dispersive model. ★★★

➢ **Semi-conservative model:** In this model, one strand of DNA is conserved & other strand is synthesized according to complementary bases.

➢ **Conservative model:** In this model, parental DNA remains intact. Daughter DNA consists of entirely new molecules.

➢ **Dispersive model:** In this model, parental DNA is completely dispersed in daughter DNA. So daughter DNA is mixture of old & new DNA.

17. What is DNA replication.

➢ **DNA replication:** Replication is a process in which an exact copy of DNA is produced.

- It occurs during inter-phase (S phase). DNA replication takes place in nucleus of cell.
- **Enzymes:** There are many enzymes involve in DNA replication like DNA polymerase I, II, and III. Helicase & ligase etc.

18. What is RNA primer & DNA polymerase III. Write its role.

➢ **DNA polymerase III:** It is 10 time larger & complex molecule than DNA polymerase I.
- **Role:** It catalyzes DNA replication. It adds 1000 nucleotide/second in DNA strand.

➢ **RNA primer:** RNA primer has 10 nucleotides of RNA. This sequence is complementary to DNA template.
- **Significance:** Only RNA primer starts DNA replication.

19. Difference b/w leading & lagging strand. ★★★

Leading strand	Lagging strand
Leading strand moves towards replication fork.	It moves away from replication fork.
Nucleotides are added continuously to **3'** end.	Nucleotides are added discountinously.
Require single primer for synthesis of leading strand.	Require many primer for synthesis of lagging strand.
Forms at high speed.	Forms at less speed.
No Okazaki fragments formed.	Okazaki fragments formed.

20. What are Okazaki fragments. ★★★★

➢ **Okazaki fragments:** In lagging strand, series of short DNA segments are synthesized. They connected later by Ligase enzyme called Okazaki fragments.
- **Amount:** They are **100-200** nucleotides long in eukaryotes & 1000-2000 nucleotides long in prokaryotes.
- **Formation:** Okazaki fragments are synthesizes by **DNA polymerase III** in 5' to 3' direction.

21. What is alkaptonuria. ★★★★★

➢ **Alkaptonuria:** It is genetic disease observed by Garrod.
- **Cause:** It is caused due to absence of enzyme that breaks homogentisic acid.
- **Effect:** Patient produce urine with homogentisic acid. Homogentisic acid rapidly oxidizes in air. So urine turns black.

22. What is role of DNA polymerase I & DNA ligase.

➢ **DNA polymerase I:** It is small enzyme. **DNA Pol I** plays supporting role in DNA replication. It involves in proof reading.

➢ **DNA ligase:** It attaches DNA fragments in lagging strand.

23. Why Vernon ingram and Sanger famous for.

➢ **Vernon ingram:** He discovered molecular basis of sickle cell anemia in 1958. It is genetic disease due to protein defect. He analyzed the structure of normal & sickle cell haemoglobin. Sickle cell anemia is caused by change from glutamic acid to valine at position 6 in beta chain of hemoglobin.

➢ **Sanger:** In 1953, an English biochemist Frederick Sanger, described the complete sequence of amino acids of **insulin.** Sanger's achievement was significant, as it was demonstrated for the first time that proteins consisted of definable sequences of amino acids.

24. What is sickle cell anemia. ★★

➢ **Sickle cell anemia:** It is genetic disease due to protein defect. V. Ingram analyzed the structure of normal & sickle cell haemoglobin. Sickle cell anemia is caused by change from glutamic acid to **valine** at position 6 in beta chain.

25. Define central dogma. Write its steps. ★★

➢ **Central dogma:** Mechanism of reading & expression of genes in cell called central dogma.

- It was proposed by Crick.

❖ **Steps:**

- Transcription
- Translation.

26. Difference b/w transcription & translation.

Transcription	Translation
Synthesis/copping of mRNA from DNA called **transcription.**	Synthesis of protein from RNA called translation.
It is first step of central dogma.	It is second step of central dogma.
It occurs in nucleus.	It occurs on ribosome (cytoplasm).
It occurs in **5' to 3'** direction.	It occurs in 5' to 3' direction.

27. Write function of promoter in transcription.

➢ **Promoter:** Promoter is located at beginning of every gene.

- **Function:** RNA polymerase binds to promoter & starts transcription.

28. Write chemical composition of RNA.

➢ **Composition of RNA:** RNA composed of nitrogenous bases (A, G, C & U), pentose sugar & phosphate group. Nucleotides are building block of RNA. RNA is single stranded molecule.

29. Write different types of RNA.

➢ **rRNA:** It is found in ribosome. It provide site for protein synthesis.

- rRNA is most abundant (80%) RNA in cell.

➢ **tRNA:** They transfer amino acid from cytoplasm to ribosome for protein synthesis.

- There are **45** different types of tRNA in human cell. tRNA forms 20% of total RNA in cell.

➢ **mRNA:** It is long strand. It is formed from DNA & travel to ribosome for protein synthesis. mRNA is least type (3%) of RNA in cell.

30. Difference b/w tempelate & coding strand.

Template strand	Coding strand
Template strand is formed during transcription.	Opposite strand to template called coding strand.
It is also called antisense strand.	It is also called sense strand.
It contains anti-codon.	It contains codon.
Template is transcribed to mRNA.	It is not transcribed to mRNA.

31. Write role of RNA polymerase.

➢ **RNA polymerase:** RNA polymerase enzyme synthesizes RNA. Prokaryotes have only one RNA polymerase for synthesis of all three types of RNAs.

❖ **Types:** Eukaryotes have three type of RNA polymerase for three types of RNAs synthesis.

- **RNA polymerase I:** RNA Polymerases I synthesize **rRNA.**
- **RNA polymerase II: RNA Polymerases II** synthesize mRNA.
- **RNA polymerase III:** RNA Polymerases III synthesize tRNA.

32. What is transcriptional bubble. ★★

➢ **Transcriptional bubble:** DNA strand open where enzymes (RNA Polymerase) attached with template strand to form transcription bubble. Transcription bubble moves DNA down. It is almost 10 nucleotides long. It is site where transcription starts.

33. Why a cap & tail are added to eukaryotic mRNA.

➢ **Cap & tail:** Cap is attached to 5' end in form of 7 methyl GTP.

- Tail is attached to 3' end in form of poly A tail.
- **Function:** Cap & tail save mRNA from action of enzymes (nucleases & phosphatases).

34. Define genetic code.

➢ **Genetic code:** Combination of 3 nucleotides that specify particular amino acid called **genetic code.** There are 64 genetic codes for 20 amino acids. Three codes are non sense that is not code amino acid.

❖ **Properties:**

- It is triplet.
- Genetic code is universal.
- It is coma less.

35. Difference b/w codon & anticodon. ★★

➢ **Codon:** Sequence of three nucleotides (codon) present on mRNA.

➢ **Anti-codon**: Sequence of three nucleotides (anti codon) present on **tRNA.**

36. What is initiation & termination codon.

➢ **Initiation codon:** Initiation codon is **AUG.**

- Every gene start with initiation codon **AUG** that encode **methionine.**
- **Function:** It starts translation.

➢ **Termination codon:** Termination/non sense codons are **UAA, UGA** & UAG. It is present at the end of gene. They do not code any amino acid. That's why they are called non sense codon.

- **Function:** They end the translation.

37. How translation terminated.

➢ **Termination of translation:** When a chain with non-sense codon comes. tRNA not bind to these sequence. They recognized by release factor. Release factor release newly formed polypeptide chain from ribosome.

38. What are mutagens.

➢ **Mutagens:** Agents that cause mutation called mutagens.

- **Example:** Radiations (X and UV rays) & chemicals (drugs and cigarette smoke)

39. Difference b/w chromosomal aberration & point mutation. ★★★★★

Chromosomal aberrations	Point mutation
Any change in chromosome called chromosomal aberrations	Mutation that changes the sequence of DNA nucleotides (one or few base pairs) called point mutation.
They are mega changes.	They are micro changes.
Many genes affected.	Single gene affected.
They are caused mostly due to non disjunction.	They are caused by mutagens.
Example: Down's & Turner syndrome.	**Example: Sickle cell anemia** and phenylketonuria .

40. What is phenylketonuria. Give its symptoms.

➢ **Phenylketonuria:** It is caused due to accumulation of phenylalanine in cells because of defective phenylalanine hydroxylase enzyme. It is caused due to point mutation.

- **Symptoms:** Mental retardation.

Exercise Short Question

1) What is function of RNA polymerase in transcription.

- **RNA Polymerase:** RNA Polymerase synthesize RNA from DNA. It binds with DNA's promoter region and transcribes DNA into 5' to 3' direction. It synthesizes all three types of RNA from DNA by transcription process.

2) How did Crick and his colleagues determine how many nucleotides are used to specify each amino acid.

- **Crick:** They made RNA from triplet of all 64 codons. They use amino-acyl tRNA synthtase for synthesis of artificial RNA in cell free system (laboratory).

3) What is anticodon.

See question number: 35

4) What are three major classes of RNA.

See question number: 29

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Chromosome are thread like structure that appear during = **Cell division**

2) Chromosome was first observed by = **Walther Flemming in 1882 in salamander**

3) How many nucleotides in typical chromosome in human = **140 million**

4) V-shaped chromosome called = **Metacentric**

5) Chromosome has central role in heredity was suggested by = **Karl Correns**

6) Basic structure of nucleic acid was determined by = **P.A Levene**

7) Who prepared X-ray diffraction pattern of DNA = **Rosalind Franklin**

8) Enzyme that joins two piece of DNA = **DNA ligase**.

9) Beadle &tatum exposed neurospora spores to = **X-rays**

10) Transfer of information from DNA to RNA called = **Transcription**

11) Information in mRNA is used to synthesize polypeptide called = **Translation**

12) Chromosome in honey bee = **32**

13) Chromosome in penicillium = **One pair**

14) Total complement / morphological characteristic of chromosome **= Karyotype**

15) 5 carbon sugar in DNA = **Ribose**

16) ____ chromosome in frog = **26**

17) DNA was discovered in = **1869**

18) Sequence of nucleotide that determine sequence of amino acid = **Gene**

19) Organism that have mutation = **Mutant**

20) Ultimate source of changes = **Mutation**

21) Stop signal during transcription = **GC**

22) Stop signal of GC pair is part of = **DNA**

23) Amino acid attach to tRNA at __ end = **3**

24) ___ number of chromosome in corn = **10**
25) Chromosome with equal length of chromatids = **Metacentric**
26) Miescher extracted white substance from nuclei of fish sperm and named = **Nuclein**
27) ___ suggested that information on DNA of chromosome specify enzyme = **Garrod**
28) ___ DNA structure are more strongly linked = **Guanine and cytosine**
29) Pentose sugar in DNA is = **Deoxyribose**
30) ___ responsible for correct initiation of transcription = **Initiation factor**
31) Human cell contain ___ type of tRNA = **45**
32) TTGACA binding site in prokaryotes = **-35**
33) UGA Codon code in mitochondria = **Tryptophan**
34) AGA specifies = **Arginine**
35) Organism that have mutation = **Mutants**

Exercise MCQs

1) mRNA is synthesize by = **RNA polymerase**
2) Which is non sense codon = **UAA**
3) Enzyme are responsible for assembly of = **All (Carbohydrate, protein and nucleic acid)**
4) In bacteria, newly synthesize mRNA is released in = **Cytoplasm**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Define karyotype. Explain types of chromosome.
2. Write composition of chromosome. ★★★★
3. Describe chromosomal theory of inheritance. ★
4. How morgan proved theory of heredity. ★★
5. Discuss DNA as heredity material by Griffith experiment.
6. Write a note on transformation.
7. How Hershey & Chase demonstrate DNA is hereditary material.
8. Describe chemical nature of DNA.
9. Discuss Watson & Crick model about DNA. ★★
10. Discuss Meselson-Stahl experiment./How would you prove that DNA replicate by semi-conservative. ★★★★★
11. Discuss DNA replication process. Also sketch & label replication fork. ★★★★★
12. Explain function of DNA polymerase III in DNA replication.
13. Explain one chain one polypeptide hypothesis.
14. How cells use RNA to make protein. ★★★
15. Explain three types of RNA.
16. Write a note on transcription. Also draw transcription bubble. ★★★★
17. Describe genetic code with its properties. ★★
18. Discuss initiation of translation with charging of tRNA.
19. Write a detail note on mutation. ★★

CH # 21: CELL CYCLE

Short questions (Selected from past papers)

1. **Define cell cycle. Give importance.**

➢ **Cell cycle:** Sequential changes like growth, DNA replication & cell division occurring within cells called cell cycle.

- **Example:** Mitosis and Meiosis.

2. **What do you know about interphase.**

➢ **Interohase:** Life cycle of cell b/w two consecutive divisions called **interphase**.

- **Interphase** is a period of non-apparent division. It is also called resting phase.

3. **Is interphase is resting phase. Justify it.**

➢ **Interphase as resting phase:** In interphase, cell prepares itself for cell division. It is period of extensive biochemical activity. Cell does not divide during interphase. That's why interphase is also called resting phase.

4. **Difference between interphase and mitotic phase.**

Interphase	Mitotic phase
Interphase which is the period of non-apparent division.	Period of division also known as mitotic phase.
Sub-phase: G1, S & G2.	**Sub-phase:** Karyokinesis and cytokinesis.
It is lengthy phase (90%) of cell cycle.	It is short phase (10%) of cell cycle.

5. **Write different steps of interphase.**

G_1	Cell grows in size.	Enzymes are synthesized. **G1** is Period of extensive metabolic activity.
G_0	Post mitotic phase of cell	Phase lasts for days & even for life time. Nerve cell & eye lens cell remain for life time in **G_0 phase**.
S	DNA synthesis.	Duplication of chromosome occurs in **S phase**.
G_2	Energy is stored.	Synthesis of RNA, microtubule & mitotic proteins.

6. **Write duration of cell cycle in human.**

➢ **Duration of cell cycle:** Cell cycle in human is **24 hours**. Interphase takes 23 hours and 30 minutes. Mitosis takes 30 minutes only.

7. **Difference b/w karyokinesis & cytokinesis.** ★★★★

Karyokinesis	Cytokinesis
Division of nucleus called **karyokinesis.**	Division of cell/cytoplasm called **cytokinesis.**
Sub-phase: Prophase, Metaphase, Anaphase and Telophase.	Plants (phragmoplast) and animals (cleavage furrow).
It is lengthy phase than cytokinesis.	It is shorter phase than karyokinesis.

8. **Write importance of mitotic apparatus.**

➢ **Importance of mitotic apparatus:** They attach to kinetochore of chromosome. They attach to chromosome & separate them during Anaphase. They ensure the equal distribution of chromosome in each daughter cell. Mitotic apparatus organized in **prophase.**

9. What is kinetochore.

- **Kinetochore:** Centromere has special area called kinetochore made of special protein. Kinetochore fibers attach to **kinetochore** of chromosome for separation.

10. Difference b/w chromosome & chromatin.

Chromosome	Chromatin
Chromosome consists of chromatids & centromere.	Chromatin is thread like structure.
Chromosome appears only during **cell division**.	Chromatin appears during cell division.
Chromosome is formed from coiling of chromatin.	Chromatin is formed from uncoiling of chromosome.

11. Define equatorial plate.

- **Equatorial plate:** The kinetochore fibers of mitotic spindle attach to the kinetochore region (specialized area in centromere) of chromosome, and align them at the equator. In this way, Chromosome forms equatorial plate or metaphase plate.

12. Describe anaphase & telophase of mitosis.

- **Anaphase: Anaphase** is most critical phase of mitosis. Kinetochore fibers exert force on centromere & separate sister chromatids. Sister chromatids are separated from centromere during **anaphase**, half sister chromatids travel towards each pole.
- **Telophase:** Telophase is reversal of prophase. Chromosomes decondensed & unfold. Nuclear membrane & nucleoli reorganized. Thus two nuclei are formed.

13. Explain cytokinesis in plants and animals. ★★★★

- **Cytokinesis in plants:** Cytokinesis in plants occurs by phragmoplast. Vesicle from **Golgi complex** line up at centre of cell to form phragmoplast during end of **telophase.** Membranes of vesicles become plasma membrane of daughter cell. So two cells formed.
- **Cytokinesis in animals:** During late telophase the astral microtubules send signals to the equatorial region of the cell, where actin and myosin are activated which form contractile ring, followed by **cleavage furrow**, which deepens towards the center of the cell, dividing the parent cell into two daughter cells.

14. What is role of centrioles in animal cell.

- **Centrioles:** Centrioles in inetrphase divide into two and then moves towards opposite poles to establish bipolarity of dividing cell.
- **Function:** Centrioles form microtubules (which separate chromosome) during cell division.

15. Write importance of mitosis.

- **Importance of mitosis:** Asexual reproduction takes place by mitosis.
  (ii) Regeneration takes place by mitosis. (iii) Tissue culturing & cloning take place by mitosis.
  (iv) Mitosis produces **identical cells/offspring.**

16. Define tumor & cancer. How cancerous cells identify. ★★

- **Tumor:** Unwanted clone of cell called **tumor.**
- **Cancer:** Uncontrolled cell division called cancer.
- **Identification:** Cancer cells are less differentiated, rapidly growing/dividing & have large nucleus.
- **Cause:** Cancer is caused by mutation in **somatic cells.**

17. Difference b/w malignant & benign tumor. ★★★★

Benign tumor	Malignant tumor
If tumor remains at its original position called	If tumor spread to other part of body called

benign tumor.	malignant tumor.
They are small in size.	They are large in size.
Cells of **benign** tumor behave like normal cell.	Spreading and establishment of tumor cells in other body parts called metastasis.
They are less dangerous.	They are more dangerous.

18. Define metastasis.

- **Metastasis:** Spread of tumor & establishment to other part of body called **metastasis**.

19. Difference between normal cells and cancerous cells.

Cancer cells	Normal cells
They are less differentiated than normal cells	They are more differentiated than cancer cells
They exhibit the characteristics of rapidly growing cells	They are not divides rapidly.
They have high nucleus to cytoplasm ratio	They have normal nucleus to cytoplasm ratio
They have prominent nucleoli and many mitosis.	They lack prominent nucleoli.

20. Difference b/w prophase & prophase I.

Prophase	Prophase l
It is shorter than prophase l.	It is very long phase.
It is not divided into sub stages.	It is divided into five sub stages.
It is phase of mitosis.	It is phase of meiosis l.
No genetic recombination occurs.	Genetic recombination occurs.

21. Define meiosis.

- **Meiosis:** Cell division in which number of chromosome in daughter cell is reduced to half as compared to parent cell called **meiosis**. Each diploid (2n) cell produces **four** haploid (n) cells after meiosis.
- **Example:** In plants, **spores** are produced by meiosis. In animals, gametes formed by meiosis.

22. Define homologous chromosomes.

- **Homologous chromosomes:** Each diploid cell has two chromosomes of each type, one member from each parent. These similar but not necessarily identical chromosomes are called as homologous chromosomes.
- **Example:** Chromosome in neuron (diploid cell).

23. Name different steps of prophase-I.

- **Steps of prophase I:** Leptotene, Zygotene, Pachytene, Diplotene & Diakinesis.

24. Write changes occurring in zygotene&diplotene.

- **Zygotene:** Pairing of homologous chromosome during **zygotene** called **synapsis**. Pairing is point to point. Each paired structure called tetrad/bivalent.
- **Diplotene:** Paired chromosome repels each other & began to separate in **diplotene** but homologous chromosome remains united by chiasmata. Each bivalent has at least one chiasmata.

25. Define bivalent/tetrad.

- **Tetrad:** Pairing of homologous chromosome form tetrad. Bivalent have **four** chromatids that's why they are called tetrad.

26. What is pachytene & diakinesis.

- **Pachytene:**

- Pairing of homologous chromosome completed in **pachytene**.

- Chromosome becomes thick.
- Crossing over (Reshuffling of genetic material) takes place during pachytene.
- **Pachytene** may last for days, weeks or even years/ longest phase.

➢ **Diakinesis:**

- Maximum condensation of chromosome takes place in **diakinesis**.
- Separation of homologous chromosome but still united at one point.
- Nucleoli disappear during Diakinesis.

27. What do you know about metaphase I.

➢ **Metaphase-I:** Nuclear membrane disorganize during metaphase I. spindle fibers formed & attach to homologous chromosome. They arrange chromosome at equator.

28. Define crossing over.

➢ **Crossing over:** Exchange of segment b/w non sister chromatids of homologous chromosome called crossing over. Crossing over takes place during **pachytene.**

29. Write importance of meiosis.

➢ **Importance of meiosis:**

- Meiosis causes variation in next generation.
- Meiosis maintains the constant number of chromosome in next generation.

30. What is non-disjunction & Down syndrome. ★★★

➢ **Non-Disjunction:** Some time chromosome fail to segregate during **anaphase** & telophase that cause unequal separation of chromosome in daughter nuclei called **non-disjunction.**

➢ **Down's syndrome:** In **Down's syndrome**, 21st pair of chromosome fails to segregate. Individual of Down syndrome has **47** (2n+1) chromosome. Down syndrome is also called **mongolism.** Chance of 45 years old woman having Down syndrome child is **3/100** times.

- **Cause:** They are caused due to non disjunction of chromosome 21.
- **Symptoms**: Flat & broad face, protruding tongue, mental retardation & defective CNS.

31. What is Klinefelter& turner syndrome. ★★★★★

Klinefelter	Turner
Cause: Non disjunction in male with 47 chromosome (44+**XXY)**	**Cause:** Non disjunction in female with 45 chromosome (44+X)
Symptoms: Phenotypically male with large breast. They show tallness & obesity.	**Symptoms:** Phenotypically female. Short stature & webbed neck.
Sex organ: Small testies without sperm.	**Sex organ:** Without ovaries & absence of egg.

32. How does cell death help in development in multicellular organism.

➢ **Role of cell death:** Programmed cell death control the development of multicellular body.

- Cell death lead to deletion of entire structure like tail of human embryo.
- Cell death also deletes structure like tissue b/w digits.

33. What is necrosis &apoptosis. ★★

Apoptosis	Necrosis
Cell death due to internal programming & morphological changes.	Cell death due to tissue damage called **necrosis.**
Cell commits **suicide** during apoptosis.	Cells are murdered.
Dying cell shrink, condensed & split up.	Dying cell swells & bursts.
They do not damage neighboring cells.	They damage neighboring cells.
Example: Death of Red blood cells after 4 month.	**Example:** Injury, cancer and spider bite.

Exercise Short Question

1) **Difference between apoptosis and necrosis.**
   See question number: 33
2) **Write functions of mitotic apparatus.**
   See question number: 8
3) **How can you identify cancerous cell.**
   See question number: 19
4) **Give significance of meiosis.**
   See question number: 29
5) **Define chromosomal non disjunction.**
   See question number: 30
6) **Write symptoms of Turner syndrome.**
   See question number: 31
7) **Define cell cycle. Highlight its significance.**
   See question number: 1
8) **Is interphase is resting phase. Why.**
   See question number: 3
9) **In what respect mitosis of plant differ from animal cells.**

Mitosis of plants	Mitosis of animals
Mitotic apparatus of plant lack centrioles.	Mitotic apparatus of animal has centrioles.
Mitotic apparatus consist of only spindle fibers.	Mitotic apparatus consist of spindle fibers, centrioles and aster.
Cytokinesis takes place by cleavage furrow.	Cytokinesis takes place by phragmoplast .

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Microtubule composed of = **Tubulin+RNA**.
2) Centrioles present in same = **Centrosome**
3) Which phase has least number of chiasmata = **Diplotene**
4) Chromatin material visible during = **Interphase**
5) ____ absent in animals = **Centrioles**
6) Healing of wound and repair of tissue by = **Mitosis**
7) Length of cell cycle in yeast = **90 min**
8) ___ number of microtubules sets arise from centriole **= 3**
9) Cytoplasm become more viscous during = **Prophase**
10) Post mitotic cell exit the cell cycle during = **G_0**
11) Vesicle forming phragmoplast originate during = **Metaphase**
12) ____ significant happening of meiosis = **Crossing over & Random assortment of chromosome**
13) Bivalent / tetrad formed during **= Zygotene**
14) Programed and organized cell death called = **Apoptosis**
15) Prophase Stage at which chromosome become visible, short and thick = **Leptotene**

16) Trisomy at chromosome no 18 = **Edward**

17) Trisomy at Chromosome no 21 = **Down**

18) Interphase of meiosis lack = **G2**
19) S phase of cell cycle take ___ hours = **10**
20) Interphase divided into = **S, G1, G2**
21) Chromosome appear outside the nucleus during = **Cell division**
22) Centrioles present in = **Centrosome**
23) Network of threads appear during cell division = **Chromosome**
24) Plant cell wall is determined by = **Golgi apparatus**
25) ___ tumor has branches = **Malignant**
26) Presence of invading cells is indication of = **Malignancy**
27) Cancer occur due to = **Mitosis**
28) During pachytene = **Pairing of Homologous chromosome**
29) Term bivalent means = **Two chromosome**
30) Actual decrease of chromosome number occur in = **Meiosis l**
31) Leptotene and zygotene lasts for = **Few hours**
32) Meiosis ll like = **Mitosis**
33) Meiosis occur during = **Diploid**
34) Mangolism is phenotypically = **Male/Female**
35) In ____, male has enlarged breast, obesity and small testes = **Klinefelter**
36) XYY condition found in = **Jacob**
37) Chances of teenage mother having Down syndrome = **1/1000**
38) ___ is due to trisomy in chromosome no 13 = **Patau**
39) In Turner syndrome, affected person has **= XO**
40) Cell commits suicide in absence of = **Survival signal**

Exercise MCQs

1) In kline filter syndrome = **Additional sex chromosome**
2) Mitosis is divided into = **Both (karyokinesis and cytokinesis**)
3) Separation of homologous chromome occur during = **Anaphase**

LONG QUESTIONS
(SELECTED FROM PAST PAPERS)

1. Explain metaphase & anaphase of mitosis.
2. Write a note on importance of mitosis & meiosis.
3. Explain malignant tumor or cancer.
4. Discuss different steps of prophase I of meiosis.
5. Explain meiotic errors with reference to Down & Klinefelter syndrome.
6. Write a note on necrosis & apoptosis.

CH # 22: VARIATIONS & GENETICS

Short questions (Selected from past papers)

1. **Define gene, allele & locus.** ★★★

➢ **Gene:** Part of DNA that control specific character called gene.

➢ **Loci: Position of gene** on chromosome called **loci**.

➢ **Allele:** Partners of gene pair called alleles.

2. **Difference b/w genotype & phenotype.** ★★★★★★

Phenotype	Genotype
Physical appearance of a trait called **phenotype.**	Genetic combination of trait in an organism called **genotype.**
Phenotype influenced by environment.	Genotype not influenced by environment.
Phenotype may change with time.	Genotype remains same throughout life.
Example: Blood groups A, B, AB & O.	**Example:** Gene I^A, I^B & i.

3. **Define gene pool.**

➢ **Gene pool:** All the genes/alleles found in a breeding population at a given time are collectively called the **gene pool**. It is the total genetic information encoded in the total genes in a breeding population existing at a given time.

4. **What is beanbag genetics.**

➢ **Beanbag genetics:** Beanbag genetics are used to understand the concept of gene pool. In beanbag genetics, alleles are like a bean in bean bag. Thus bean bag consist of all the alleles of all traits at same time.

5. **Define true breeding varieties.**

➢ **True breading varieties:** True breeding varieties always produce identical offspring by self fertilization.

- **Example:** Homozygous round seed (RR) and wrinkled seed (rr).

6. **Difference b/w monohybrid & dihybrid cross.**

Monohybrid cross	Dihybrid cross
A cross in which only one trait is studied at a time called monohybrid cross.	A cross in which two characters studied at a time called dihybrid cross.
Single pair of gene involved.	Two pairs of genes involved.
Phenotypic ratio: 3:1	**Phenotypic ratio:** 9:3:3:1
Example: When we study only shape of seed in cross.	**Example:** When we study shape & color of seed in a cross.

7. **Difference b/w dominant & recessive allele.**

Dominant allele	Recessive allele
Allele that masks the effect of other allele is called dominant allele.	Allele which is masked by other allele called recessive allele.
It is represented by capital letter (R).	It is represented by small letter (r).
Example: Alleles of round seed.	**Example:** Alleles of wrinkled seed.

8. **Define law of segregation.**

➢ **Law of segregation:** Both alleles for each trait are segregate during meiosis in individual. So each gamete receives only one allele. Alleles are again unites by fertilization during zygote formation.

- **Formulation:** This law was formulated by G. Mendel.

9. **Difference b/w homozygous & heterozygous.** ★★★★★

Homozygous	Heterozygous

When both alleles of a gene pair are same called homozygous.	When both alleles of a gene pair are different called heterozygous.
Produce single type of gametes.	Produce two types of gametes.
Do not show hybrid vigor.	Show hybrid vigor.
Example: RR for round seed.	**Example:** Rr for round seed.

10. Define test cross. Write their importance. ★★★★

- **Test cross:** Cross that used to determine the genotype of organism called test cross.
- **Significance: Test cross** used to determine the homozygous or heterozygous nature of genotype of an individual.
- **Example:** Cross between wrinkled seed plant (rr) with round seed plant (RR/Rr).

11. Define law of independent assortment.

- **Law of independent assortment:** When two contrasting pairs of trait followed in same cross, their alleles assort independently into gametes. Alleles of one pair (seed shape) assort independently from alleles of other pair (seed color).
- **Formulation:** This law was formulated by G. Mendel.

12. Define probability & product rule. ★★

- **Probability:** Chance of an event to occur called probability.
- **Product rule:** When we multiply the probabilities of two different events called product rule.
- **Use:** It is used in dihybrid cross.

13. Define linked genes.

- **Linked genes:** All Genes present on same chromosome are called linked genes.
- **Example:** All Genes present on X-chromosome.

14. What is albinism.

- **Albinism:** Normal individuals have melanin pigment in their skin, hair and eyes. Albinos totally lack melanin pigment in their bodies. Albinism is a **recessive** trait in humans.

15. Define dominance.

- **Dominance:** Physiological effect of an allele over its partner allele called dominance.
- **Example:** Round seed trait is dominant over wrinkle seed trait.

❖ **Types:**

- Complete dominance
- Incomplete dominance
- Co dominance
- Over dominance.

16. Define complete & incomplete dominance. ★★★

- **Complete dominance:** When dominant allele I completely hide the effect of recessive allele I. So heterozygote (Rr) has same phenotype (as in dominant allele). This phenomenon called complete dominance.
- **Example:** Round seed is dominant over wrinkled seed.
- **Incomplete dominance:** In incomplete dominance, both allele show intermediate phenotype instead of showing dominant-recessive relationship.
- **Example:** Flower color of 4'O clock plant.

17. Write contribution of Carl Correns.

- **Carl Correns: Carl correns** discovered the phenomenon of incomplete dominance during working on 4'O clock plant.

❖ **Procedure**:

- He crossed true breeding red flower with white flower. In F-1, all flowers were pink color.
- Then he crossed pink flower to get F-2. In F-2, their ratio was 1-red, 2-pink & 1-white flower.

18. What is co-dominance & over dominance.

➢ **Co-dominance:** In **co-dominance**, both alleles are expressed in heterozygous condition.

- **Example: AB and MN blood group system.**

➢ **Over dominance:** In **over dominance,** dominant heterozygote exceeds in quantity of phenotypic expression from both homozygote parent.

- **Example**: Heterozygote drosophila has more eye pigment then homozygote.

19. Define multiple alleles & pleiotropy. ★★★★★★

➢ **Multiple alleles:** Genes with more than two alleles are called multiple alleles.

- **Example:** Gene of ABO blood group has three alleles (I^A, I^B& i).

➢ **Pleiotropy:** When a single gene affects more traits called pleiotropy.

- **Example:** Gene of growth in human affects weight and height.

20. What do you know about ABO blood group system.

➢ **Discovery:** ABO blood group system was discovered by **Karl Landsteiner** in **1901.**

➢ **ABO blood group:** There are four blood groups on the basis of antigens present on RBCs. Antibodies present in blood plasma.

Blood group:	Antigen:	Antibody:
Blood group A:	A	B
Blood group B:	B	A
Blood group AB:	AB	No
Blood group O:	No	AB

- ABO blood group is encoded by single polymorphic **gene-I** on chromosome **9**.
- This I-gene has **three** alleles I^A, I^B & i.

21. What is universal recipient & donor blood group.

➢ **Universal recipient:** Blood group **AB** called universal recipient because they have no anti-body. So they receive blood from all blood groups.

➢ **Universal donor:** Blood group **O** called universal donor because they have no antigen. So they can donate blood to all blood groups.

22. What are secretors.

➢ **Secretors**: A and B antigens can also be present in saliva and other body fluids of some persons called secretors. Secretors have dominant secretor gene "Se" on chromosome **19.**

23. Write scientific name of rhesus monkey.

➢ **Rhesus monkey:** The scientific name of rhesus monkey is ***Macaca mulato***. Rh blood group system is named after **Rhesus monkey** because Rh system was 1st discovered in this monkey.

24. What is erythroblastosis foetalis. ★★★★

➢ **Erythroblastosis foetalis:** It is caused due to maternal fetal Rh incompatibility (child is Rh +ve and mother is Rh –ve), RBCs of fetus destroy & fetus becomes anaemic. Anaemic fetus releases immature erythroblast in blood. That's why this disease called erythroblastosis foetalis. This anaemia leads to abortion or still birth.

25. What is epistasis & Bombay phenotype. ★★★★

➢ **Epistasis:** When one gene hides the effect of other gene at different locus called **epistasis.**

- **Example:** Bombay phenotype is example of **epistasis.**

➢ **Bombay phenotype:** Expression of I^A & I^B genes (at chromosome 9) depends upon gene H (at chromosome 19). H gene produces an enzyme which inserts sugar on glycoprotein of RBCs. Antigen

A & B attach to this sugar. Recessive allele h cannot insert sugar, so no attachment of antigen A and B takes place. Then RBCs lack antigen A & B. they are phenotypically like O blood group but genotypicaly AB & their phenotype called Bombay phenotype.

26. Difference b/w qualitative & quantitative trait.

Qualitative trait	Quantitative trait
Qualitative trait depends upon quality of alleles/genes.	Quantitative trait depends upon quantity of alleles/genes.
These traits are controlled by single gene.	These traits are controlled by many genes.
Show discrete phenotype.	Show continuous phenotype.
Qualitative traits cannot be measured.	Quantitative traits can be measured.
Example: Seed shape of pea plant.	**Example:** Weight, skin & height.

27. What are polygenic traits & polygenes. ★★

- **Polygenic traits:** Trait that is encoded by alleles of many genes present at different loci called polygenic trait.
- **Example:** Human skin color.
- **Polygenes:** Genes that control polygenic trait called polygenes.
- **Example:** Genes (ABC) of skin color.

28. What do you know about human skin color.

- **Human skin color:** Human skin color is quantitative trait controlled by **3 to 6 genes pair**.
- Dark skin is dominant over white skin. Dark skin has more dominant genes than white skin.

29. Define genic system.

- **Genic system:** In this system the sexes are specified by simple allelic differences at a small number of gene loci. Genic system present in **yeast.**
- **Example:** a and α are the two mating types (sexes) of yeast, controlled by MAT a and MAT α alleles respectively.

30. Define gene linkage & linkage group. Write its advantages.

- **Gene linkage:** All genes of same chromosome are linked to each other called linkage.
- **Disadvantage:** They minimize the chance of genetic recombination & variations.
- **Linkage group:** Chromosomes carry its linked genes in form of linkage group.
- **Example:** Human has 23 linkage groups.

31. Define crossing over.

- **Crossing over:** Exchange of segment b/w non-sister chromatids of homologous chromosome called crossing over. Crossing over occurs during prophase of meiosis.
- **Function:** Crossing over cause genetic recombination.

32. Define recombinant frequency. Write its formula.

- **Recombinant frequency:** Proportion of recombinant types b/w two gene pairs as compared to sum of all genes.
- **Formula:** Recombination frequency = Recombination type/sum of all combinations * 100

33. Difference b/w sex chromosome & autosomes. ★★

Sex chromosome	Autosome
Sex determining chromosomes are called sex chromosomes.	All chromosomes other than sex chromosome are called sex chromosome.
Few chromosomes in genome are sex chromosome.	Most chromosomes in genome are autosome.
Different in male and female.	Same in male and female.
There are two sex chromosomes in human beings.	There are 44 autosomes in human beings.

Example: X & Y chromosome.	**Example:** 1 & 2 Chromosome.

34. Define homogametic and Heterogametic organism.

- **Homogametic:** organism producing only one type of gametes.
- **Example:** Human female egg (XX chromosome)
- **Heterogametic**: organism producing two different types of gametes.
- **Example:** Human male sperm (X and Y chromosome).

35. What is XO-XX pattern of sex determination.

- **XO-XX pattern:** This pattern is found in grasshopper & protenor bug.
- **Male:** Male has only one X chromosome. So male is XO. Male is heterogametic.
- **Female:** Female has XX chromosome. So female is XX. Female is homogametic.

36. Define nullo gamete.

- **Nullo gamete:** A gamete without sex chromosome called **nullo** gamete.
- **Example:** Nullo gamete is found in male grasshopper.

37. What is WZ-ZZ/XX-XY mechanism of sex determination.

- **WZ-ZZ sex determination:** This mechanism was discovered by J. Seiler in moth. This method is common in birds & moths.
- **Female:** Female is heterogametic (XY). Female produce two type of gamete X & Y.
- **Male:** Male is homogametic (XX). Male produce only X gamete.

38. Why female in birds is heterogametic justify.

- **Heterogametic female:** In birds, female is heterogametic. Female produces two types of gametes XY. So female in birds is heterogametic.

39. How sex is determined in yeast.

- **Sex determination in yeast:** Yeast has no sex chromosome. Genic system is used for determination of sex. So their sex is determined by simple allelic difference at loci a & α. Their sexes are controlled by MAT a & MAT α alleles.

40. Difference b/w X & Y linked inheritance.

X-linked inheritance	Y-linked inheritance
Genes present on X chromosomes are called X linked genes.	Genes present on Y chromosomes are called Y linked genes
Inheritance of X linked genes called X linked inheritance.	Inheritance of Y linked genes called y linked inheritance.
Both male and female show X-linked inheritance	Only male show Y-linked inheritance
Example: Colorblindness and haemophilia.	**Example:** Maleness and hairy ear.

41. Define pseudoautosomal genes. ★★

- **Pseudoautosomal genes**: Genes which are present on both X & Y chromosomes are called pseudoautosomal genes. Their pattern of inheritance is similar to autosomal genes.
- **Example**: Bobbed gene of drosophila.

42. What is haemophilia. Write its types.

- **Haemophilia: Haemophilia** is X-linked recessive trait. Blood of Haemophilic person does not clot due to abnormallity of blood clotting factor. Minor cut can cause death due to bleeding.

Haemophilia A	Haemophilia B	Haemophilia C
Non-allelic recessive trait	Non allelic recessive trait.	Autosomal recessive trait.
It is 80% of total haemophilia.	It is 20% of total haemophilia	It is 1% of total haemophilia.

Cause: It is caused due to abnormality of factor VIII.	**Cause:** Haemophilia B is caused due to abnormality of factor **IX.**	**Cause:** It is caused due to abnormality of factor XI.

43. Define protanopia, deuteranopia & tritanopia. ★★

- **Protanopia:** Protanopia is a **red blindness.**
- **Deutranopi: Deutranopia** is **green** blindness.
- **Tritanopia:** Tritanopia is blue blindness.

44. Define monochromacy.

- **Monochromacy: Monochromacy** is a true color blindness. Monochromat can receive only one color out of three colors.
  - **Example:** Red-green color blindness.
  - **Common:** Monochromacy is more common in male than female.

45. What is testicular feminization syndrome &hypophosphatemicrickets.

- **Testicular feminization syndrome:** It is rare X-linked recessive trait.
  - **Cause:** Male has XY chromosome but tfm gene on X chromosome develop them into female. They have breast, female genitalia, blind vagina, no uterus & small testies. It is an androgen insensitivity syndrome.
- **Hypophosphatemic rickets:** It is X-linked **dominant trait.** It is different from rickets.
  - **Cause:** It is caused by abnormality in genes that encode bone protein.
  - **Common:** It is more common in female than male.

46. Difference b/w sex limited & sex influenced trait. ★★★★

Sex limited trait	Sex influenced trait
Sex limited traits are limited to only one sex due to **anatomical difference.**	These traits are present in both male & female.
These traits affect the body of male or female only.	These traits are more common in one sex.
Genes of these traits are present on X/Y chromosome.	Genes of these traits are present on autosome.
Example: Genes of milk & genes of beard.	**Example : Baldness**

47. What is type II is NIDDM.

- **NIDDM:** Diabetes mellitus type II is non insulin dependent diabetes.
  - **Cause:** Patient produces endogenous insulin & loses response to insulin. Cells of **diabetic** patient cannot take glucose from blood. It is more common in old aged & obese persons.

48. What is MODY. Write its cause. ★★★★

- **MODY:** MODY (maturity onset diabetes of young) is disease early before 25 years.
  - **Cause:** MODY is **Autosomal dominant trait**. About 50% MODY is caused by mutation in **glucokinase genes.** Mutation in genes that encode transcription factors.

49. What is multifactorial trait.

- **Multifactorial trait:** Environment influences the polygenic inheritance called multifactorial inheritance.
  - **Example: Diabetes mellitus** & blood pressure.

Exercise Short Question

1) **Differentiate between phenotype and genotype.**
   See question number: 2
2) **Differentiate between homozygous and heterozygous.**

See question number: 9

3) **Differentiate between autosome and sex chromosome.**
   See question number: 33
4) **Differentiate between allele and multiple allele.**
   See question number: 1 & 19
5) **Differentiate between incomplete and co dominance.**
   See question number: 16 & 18
6) **Differentiate between continous and discontinuous variation.**
   See question number:
7) **Differentiate between gene and allele.**
   See question number: 1
8) **Differentiate between dominance and epistasis.**
   See question number: 15 & 25
9) **Differentiate between X linked and Y linked trait.**
   See question number: 40
10) **Differentiate between sex limited and sex influenced trait.**
    See question number: 46
11) **Differentiate between dominant and recessive trait.**
    See question number: 7
12) **Differentiate between wild type and mutant type.**

- **Wild type:** Trait present naturally in a population.
- **Example:** Red eye of Drosophila.
- **Mutant:** Trait in which mutation takes place.
- **Example:** White eye of Drosophila.

13) **What is gene pool.**
    See question number: 3
14) **Was pea a lucky choice for Mendel. What would have happened if he had studied an eight character.**

- **Pea plant:** Yes, pea was lucky choice of Mendel. Pea has many contrasting traits which prove very beneficial in Mendel experiment. Pea plant has short life span.
- **Contrasting traits:** Pea can be self fertilized and cross fertilized. (ii) Pea plant has white and purple flower.

15) **What is a test cross. Why did Mendel devise this cross.**
    See question number: 10
16) **What would happen if alleles of a pair do not segregate at meiosis? How would it affect the purity of gamete.**

- **Purity of gamete:** If alleles don't segregate at meiosis, gametes can have extra / lesser chromosome. If such gamete fuse with normal gamete, then produce abnormal individual. In this way, it can affect purity of gamete.

17) **If the alleles don't assort independently, which recombination is missing in progeny.**

- **Recombination:** Progeny does not have recombination if alleles don't assort independently.

18) **Why has each gamete equal chances of getting one or other allele of pair.**

- **Gamete:** Alleles are present on different chromosome. During gamete formation every chromosome assort independently. So each gamete receives one chromosome from homologous pair of chromosome.

19) Does dominant allele modify the determinative nature of its recessive allele partner. What sort of relationship does they.

- **Dominant allele:** Dominant allele does not change the nature of recessive allele. It only hides the effect of recessive allele.

20) Which type of traits assort independently.

- **Traits**: Traits present on different homologous chromosomes and are not linked assort independently.

21) Why does the blood group phenotype of person remains constant thorough out life.

- **Blood groups**: Blood groups control by genes. So blood group cannot be changed during life time.

22) What is universal donor blood group.

See question number: 21

23) How can ABO blood incompatibility protects baby against Rh incompatibility.

If fetal blood cells are ABO incompatible to maternal blood. They are hemolyzed in uterine sinuses so Rh antigen is not available to provide antigenic stimulus.

24) Which type of gene does not obey law of independent assort independently.

- **Linked gene**: Linked gene does not obey law of independent assortment.

25) How can linked genes be separated from each other.

- **Linked gene**: Linked gene can be separated by crossing over.

26) What is multifactorial inheritance.

See question number: 49

27) What is MODY.

See question number: 48

28) Can a child have more IQ than their parent.

- **IQ level:** Intelligence is polygenic character. Environment can promote intelligence. So child can have more IQ then their parents.

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Mendelian factor renamed genes by = **Johannsen**

2) Blood serum containing antibodies called = **Antiserum**

3) Best example of inheritance of multiple allele is = **Rh blood group**

4) How many genes controlled wheat grain color = **3 gene pair**

5) Gene that trigger maleness = **SRY**

6) *Ascaris incurve* female has chromosome = **42**

7) Genic system for sex determination was found in = **Yeast**

8) Sex chromosome was discovered by = **Correns**

9) Gene for eye color in drosophila is located on = **X chromosome**

10) Bobbed gene in drosophila is located on = **X & Y chromosome**

11) Bilirubin damage neuron and turn skin/eye color to yellow, that condition called = **Jaundice**

12) Blood group A transfuse blood to = **Blood group A & AB**

13) Gene for blue opsin present of __ chromosome **= 7**

14) Women bald only when she is = **Homozygous recessive**

15) Haemophilia C effect = **Both sexes equally**

16) In F3, round seed were **= 1/3**

17) In test cross, heterozygote produces = **50:50**

18) Number of wrinkle green in F2 = **1/16**

19) Number of round green in F2 = **3/16**

20) Erythroblastosisfoetalis is caused when = **Rh +ve male with Rh -ve female**

21) *Ascaris incurve* male has ___ chromosome = **35**

22) Drosophila males for eye color are = **Hemizygous**

23) Who first time found white eye mutant drosophila = **Bridges**

24) SRY found in Y chromosome determine = **Maleness**

25) 1:2:1 is ratio of = **Genotypic of monohybrid cross**
26) ___ inheritance with same type of Genotypic and phenotypic ratio = **Incomplete**
27) Alternative form of gene, whose number is more than two = **Allelomorph**
28) Enlargement spleen and liver occur in = **Eryhroblastosis foetalis**
29) Hemophilia C affects = **Both sexes equal**
30) Blue cone monochromacy is = **Red and green cone absent**
31) ___ is more in male = **X-linked recessive**
32) Insulin gene located on ___chromosome = **11**
33) What is risk of hemophilia child when father is hemophilic but mother is carrier = **Half sons and half daughtera affected**

Exercise MCQs

1) When a single gene has multiple phenotypic effects = **Pleiotropy**

2) When both alleles express in heterozygote = **Co dominance**

3) A heterozygote offspring quantitatively exceeds the phenotypic expression of both homozygous patents = **Over dominance**

4) How many gene pair contribute to wheat grain color = **4**

5) Who first time found white eye mutant drosophila = **Bridges**

6) ___ traits transmitted from father to son = **Autosomal and Y linked both**
7) ____ reduces chance of recombination and variation **= Linkage**

8) ____ not sex linked trait = **Hypophosphatemic rickets**

9) ___ trait zigzag from maternal grandfather to carrier mother to grandson = **X linked**

10) When a haemophilic carrier female marries a normal person, __ offspring affected = **half sons**

11) ___ risk of color blind child in family, when mother is color blind and father is normal = **50%**

12) ___ risk of color blind child in family, when father is color blind and mother is normal = **0%**

13) 1:2:1 is ratio of = **Genotypic of monohybrid cross**
14) ___ inheritance with same type of Genotypic and phenotypic ratio = **Incomplete**
15) Alternative form of gene, whose number is more than two = **Allelomorph**

16) Enlargement spleen and liver occur in = **Eryhroblastosis foetalis**
17) Hemophilia C affects = **Both sexes equal**
18) Blue cone Monochromacy is = **Red and green cone absent**
19) ___ is more in male = **X-linked recessive**
20) Insulin gene located on ___chromosome = **11**
21) What is risk of hemophilia child when father is hemophilic but mother is carrier = **Half sons and half daughters affected**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Explain Mendel law of segregation and independent assortment. ★★
2. Explain test cross with example.
3. Explain in-complete & co-dominance with example. ★★
4. Discuss genetics of ABO blood group system. ★★★
5. Describe Rh factor. Write its role in blood pressure & pregnancy/erythroblastosis. ★★★★
6. Explain epistasis with reference to Bombay phenotype & pleiotropy. ★★★
7. Write a note on gene linkage & crossing over.
8. Discuss XO-XX, XY-XX & ZZ-ZW pattern of sex determination.
9. Discuss sex determination in human. ★★
10. Write comparison of chromosomal determination of sex b/w drosophila & human.
11. Explain sex determination in plants. ★★
12. Write a detail note on genetics of color blindness & diabetes mellitus. ★★

CH # 23: BIOTECHNOLOGY

Short questions (Selected from past papers)

1. **Define biotechnology.**

➢ **Biotechnology:** Use of living organism in manufacturing & services industries called biotechnology.

- **Example:** Production of insulin and growth hormone etc.

2. **Why biotechnology is important for human beings.** ★★

➢ **Importance of biotechnology:**

- Genes are removed & inserted into organism through biotechnology.
- Many drugs & medicines are produced through biotechnology.
- Biotechnology control environmental pollution.
- Biotechnology is used in food and beverage industry.
- Genetically engineered organisms are produced by biotechnology.

3. **What is recombinant DNA technology.**

➢ **Recombinant DNA technology:** Recombinant DNA contains DNA from two different sources (gene of interest + plasmid). Recombinant DNA technology is commonly called genetic engineering.

- **Use:** It is used in Biotechnology for production of transgenic organism.

4. **Write steps involved to produce recombinant DNA.**

➢ **Steps of recombinant DNA:** Followings are the steps to produce recombinant DNA.

- Isolation of Gene of interest (genes to be cloned).
- Molecular scissor/restriction Endonuclease (cut the gene of interest).
- Vector/plasmid (carrier of gene).
- Gene expression system/GMO (get specific product).

5. **Write three possible ways to get gene of interest.**

➢ **Gene of interest:** There are three methods to get gene of interest.
Isolation of gene from chromosome (ii) Synthesize it chemically
(iii) Make it from m-RNA.

6. **What is restriction endonuclease/molecular scissors. Give importance.** ★★★★★★

➢ **Restriction endonuclease: Restriction endonuclease**/molecular scissors is enzyme that cut the genes/DNA. In **1970, Hamilton O. smith** isolates the first restriction enzyme.

- **Example: EcoR1** is commonly used restriction enzyme.
- **Importance: Restriction enzyme** is used to cut the genes of interest.
They restrict the growth of viruses. That's why called restriction endonuclease.

7. **What is palindromic sequence.** ★★★

➢ **Palindromic sequence:** Palindromic sequence consists of four to six nucleotides.

- These nucleotides arranged in reverse order.
- **Example:** 5' GAATTC 3'
3' CTTAAG 5'
- **Role:** Restriction enzyme cut genes at palindromic sequence.

8. **What is vector/molecular carrier. Give importance.** ★★

➢ **Vector:** Gene of interest introduced into host cell through **vector.**

- **Example:** Plasmid and bacteriophage etc.
- **Importance:** They are used in recombinant DNA technology.

9. Define plasmid. Give example.

➢ **Plasmid:** Plasmids are extra chromosomal circular DNA molecule in bacteria.

❖ **Example:**

- **pSC-101** (has antibiotic resistance against **tetracycline**)
- pBR-322 (has antibiotic resistance against **tetracycline & ampicillin**).

10. What is chimaeric/recombinant DNA.

➢ **Chimaeric DNA:** DNA molecule that contains two different pieces of DNA called **chimaeric DNA.**

- Two different piece of DNA (plasmid + gene of interest) is joined by **DNA Ligase**.

11. Write the way in which bacterial cell become permeable of plasmid.

➢ **Method for permeable: Calcium chloride** is used to increase the permeability of bacteria for intake of plasmid.

12. Write role of lambda phage.

➢ **Lamda phage:** Lambda phage is bacteriophage which eats bacteria.

- Lambda phage is used as a vector in biotechnology.
- Their DNA used for transfer of gene of interest in host cell.

13. What is genome & genomic library.

➢ **Genome:** All genes of an individual called **genome**.

➢ **Genomic library:** Collection of bacterial or Bacteriophage **clones** that contain genes of interest called **genomic library**.

14. Define probe. Write its role. ★★

➢ **Probe:** Single stranded sequence of nucleotides that bind to specific piece of **DNA** called probe.

- **Function:** Probe is used to find gene of interest/**genomic library.** Probe is radioactive /fluorescent. In this way location of probe is easily found.

15. Define PCR.

➢ **Polymerase chain reaction:** Technique in which DNA is copied many time by DNA polymerase in test tube called PCR. PCR creates millions copies of target gene.

- **Developed:** PCR is developed by **Carry B. Mullis** in **1983**.
- **Use:** PCR is used to diagnose **viral infections, genetic disorders, and cancer.**

❖ **Steps:**

- Denaturation (95^0C)
- Anealing (55^0C)
- Extension (72^0C)

16. What is taq polymerase. ★★

➢ **Taq polymerase:** DNA polymerase is commonly called **Taq polymerase**. Taq polymerase is temperature insensitive. DNA polymerase is extracted from **bacterium** *Thermus aquaticus* that live in hot springs.

❖ **Function:**

- It is used to form new stranded of DNA.
- It is used in PCR.

17. Define DNA fingerprinting.

➢ **DNA finger printing:** Entire genome of an individual can be analyzed by DNA finger printing.

❖ **Uses of DNA fingerprinting:**

- To diagnose viral infections, genetic disorders, and cancer.
- In forensic laboratories to identify criminals.

- To determines the evolutionary history' of human population.
- **DNA fingerprinting** is used in parentage.

18. What is gel electrophoresis.

➢ **Gel electrophoresis: Gel electrophoresis** separates the fragments of DNA length wise/molecular weight/size. They produce bands of DNA fragments. Then bands on gel transferred to the membrane for analysis.

19. Write uses of DNA analyzing/gene sequencing.

➢ **Uses of DNA analyzing:**

- It is used to diagnose viral infection etc.
- It is used to identify criminals.
- It is used in parentage.

20. What is gene sequencing. ★★

➢ **Gene sequencing:** Determining the nucleotide sequence of DNA called DNA sequencing.

- **Development:** DNA sequence was developed in 1970.

❖ **Principle:**

- Generation of different size of DNA pieces.
- Separation of these pieces on gel.
- Reading sequences from gel.

❖ **Methods:**

- Maxam Gilbert method.
- Sanger method.

21. Write Sanger & Maxam-Gilbert method.

➢ **Sanger:** Dideoxyribonucleoside triphosphates are used to terminate DNA synthesis at different site.

➢ **Maxam-Gilbert:** DNA threads are chemically cut into pieces of different sizes.

22. What is human genome project. Write their goals. ★★★

➢ **Human genome project:** Human genome project was started in 1990 in US. The entire human genome was published in 2001. Chromosome 22 is smallest chromosome.

❖ **Goals:**

- Construction of genetic map.
- Construction of base sequence map.
- Find the arrangement and position of genes.

23. What is transgenic organism.

➢ **Transgenic organism:** Organism with foreign DNA/gene called **transgenic organism.**

- **Uses:** They are used in biotechnology for production of desired products.
- **Example:** Bacteria (ii) Plants (iii) Animals

24. Define bioreactors. ★★★

➢ **Bioreactors:** Recombinant DNA technology is used to produce bacteria in large vats called bioreactors.

- **Example:** Fermenters (ii) Stirring tanks

❖ **Function:**

- Bioreactors provide optimum conditions to bacteria.
- They also produce space for production of desired products.

25. Write role of suicide genes.

➢ **Suicide genes:** Suicide genes are given to bacteria that remove Sulphur from coal.

- **Role:** They destruct the bacteria after completed the job.
- **Example:** CD gene (cytosine deaminase) & HSVtK gene (herpes simplex virus thymidine kinsae).

26. Define protoplast.

➢ **Protoplast:** Plant cell with removed cell wall called protoplast.

- **Use:** It is used in Biotechnology for production of various products & somaclonal variations.

27. What is aspartame.

➢ **Aspartame:** Aspartame is **dipeptide** sweetener. It is also called nutrasweetner.

- **Use:** It is used as sweetener.
- **Production:** Aspartame is produced from phenylalanine & aspartic acid.

28. Define Transgenic plants & animals. ★★

➢ **Transgenic plants:** Plants with foreign DNA called transgenic plants.

- **Example:** Bt cotton
- **Use:** Transgenic plants used in biotechnology.

➢ **Transgenic animals:** Animals with foreign DNA called transgenic animals.

- **Example:** Transgenic sheep and goat.
- **Use:** Transgenic animals used in biotechnology.

29. How transgenic animals are developed.

➢ **Production of transgenic animals:** There are two methods for production of transgenic animals.

- **Microinjection:** In this method, microinjection is used to transfer of foreign gene into egg by hand.
- **Vortex mixing:** Eggs are placed in agitator with DNA & silicon carbide needle. Needle make hole in egg for entry of DNA. In this way eggs are fertilized & produce transgenic animals.

30. What is biodegradable plastic. Write its origin.

➢ **Biodegradable plastic:** A weed called mouse-eared cress has been engineered to produce a biodegradable plastic (polyhydroxy-butyrate) in cell granules.

31. What is gene pharming. ★★★

➢ **Gene pharming:** Use of transgenic farm animals to produce pharmaceutical products called **gene pharming.**

- **Products:** Drugs, vaccine & human proteins.
- **Example: Goats** are used for production of Antithrombin III (involve in blood clotting).

32. Why urine is preferable vehicle for biotechnology product than milk.

➢ **Preference of urine:** Urine is preferable vehicle for biotechnology products than **milk**.

- All animals produce urine but only female produce milk.
- All animals produce urine from birth but female produce milk after maturity.

33. Why transgenic animals cloned.

➢ **Cloning of transgenic animals:**

- Transgenic animals cloned for production of biotechnology products.
- They produced genetically identical animals (preserve desirable characters).

34. Define cumulus cell.

➢ **Cumulus:** Cells that cling to an egg after ovulation called **cumulus cells.**

- **Example:** Granulosa cells.
- **Function:** Surround and nourish the egg.

35. Define gene therapy. ★★★

➢ **Gene therapy:** Insertion of gene into human cell for treatment of genetic diseases called gene therapy.

❖ **Uses:**
- Used for replacement of faulty genes in patient.
- Used for treatment of disease like cancer.

❖ **Methods:**
- In Vivo gene therapy
- Ex Vivo gene therapy

36. Difference b/w in vivo & ex vivo gene therapy.

Ex Vivo gene therapy	In Vivo gene therapy
Insertion of gene in cell outside the body.	Insertion of gene in cell within the body
Lab tools are used in Ex vivo gene therapy.	Viruses are used in In-vivo gene therapy.
Ex vivo is better than In vivo.	In vivo is less better than Ex vivo.
Uses: Used for treatment of SCID & **hypercholesterolemia.**	**Uses:** Used for treatment of cystic fibrosis & cancer.

37. What is SCID & ADA. ★★

➢ **SCID:** Severe combined immune deficiency syndrome is abbreviated as SCID.
- **Cause:** SCID is caused due to lack of enzyme **adenosine deaminase.**
- **Treatment:** SCID is treated by ex-vivo gene therapy.

➢ **ADA:** Adenosine deaminase is abbreviated as ADA. ADA is enzyme.
- **Function:** ADA enzyme involved in maturation of T & B lymphocyte cells.
- **Affect:** Adenosine deaminase cause SCID in children.

38. How hypercholesterolemia can be cured by gene therapy.

➢ **Hypercholesterolemia:** High level of cholesterol in blood causes hypercholesterolemia. Liver cells lack receptor for cholesterol removing. It cause heart attack at young age.
- **Treatment:** It is control by Ex vivo gene therapy.

❖ **Procedure:**
- Small portion of liver is surgically removed.
- It is infected with retrovirus. Virus contain normal gene for receptor.
- Blood cholesterol level decrease in patient.

39. What is cystic fibrosis. ★★

➢ **Cystic fibrosis:**
- **Cause:** It is caused due to absence of gene that codes trans-membrane carrier of Cl^-.
- **Affects:** Patient of systic fibrosis die due to infections in **respiratory tract.**
- **Treatment:** Cystic fibrosis is treated by in-vivo gene therapy.

40. How cancer & coronary artery angioplasty is treated by gene therapy.

➢ **Treatment of cancer:** Genes (tolerant to chemotherapy) are inserted into patient. Now bone marrow cells are protected. Thus chemotherapy kills cancer cells.

➢ **Treatment of coronary artery:** During treatment of **coronary artery angioplasty,** a ballon catheter is used to open closed artery. Ballon is coated with plasmid that contains a gene for vascular endothelial growth factor. Gene proliferate the blood vessels. Thus blood easily passed from obstructed area.

41. What is micro-propagation.

➢ **Micro-propagation:** Growth of tissue in artificial medium called tissue culturing or micro-propagation.

- **Methods:** (i) Phloem culturing (ii) Meristem culturing (iii) Anther Culturing

❖ **Advantage:**

- Plant tissue has ability to form complete plant.
- Micro-propagation is used for production of large number of plants in short time and at limited space.

42. What is totipotent/why Gottlieb Haberlandt said that plant cells are totipotent. ★★★★★★

➢ **Totipotent: Haberlandt** said that plant cells are totipotent. Totipotent means each cell has potential to become a complete plant. Therefore single cell become a complete plant.

43. What is cell suspension culture &hybridization.

➢ **Cell suspension culture:** In this case, growing culture are cut into small pieces & shaken in nutrient medium. Thus single cell form suspension of desirable chemicals.

❖ **Example:**

- Cell suspension culture of ***Digitalis lanata*** produce digitoxin.
- *Cinchona ledgeriana* produce **quinine.**

➢ **Hybridization:** Crossing of different plants or even species called hybridization.

- **Use:** It is used to produce desirable organism.
- **Example:** Hybrid corn, tomato and carrots etc.

44. What is luciferase.

➢ **Luciferase:** Gene of **firefly** inserted into **tobacco** protoplast that produce luciferase enzyme. When tobacco plant is sprayed by **luciferin** the plant will glow.

45. What is particle gun.

➢ **Particle gun:** Particle gun bombards callus with DNA coated microscopic metal particles.

- **Developed:** John & Klein developed particle gun for introducing DNA into callus.
- **Use:** Corn and wheat are genetically engineered by particle gun.

46. Name two salt tolerant plants.

➢ **Salt tolerant plants:** Followings are the salt tolerant plants produced by genetic engineering.

- **Example:** Cereal, rice, **Arabidopsis** & sugar cane.

Exercise Short Question

1) How and why transgenic animals that secrete product are often cloned.

➢ **Transgenic animals:** Transgenic animals are cloned to get desired product. During cloning, large number of transgenic animals produce (to get products). Without cloning, transgenic animals not produce desired product at large scale.

2) Explain goal and benefits of human genome project.

See question number: 22

3) Explain ex vivo and in vivo gene therapy in human with example.

See question number: 36

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Polyhydroxy-butyrate is also called = **Biodegradable plastic**

2) Coconut milk contain hormone = **Cytokinins**

3) Tissue culture & cloning seek help from = **Mitosis**

4) F.C steward grew a complete carrot plant from a piece of = **Phloem**

5) Meristem is different from other parts of plants because it is = **Virus free**

6) Team of Japanese scientist working on introducing C_4 photosynthetic in = **Rice**

7) Antibodies made by soya bean are used for treatment of = **Genital herpes**

8) ___ produce by transgenic bacteria and plant = **Antibody**

9) Huntington patient has unique site on ____, where restriction endonuclease cut = **DNA**

10) Cloning is type of = **Asexual reproduction**

11) Growth of tissue in an artifical culture medium = **Tissue culture**

12) DNA fingerprinting prepared by = **Blood**

13) Disputed paternity is determined nowadays by = **DNA fingerprinting**

14) Plasmid discovered while studying the sex life of = **E. coli**

15) Transgenic plants are produced when foreign genes are introduced into = **Plant protoplast**

16) If correct proportion of Oxygen and cytokinins are added in a liquid medium 1000 of copies of new shoots will develop from a single shoot tip by = **Meristem culture technique**

17) The organisms used as bio filter is = **Transgenic bacteria**

18) Reverse transcription yields = **cDNA**

19) Which of the following organism is used to prevent airborne chemical pollutants = **Transgenic bacteria**

20) How many base pairs are found in Human Genome = **3 billion**

21) Primer for PCR contains about = **10-20 bases**

22) For the treatment of familial hyper cholesterolemia patients __ normal gene is inserted into patient through = **Retrovirsus**

23) An enzyme Alpha glactosidase can be used to treat human = **Lysosome storage disease**

24) Which one is used to make the animal eggs transgenic = **Vortex mixing**

25) Alpha glactosidase can be used to treat a human lysosome storage disease is harvested from = **Tobbacco plants**

26) Hot dry weather is well controlled by = **C4 plants**

Exercise MCQs

1) ____ true statement = **Both plasmid and viruses are vector**

2) ___ is benefit of insulin produce by biotechnology = **All (effective, mass production, non allergic and cheap)**

3) Restriction fragment length polymorphism = **All (formed by restriction enzyme, basis for DNA fingerprints, subjected to gel electrophoresis)**

4) ___ not biotechnological product = **DNA probes**

5) ___ benefit of using retroviruses as vactor = **Both (incorporate with host DNA and eliminate unnecessary steps)**

6) Gel electrophoresis = **Measure size of DNA & protein**

7) ___ incorrectly matched = **DNA ligase - Mapping**

CH # 24: EVOLUTION

Short questions (Selected from past papers)

1. **Define evolution. Name theories of Lamarck & Darwin.**

➢ **Evolution:** Process that transformed life on earth from earliest form to diverse form called evolution.

- **Example:** Evolution of Eukaryotes from prokaryotes.

➢ **Theory of Lamark:** Inheritance of acquired characteristics (ii) Theory of use & disuse.

➢ **Theory of Darwin:** Theory of natural selection.

2. **What is theory of special creation & Lamarkism.** ★★★★

➢ **Special creation:** According to this theory, all living things came into existence in their present form & created by nature. Carolus Linnaeus believed on this theory.

➢ **Lamarkism:** There are two points about Lamarkism.

- Use & disuse of organs.
- Inheritance of acquired character.

3. **Write contribution of Cuvier.**

➢ **Cuvier:** Contribution in paleontology (ii) Explain earth history by catastrophic.

4. **What is hydrothermal vents.** ★★★★★★★

➢ **Hydrothermal vents:** Deep oceans have under water hot springs called hydrothermal vents. Archaebacteria tolerate temperature up to **120^{0}C** & live in these vents. They get energy & raw materials for their survival from these vents.

5. **What is endosymbiotic & membrane invagination hypothesis.** ★★

➢ **Endosymbiotic hypothesis:** In this hypothesis, large anaerobic amoeboid bacteria ingested small aerobic bacteria. Ameboid bacteria did not digest aerobic bacteria. That aerobic bacteria live symbiotically inside the amoeboid bacteria and developed into **mitochondria** (site of aerobic respiration) & energy conversion take place.

- **Proposed:** Endosymbiotic hypothesis was proposed by **Lynn Margulis**.

➢ **Membrane invagination hypothesis:** Prokaryotic cell membrane invaginates (invagination contain DNA) to form double membrane bound organelle like mitochondria, nucleus & chloroplast of eukaryotes.

6. **What is theory of inheritance of acquired characteristics.**

➢ **Inheritance of acquired characteristics**: This theory was proposed by Lamark. According to this theory, acquired character/modification of organism acquire during its lifetime can be passed to its offspring.

- **Objection:** Acquired character cannot be inherited.
- **Example:** Long nick of giraffe. (ii) Bicep of blacksmith.

7. **Why Galapagos famous for.**

➢ **Galapagos famous:** Galapagos is an island near South American coastline. They show puzzling geographical distribution of animals. Animals of Galapagos show similarity with animals of South America mainland but most animals lived only on Galapagos.

- **Darwin:** Darwin collected **13** types of finches from Galapagos. These finches are quite similar but belong to 13 different species.

8. **What is neo-Darwinism. / What is modern synthesis.** ★★★★★

- **Neo-Darwinism:** Modified form of Darwin theory called neo-Darwinism. It was developed early in 1940. It is modified by ideas of paleontology, taxonomy & biogeography etc. Progress in population genetics, Mendelism and Darwinism reconciled and comprehensive theory of evolution became Neo-Darwinism.

9. Write importance of population genetics in evolution.

- **Importance of population genetics:**
  - Population genetics is important in evolution.
  - It emphasize on genetic variations.
  - It recognizes the importance of quantitative character.

10. What is the role of geographical barriers in evolution.

- **Role of geographical barriers:** Geographical barrier separate the members of population. After a long time they show morphological & genetic changes that leads to evolution like armadillos (armored mammals) live only in America.
- **Example:** Rivers, mountains and streams etc.

11. Define fossils. Where most fossils found.

- **Fossils:** Fossils are either the actual remains or traces of organisms that lived in ancient geological times.
- **Evidence of evolution:** Fossils provide visual record of evolution. Fossils record present in complete series. For example, fishes are earliest vertebrates. Then amphibians formed, followed by reptiles then birds and last one is mammal.
- **Location:** Most fossils are found in sedimentary rocks.

12. Define homologous & analogous organ with example. ★★★★★★★★★★★★

- **Homologous organ:** Homologous organ are similar in structure but perform different functions.
- **Example:** Forelimbs of human, cat, bat & mammals.
- **Analogous organ: Analogous organ** are similar in function but different in structure.
- **Example:** Wings of bat, birds & insects.

13. What is convergent & divergent evolution.

- **Divergent evolution:** Formation of homologous organ is result of **divergent** evolution.
- **Example:** Forelimbs of human, cat, bat & mammals.
- **Convergent evolution:** Formation of analogous organ is result of convergent evolution.
- **Example:** Wings of bat, birds & insects.

14. Define vestigial organ with example. ★★★★★

- **Vestigial organs:** Vestigial organs are historical remnants that had important function in ancestors but not essential now.
- **Example:** Vermiform appendix in **carnivores.** (ii) **Ear muscle in man.**

15. Write function of Eustachian tube.

- **Eustachian tube:** Eustachian tube connects **middle ear** with throat in human.
- **Formation:** It is formed from gill pouch during embryonic development.

16. Difference b/w natural selection & artificial selection.

Natural selection	Artificial selection
It takes place by interaction b/w environment & population.	It takes place by breeding plants & animals.
In natural selection, environment selects variations/characters.	In artificial selection, human select variations/character.
Natural selection takes long time.	Artificial selection takes short time.

Example: Evolution of antibiotic resistance in bacteria.	**Example:** Cloning of sheep.

17. Define species & population.

- **Species:** Group of individuals that have potential to interbreed naturally.
- **Example:** Human
- **Population:** Group of same species living in same place at same time called **population**.
- **Example**: Human population of Pakistan in 2017 was 220 million.

18. Write the main points of theory of natural selection.

- **Natural selection:**
  - Production of more individuals than the environment can support.
  - Survival in the struggle for existence is not random.
  - Unequal ability of individuals to survive and reproduce.

19. Discuss decent with modification.

- **Decent with modification:** Darwin believed in perceived unity in life, with all organisms related through descent from some common ancestor. In the Darwinian view, the history of life is like a tree, with multiple branching and re-branching from a common trunk.

20. What is mean by survival of fittest.

- **Survival of fittest:** Survival in the struggle for existence is not random, but depends on the hereditary material of the surviving individuals. Those individual whose inherited characteristics are best to their environment, leave more offspring than other individuals.
- **Term:** Survival of fittest was used by H. Spencer.

21. Define gene pool & fixed alleles. ★★

- **Gene pool:** Total genes in **population** at any time called **gene pool**.
- **Example**: All genes of frogs living in pond.
- **Fixed alleles:** If all members of a population are homozygous for same allele called fixed allele.
- **Example:** Homeotic gene in human. (ii) DGAT-1 in buffalo.

22. What is Hardy-Weinberg theorem. ★★★

- **Hardy-Weinberg theorem:** Number of alleles & genotype in a population remain constant over generations until external factor (Mutation, Migration, Genetic drift & Selection) acted, except sexual recombination.
- **Use:** This theorem describe the frequencies of non evolving population.
- **Formulation:** This theorem was formulated by Hardy & Weinberg in 1908.
- **Formula:** $(p+q)^2 = p^2 + 2pq + q^2$

23. Name four factors affecting gene frequency.

- **Factors of gene frequency:** (i) Mutation (ii) Migration (iii) Genetic drift (iv) Selection

24. How genetic drift affect gene frequency. ★★★★★★★

- **Genetic drift:** Change in number of alleles at locus by chance called **genetic drift**.
- **Example**: Bottle neck effect.
- **Conditions**:
  - It takes place in small population.
  - Few individual fail to reproduce that cause loss of genes from population.

25. Difference b/w endanger, threatened & extinct species. ★★★★★★

- **Endanger species:** Species which are near to extinct called **endanger species**.
- **Example**: **Indus dolphin** and Marco polo sheep etc.

- **Extinct species:** Species which are no longer exist on earth called extinct species.
- **Example:** In Pakistan Cheetah, Tiger, Asian lion, Indian rhino, Cheer pheasant and **Crocodile.**
- **Threatened species:** Species which become endanger in future called threatened species.
- **Example:** Snow leopard & musk deer.

26. Write two measures to protect endanger species.

- **Measure for protection:**
  1. National park should be established.
  2. Zoo & botanical gardens should be established.
  3. Protect the landscapes.

27. Name any five endanger & extinct species in Pakistan. ★★

- **Endanger species in Pakistan:** Indus dolphin, Black Buck, Common Leopard, Marco Polo Sheep & Houbara Bustard.
- **Extinct species in Pakistan:** Cheetah, Tiger, Asian Lion, **Crocodile** & Indian Rhino.

Exercise Short Question

1) **What are hydrothermal vents.**
   See question number: 4
2) **State endosymbiont hypothesis.**
   See question number: 5
3) **Define population genetics.**
- **Population genetics:** Study of gene pool and variation in a population called population genetics.

4) **How does fossils record provide evidence of evolution.**
   See question number: 11
5) **Explain homology with example.**
- **Homology:** Similarity in characteristics due to common ancestry called **homology.**
- **Example:** Fore limbs of human, cat, bat and mammals.

6) **What are vestigial organs. Give example.**
   See question number: 14
7) **How are evolutionary relationships reflected in DNA and protein.**
- **Evolutionary relationships:** Evolutionary relationships in species reflected in DNA and protein and in genes. DNA and protein are made of same type of monomers in all living organism.

8) **State Hardy Weinberg theorem.**
   See question number: 22
9) **Write difference between endanger and threatened species.**
   See question number: 25
10) **Write name of five species that declared extinct in Pakistan.**
   See question number: 27

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Who believed in theory of special creation = **Carlous Linnaeus**
2) Who published Essay on ''principal of population'' = **Malthus**
3) Who wrote Essay on origin of species = **Darwin**

4) Who published papers on inheritance **= Mendel**

5) Flagella may have arisen through = **Spirochetes**

6) Lamarck was incharge of invertebrates at natural history museum in = **Paris**

7) Acquired characteristics cannot be = **Inherited**

8) Wallace developed theory of natural selection identical to = **Darwin**

9) Darwin published 'origin of species' in = **1859**

10) Armored mammals that live only in America is = **Armadillos**

11) Oldest known fossils are = **Prokaryotes**

12) Most fossils are found in = **Sedimentary rocks**

13) Whales & some snakes retain vestiges of = **Pelvis & leg bone**

14) Respiratory protein found in all aerobes = **Cytochrome c**

15) Ultimate source of all changes = **Mutation**

16) Emigration & immigration cause disturbance in = **Gene pool**

17) Mostly species extinction caused by = **Habitat destruction**

18) Zoos & botanical garden save species whose extinction is **= Imminent**

19) Endanger species of plants have been recorded more than = **500**

20) 1st person argued about Evolution = **Darwin**

21) Lyell published principle of = **Geology**

22) Endo symbiotic hypothesis explain the origin of = **Eukaryotic**

23) In natural selection, environment play role in = **Population**

24) Hardy Weinberg theorem describe the frequency of genotype of non evolving **= Population**

25) Biogeography is geographical distribution of ___ = **Species**

26) Darwin collected 13 types of ___ = **Finches**

27) Number of cervical vertebrae in mammal = **7**

28) According to Endo symbiotic hypothesis ingestion of prokaryotes similar to cyanobacteria have developed into = **Chloroplast**

29) Prokaryotes have a formed more than = **3.5 billion years ago**

30) First Eukaryotes were appeared about = **1.5 billion**

31) First photosynthetic organism probably used hydrogen sulphide as a source of hydrogen for reducing carbon dioxide to = **Sugar**

32) Which one is not a vestigial organ of human being = **Eyelid**

33) Floral parts of flowering plants are = **Homologous**

34) In fish the gill pouches develop into = **Gills**

35) Selection directly acts on = **Phenotype**

Exercise MCQs

1) Gill pouches of mammals and birds embryo are = **Ontogeny recapitulate phylogeny**

2) Darwin theory (origin of species) concerned with = **How new specie arise**
3) Smallest biological unit that can evolve over time = **Population**
4) Gene pool consist of = **All alleles of population**
5) In a population with two alleles for a particular locus, B and b, the allelic frequency of B is 0.7. What would be the frequency of heterozygous if population is in hardy Weinberg equilibrium = **0.42**
6) Population in hardy Weinberg equilibrium, 16% individuals show recessive trait. What is frequency of dominant allele in population = **0.84**
7) Selection acts directly on = **Genotype**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Discuss evolution from prokaryotes to eukaryotes. ★★★★
2. Explain endosymbiotic hypothesis. ★★★
3. Describe theory of inheritance of acquired characteristics. / explain Lamarck theory of inheritance. ★★★★
4. Discuss Darwin theory of natural selection. ★★★★★★★★
5. Write a detail note on neo-darwanism. ★★★
6. How fossils record & comparative anatomy favors evolution. ★★★
7. How comparative embryology & molecular biology favors evolution.
8. Explain artificial & natural selection.
9. Write a note on Hardy-Weinberg Theorem. ★★★
10. Discuss four factors that effects gene frequency. ★★★★
11. What is endanger species. Write different measure to preserve them. ★★

CH # 25: ECOSYSTEM

Short questions (Selected from past papers)

1. **Define ecology & ecosystem.** ★★★★★
- **Ecology:** Study of relationship b/w organisms to their environment called **ecology**.
- **Ecosystem:** Interaction b/w biotic & abiotic component of environment called ecosystem.
- **Components:** Biotic and abiotic.

2. **Define population & community.** ★★★★
- **Population:** Group of same species living in same place at same time called **population**.
- **Example**: Human population of Pakistan in 2017 was 220 million.
- **Community:** All population within an ecosystem that are connected with each other called **community.**
- **Example:** Forest (ii) Pond

3. **Write names of different levels of ecosystem.**
- **Levels of ecosystem**: (i) Individual level (ii) Population level (iii) Community level (iv) Biome.

4. **Define biome.**
- **Biome:** Major types of ecosystems, those that occupy broad geographical regions are called biomes. **Composition:** Each biome consists of a combination of plants and animals in the climax community.
- **Example:** Forest biome (ii) Grassland biome (iii) Desert biome.

5. **Define biosphere. How it is thick.** ★★★★★
- **Biosphere:** Part of earth inhibited by organism called **biosphere**.
- **Range:** Biosphere extends **8-10 km** upper & same into depth.

6. **Define habitat & ecological niche.** ★★★★
- **Ecological niche:** Role of species in community called ecological niche.
- **Example:** Darwin finches. (ii) Dung beetle.
- **Charles Eton** defines niche 'species **occupation/role** called niche.'
- **Joseph Grinell** first proposed the term niche.
- **Habitat:** Location of organism called **habitat.**
  - **Example:** Grasshopper lives in grass.

7. **Difference b/e autecology & synecology.** ★★★★★★★★★★★★★

Autecology	Synecology
Study of relationship of single population with environment called **autecology**.	Study of relationship of many populations with environment called **synecology.**
In autecology, we study only one population.	In synecology, we study community.
It is also called species ecology.	It is also called ecology of communities.
Example: Effect of water pollution on soybean plants	**Example:** Effect of animals on soybean plants.

8. **Difference b/w biotic & abiotic components.**

Biotic component	Abiotic components
Living component of an ecosystem called biotic components.	Non-living component of an ecosystem called abiotic components.
They adapt according to changes.	They do not adapt according to environment.
More affected by environment.	Less affected by environment.
Example: Producers, Consumers & Decomposers.	**Example: Temperature,** Atmosphere, Soil, Water

9. Define producers, consumers & decomposers. ★★★

➢ **Producers:**

- **Producers** are green plants that capture light energy.
- **Green plants/producers** prepare their own food from inorganic substance (water & CO_2).
- They are autotrophs
- **Example:** Green plants and Algae.

➢ **Consumers:** Consumers obtain their food from producer. (ii) They are heterotrophic.

- **Example:** Animals and Human.

➢ **Decomposer:**

- They get their food from dead materials.
- They are heterotrophs.
- **Decomposers** release chemical elements as ions.

- **Example:** Fungi & Bacteria.

10. Define food chain & food web. ★★★★★★★★

➢ **Food chain:** Process of eating & being eaten by organism called food chain.

➢ **Food web:** Combination of many food chains called food web.

- All food chains & food webs start from **producers**.

11. Define trophic level.

➢ **Trophic level:** Level of food chain in which organism feeds called trophic level.

- **Example:** First trophic level made of producer.

12. Define succession. Difference b/w primary & secondary succession. ★★★★

➢ **Succession:** Change in community structure of an ecosystem over a period of time called **succession.**

Primary succession	Secondary succession
Formation of new ecosystem where previously life does not exist called primary succession.	Formation of new ecosystem where previously life exists called secondary succession.
It takes long time.	It takes short time.
Seral stages are many.	Seral stages are few.
Example: Formation of forest over bare area.	**Example:** Formation of forest over burnt area.

13. What is pioneer & climax community.

➢ **Pioneer:** Organism that starts succession called **pioneer**.

- **Example:** Lichens.

➢ **Climax community:** Succession ends with a uniform community called **climax community**

- **Example:** Forest.

14. Difference b/w hydrosere & xerosere. ★★★

Hydrosere	Xerosere
Primary succession occurs in a pond called **hydrosere.**	Succession occurs on dry land called **xerosere.**
Phytoplankton are pioneers.	Lichens are pioneers.
It has few sere stages than xerosere.	It has more sere stages than hydrosere.
Example: Oxbow lake & kettle lake.	**Example:** Amazon forest.

15. Difference b/w crustose & foliage lichen stage.

➢ **Crustose lichen stage:** Crustose are leafless structure that cover upper layer of crust.

- Crustose lichen lives in extreme conditions & become desiccated during dry season.
- **Example:** *Graphic scripta* / script lichen.

➢ **Foliage lichen stage:** In **foliage lichen stage**, lichen is like a crumpled leaf attach to one point.

- They produce shade on crustose lichen & their growth reduced.
- **Example:** Permellia & **Dermatocarpon.**

16. What is climax forest.

➢ **Climax forest:**

- Climax stage of woody plants called climax forest.
- Shade of these plants inhibits the growth of many small plants.
- It is stable stage/last of succession.

17. Difference b/w predator & prey. ★★★

Predator	Prey
Animal that preys other animal called predator.	Animal that is caught & eaten by other animal called **prey**.
Predator is usually big size than prey.	Prey is usually small size than predator.
Predator is stronger than prey.	Prey is weaker than predator.
Populations of predators are usually smaller than prey.	Populations of prey are usually larger than predators.
Example: Consumer like lions.	**Example**: Goat and Deer.

18. Write significance of predation.

➢ **Significance of predation:** Sizes of prey & predator are related to each other. If number of prey increased, it increases the predators. If number of preys decrease, it decreases the predators.

- If population of predator increases than population of prey **decreases.**
- **Example: Fox/Rabbit.**

19. Difference b/w predation & parasitism. ★★★

Predation	Parasitism
Association b/w prey & predators are called predation.	Parasite gets food from host & harms them. This association called parasitism.
Predator kills prey.	Parasite weakens the host (not killed).
This is not a specific relationship.	This is very specific relationship.
Example: Association of mouse/cat & **Fox/Rabbit.**	**Example:** Association of tape worm & human.

20. Define infestation.

➢ **Infestation:** Parasite cause disease in organism called **infestation**.

- **Example**: Malaria etc.

21. Difference b/w endoparasite&ectoparasite.

Endoparasite	Ectoparasite
Endoparasite lives inside the body of the host called endoparasite.	Ectoparasite lives outside the body called ectoparasite.
They lack digestive system.	They have digestive system.
They live permanently inside the host.	They live permanently/temporary inside the host.
Example: Tape worm in human intestine.	**Example:** Lice in hair.

22. Define symbiosis. Give example.

➢ **Symbiosis:** Association b/w two organisms in which one or both organism get benefit called symbiosis.

❖ **Types:**

- Mutualism
- Commensalism
- Parasitism

- **Example:** Lichens (algae + fungi) & Mycorrhizae (roots + fungi).

23. What is mutualism & commensalism. ★★★

➢ **Mutualism:** Association b/w two organisms in which both organisms get benefited called **mutualism**.

- **Example: Lichens** (ii) **Insect/flowering plant**.

➢ **Commensalism:** Association b/w two organisms in which only one organism gets benefited called **commensalism.**

- **Example:** Epiphytes (ii) **Shark and Rimoras**.

24. What are root nodules.

➢ **Root nodules: Bacteria** living in roots of legume plants (root nodules).

- **Bacteria**: In root nodules, Bacteria fix **nitrogen** to form **amino acid** in soil, that is used by plants.
- **Plant**: Plant gives food & protection to bacteria.

25. Difference b/w mycorrhiza& lichens. ★★★

➢ **Lichens:** Symbiotic association b/w **algae** & **fungi** called lichens. They grow on rocks. They colonized bare rock & important colonizers/pioneers.

➢ **Mycorrhizae:** Symbiotic association b/w plant's roots (pine and beech) & fungi. Plants provide enzyme to fungi for digestion of carbohydrates. Fungi provide minerals to plants.

26. What is grazing. How over & moderate grazing affect soil.

➢ **Grazing:** Process in which animals feed on grasses called grazing.

- **Over grazing:** If animals eat grasses completely called over grazing.
  Over grazing transform grassland to **desert**.
- **Moderate grazing:** Moderate grazing maintain **grassland** ecosystem.
  They destroy the competitors & help to grass re-grow.

27. What is biogeochemical cycle. How it maintain fertility of soil. ★★

➢ **Biogeochemical cycles:** Movements of nutrient from living to non-living & than again to living things of ecosystem called biogeochemical cycle.

- **Example:** N_2 cycle and Carbon cycle.
- **Maintain soil fertility:** This cycle decompose & recycle the dead bodies of organism. Plant use these decomposed matter for growth. In this way, fertility of soil maintains.

28. Difference b/w micro & macronutrients. ★★

Macronutrients	Micronutrients
Macronutrients are required in large amount by organism.	Micronutrients are required in small amount by organism.
May or may not be minerals.	All are minerals.
They require more than 10mg daily.	They require less than 10mg daily.
Example: Hydrogen, Oxygen, **Calcium, Sulphur** & Carbon	**Example:** Zinc, Iron & Iodine etc.

29. Define three steps of nitrogen cycle. ★★★

➢ **Ammonification:** Breakdown of nitrogenous compound (proteins and Nucleic acid) into ammonia by microorganism called ammonification.

- **Conversion:** It is carried by ammonifying bacteria.

➢ **Nitrification:** Formation of nitrates from ammonia called nitrification.

- **Conversion:** It is carried by nitrifying bacteria.

➢ **Assimilation:** Absorption & utilization of nitrates by plant called assimilation.

30. Define de-nitrification.

➢ **De-nitrification:** Formation of nitrogen from nitrates called **de-nitrification.**

- **Conversion:** It is carried by de-nitrifying bacteria.

31. How nitrogen depletion overcome in soil naturally.

➢ **Overcome of nitrogen depletion:**

- By nitrogen fixing bacteria.
- By addition of nitrogenous fertilizers.
- By addition of dead/decaying material of plant and animals.

32. Difference b/w gross & net primary productivity.

Gross primary productivity	Net primary productivity
Amount of energy that is fixed by plants called **GPP**.	Amount of energy that is left after plants have met their respiratory needs is called NPP.
It is always more than NPP.	It is always less than GPP.
It depends upon photosynthesis only.	It depends upon photosynthesis and respiration.

33. What is humus.

➢ **Humus:** Decomposed organic matter present in soil called humus.

- **Formation:** They are formed by decomposition of dead materials.

Exercise Short Question

1) **What are Biogeochemical cycle.**
   See question number: 27
2) **Sketch three main types of Nitrogen cycle.**
   See question number: 29
3) **Define grazing.**
   See question number: 26
4) **What percentage of sun energy reaches to plant.**
   Only 1% sun light reach to plant.
5) **What is autecology.**
   See question number: 7
6) **Define synecology.**
   See question number: 7

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Major type of ecosystem that occupy geographical region = **Biome**
2) Biome is a large regional **= Community**
3) Who maintain the stability of ecosystem = **Food web**
4) Herbacecious stage of xerosere is = **4th**
5) Which succulent plant store water in parenchyma tissue = **Cacti**
6) Polytrichum&tortula appear in which xerosere stage = **Moss stage**
7) Oxidation of ammonia by soil bacteria called = **Nitrification**
8) Which is steadily loss due to soil erosion & fire = **Nitrates**
9) How much sun energy is trapped by producers = **1%**

10) Basic functional unit of ecology = **Ecosystem**

11) Distinct level of food chain = **Trophic level**

12) In ecosystem, 2nd trophic level is = **Primary consumer**

13) Relationships between insect and flowering plants = **Mutulism**

14) Nitrate reduce to _____, in plant cell **= Ammonia**

15) Basic functional unit of ecology is = **Ecosystem**
16) Lithosphere includes = **Soil**
17) Mutualism is a type of **= Symbiosis**
18) Association between organisms of diffident species in which one partner gets benefit and other is harmed = **Parasitism**
19) Food relationship Predator pay creates = **Chain**
20) Energy from sun flows through an ecosystem in the form of = **Radiant Heat**

Exercise MCQs

1) Study of relationship of an organism to their environment = **Ecology**
2) Similar group of individuals that can interbreed and produce fertile offspring = **Species**
3) When living and non living interacts to produce stable system, exchange of material and energy flow takes place = **Ecosystem**
4) The living organism which can prepare their own food = **Producer**
5) ___ organism Cannot prepare their own food and obtain readymade food = **Consumer**

LONG QUESTIONS
(SELECTED FROM PAST PAPERS)

1. Discuss components of ecosystem. Also explain its components. ★★★
2. Discuss processes in ecosystem & interaction b/w biotic & abiotic components.
3. Explain food web. How it is constructed at various trophic levels. ★★
4. Define succession. Explain different stages of xerosere. ★★★★
5. Explain predation & parasitism & its significance. ★★★★
6. Define symbiosis. Explain its two types.
7. Discuss grazing. ★★
8. Explain biogeochemical cycle with reference to nitrogen cycle. ★★★★★
9. Describe nitrogen depletion & its remedies. ★★
10. Discuss flow of energy in food chain of an ecosystem.

CH # 26: SOME MAJOR ECOSYSTEM

Short questions (Selected from past papers)

1. **Difference b/w weather & climate.** ★★★★★★★

Weather	Climate
Short term fluctuation in temperature, humidity, cloud & wind etc for hours/day called weather.	Patterns of weather in a year in a region called climate.
It is short term.	It is long term.
Weather changes/evolve every day.	Climate cannot changes/evolve every day.
Example: Rainy, hot and cold.	**Example:** Antarctica has cold climate.

2. **Difference b/w terrestrial & aquatic/Hydrosphere ecosystem.** ★★

➢ **Aquatic ecosystem:** Ecosystem of water called aquatic ecosystem. Temperature is moderate. Water is abundant & less oxygen. It is largest ecosystem consist of **71%** of earth surface.

➢ **Terrestrial ecosystem:** Ecosystem of land called terrestrial ecosystem. Temperature is not equally distributed. Air is abundant & less water.

3. **Name three zone of fresh water ecosystem.**

➢ **Zones of fresh water:**

- Littoral zone
- Limnetic zone
- Profundal zone.

- Fresh water ecosystem covers less than **1%.**

4. **Name four feature of aquatic ecosystem.**

➢ **Features:**

- Temperature is moderate to support life.
- Water is transparent & absorbs enough light energy to support life.
- Nutrient is abundant near bottom. Abundant water supports life.

5. **Name two factors that influenced life on land.**

➢ **Factors:**

- Temperature
- Water
- Nutrients
- Air

6. **What is productivity of aquatic ecosystem.**

➢ **Productivity:** Productivity can be indicated by **consumption of CO_2 & evolution of O_2** during photosynthesis.

- Productivity determined by light & nutrients. Productivity of aquatic ecosystem varies due to change in light & nutrient in aquatic ecosystem.

7. **Difference b/w littoral & limnetic zone.** ★★★

➢ **Littoral zone:** Zone near shore called **littoral zone.**

- Plants are abundant due to enough light & nutrients.
- **Littoral zone** is rich in life.

- **Plants:** Water lilies & Algae etc.
- **Animals:** Frogs & Turtles etc.

- **Limnetic zone:** Open water zone called limnetic zone.
  - In **limnetic zone,** enough light penetrate to support photosynthesis.
  - Plants are present due to light.
- **Plants:** Phytoplanktons & **Cyanobacteria** etc.
- **Animals:** Protozoa & Fish etc.

8. Define planktons. Write its types.

- **Planktons:** Microscopic floating organism called **planktons**.
- **Example**: Protozoa & cyanobacteria.

There are two types of planktons.

- **Phytoplanktons:** Drifting **plants** are called phytoplanktons.
  - **Example:** Cyanobacteria & Algae etc.
- **Zooplanktons:** Drifting animals are called **zoo-planktons**.
  - **Example: Protozoa** & Crustaceans.

9. What is profundal zone. ★★★

- **Profundal zone:** Bottom area of lake without light called profundal zone. In **profundal zone**, light is insufficient to support photosynthesis.
- **Plants:** Plants are absent in this zone.
- **Animals: Decomposers, detritus feeders,** fishes & insects etc.

10. Define eutrophication. Write its role on animal life.

- **Eutrophication**: Nutrient rich lake due to biological activity called eutrophication.
- **Effect on animals**: They cause deficiency of oxygen & kills animal life.
- **Effects on plants: Blue green algae/cyanobacteria** form scum that prevents penetration of light to carry photosynthesis. Which leads to deficiency of oxygen & kills living organism.

11. What is lithospheric /terrestrial ecosystem.

- **Lithospheric ecosystem:** Ecosystem present on land/soil called **lithospheric/terrestrial** ecosystem.
- **Example:** forest and grassland etc.

12. Write composition of air in terrestrial ecosystem.

- **Composition of air:** Composition of air is more uniform due to motion. Amount of N_2 (78%), Oxygen (21%) & CO_2 (0.04%) is much constant.

13. Write two adaption of organism for terrestrial ecosystem. ★★★

- **Adaptation for terrestrial ecosystem:**
  - Plants develop supporting tissue & animals develop skeleton against **gravity** (mechanical stress) for terrestrial ecosystem.
  - Plants & animals conserve water by bark and skin respectively.

14. Write five major ecosystems in Pakistan.

- **Major ecosystem:**
  - Temperature deciduous forests
  - Coniferous alpine & boreal forests
  - Grassland ecosystem
  - Desert ecosystem
  - Tundra ecosystem.

15. Name Six major terrestrial biomes.

- **Six major terrestrial biomes:**
  - Temperate Deciduous Forests.

- Coniferous Alpine and Boreal Forests.
- Rain forest.
- Grassland Ecosystem.
- Desert Ecosystem.
- Tundra Ecosystem.

16. What is temperate deciduous forest. Give location. Enlist dominant plants.

➢ **Temperate deciduous forest:** These forest found in cool habitat. But during summer they shed their leaves to avoid from water loss.

- **Location: Neelam valley & Shogran** in Pakistan.
- **Rain fall:** The average rain fall is **750-1500mm.**
- **Dominant plants: *Taxus baccata, Pinus wallichiana*,** some grasses, ferns & lichens.

17. What is taiga.

➢ **Taiga:** Northern coniferous forests are also called **taiga.**

- **Example:** Siberian Taiga (ii) Scandinavian Taiga

18. Where coniferous forests found.

➢ **Coniferous forest:** These forests are found in upper kaghan, dir, chilas, malamjaba& swat in Pakistan. ★★★★★

19. Difference b/w alpine & boreal forest.

Alpine forest:	**Boreal forest:**
Alpine forests are present at high **altitude.** That's why called alpine forest.	**Boreal** forests are present at high latitude. That's why called boreal forest.
Example: Forest on Himalaya	**Example:** Forest of Canada and Russia.

20. Write human impact on coniferous forest.

➢ **Human impact:** Most remains un-disturb due to severe climate & remoteness. Their wood uses for lumber (use in construction). So they have been cleared in world.

21. Difference b/w prairies & savanna. ★★

➢ **Prairies:** Grassland without woody trees called prairies.

- **Location:** They are present in temperate climate.
- **Example:** Prairies of northern America & pampas of argentina.

➢ **Savanna:** Grassland with woody trees called **savanna.**

- **Location:** They are present in tropic climate.

22. What is graminoids.

➢ **Graminoids:** Graminoids are dominant species of grass land ecosystem. They are grasses like plants.

- **Example:** Cheat grass (ii) Soft rush

23. What is layering in grass land ecosystem.

➢ **Layering:** Layering is characteristics feature of **grassland**.

❖ **Composition:**

- Tall grasses form first layer.
- Middle grasses form second layer.
- Low grasses form third layer.

24. Write soil conditions of grass land ecosystem.

➢ **Soil conditions:** Soil moisture is low due to high evaporation. Upper layer is moist but deeper is dry. Soil of grassland is impermeable with excessive **salinity.**

25. What is Pampas.

➢ **Pampas:** Grassland of Argentina called pampas.

26. What is productivity of sub-humid tropical & temperate grass land.

- **Sub-humid:** Productivity of sub-humid tropical grass land is more than 4000g/m^2.
- **Temperate:** Productivity of **temperate grass land** is 700-1500g/m^2 annually.

27. Describe animal life of grass land ecosystem.

- **Animal life:** Dominant species are herbivores. Predators are reptiles, amphibians & mammals that prey on insects. Foxes & wolves are common.

28. Name desert found in Pakistan.

- **Thal: Thal** is present in western Punjab i.e Mianwali & Bhukhar.
- **Cholistan: Cholistan** is present in southern Punjab i.e Fort abbas, Bahawalpur, Bahawalnagar, Yazman & khan pur etc.
- **Thar: Thar** is present in Sindh.

29. Define desertification.

- **Desertification:** Spreading of deserts called desertification.
- **Example:** Sahel.
- **Cause:**
  - Over population.
  - Low rain fall.
  - Deforestation.

30. Write two cause of famine in Sahel.

- **Famine in Sahel:** Over population. Low rain falls for 25 year.

31. Write human impact on tundra & desert ecosystem. ★★★★★

- **Human impact on desert ecosystem:** Spreading of desert called desertification. Sahel is an example of desertification. Over population causes loss of ecosystem. It causes famine.
- **Human impact on tundra: Tundra** has most fragile biomes. Human activity affects tundra badly. Luckily these effects are locally like near pipelines & mines etc.

32. Give location of tundra ecosystem in Pakistan.

- **Location of tundra: Tundra** is present in karakoram & koh hindukush.

33. What type of animal life found in tundra.

- **Animal life in tundra:** Ground is carpeted with small flowers & willows trees. Mosquito & insects are common animals that are eaten by birds. Tundra vegetation supports lemmings that are eaten by foxes & wolves.

34. Difference b/w altitude & latitude.

- **Altitude:** Height from ground called altitude.
- Altitude increases as move towards height.
- **Latitude:** Distance from equator to poles.
- Latitude increases as move towards poles.

Exercise Short Question

1) **Define productivity of an ecosystem.**
   See question number: 6
2) **List four adaptations in plants and animals for terrestrial ecosystem.**
   See question number: 13
3) **Name three zones in lake ecosystems.**
   See question number: 3

4) **How many biomes present in world, name any five of them.**
   See question number: 15
5) **Write names of some major ecosystem on land in Pakistan.**
   See question number: 14

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) At which depth little light support photosynthesis = **600 feet**

2) What is rain fall in desert ecosystem = **25-50cm/10-20 inch**

3) Which ecosystem increase due to human activity = **Desert biome**

4) Water is stored in thick & fleshy stem of = **Cacti**

5) Desert plants conserve = **Water**

6) Aractic tundra stretch across northen America & = **Siberia**

7) Lithosphere include **= Soil**

8) A 10 cm long & 7 cm in diameter of willow tree how old it = **50 years**

9) Marine water on earth = **71%**

10) Nutrient tend to concentrate in bottom area in ___ ecosystem = **Aquatic**

11) Chilas has major ____ ecosystem = **Alpine**

12) *Macca mulatto* is scientific name of = **Monkey**
13) ___ ecosystem has minimum nutrient in soil = **Desert**
14) Sahara desert found in = **Africa**

15) Which is example of desert plant = **Cactus & Euphorbia**

16) Aquatic environment can be classified as = **Fresh & marine water**
17) Succulent plants are found in = **Desert**
18) Phytoplankton includes I know bacteria which serves as = **Producer**
19) Freshwater ecosystem covers less than = **1%**
20) Producers in lamnetic zones are = **Cyanobacteria**
21) The ecosystem in which soil is grass brown very fertile and reach in inorganic matter is = **Temperate deciduous**
22) Zoological name of leopard cat is = ***Felis bengalensis***
23) in Pakistan grassland ecosystem is found in = **North kalat**
24) All of the grasses form second layer in grassland ecosystem accept and = **Andropogon**
25) Tundra ecosystems have = **Caribou & Arctic foxes**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Explain three zones of fresh water lake.
2. Discuss grass land ecosystem & tundra ecosystem.

CH # 27: MAN & HIS ENVIRONMENT

Short questions (Selected from past papers)

1. **Define nutrient cycle. Name three factor that upset nutrient cycle.**

➢ **Nutrient cycle:** Dead material becomes food for other living organism. This food consumed/decay & become food again called nutrient cycle.

❖ **Disturbance:**

- Enough food is not produced.
- Enough food is not consumed.
- Decayed food not returns to ground.

2. **Difference b/w renewable & nonrenewable resources. Give example.** ★★★★★★★★★

Non-renewable resources	Renewable resources
Nonrenewable resources once consumed cannot be replaced.	Renewable resources consume again & again.
They are exhaustible.	They are never depleted.
They can be recycled.	They cannot be recycled.
Most of them have adverse effect on environment.	Most of them have no adverse effect on environment.
Example: Metals & Fossils fuels etc.	**Example: Land, Air, & Water** etc.

3. **What is air. Write its composition & role.**

➢ **Air:** Air is several kilometer thick blanket of atmosphere surrounding the earth.

- **Composition:** Nitrogen (78%), Oxygen (21%), CO_2 **(0.03%)**, & Nobel gases (trace).
- **Role:** CO_2 used in photosynthesis. O_2 used in respiration. N_2 used for making nitrate

4. **Define soil. Write its constituents.** ★★★★★

➢ **Soil:** Upper layer of earth crust called **soil.**

- **Components:** Soil particles, Soil water, Soil matter, & Soil organism.

5. **Write misuse/abuse of lands.**

➢ **Misuse of land:** Erosion, Poor agriculture practice, Overgrazing & Leeching.

6. **What is wild life. Give importance.**

➢ **Wild life:** Non-cultivated plants & non-domesticated animals called wild life.

- **Example:** lion, tigers, elephants and herbs etc.

❖ **Importance:**

- They are source of food.
- They play important role in food chain.

7. **Define endanger species**.

➢ **Endanger species:** Species that are near to extinction.

- **Example:** Lion, tiger and elephant etc.

8. **What is fossil fuels. Why they are called fossils fuels.** ★★★

➢ **Fossils fuels:** Coal, Oil & Gases are called fossils fuels. They are source of energy. They are called fossils fuels because they are dead remains of plants & animals that fossilized in earth & sea due to environmental hazards.

9. **What is tidal power & tidal barrage.**

➢ **Tidal power:** Tides are caused due to gravitational pull of moon & sun on water surface. These tides generate electricity in tidal power stations.

- **Tidal barrage:** Tidal power station consists of long barrier called tidal barrage.
- **Function:** Flow of water across the Tidal barrage runs the turbines that produce electricity.

10. What is hydroelectric power & geothermal energy. ★★★

- **Hydroelectric power:** Energy generated by falling water called **hydroelectric power**. This energy is used to run the turbines for electricity generation.
- **Importance: Hydroelectric power** is cheapest & non-pollutant source of energy.
- **Geothermal energy:** Heat energy of earth called geo thermal energy. They are present in form of volcanoes, hot springs & geysers.
- **Importance:** It is free & can last for long time.

11. What is nuclear energy.

- **Nuclear energy:** Nuclear energy is made from nuclear fuels by nuclear fission in nuclear power station. This energy converts water into steam to run the turbine. This turbine generates electricity. Nuclear power station lasts for **30 years.**
- **Advantage:** This is pollution free energy.

12. What is solid waste. Write its advantages. ★★★★

- **Solid waste:** Conversion of solid waste to form oils & gases. Solid waste is produced from different process like agriculture, pyrolysis and bioconversion.
- **Example:** Trash, paper, plastic & cans etc.
- **Importance:** Conversion of solid waste reduces pollution.

13. Explain ocean thermal energy as renewable source of energy.

- **Ocean thermal energy:** In tropical ocean, temperature of surface water is 25^0C while in depth temperature is 5^0C. So heat transfers from high temperature to low. Man develops such technology to drive turbine for electricity generation.

14. Write four methods to reduce energy. ★★★★★

- **Conservation of energy:**
  - Use energy efficient machines.
  - Recycling.
  - Use public transport.
  - Less use of AC.

15. How degradation & depletion of resources occur on earth.

- **Degradation & depletion of resources:** Over hunting & over fishing, deforestation, population explosion, over use of water & over use of fossils fuels cause degradation & depletion of resource on earth.

16. What is population explosion & population pressure. ★★★

- **Population explosion:** Rapid increase of human population called population explosion.
- **Population pressure:** Affects of population explosion on environment called population pressure.

17. Define demography. Write importance.

- **Demography:** Study of human population & things that affect them called **demography**.
- **Importance:** We can measure birth rate, growth rate, death rate & demand of resources by demography.

18. Name factor that affect population.

- **Factors:** Followings are factors that affect population.
  Better living conditions, education, better food & medicine etc.

19. Give consequence of population increase.

- **Consequence of population:** Overcrowding, more crime violence, social disease, starvation, destruction of plants, animals & wildlife etc.

20. Define deforestation, afforestation & reforestation.

- **Deforestation:** Clearance of forest for different purpose called **deforestation**. Deforestation makes the soil barren.
- **Reforestation:** Re-plantation of forest called reforestation.
- **Afforestation:** Establishment of new forest on forestless land called **afforestation.**

21. Why forests called environmental buffers.

- **Environmental buffer:** Forest receive heavy rain fall & release water slowly to soil. That's why **forest** are called environmental buffer.

22. Write importance of forest. ★★

- **Importance of forest:**
  - They are source of food.
  - They are habitat of many species.
  - They are source of medicine & timber.
  - They act as environmental buffer.

23. Define biodiversity & forest.

- **Biodiversity:** Total number of species within ecosystem called biodiversity.
- **Example:** Flora & Fauna
- **Forest:** Place of large number of natural vegetation.
- **Example:** Amazon

24. Define pollution & pollutants. Name its types. ★★

- **Pollution:** Anything produced by human that is harmful for living organism called **pollution.**
- **Types:** Air pollution, Water pollution, Soil pollution & Noise pollution.
- **Pollutants:** Harmful substance that causes pollution called pollutants.
- **Example:** CO, NO_2, SO_2, detergents & lead etc.

25. What is air pollution. Write air pollutants.

- **Air pollution:** Harmful substance present in air cause air pollution./Befouling of air called **air pollution.**
- **Air pollutants:** SO_2, NO_2, CO, CFCs & lead.

26. What is ozone layer. ★★★★★★

- **Ozone layer:** It is present from 10-50 km above earth. Ozone protects us by filtering **UV radiations**. Ozone consists of three molecule of **oxygen** (O_3). Ozone is **bluish,** explosive & poisonous gas. There is ozone hole over **Antarctica.**

27. What is CFCs. Write its source &effects.

- **Chloroflurocarbons:** Increase level of **CFCs** cause ozone depletion. They consist of chlorine, fluorine & carbon. Single chlorine molecule destroys up to **1 million** molecule of ozone (O_3).
- **Source:** AC, vehicles & refrigerators.
- **Effects:** It affects ozone layer badly. It destroy ozone molecule & cause ozone depletion.

28. AC cause destruction of ozone layer justify.

- **Destruction of ozone by AC:** AC release CFCs (Cl, F & C). One molecule of chlorine can destroy one million molecule of ozone. That's why AC causes destruction of ozone layer.

29. What is greenhouse effect. Write its cause. ★★★★

- **Greenhouse effect:** Warming of earth due to greenhouse gases like CO_2, CH_4& water vapors called GHE. CO_2 absorbs sun energy but not allow to escapes out, as a result temperature of atmosphere increases.
- **Cause:** Urbanization, Deforestation & Industrialization are causes of GHE.

30. What is acid rain. Give 4 effects. ★★★★

- **Acid rain:** Falling of acid (sulphuric acid & nitric acid) in dissolved form/microscopic particles in rain called acid rain. These acids form by the reaction of rain water with SO_2 & NO_2.
- **Effects:** It damages living organism. It causes soil erosion. **Acid rain** causes stone cancer. It kills microscopic organism.

31. What is stone cancer.

- **Stone cancer: Acid rain** eroded the stone called stone cancer.
- **Example:** Taj Mahal.

32. What is water pollution. Write its two cause. ★★

- **Water pollution:** Human activities pollute the water of canals, rivers and stream etc called water pollution. This polluted water affects living organism badly.
- **Cause:** Incomplete sewage treatment (ii) Oil & detergents.

33. What is eutrophication/algal bloom. ★★★★★★

- **Eutrophication:** Nutrient rich lake due to biological activity (addition of phosphates and nitrates) called eutrophication. Eutrophication cause excess growth of algae which leads to algal bloom.
- **Example:** Barron Lake.
- **Effect**: Dead algae decomposed by aerobic bacteria. They cause deficiency of oxygen & kills animal.

34. Define industrial effluents. Give their role. ★★

- **Industrial effluents:** Chemical waste of industry called industrial **effluents**.
- **Example**: Toxic chemicals like lead, mercury and arsenic etc.
- **Role:** They kill microorganism in water. They cause water pollution.

35. How pesticide affect human health.

- **Pesticide:** Chemical that destroy agricultural pest called **pesticides.**
- **Example:** Herbicide, fungicide & insecticide.
- **Affect on health:** Pesticides cause cancer & some other disorder in humans.

36. What is monoculture. Write its disadvantage.

- **Monoculture:** Cultivation of only one kind of species called monoculture.
- **Example:** Cultivation of only rice.
- **Disadvantage:** They are very susceptible to pathogens.

37. Define insecticides, herbicides & fertilizers.

- **Insecticides:** They are used to kill insects.
- **Example:** DDT, deet & dursban.
- **Herbicides: Herbicides** are used to kill weed plants.
- **Example: Diclofop, bensulide & glyphosate.**
- **Fertilizers:** Addition of nutrient in soil for increasing fertility called fertilizers.
- **Example:** Nitro-phosphate & urea.

38. Difference b/w health & disease. ★★★

- **Health:** Steady internal state of homeostasis called **health.**
- **Disease:** Change in steady internal state of homeostasis by disorder in body called disease.

- **Example:** Fever & malaria etc.

39. Write few name of congenital and pathogenic disease.

- **Congenital:** Hemophilia, Down and Turner syndrome etc.
- **Pathogenic:** Malaria, Small pox and AIDS etc

Exercise Short Question

1) **What is ozone layer.**
   See question number: 26
2) **What do you know about non-renewable resources.**
   See question number: 2
3) **What is difference between deforestation and afforestation.**
   See question number: 20
4) **What do you know about biodiversity.**
   See question number: 23
5) **What is water pollution.**
   See question number: 32
6) **Define Greenhouse effect.**
   See question number: 29
7) **What is acid rain.**
   See question number: 30
8) **What is algal bloom.**
   See question number: 33

MULTIPLE CHOICE QUESTIONS
(SELECTED FROM PAST PAPERS)

1) Air is polluted by industrialization & = **Automobiles**

2) What is the percentage of fresh water = **1%**

3) How much water is available for domestic/industrial use = **10%**

4) Percentage of land on earth is = **30%**

5) Percentage of water on earth is = **70%**

6) How much area is available for cultivation = **11%**

7) Percentage of fossils fuels in our daily energy requirements is = **95%**

8) Moving air called = **Wind**

9) Population of Pakistan during independence was = **32.5 million**

10) UV radiations release which molecule from CFCs = **Chlorine**

11) Which destroy ozone molecule in ozone layer = **Chlorine**

12) Lung cancer is caused by = **Sulphur dioxide**

13) Which cause headache brain damage & even death = **CO**

14) Some detergents contain a lot of = **Phosphate**

15) Agro chemicals that used in agriculture called = **Pesticides**

16) Disease that transmitted from one organism to other = **Infectious disease**

17) Nutritional deficiency cause = **Beriberi**

18) Most widely used source of energy = **Water**

19) Stone cancer is result of ___ pollution = **Air**

20) Agrochemicals used in agriculture are mostly = **Insecticide, fungicide and herbicides**

21) Which is mental illness = **Alzheimer**

22) Agriculture was started some years ago = **10,000**
23) Treasure of all type of resources is = **Environment**
24) Most widely used source of energy on Earth is = **Sun**
25) Water present in the form of frozen ice cap is = **2%**
26) It is a fossilized fuel = **Oil**
27) Driving force behind all of natural cycle is = **Sun**
28) The cause of acid rain is = **NO_2 & SO_2**
29) The lead poisoning damage the human = **Brain**
30) Increase of environmental temperature due to higher amount of carbon dioxide is known as = **Global warming**
31) The atmosphere gas gives like glass sheet of greenhouse is = **CO_2**
32) Goiter disease Occurs due to = **Nutritional deficiency**
33) The cause of Kwashiorkor disease is = **Nutritional deficiency**

Exercise MCQs

1) ___ continent has highest population rate = **Asia**
2) If a population is above carrying capacity ___ happens = **It must decline**
3) What is our principal source of energy = **Solar energy**
4) Batteries store ___ type of energy = **Chemical**

LONG QUESTIONS

(SELECTED FROM PAST PAPERS)

1. Describe water & land as renewable resources.
2. Discuss non-renewable resources.
3. Discuss fossils fuels & wild life.
4. Write a note on energy conservations.
5. Describe modification of environment & importance of forest.
6. Write a note on population explosion.
7. Explain deforestation & afforestation.
8. Discuss atmospheric & water pollution.
9. Discuss ozone layer &green house effect.
10. Discuss acid rain & algal bloom/Eutrophication.
11. Describe uses & misuses of agrochemicals.

BEST OF LUCK

12th Class Biology pairing scheme (2023)

Objective part

Q1. MCQs

2 MCQs from each Chapter	Chapters # 16, 17, 20 & 23
1 MCQs from each Chapter	Chapters # 15, 18, 19, 21, 22, 24, 25, 26 & 27

Subjective part

Q2. Short Questions

Chapters	Questions	Chapters	Questions	Chapters	Questions
15	3	18	2	27	2
16	3	26	2		

Q3. Short Questions

Chapters	Questions	Chapters	Questions
17	3	23	3
22	3	25	3

Q4. Short Questions

Chapters	Questions	Chapters	Questions
19	2	21	2
20	3	24	2

Long Questions

Q5# Chapters 15 & 21

Q6# Chapters 16 & 25

Q7# Chapters 17 & 24

Q8# Chapters 18 & 22

Q9# Chapters 19 & 23

Student study plan for FSc Biology II (2023)

➢ For 37 marks.

MCQs (All Chapters) = **17 Marks**
Chapter 15 (3 Short Q + 1 long Q) = **10 marks**
Chapter 25 (3 short Q + 1 long Q) = **10 marks**

➢ For 45 marks.

MCQs (All Chapters) = **17 Marks**
Chapter 15 (10 marks) + 25 (10 marks) = **20 marks**
Chapter 21 (2 short Q + 1 long Q) = **8 marks**.

➢ For 51 marks.

MCQs (All Chapters) = **17 Marks**
Ch 15 (10) + 25 (10) + 21 (8) = **28 marks**
Chapter 24 (1 short Q + 1 long Q) = **6 marks**.

➢ For 61 marks.

MCQs (All Chapters) = **17 Marks**
Ch 15 (10) + 25 (10) + 21 (8) + 24 (6) = **34 marks**
Chapter 23 (3 short Q + 1 long Q) = **10 marks**.

➢ For 65 marks.

MCQs (All Chapters) = **17 Marks**
Ch 15 (10) + 25 (10) + 21 (8) + 24 (6) + 23 (10) = **44 marks**
Chapter 27 (2 short Q) = **4 marks**.

➢ For 73 marks.

MCQs (All Chapters) = **17 Marks**
Ch 15 (10) + 25 (10) + 21 (8) + 24 (6) + 23 (10) + 27 (4) = **48 marks**
Chapter 19 (2 short Q + 1 Long Q) = **8 marks**.

➢ For 83 marks.

MCQs (All Chapters) = **17 Marks**
Ch 15 (10) + 25 (10) + 21 (8) + 24 (6) + 23 (10) + 27 (4) + 19 (8) = **56 marks**
Chapter 16 (3 short Q + 1 Long Q) = **10 marks**.