

### Contest 1a

Distinguish between reptiles and amphibians with respect to the following.

1. Type of respiratory organs  
**The respiratory organs in Amphibians are gills, skin, and lungs, whereas reptiles have only lungs**
2. Reproduction Type  
**Amphibians are oviparous organisms, whereas reptiles can be oviparous or viviparous**
3. Mode of fertilization  
**Amphibians exhibit external mode of fertilization, whereas reptiles exhibit internal mode of fertilization**

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### Contest 1b

Describe chordates with respect to the following.

1. Body temperature  
**They are either cold or warm-blooded organisms**
2. Type of blood vascular system  
**Have a closed vascular system**
3. Germ layers  
**Triploblastic**

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### Contest 2a

Indicate whether the following are anabolic or catabolic processes

1. Photosynthesis  
**Anabolic**
2. Excretion  
**Catabolic**
3. Cellular respiration  
**Catabolic**

### Contest 2b

Describe hormones with respect to the following

1. Site of action  
**Hormones perform activity at some distance away from the site of origin.**
2. Fate of their chemical composition after reactions  
**Their chemical composition changes after reaction**
3. Type of glands that synthesize and secrete them  
**Hormones are synthesized and secreted by endocrine glands.**

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### Contest 3a

Distinguish between animal cells and plant cells with respect to the following

1. Size and shape  
**The shape and sizes of animal cells vary greatly from irregular shapes to round shapes, most defined by the function they perform, whereas plant cells are similar in shape with most cells being rectangular or cube-shape**
2. Vacuoles  
**Animal cells may have many small vacuoles, a lot smaller than the plant cells/ Plant cells have a large central vacuole that can occupy large portion of the cell's volume.**
3. Golgi bodies  
**Animal cells have larger and fewer Golgi bodies, whereas plant cells have smaller but more Golgi bodies**

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### Contest 3b

Describe oviparous animals with respect to the following.

1. Mode of reproduction  
**Oviparous animals lay eggs that later hatch to form young ones.**
2. Type of fertilization  
**Oviparous animals might undergo internal or external fertilization.**
3. **Chance of survival of young ones**  
The chance of survival of the young ones is less as the eggs are laid in the environment where they are prone to various dangers

### Contest 4a

Indicate the type of chromosomal mutation to which the following descriptions refer.

1. Results from the shift or transfer of a part of a chromosome or a set of genes to a non-homologous chromosome.

**Translocation**

2. When a part of a chromosome is present in excess of the normal composition

**Duplication/Amplifications**

3. It occurs due to the loss of a part of a chromosome as a result of the breakage of the chromosome.

**Deletion**

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### Contest 4b

Classify the following group of fungi as Zygomycetes, Ascomycetes or Deuteromycetes

1. Mushrooms

**Deuteromycetes**

2. Yeasts

**Ascomycetes**

3. Bracket fungi

**Deuteromycetes**

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### Contest 5a

Indicate the type of camouflage in animals to which the following refer.

1. The animal hides against a background of the same colour in order to protect themselves from predators and also for hunting their prey.

**Concealing colouration**

2. The dark spots or stripes found on the animal's skin that are mainly used to camouflage themselves and to escape from their predators.

**Disruptive coloration**

3. The change in an animal's appearance or colour which gets the blend with their surroundings by their colour, texture and shape. It is mainly seen in insects like spiders, leaf butterfly, dragonfly katydid, stick bugs or stick insect

**Disguise colouration**

### Contest 5b

Mention one of the primary functions of RNA:

1. Facilitates the translation of DNA into proteins
2. Functions as an adapter molecule in protein synthesis
3. Serves as a messenger between the DNA and the ribosomes.
4. They are the carrier of genetic information in all living cells
5. Promotes the ribosomes to choose the right amino acid which is required in building up of new proteins in the body.

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### Contest 6a

Indicate the benefits that plants or animals obtain by the presence of the following features.

1. Sunken stomata and the folding of leaves  
**Prevent water loss**

2. Spines and shells on animals  
**Physical protection**

3. Long necks of some herbivores  
**For feeding in the tops of trees**

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### Contest 6b

Explain the following with respect to the arrangements of vascular bundles in angiosperms

1. Conjoint  
**In conjoint vascular bundles, the xylem and phloem tissues are present on the same radius and only opposed to each other.**
2. Bicollateral  
**Conjoint vascular bundle in which phloem is present on both sides of xylem**
3. Concentric vascular bundles.  
**The xylem either surrounds the phloem tissue occasionally or vice versa.**

### Contest 7a

Indicate the primary meristem that gives rise to the following cells

1. Sieve tube element

**Procambium**

2. Guard cell

**Protoderm**

3. Vessel element

**Procambium**

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### Contest 7b

The genotypes of certain species of plants are represented as, TT, Bb, DD, bb, Dd.

1. Which of them are hybrids?

**Bb and Dd**

2. Which of them are homozygous?

**TT, DD and bb**

3. Which of the genotypes will be considered as pure breeds?

**TT, DD and bb**

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### Contest 8a

Indicate the part of dicotyledonous seed to which the following descriptions refer.

1. The part that encloses and protects the seed from insects and fungi, and other pathogens

**Testa /The seed coat**

2. The hole which allows water to enter when the seed starts to germinate

**Micropyle**

3. The modified leaves containing food reserves.

**Cotyledons**

### **Contest 8b**

Mention the terms that are used to describe the following with respect to the development of animals.

1. How a cell diverges from its early morphology into a more specialized morphology.  
**(Cellular) differentiation**
2. Describes how cells, tissues, and organs are arranged in an organism  
**Pattern formation**
3. The capability of certain embryonic cells to form any type of adult cell  
**Totipotency**

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### **Contest 9a**

Classify the following under one of these types of behaviours in organisms. Communication Behavior, Territorial Behavior. Dispersal behaviour or Defensive behaviour

1. Ants use pheromones to determine if another ant is an intruder or a member of the colony.  
**Communication behaviour**
2. Some animal species move away from the area in which they were born to live in other areas.  
**Dispersal behaviour**
3. A carnivorous organisms that bares its teeth and growls when cornered by a predator.  
**Defensive behaviour**

### Contest 9b

The human body is composed of just four basic kinds of tissue. Name one each.

1. Nervous
2. Muscular
3. Epithelial
4. Connective tissue

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### Contest 9b

Describe chromatids with respect to the following

1. Role in protein synthesis  
**Chromatids are not involved in protein synthesis**
2. Structure  
**Chromatids have a thin and long fibrous structure.**
3. Compactness compared to chromosome  
**Chromatids are less condensed than chromosomes.**

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### Contest 10a

1. What is a non-communicable disease?  
**A disease that is not transferred from an infected person to another via any means and are mostly caused by factors like improper lifestyle and eating habits.**
2. What is the role of agents or vectors for the infection of non-communicable disease?  
**There are no agents for infection of non-communicable diseases (as they primarily depend on the personal diet, allergy, or physical inactivity)**
3. How do non communicable diseases spread from person to another?  
**These do not spread from one person to another at all.**

**Contest 10b**

Mention one of the **four** main supporting tissues in angiosperms.

1. **Parenchyma**
2. **Collenchyma**
3. **Sclerenchyma (fibre)**
4. **Xylem (wood)**

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**Contest 11a**

Distinguish between cold blooded and warm blooded animals with respect to the following

1. Effect of temperature on their metabolic rates  
**Metabolic rates of cold-blooded animals depend entirely on the environmental temperature, but in warm blooded animals, environmental changes have no effect on metabolic rates**
2. Resistance against disease causing organisms  
**Warm-blooded animals have a much stronger immune system to defend against disease causing organisms than cold blooded animals.**
3. Heat source  
**Cold blooded animals mostly depend upon direct sunlight and heat from the surrounding environment but warm blooded animals produce heat from the consumption of foods.**

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**Contest 11b**

Name the principal locomotory organs in the following organisms

1. Snails  
**Muscular foot**
2. Paramecium  
**Cilia**
3. Echinoderms  
**Tube feet**



### Contest 12a

Name the type of connective tissue to which the following descriptions refer.

1. It eases joint movements; resists compression at joints and shapes outer ear.

**Cartilage**

2. Physically supports the body, provides movement, encloses and protects soft organs, stores and releases calcium and phosphorus.

**Bones**

3. Moves vocal cords; forerunner of foetal skeleton; growth zone of children's bones.

**Cartilage**

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### Contest 12b

The leaves of plants have various tissues and structures that enable them perform their function. State how the following features adapt the leaves of plants to their function

1. Spongy layer

**Contains air spaces that allow carbon dioxide to diffuse easily through the leaf**

2. Thin epidermis

**To allow more light to reach the palisade cells**

3. Network of veins

**To support the leaf and transport water and carbohydrates**

### Contest 13a

1. Mention the laws that describe the inheritance of alleles.  
**Law of segregation and law of independent assortment**
2. Give the ratio of the offspring with respect to the law of segregation  
**3:1**
3. Give the ratio of the offspring with respect to the law of independent assortment  
**9:3:3:1**

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### Contest 13b

Provide the names given to the following.

1. Flowers without a calyx  
**Asepalous**
2. A floral structure consisting of the calyx and corolla especially when the two whorls are fused.  
**Perianth**
3. Flowers without a corolla  
**Apetalous.**

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### Contest 14a

State one of the **four** common features of enzymes

1. **Enzymes do not make a reaction occur that would not occur on its own, they just make it happen much faster.**
2. **The enzyme molecule is not permanently altered by the reaction. It may be changed transiently, but the enzyme at the end of the reaction is the same molecule it was at the beginning. Therefore, a single enzyme molecule can be used over and over to catalyze the same reaction.**
3. **An enzyme can catalyze both the forward and the reverse reaction. One direction may be more favorable than the other, but the unfavorable direction of the reaction can occur.**
4. **Enzymes are highly specific for the substrates they bind, meaning they catalyze only one reaction.**

## Contest 14b

Indicate what happens during the following stages of translation in protein synthesis

1. Initiation step,  
**It involves the binding of mRNA to the ribosomes, followed by the transfer and binding of activated amino acid to the tRNA.**
2. Elongation  
**Two amino acids are joined by the peptide bond as the mRNA and ribosomes move with respect to one another to ensure the translation of codons successively.**
3. Termination  
**When a stop codon is reached, the ribosome releases the polypeptide**

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**Contest 15a**

1. What name is given to the male gametophyte of flowering plants?  
**(Mature) pollen grain**
2. In which part of filaments are pollen produced?  
**In the anthers / the distal end of filaments.**
3. The filament and anther together constitute what structure?  
**The stamen**

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**Contest 15b**

Mention one of the main functions of epithelial tissue

1. **Absorption**
2. **Protection**
3. **Receptor (Sensation)**
4. **Secretion**
5. **Transportation**

### Contest 16a

Distinguish between Kwashiorkor and Marasmus with respect to the following

1. Muscle wasting  
**In Kwashiorkor, muscle wasting is mild or absent whereas there is severe muscle wasting Marasmus**
2. Prominence of ribs of the individuals  
**The ribs are not prominent in persons suffering from Kwashiorkor, but they are prominent in persons suffering from Marasmus**
3. Type of diet that the individuals need  
**The person suffering from Kwashiorkor needs adequate amount of protein, whereas the person suffering from Marasmus need adequate amount of protein, fats ad carbohydrates**

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**Contest 16b**

Indicate the part of the cell wall of plants to which the following descriptions refer

1. It serves as a cementing layer between the primary walls of adjacent cells.  
**The middle lamella**
2. It is responsible for most of the plant's mechanical support as well as the mechanical properties prized in wood  
**Secondary cell wall**
3. It is formed between the middle lamella and plasma membrane in growing plant cells. It is primarily composed of cellulose microfibrils contained within a gel-like matrix of hemicellulose fibers and pectin polysaccharides  
**Primary cell wall**

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**Contest 17a**

Name the types of fruits to which the following descriptions refer

1. They possess a Close-fitting pericarp that surrounds a single seed. Eg sunflower  
**Achene**
2. They possess a close-fitting pericarp fused to a single seed. eg corn  
**Grain**
3. Fruit opening by several splits or pores as in cotton  
**Schizocarp**

### Contest 17b

1. In which part of animal cell are ribosomes parts made?  
**They are made in the nucleolus of the nucleus**
2. What kind of ribosomes makes proteins that remain inside the cell?  
**Free ribosomes**
3. What causes the difference in appearance in the two kinds of endoplasmic reticulum?  
**The rough endoplasmic reticulum has ribosomes attached to the surface whereas the smooth endoplasmic reticulum lacks ribosomes**

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### Contest 18a

Indicate the characteristics of flowers pollinated by the following agents

1. Bats  
**Flowers that are pollinated by bats bloom at night, tending to be large, wide-mouthed, and pale-colored; they may also give off strong scents.**
2. Small birds  
**Flowers that are pollinated by small birds usually have curved, tubular shapes**
3. Wind  
**Wind-pollinated flowers do not produce scents or nectar; instead, they tend to have small or no petals and to produce large amounts of lightweight pollen.**

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### Contest 18b

Distinguish between vertebrates and invertebrates with respect to the following

1. Metamerism  
**Invertebrates have true /pseudo metamerism or no metamerism, but vertebrates have true metamerism**
2. Type of coelom  
**Invertebrates are Acoelomate, pseudocoelomate or truly coelomate, but vertebrates are truly coelomate**
3. Position of gut in relation to nerve cord  
**In invertebrates, the gut is dorsal to the nerve cord, whereas in vertebrates it is ventral to the nerve cord**

### Contest 19a

Name the types of fruits to which the following descriptions refer

1. They possess pods that split along two opposite sides  
**Legumes**
2. They have a thick, woody pericarp that surrounds a single seed  
**Nut**
3. They are formed by fusion of several separate pistils of several grouped flowers  
**Multiple fruit (don't accept aggregate fruit - Formed by fusion of several separate pistils of one flower)**

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### Contest 19b

Distinguish between an axon and a dendrite with respect to the following

1. Number per nerve cell  
**Only one axon per nerve cell, but there are many dendrites in a nerve cell.**
2. Direction of Conduction  
**An Axon conducts impulses away from the cell body (soma), whereas a dendrite conducts impulses towards the cell body.**
3. Where they arise from  
An axon arises from the discharging end of a neuron (axon hill lock), whereas a dendrite arises from the receiving end of a neuron

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### Contest 20a

State one of the five main limitations of ecological pyramids.

1. **More than one species may occupy multiple trophic levels as in the case of food web. Thus, this system does not take into account food webs.**
2. **The saprophytes are not considered in any of the pyramids even though they form an important part of the various ecosystem.**
3. **These pyramids are applicable only to simple food chains, which usually do not occur naturally.**
4. **These pyramids do not deliver any concept in relation to variations in season and climate.**
5. **They do not consider the possibility of the existence of the same species at different levels.**

**Contest 20b**

Describe cellular respiration with respect to the following.

1. Cells in which it occurs  
**It occurs in all living cells**
  
2. The exact site of the mitochondrion in which it occurs  
**The inner membrane / Cristae**
  
3. Where ATP synthesis occurs  
**It occurs towards the matrix side**

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**Contest 21a**

Distinguish between xylem and phloem with respect the following

1. Location in the plant  
**The xylem is located deeply in the plant in the centre of the vascular bundle whereas the phloem is located on the outermost side of the vascular bundle of the plant.**
  
2. Direction of movement of substances within them  
**Movement in Xylem is unidirectional but movement in the Phloem is bidirectional.**
  
3. Proportion of plant body  
**Xylem mostly contains the bulk of the plant body, but phloem consists of a small portion of the plant body**

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### Contest 21b

Distinguish between cytoplasm and nucleoplasm with respect to the following

1. Their location with respect to the nucleus

**Cytoplasm is found inside the cell, outside the nucleus, but nucleoplasm is found inside the nucleus.**

2. Cell types in which they can be found

**Cytoplasm is found in all the known living cells, but nucleoplasm is found only in eukaryotic cells.**

3. Structures suspended in them

**Inclusions and organelles are suspended in the cytoplasm, whereas Nucleolus and chromatin are suspended in the nucleoplasm.**

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### Contest 22a

Distinguish between fertilization and pollination in flowering plants with respect to the following.

1. Role of Pollen tube

**Male gametes are transferred to ovum through pollen tube during fertilization, but pollen tube does not play any role during pollination**

2. Role of external agents

**External pollination agents, play a role in the transfer of pollen grains, but external agents do not play any role in fertilization**

3. Function

**Pollination is the first step to fertilization where pollens reach stigma from the anther, whereas fertilization results in zygote formation which divides to form an embryo**

4. Occurrence

**Pollination occurs in flowering plants only, but fertilization Occurs in almost every plant and living being**

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### Contest 22b

Describe DNA with respect to the following

1. Location

**DNA is found in the nucleus, with a small amount of DNA also present in mitochondria**

2. Structure

**Long, ladder-like macromolecule that twists to form a double helix.**

3. Major enzyme involved in propagation

**DNA polymerase**

4. Ultraviolet (UV) Sensitivity

**DNA is vulnerable to damage by ultraviolet light.**

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### Contest 23a

Distinguish between blood plasma and serum with respect to the following

1. Cell arrangement

**Cells of serum are usually attached together by clot formation, but cells of plasma are not attached together and suspended in plasma.**

2. Discoloration on standing

**The serum does not discolor on standing, but the Plasma tends to discolor on standing.**

3. Feasibility of Separation

**Separation of serum requires higher levels of expertise, expenses and is time-consuming., but Separation of plasma is relatively easy and inexpensive**

4. Clotting factors

**Serum is the watery fluid from blood without the clotting factors, whereas plasma is the blood fluid that contains blood-clotting agents.**

**Contest 23b**

Describe anabolic reactions with respect to the following

1. Oxygen utilization

**Anabolism does not use oxygen**

2. Energy Conversion

**In anabolism, kinetic energy is converted to potential energy**

3. Effect on the Human Body

**Anabolism repairs and furnishes tissues and subsequently increases the muscle mass.**

4. Energy and Heat Requirement

**Anabolism is an endergonic reaction / The reaction requires ATP energy as it absorbs heat.**

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### Contest 1a

Mention one of the principal functions of the amniotic fluid.

1. **It acts as a cushion:** This protects the fetus from injury should the mother's abdomen be the subject of trauma or a sudden impact.
2. **It protects the umbilical cord:** Amniotic fluid flows between the umbilical cord and fetus.
3. **It protects the fetus from infection:** Amniotic fluid has antibacterial properties.
4. **It contains essential nutrients:** These include proteins, electrolytes, immunoglobulins, and vitamins that assist in the development of the fetus.
5. **It allows for the fetus to move:** Amniotic fluid also allows the developing fetus to move around in the womb, which in turn allows for proper development and growth of the musculoskeletal system, gastrointestinal system, and pulmonary system.
6. **It assists in maintaining stable temperature:** Amniotic fluid assists in keeping a constant steady temperature around the fetus throughout pregnancy, protecting the baby from heat loss.
7. **It allows Development of Body Parts:** Amniotic fluid circulates freely within the womb, keeping every part of the body lubricated. That allows for the growth of the external body parts such as fingers and toes and stops them from becoming clumped together. It also helps in the development of the lungs and the digestive system

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### Contest 1b

Indicate the parts of an ovule of a flower to which the following descriptions refer

1. It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary

**Funiculus**

2. They are the outer layers surrounding the ovule that provide protection to the developing embryo.

**Integuments**

3. It is a mass of the parenchymatous tissue surrounded by the integuments from the outside. It provides nutrition to the developing embryo.

**Nucellus**

### Contest 2a

1. What is triple fusion in relation to angiosperms?

**Triple fusion is the fusion of the male gamete with two polar nuclei inside the embryo sac of the angiosperm.**

2. Where does triple fusion take place?

**This process of triple fusion takes place inside the embryo sac.**

3. Name the nuclei involved in triple fusion.

**One male gamete nucleus and two polar nuclei are involved in this process.**

Since this process involves the fusion of three haploid nuclei, it is known as triple fusion. It results in the formation of the endosperm.

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### Contest 2b

Name one of the three important components of biodiversity.

1. **Genetic diversity**
2. **Species diversity**
3. **Ecosystem diversity**

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### Contest 3a

State one way by which the process of diffusion is important to flowering plants

1. **The exchange of gases through stomata takes place by the process of diffusion.**
2. **Transpiration occurs by the principle of diffusion.**
3. **Water and ions in the soil are absorbed by simple diffusion.**
4. **The food material is translocated by this process.**
5. **This process keeps the walls of the internal tissues of the plant moist.**
6. **It is responsible for spreading the ions and molecules throughout the protoplast.**
7. **Aroma of flowers is due to the diffusion of aromatic compounds to attract pollinating insects.**

### Contest 3b

Provide appropriate technical terms to which the following descriptions refer

1. Blood-filled cavity in arthropods  
**Haemocoel**
2. Stinging organ of jelly fishes  
**Nematocysts**
3. Lateral appendages in aquatic annelids  
**Parapodia,**

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### Contest 4a

Name one of the four major causes for the loss of biodiversity around the world.

1. **Habitat loss and fragmentation**
2. **Over-exploitation**
3. **Alien species Invasions**
4. **Co-extinction**

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### Contest 4b

1. What name is given to the thick oily substance, secreted by the sebaceous glands of the skin that consists of fat and cellular debris?  
**Sebum**
2. Name one of the two main types of sweat glands in the body of humans  
**Eccrine sweat glands/ apocrine sweat glands.**
3. Each sweat gland is made up of two portions. Mention one of the portions  
**A secretory section / An excretory duct**

### Contest 5a

The air that humans breathe contains particulate matter such as dust, dirt, viral particles, and bacteria that can damage the lungs or trigger allergic immune responses. Mention the protective mechanisms that enables the following parts of the respiratory system avoid problems or tissue damage.

1. In the nasal cavity  
**Hairs and mucus trap small particles, viruses, bacteria, dust, and dirt to prevent their entry.**
2. The lungs  
**Produce mucus—a sticky substance made of mucin, a complex glycoprotein, as well as salts and water—that traps particulates.**
3. The bronchi and bronchioles  
**Contain cilia, small hair-like projections that line the walls of the bronchi and bronchioles**

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### Contest 5b

Indicate how sandy soils differ from clayey soils with respect to the following.

1. Ability to hold nutrients  
**Sandy soil lacks the ability to hold nutrients whereas clayey soil has the ability to hold nutrients.**
2. Moisture holding capacity  
**Sandy soil has poor moisture holding capacity whereas clayey soil has good moisture holding capacity**
3. Air space  
**Sandy soil has good/large air spaces whereas clayey soil has poor/small air spaces**

### **Contest 6a**

Mention the plant hormones to which the following descriptions refer.

1. It inhibits plant metabolism and regulates abscission and dormancy. It is also called “stress hormone” as it increases the tolerance of plants.

**ABA / Absciscic Acid**

2. Promotes bolting, i.e. sudden elongation of internodes just before flowering in rosette plants like cabbage, beet

**Gibberellins Hormone**

3. They are widely used in agricultural and horticultural practices. They are found in growing apices of roots and stems and then migrate to other parts.

**IAA/Auxins**

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### **Contest 6b**

There are four main accessory ducts and they play an important role in the transport and temporary storage of sperms. Mention one each.

1. **Vasa efferentia**
2. **Epididymis**
3. **Vas deferens**
4. **Rete testis**

### Contest 7a

Classify the following diseases as 'Transmissible' or 'Non-transmissible'.

1. Influenza  
**Transmissible**
2. Arthritis  
**Non transmissible**
3. Coronary heart disease  
**Non transmissible**

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### Contest 7b

Name one abiotic factor which might affect a plant growing on mountains.

1. **Temperature**
2. **Wind speed**
3. **Drainage of water**
4. **Light intensity**

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### Contest 8a

Give the terms to which the following descriptions refer.

1. All the organisms of one species living in a defined area.  
**Population**
2. The place where an organism is usually found.  
**Habitat**
3. A self-supporting group of organisms and their environment  
**Ecosystem.**



### Contest 8b

Distinguish between perisperm and endosperm of a seed with respect to the following

1. Origin

**Perisperm originates from the nucellus, whereas the endosperm originates from the primary endosperm nucleus.**

2. Ploidy

**The perisperm contains diploid cells whereas the endosperm contains triploid cells.**

3. Tissues that absorb their nutrients

**The nutrients in the perisperm are absorbed by the endosperm, whereas the nutrients in the endosperm is absorbed by the embryo**

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### Contest 9a

What part do the following organisms play in the nitrogen cycle?

1. Nitrifying bacteria,

**Nitrifying bacteria convert ammonia and other nitrogenous substances (e.g. urea) into nitrates**

2. Nitrogen-fixing bacteria

**Nitrogen-fixing bacteria convert gaseous nitrogen into nitrogenous compounds.**

3. Denitrifying bacteria

**Denitrifying bacteria decompose nitrogenous compounds to produce gaseous nitrogen.**

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### Contest 9b

Indicate the body fluids in humans into which the following substances do pass.

1. Glucose

**Enter the blood stream**

2. Fatty acids, glycerol

**May enter the blood or the lymph**

3. Amino acids pass

**Enter the blood stream**

### Contest 10a

In a certain breed of rabbits, the allele (**F**) for short fur is dominant to the allele (**f**) for long fur.

1. What is the genotype of a true-breeding, long-furred rabbit?  
**A true-breeding, long-furred rabbit has the genotype ff.**
2. What is the phenotype of a rabbit with the genotype **Ff**?  
**The Ff genotype will produce a short-furred phenotype**
3. In an **Ff** genotype, which allele is expressed in the phenotype?  
**In an Ff genotype, the dominant allele (F) will be expressed**

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### Contest 10b

Name the major mineral element needed by each of the following.

1. Bones  
**Calcium**
2. Red blood cells,  
**Iron**
3. The thyroid gland  
**Iodine**

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### Contest 11a

Explain the following biological terms with respect to the rib cage of humans.

1. True ribs  
**True ribs are dorsally, attached to the thoracic vertebrae and ventrally connected to the sternum (the breast bone) with the help of hyaline cartilage.**
2. Bicephalic ribs.  
**The ribs have two articulation surfaces on the dorsal end**
3. Floating ribs  
**These are ribs that are not connected ventrally to the sternum (the breast bone) / they are not attached to the sternum (the breast bone) or to another rib.**

**Contest 11b**

Describe the seed of flowering plants with respect to the following.

1. Relationship with the fruit  
**The fruit covers the seed of flowering plants**
2. The main components  
**The three main components of seed are the embryo, endosperm, and the seed coat**
3. Definition  
**The seed refers to the unit of reproduction of a higher plant, capable of developing into another such plant**

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**Contest 12a**

Give one similarity between stolons and rhizomes

- 1. Stolon and rhizome are two integral parts of the stem.**
- 2. Both contain nodes and internodes.**
- 3. They grow away from the plant, aiding vegetative reproduction.**
- 4. They serve as storage parts of nutrients.**
- 5. They help the plant to survive under unfavourable conditions.**

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**Contest 12b**

State what the liver does to the following in the human body

1. Hormones  
**Converts hormones to inactive compounds / it secretes it into the blood**
2. Alcohol  
**Oxidizes alcohol to carbon dioxide and water**
3. Vitamin  
**Stores vitamin A.**

### Contest 13a

Distinguish between stem tuber and root tuber with respect to the following

1. Scaly leaves and axillary buds

**Stem tubers possess scaly leaves and auxiliary buds while root tubers do not possess scaly leaves and auxiliary buds.**

2. Number of tubers

**Several stem tubers occur per plant while only a single tuber occurs per a plant. .**

3. Where they arise

**Stem tuber arises at the tip of an underground branch, whereas r root tuber can arise from any part of the root.**

.....

### Contest 13b

Name one of the structures that one can find in the dermis of the mammalian skin.

1. **Sensory nerve endings,**
2. **Nerve fibres,**
3. **Capillaries,**
4. **Arterioles and venules,**
5. **Sweat glands and ducts,**
6. **Sebaceous glands**
7. **Hair follicles.**

.....

### Contest 14a

1. Why are homologous traits similar?

**They are derived from a common ancestor**

2. What makes a trait vestigial?

**When the trait is rudimentary and no longer functional**

3. What name is given to a trait that improves the fitness of its bearer, compared to individuals without the trait?

**Adaptation**

## Contest 14b

Air in the lungs is measured in terms of lung volumes and lung capacities. Explain the following with respect to the lung capacity and volume

1. Total lung capacity (TLC)

**Total volume of air in the lungs after a maximal inspiration**

2. Vital capacity (VC)

**Maximum amount of air that can be moved in or out of the lungs in a single respiratory cycle**

3. Residual volume (RV)

**Air left in the lungs after a forced exhalation**

.....

### Contest 28a

Give one disadvantage of transpiration in plants

**1. Wilting**

Wilting reduces photosynthesis and other metabolic activities.

**2. Reduced Growth**

Transpiration reduces availability of water inside the plant. Water deficit decreases growth and hence the plant gives a stunted appearance.

**3. Reduced Yield**

Decreased availability of water inside the plant checks meristematic activity and hence the formation of flowers, fruits and seeds.

**4. Abscisic Acid**

Water stress produces abscisic acid. Abscisic acid prevents several plant processes and promotes abscission of leaves, flowers and fruits.

**5. Wastage of Energy**

The energy used in absorption and conduction of water goes waste.

**6. Modifications**

In order to reduce transpiration during critical periods, the plants produce several types of modifications— thick cuticle, hair, prickles, spines, thorns, sunken stomata, phylloclades, cladodes,

.....

### Contest 28b

The renal tubules are a series of tubes that begin after the Bowman capsule and end at collecting ducts. Mention the part of the tubule to which the following descriptions refer.

1. This section functions especially in the resorption of sugar, sodium and chloride ions, and water from the glomerular filtrate..

**Proximal convoluted tubule / proximal tubule**

2. Its function allows production of urine that is far more concentrated than blood, limiting the amount of water needed as intake for survival.

**Loop of Henle.**

3. It is a short nephron segment, interposed between the macula densa and collecting duct. Even though it is short, it plays a key role in regulating extracellular fluid volume and electrolyte homeostasis

**Distal convoluted tubule.**

**Contest 28c**

State one of the 5 essential steps in the origin of the eukaryotic cell.

- 1. The origin of flexible cell surface**
- 2. The origin of nuclear envelope.**
- 3. The appearance of digestive vesicles.**
- 4. The origin of cytoskeleton**
- 5. The endosymbiotic acquisition of certain organelles.**

.....

**Contest 29a**

The following hormones affect osmoregulation. Mention where they are produced.

1. Aldosterone  
**Adrenal cortex**
  
2. Anti-diuretic hormone  
**Hypothalamus (stored in the posterior pituitary)**
  
3. Epinephrine and Norepinephrine  
**Adrenal medulla (the inner portion of the adrenal gland)**

.....

**Contest 29b**

State one of the ways in which the absorbing surface of the small intestine is increased.

- 1. By being very long,**
- 2. By having internal folds,**
- 3. By having villi**
- 4. Presence of micro-villi on the epithelial cells.**

### Contest 29c

Give one characteristic of a corm of cocoyam

1. **It is vertically oriented**
2. **It bears many adventitious roots towards the base.**
3. **A corm bears circular nodes.**
4. **It bears foliage leaves.**
5. **Lateral buds are quite conspicuous.**
6. **It does not bear depressions.**
7. **Corms of the successive years persist and generally lie around or above the older ones.**

.....

### Contest 30a

Apart from provision of support, mention one function of a plant cell

1. **Withstand turgor pressure:** Turgor pressure is the force exerted against the cell wall as the contents of the cell push the plasma membrane against the cell wall.
2. **Regulate growth:** The cell wall sends signals for the cell to enter the cell cycle in order to divide and grow.
3. **Regulate diffusion:** The cell wall is porous allowing some substances, including proteins, to pass into the cell while keeping other substances out.
4. **Communication:** Cells communicate with one another via plasmodesmata (pores or channels between plant cell walls that allow molecules and communication signals to pass between individual plant cells).
5. **Protection:** The cell wall provides a barrier to protect against plant viruses and other pathogens. It also helps to prevent water loss.
6. **Storage:** The cell wall stores carbohydrates for use in plant growth, especially in seeds.

.....

### Contest 30b

1. What is the main function the cornified layer of the skin?  
**The cornified layer reduces evaporation from the skin and resists entry of bacteria.**
2. What is meant by vasodilation?  
**Vasodilation is an increase in diameter of small arterioles and capillaries.**
3. What is the effect of vasoconstriction on the body?  
**Vasoconstriction reduces heat loss from the body.**



### Contest 30c

Distinguish between moulds and yeasts with respect to the following.

1. Sexual Spores

**No sexual spores are found in yeasts, but moulds have sexual spores (Zygosporos, Ascospores, etc).**

2. Mode of Reproduction

**The most common mode of reproduction in yeast is “budding.”, but that of moulds is through small spores, which can be either sexual or asexual**

3. Appearance

**Yeast are white and thready. Usually oval in shape but moulds have a fuzzy appearance and can be found in several shapes**

.....

### Contest 31a

Name one of the mechanisms that cause allele frequencies to change

**1. Mutation**

**2. Selection**

**3. Migration**

**4. Genetic drift**

### Contest 31b

Explain the following terms with respect to respiration

1. Tidal volume,  
**Measures the amount of air that is inspired and expired during a normal breath.**
2. Expiratory reserve volume  
**It is the additional amount of air that can be exhaled after a normal exhalation. It is the reserve amount that can be exhaled beyond what is normal**
3. Residual volume.  
**It is the amount of air that is left after expiratory reserve volume is exhaled**

.....  
**Contest 31c**

Give one similarity between reversible and irreversible enzyme inhibition

1. **Reversible and irreversible enzyme inhibition are two types of enzyme inhibition mechanisms.**
2. **They are responsible for reducing the activity of the enzyme.**
3. **Usually, they reduce the compatibility of the enzyme to its substrate, inhibiting the formation of the enzyme-substrate complex.**
4. **During inhibition, inhibitor molecules bind to the enzyme either temporarily or permanently.**
5. **Naturally, enzyme inhibition helps to regulate metabolism. Also, many drug molecules are enzyme inhibitors.**

### Contest 32a

Distinguish between normal hemoglobin and sickle cell hemoglobin with respect to the following

1. The shape of red blood cells

**The red blood cells in normal hemoglobin is biconcave in shape while sickle cell hemoglobin makes red blood cells to become crescent in shape**

2. Solubility under low oxygen concentrations

**Normal hemoglobin is more soluble under low oxygen concentrations, while sickle cell hemoglobin is less soluble.**

3. Difficulty in flowing through veins

**Normal hemoglobin allows red blood cells to freely flow through the veins while sickle cell hemoglobin causes sickle red blood cells to become sticky at the branching points of the veins.**

.....

### Contest 32b

Indicate whether the following are examples of positive or negative feedback

1. When blood sugar levels rise, insulin is released and transports the glucose into the cells, thereby lowering blood glucose levels.

**Negative feedback**

2. When blood levels of calcium get too high, the thyroid gland is stimulated to release calcitonin which inhibits osteoclast activity and stimulates calcium uptake by the bones

**Negative feedback**

3. Contraction of the uterus during childbirth causes the release of oxytocin, which stimulates stronger contractions of the uterus, causing more oxytocin release

**Positive feedback**

**Contest 32c**

1. Which bone cell is responsible for resorbing bone matrix and releasing calcium into the blood?

**Osteoclasts**

2. What is the primary function of the bone marrow?

**Blood cell production**

3. What type of bone cell is active during the formation of new bone and during the production of bone during bone remodeling?

**Osteoblasts**

.....  
**Contest 33a**

Distinguish between animal protein and plant protein with respect to the following

1. Supply of essential nutrients

**Animal protein is a complete protein, containing all essential amino acids, but plant proteins are incomplete proteins; they provide several essential amino acids to the diet, but not all.**

2. Calorie content

**Whereas animal proteins are high in calories, plant proteins are low in calories.**

3. Health Effects

**Animal proteins have negative health effects while plant proteins show positive health effects.**

.....  
**Contest 33b**

1. The luteal surge results in which key event in the female reproductive system?

**Ovulation**

2. Which gland creates a milky, alkaline solution, which helps sperm survive in the acidic environment of the female reproductive tract?

**Prostate gland**

3. Which structure is the site of development and maturation of sperm and secretion of testosterone?

**Testes**

### Contest 33c

1. What is the reason for lipids requiring carrier proteins in order to be transported in the blood?

**Lipids are mainly nonpolar molecules. As a result, they are unable to be dissolved in aqueous solutions, such as blood. This makes them require a lipoprotein in order to be transported through the bloodstream.**

2. Phospholipids are amphipathic molecules. What does this mean?

**They have both polar and nonpolar sections / They have both hydrophilic and hydrophobic regions**

3. What are essential fatty acids?

**Essential fatty acids are fatty acids that cannot be synthesized by humans; therefore, these fatty acids need to be ingested through food.**

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### Contest 34a

Describe C3 plants with the respect to the following.

1. Initial carbon dioxide acceptor

**Ribulose-1,5-bisphosphate (RuBP) / Ribulose Biphosphate**

2. First stable product

**3-Phosphoglycerate (3-PGA) / 3-phosphoglyceric acid**

3. Requirements for the Dark Reaction

**C3 plants require 12 NADPH, and 18 ATPs for the dark reaction,**

### Contest 34b

Indicate whether the following vessels carry oxygen-poor blood or oxygen-rich blood and the part of the body to which they carry the blood.

1. Pulmonary arteries

**Carry oxygen-poor blood from the heart to the lungs so that it can become oxygenated.**

2. The aorta

**Carries oxygen-rich blood from the heart to the rest of the body and brain.**

3. The superior and inferior vena cavae

**Carry oxygen-poor blood from the body back to the heart so that it can travel to the lungs and become oxygenated again.**

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### Contest 34c

Name one of the 4 main processes by which organisms move carbon through the carbon cycle.

1. **Respiration**
2. **Decomposition**
3. **Sedimentation**
4. **Photosynthesis**

### Contest 35a

Distinguish between intracellular and extracellular enzymes with respect to the following

1. Mechanism of action

**While intracellular enzymes breakdown large polymers into smaller chains of monomers, extracellular enzymes act on the end of the polymer to breakdown its monomers one at a time.**

2. Occurrence

**Intracellular enzymes are responsible for the digestion of food particles inside the cytoplasm of unicellular organisms while extracellular enzymes are responsible for the digestion of food inside the alimentary canal of higher animals and the extracellular digestion in decomposers such as fungi and bacteria.**

3. Proportions

**Intracellular enzymes account for the majority of enzymes while the minority is extracellular enzymes.**

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### Contest 35b

The abdominopelvic cavity of humans can be subdivided into four quadrants, namely Right upper quadrant, left upper quadrant, left lower quadrant and right lower quadrant. Indicate the quadrants in which the following can be found.

1. It is the location of the larger portion of the stomach, the pancreas, spleen, portions of the transverse and descending colon, and parts of the small intestine.

**Left upper quadrant:**

2. It houses the cecum, appendix and part of the small intestines.

**Right lower quadrant**

3. It houses majority of the small intestine, some of the large intestine, the left female reproductive organs, and the left ureter.

**Left lower quadrant**

### Contest 35c

1. Organisms tend to select foods that will give them as much energy as possible, while requiring minimal energy. What is this process called?

**Efficient foraging**

2. What is the main way by which energy is lost in a food chain?

**Respiratory heat**

3. A certain insect eats certain species of plants. If the plants are producers, what is the insect classified as?

**Primary consumer**

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### Contest 36a

Distinguish between animal and plant hormones with respect to the following

1. Complexity

**While animal hormones are complex organic substances, plant hormones are simple organic substances.**

2. How they are transported

**Animal hormones diffuse through the blood while plant hormones diffuse through xylem and phloem.**

3. Speed of response

**Animal hormones produce a rapid response, while plant hormones produce a slow response.**

.....

### Contest 36b

Mention the proteins found in the following structures

1. Hair, nails, and the epidermis of skin.

**Keratin**

2. Bone and cartilage

**Collagen**

3. Found in the blood in response to injury

**Fibrin** is a clotting protein.



### Contest 36c

1. What is the function of Kinetochores which are located near the center of chromatids during cell division?

**Act as an attachment point for spindle fibers**

2. In mitosis, which characteristic of a cell in metaphase easily distinguishes it from the other stages?

**Chromosomes are aligned in the middle of the plane by what is known as the metaphase plate.**

3. Which term refers to the microtubule structures that move the chromatids to opposite poles of a cell during mitosis?

**Spindle fibers**

.....

### Contest 37a

Indicate the direction of backflow of blood prevented by the following valves in the mammalian heart.

1. The tricuspid

**The tricuspid valve prevents backflow from the right ventricle into the right atrium.**

2. The bicuspid valve

**The bicuspid valve prevents backflow from the left ventricle into the left atrium.**

3. The semilunar valves

**The semilunar valves prevent backflow into the ventricles from the aorta and pulmonary arteries.**

.....

### Contest 37b

Parasitism is of different types depending on the size, characteristics, interaction with the host, and their life cycles. Some of the parasites can exist in multiple classifications depending on the basis of classification. Explain the following types of parasitism

1. Mesoparasitism

**Mesoparasitism is a type of parasitism where the parasite lives partly within the host's body.**

2. Epiparasitism

**Epiparasitism is a type of interaction between two parasites where one parasite parasitizes the other.**

3. Brood parasitism

**Brood parasitism is a type of parasitism where the parasites depend on the host to raise their young ones. This is a form of parasitism as the parasites conserve energy whereas the host has to spend extra energy.**

.....

**Contest 37c**

Ligands are any substance that forms a complex with a biomolecule to serve a biological purpose. Mention one of the four primary types of ligands that have their functional state determined by their three-dimensional chemical conformation.

1. **Substrates**

2. **Inhibitors**

3. **Activators**

4. **Neurotransmitters**

.....

**Contest 38a**

Obligatory exchange is a type osmotic exchange that take place between a fish and its environment which is usually in response to physical factors over which the fish has little or no physiological control. Mention one of the four main factors that affect obligatory exchanges

1. **Gradient between the Extracellular Compartment and the Environment:**

The greater the ionic difference between the body fluid and external medium, the greater the tendency for net diffusion to low concentrations. Thus, a bony fish in a sea water is affected by the problem of losing water into the hypertonic sea water.

2. **Surface/Volume Ratio:**

Generally the animal with small body size desiccates (or hydrates) more rapidly than a larger animal of the same shape.

3. **Permeability of the Gills:**

Fish gills are necessarily permeable to water and solutes as they are the main site of exchange of oxygen and carbon dioxide between the blood and the water. Active transport of salts also takes place in the gills.

4. **Feeding:**

Fishes take water and solute along with the feeding. A gill takes high quantity of salt than water at the time of feeding on seashore invertebrates, these fishes, therefore, must have some special device to excrete excess of salt. However, a freshwater fish ingests large amount of water than salt and thus needs special means of salt conservation.

### **Contest 38b**

The cytoskeleton determines cell shape. It consists of three different types of filamentous proteins. Mention the type of cytoskeleton to which the following descriptions refer

1. The functions include cytokinesis, amoeboid movement, cell motility, changes in cell shape, endocytosis and exocytosis, cell contractility, and mechanical stability.  
**Microfilaments,**

2. They are the most diverse group of cytoskeletal elements. Their function is purely structural. They bear tension, thus maintaining the shape of the cell, and anchor the nucleus and other organelles in place. They have no role in cell movement

### **Intermediate filaments**

3. They are small hollow tubes. They are the widest components of the cytoskeleton. They help the cell resist compression, provide a track along which vesicles move through the cell, and pull replicated chromosomes to opposite ends of a dividing cell. They are the structural elements of flagella, cilia, and centrioles

### **Microtubules**

.....

### **Contest 38c**

1. How does blood in the renal vein differ from that in the renal artery in terms of oxygen, carbon dioxide and urea contents?

**Blood in the renal vein will have less oxygen and more carbon dioxide (as a result of the kidney's respiration) and less urea, than blood in the renal artery.**

2. What happens in the kidney tubules when the concentration of solutes in the blood rises above a certain level?

**If the concentration of solutes in the blood rises, more water is reabsorbed in the kidney tubules. (This helps to reduce the concentration of the blood.)**

3. Is the human liver a homeostatic organ? Explain your answer.

**Yes. It regulates the concentrations of glucose and amino acids**

### **Contest 39a**

State why mitosis is unlikely to occur in the following cells

1. A sperm cell

**Once sperm cells are formed they do not divide again,**

2. A hair cell

**They are dead**

3. A red blood cell  
**They have no nuclei**

.....

### **Contest 39b**

Hardy-Weinberg equilibrium shows that the gene frequency (the proportion of a particular type of gene in a population) will remain constant if certain conditions occur. Mention one of these conditions

1. **The size of the population is practically infinite.**
2. **Individuals in the population mate at random.**
3. **All individuals in the population have the same fitness, regardless of their genes.**
4. **There is no gain or loss of genes due to immigration into or emigration out of the population.**
5. **There is no new mutation in the population.**

.....

### **Contest 39c**

Give one advantage of cage culture fish when compared to other methods of fish culture

1. It requires less investment.
2. Its installation is easy.
3. Since it covers only a fraction of the pond, the remaining part can be used in the normal way.

4. It provides opportunity for controlled culture of choice.
5. Inspection of fishes and their feeding is much easier.
6. Treatment of disease is much simple than that of pond culture.
7. In emergencies it can be removed from one place to another.
8. Since the cage is meshed, the fishes inside have less chances of being attacked by predators.
9. Harvesting is very simple.
10. The number of fish required at a particular time can be harvested and in this way it helps to maintain the non-seasonal supply of the fish.
11. It is economical as compared to other methods of fish culture except fish-culture in running water.

.....

#### **Contest 40a**

The genetic code is a set of rules defining how the four-letter code of DNA is translated into the 20-letter code of amino acids, which are the building blocks of proteins. Explain the following properties of genetic code

1. The genetic code is universal  
**The same genetic code is used to code the same amino acid in all organisms including virus.**
2. The genetic code is non-overlapping  
**The same letter is not used for two different codons**
3. The genetic code has polarity  
**The code is always read in a fixed direction**

#### **Contest 40b**

1. Explain the means by which malarial parasites can be transmitted from an infected person to a healthy person?  
**The malarial parasite is transmitted when a healthy person is bitten by a mosquito which has fed on an infected person.**

2. Anti-malarial drugs kill plasmodium parasites in the blood but may not kill all the parasites. Why?  
**Anti-malarial drugs do not kill the parasites in the liver.**
3. Why was the use of DDT insecticide not successful in eradicating malaria?  
**The mosquitoes became resistant to the DDT insecticide.**

.....

### Contest 40c

1. How do Habitat loss and fragmentation lead to loss of biodiversity?  
**They result in the breaking up of the habitat into small pieces, which affects the movement of migratory animals and also, decreases the genetic exchange between populations leading to a declination of species.**
2. How can the extinction of one species lead to the extinction of another species?  
**In a native habitat, one species is connected to the other in an intricate network. The extinction of one species causes the extinction of other species, which is associated with it in an obligatory way. For example, the extinction of the host will cause the extinction of its parasites**
3. How do exotic or Invasive alien species affect biodiversity?  
**They reproduce rapidly since they do not have local enemies, out-compete native species for food, water and space, and are one of the main causes of global biodiversity loss.**  
**These species become established in their new environment and spread unchecked, threatening the local biodiversity.**