Grade 10 Science Tamil Nadu 2023

Q1. Magnification of a convex lens is always:

A. Positive

B. Negative

C. Either positive or negative

D. Zero

Solution: C

The magnification (M) of a convex lens can have different values depending on the position of the object. The magnification values can be either negative (-) (or) positive (+), because a convex lens can form virtual images as well as real images.

Q2. In which of the following reactions, mass number decreases by four of the daughter nucleus?

A. α decay

B. β decay

C. γ decay

D. neutron decay

Solution: A

When a nucleus emits an alpha particle, it loses 2 protons and 2 neutrons. As a result, the mass number decreases by 4, and the atomic number decreases by 2.

Q3. The gram molecular mass of water is:

A. 2 g

B. 16 g

C. 18 g

D. 8 g

Solution: C

Gram atomic mass of Hydrogen $= 1$ g.

Gram atomic mass of Oxygen $= 16$ g.

The formula of water is H_2O.

It contains 2 Hydrogen atoms and 1 Oxygen atoms.

Gram molecular mass of water $= 2 \times 1 + 16 \times 1 = 18$ g.

Q4. Which of the following is a universal solvent:

A. Acetone

B. Benzene

C. Water

D. Alcohol

Solution: C

Water is called a universal solvent because its polar nature allows it to dissolve many substances.

Q5. The secondary suffix used in IUPAC nomenclature of an aldehyde is

A. -ol

B. -oic acid

C. -al

D. -one

Solution: C

The secondary suffix used in IUPAC nomenclature for the functional group “aldehyde” is -al.

Q6. The heart of amphibians possesses — chambers.

A. 3

B. 4

C. 2

D. 5

Solution: A

The heart of amphibians possesses three chambers (2 atria and a single ventricle.)

Q7. Kreb's cycle takes place in -

A. Chloroplast

B. mitochondrial matrix

C. stomata

D. inner mitochondrial membrane

Solution: B

The Krebs cycle, also called the citric acid cycle or TCA cycle, happens in the mitochondrial matrix. This is the innermost part of the mitochondria, containing the enzymes and materials needed for the cycle.

Q8. Bipolar neurons are found in:

A. retina of eye

B. cerebral cortex

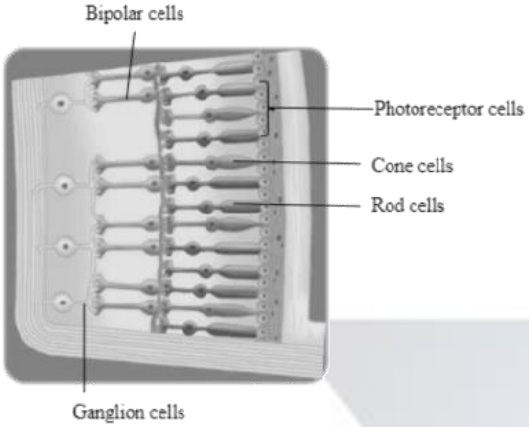
C. Embryo

D. respiratory epithelium

Solution:

A

Bipolar neurons are found in the retina of the eye. These are found in the middle layer and receive signals from photoreceptor cells. These bipolar cells connect with both rods and cones, as well as ganglion cells. They carry signals from the photoreceptor cells to the ganglion cell



Q9. Syngamy results in the formation of -.

A. Zoospores

B. Conidia

C. Zygote

D. Chlamydospores

Solution: C

Syngamy is the process in which a male and female gamete combine during fertilization to form a zygote.

Q10. Match the following:

1. Sarcoma	i) Excessive hunger
2. Carcinoma	ii) Excessive thirst
3. Polydipsia	iii) Connective tissue cancer
4. Polyphagia	iv) Stomach cancer

Solution: 1-iii , 2-iv, 3-ii, 4-i

1. Sarcoma	iii) Connective tissue cancer
2. Carcinoma	iv) Stomach cancer
3. Polydipsia	ii) Excessive thirst
4. Polyphagia	i) Excessive hunger

Q11. 9:3:3:1 ratio is due to:

A. Segregation

B. Crossing over

C. Independent assortment

D. Recessiveness

Solution: C

The 9:3:3:1 ratio is seen in a dihybrid cross where two traits are inherited

independently, as stated by Mendel's Law of Independent Assortment. This law says that the alleles for different traits separate independently when forming gametes.

Q12. The term Ethnobotany was coined by:

A. Khorana

B. J. W. Harshberger

C. Ronald Ross

D. Hugo De Vries

Solution: B

The term "ethnobotany" was created in 1895 by the botanist Harsher berg. He coined the term to describe the study of how people use plants.

Q13. Define inertia. Give its classification.

Solution:

Inertia is the property of matter that keeps it at rest or moving in a straight line at a constant speed unless acted upon by some external force.

Inertia is directly proportional to the mass of an object, meaning the more mass an object has, the greater its inertia.

Classification of inertia:

(i) Inertia of rest.

(ii) Inertia of motion.

(iii) Inertia of direction.

Q14. Why does the sky appear blue in color?

Solution:

When sunlight enters the earth's atmosphere, it gets scattered by the particles in the air. Blue light has the shortest wavelength, so it scatters the most. This scattered blue light reaches our eyes, making the sky appear blue.

Q15. Define one calorie.

Solution:

One calorie is the amount of heat required to raise the temperature of one gram of water by one degree Celsius (or one kelvin).

Q16. Mention any two applications of Avogadro's Law.

Solution:

Avogadro's Law states that equal volumes of gases, at the same temperature and pressure, contain the same number of molecules. This means the volume of a gas is directly related to the number of gas molecules when temperature and pressure are constant.

Two key important applications of Avogadro’s law are:

(i) It helps explain Gay-Lussac's law.

(ii) It is used to determine the number of atoms in a gas molecule.

Q17. List out the parasitic adaptations in leach.

Solution:

(i) They are segmented worms that are either predatory or parasitic, belonging to the subclass Hirudinea in the phylum Annelida.

(ii) They live as parasites by sucking the blood of vertebrates.

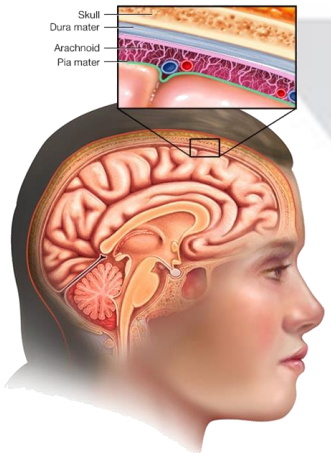
(iii) Organisms with an internal backbone covered by bone are called vertebrates.

Q18. What are the structures involved in the protection of the brain?

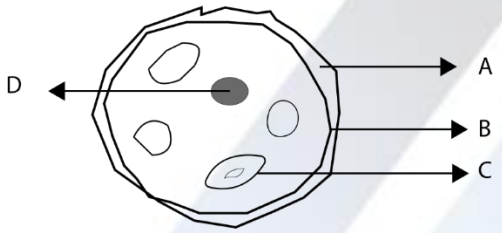
Solution:

The human brain is well protected in a bony structure called the skull. It is covered by three layers of protective membranes called cranial meninges.

The space between these layers is filled with cerebrospinal fluid, which helps cushion the brain and maintain stable pressure inside the skull.



Q19. Identify the parts A, B, C and D in the given figure.



Solution:

The given figure is of structure of pollen grains.

A- Exine

B- Intine

C- Generative Cell

D- Vegetative Nucleus

Q20. Define genetic engineering.

Solution:

Genetic engineering, also known as genetic modification, is the process of altering an organism's genes using biotechnology. It involves changing the genetic material of cells, including moving genes between species, to create better or new organisms.

Q21. What is sprite?

Solution:

The images in the background of a scratch window are called sprites. When you open scratch, a cat usually appears as the default sprite. The software allows you to change or modify the sprite.

Q22. Calculate the amount of energy released when a radioactive substance undergoes fusion and results in a mass defect of 2 kg.

Solution:

To calculate the energy released during a fusion process with a given mass defect, we can use Einstein's mass-energy equivalence equation:

By Einstein's equation, Energy released, $E = mc^2$

Mass defect in the reaction $(m) = 2$ kg

Velocity of light (c) $= 3 \times 10^8$ ms^{-1}

So,

$$E = 2 \times (3 \times 10^8)^2$$
$$= 1.8 \times 10^{17} \text{ J}$$

Q23. Deduce the equation of force using Newton's Second Law of Motion.

Solution:

Newton's second law of motion states that: the net external force applied on an object is directly proportional to the rate of change of linear momentum of the object.

Let, ' m ' be the mass of a moving body, moving along a straight line with an initial speed u. After a time interval of ' t ', the velocity of the body changes to v due to the impact of an unbalanced external force F.

=> p_1(initial momentum) = mu

p_2(final momentum) = mv

Therefore, (rate of change of momentum),

$$\Delta p = \frac{p_2 - p_1}{t} = \frac{mv - mu}{t}$$

According to newton's IInd law, F a Δp

$$\Rightarrow F = k \times \frac{mv - mu}{t} \{k \text{ is a constant }\}$$

Here, k is the proportionality constant k = 1 in all systems of units.

So, $F = \frac{m(v-u)}{t}$

Since, acceleration $= \frac{\text{change in velocity}}{\text{time}}$,

$$a = \frac{(v - u)}{t}$$

So, $F = \frac{m(v-u)}{t} = ma$

Hence, we have $F = m \times a$

Force = mass × acceleration

Q24. Differentiate the eye defects: Myopia and Hypermetropia.

Solution:

	Myopia	Hypermetropia
1.	Myopia is also called near sightedness.	Hypermetropia is also called long-sightedness.

2.	Myopia causes us to be able to see adjacent items clearly but not distant objects.	Hypermetropia is a condition in which we can perceive far things but not close ones.
3.	The picture is created in front of the Retina for those who have Myopia.	The picture is created behind the retina for those who have hypermetropia.
4.	It is caused by an abnormal curvature of the eye lens or an extension of the eyeball.	It occurs when the eyeball is too small or when the focal length of the eye is too long.
5.	A concave lens of adequate power is used to correct myopia.	A convex lens of appropriate power is used to correct hypermetropia.

Q25. (a) What do you understand by the term Ultrasonic Vibration?
(b) What is meant by reflection of sound?

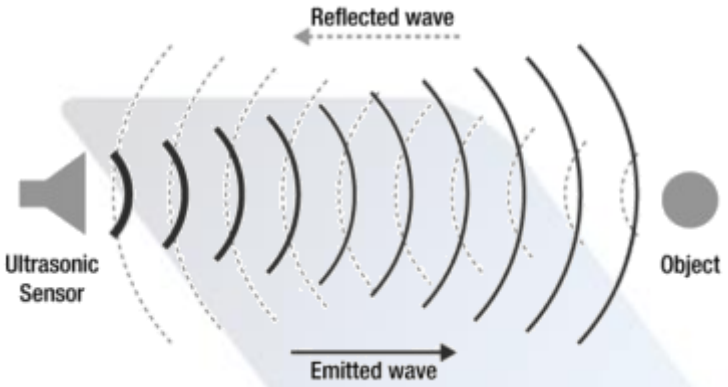
Solution:

(a) Ultrasonic vibration refers to mechanical vibrations with frequencies higher than what humans can hear, typically above 20 kHz (20,000 vibrations per second).
Uses of ultrasonic vibrations:

- Ultrasonic vibrations are used in SONAR to measure sea or ocean depths and detect underwater objects like submarines, rocks, and shipwrecks.
- They help in scanning and imaging a fetus's position and growth, as well as detecting stones in the gall bladder and kidneys.
- In milk plants, ultrasonic vibrations are used to mix fresh milk with fat and powdered milk to produce toned milk.
- Bats can hear ultrasonic sounds up to 120,000 Hz, while animals like dogs and dolphins can hear sounds up to 40,000 Hz.

(b)Reflection of Sound

The reflection of sound is similar to the reflection of light. Sound follows the laws of reflection, where the angle of incidence equals the angle of reflection. Like a billiard ball bouncing off a surface, sound bounces back from solid or liquid surfaces. To observe sound reflection clearly, the surface should be smooth or rough and large enough.



The laws of reflection of sound are as follows:

- The incidence angle will always be equal to the reflection angle.
- The incident sound waves, the normal at incidence point and reflected wave, all rest in a common plane.

Q26. (a) What is amalgam? Give an example.
(b) Mention any two uses of copper.

Solution:

(a) An amalgam is a mixture of mercury with another metal, bonded together through metallic bonding.
Silver-tin amalgam is commonly used for dental fillings.

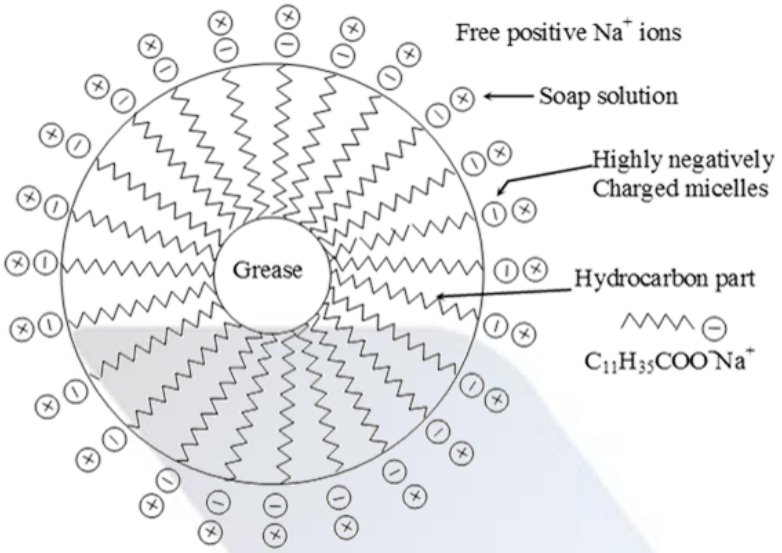
(b) Uses of copper:

- It is widely used to make electric cables and other electrical devices.
- It is also used to make utensils, containers, calorimeters, and coins.

Q27. Explain the mechanism of cleansing action of soap.

Solution:

Mostly the dirt is held to any surface such as cloth by the oil or grease which is present there. Now since the oil and grease are not soluble in water, the dirt particles cannot be removed by simply washing the cloth with water. However, when soap is applied, the non-polar hydrocarbon part of the soap molecules dissolves in oil droplets while the polar - $COO^{-}Na^{+}$groups remain attached to water molecules. In this way, each oil droplet gets surrounded by negative charge.



These negatively charged oil droplets cannot coalesce and continue breaking into small droplets. These oil droplets (containing dirt particles) can be washed away with water along with dirt particles. So, the action of soap or detergents is to emulsify oil or grease, this loosens the solid particles of dirt, and they are removed.

Q28. (a) Name the three basic tissue systems in a flowering plant.
(b) What are the factors affecting photosynthesis?

Solution:

(a)

No.	Tissue system	Tissues present
1	Epidermal tissue system	Epidermis, trichomes, hairs, stomata
2	Ground tissue system	Parenchyma, collenchyma, sclerenchyma, mesophyll
3	Vascular tissue system	Xylem, phloem, cambium

(b) Factors affecting the rate of photosynthesis:
(i) Carbon dioxide: More CO_2 in the air makes photosynthesis faster.
(ii) Water: Less water in the soil slows down photosynthesis.
(iii) Sunlight: Brighter sunlight increases the rate of photosynthesis.
(iv) Chlorophyll: The green pigment chlorophyll in chloroplasts helps in photosynthesis.

Q29. Enumerate the functions of blood.

Solution:

Blood is major fluid connective tissue in humans and many other animals. It is composed of plasma, RBC, WBC, and platelets. It is a vital fluid connective tissue in

humans and animals. It consists of plasma, red blood cells (RBCs), white blood cells (WBCs), and platelets.

Functions of the blood include:

- Carrying oxygen from the lungs to body tissues.
- Delivering nutrients from the small intestine to cells throughout the body.
- Transporting waste products to the kidneys and liver for filtration and removal.

Q30. How do rainwater harvesting structures recharge groundwater?

Solution:

Rainwater is collected from rooftops or open areas and directed to filtration pits through pipes. After being filtered, the water flows into recharge pits or ground wells.

Q31. (a) What do you understand by the term phenotype and genotype?

(b) What are allosomes?

Solution:

(a) Phenotype and genotype are terms used in genetics to describe the observable characteristics of an organism and its underlying genetic makeup, respectively.

The phenotype is the visible physical features of an organism, including aspects like height, eye color, skin complexion, and behavior. It is determined by an individual's genotype.

Genotype is the complete set of genes or genetic makeup of an organism, represented by alleles inherited from the parents. The human genetic code could be found by their genotype. It determines the traits which will be expressed. Biological tests can determine genotype.

(b) Allosomes are a type of chromosome that determine the sex of an organism and are also referred to as sex chromosomes.

Human have 22 pairs of autosomes and a pair of allosomes.

Allosomes in human females are XX and in the human males are XY.

Q32. (a) Calculate the pH of 0.01 M solution of HNO_3.

(b) A solution is prepared by dissolving 25 g sugar in 100 g of water. Calculate the mass percentage of solute.

Solution:

(a) H^+ion concentration in aqueous solution of HNO_3 is $0.01M = 10^{-2}M$

i.e. $[H^+] = 10^{-2}M$

So $pH = -\log [H^+] = -\log [10^{-2}] = -(-2)\log\ 10 = 2$

(b)The amount of solute that is sugar in the solution is 25 grams.

The amount of solvent that is water is 100 grams.

Thus the total amount of solution is $100 + 25 = 125$ grams.

Thus, the concentration of the solution can be given as-

$$\frac{\text{Mass of solute}}{\text{Mass of solution}} 100 = \frac{25}{125} \times 100 = 20\%$$

Q33. (a) (i) State Joule's Law of Heating

(ii) An alloy of nickel and chromium is used as the heating element. Why?

(iii) How does a fuse wire protect electrical appliances?

Solution:

(i) Joule's Law of Heating states that the amount of heat produced by an electric current flowing through a conductor is directly proportional to the square of the current, the resistance of the conductor, and the time for which the current flows

$H = I^2Rt$

(ii) The alloy of Nickel and Chromium is used as a heating element because:

- It has high resistivity.
- It is not easily oxidized.
- It has a high melting point.

(iii) When a large current flows through the wire, the fuse with a low melting point melts and breaks the circuit, protecting the electrical appliances. The fuse melts due to the heat generated by the current, disconnecting the circuit and preventing damage to the appliances.

(OR)

(b) (i) What is longitudinal wave?

(ii) What is a nuclear reactor? Explain its essential parts with their functions.

Solution:

(i) Longitudinal waves are waves where the movement of the medium is in the same direction as the wave.

Sound waves are an example of longitudinal waves, created by the vibration of particles in a medium. A tuning fork is an example of sound waves moving in a longitudinal direction.

Characteristics of Longitudinal Waves:

Compression: This is the area where the particles are closest to each other.

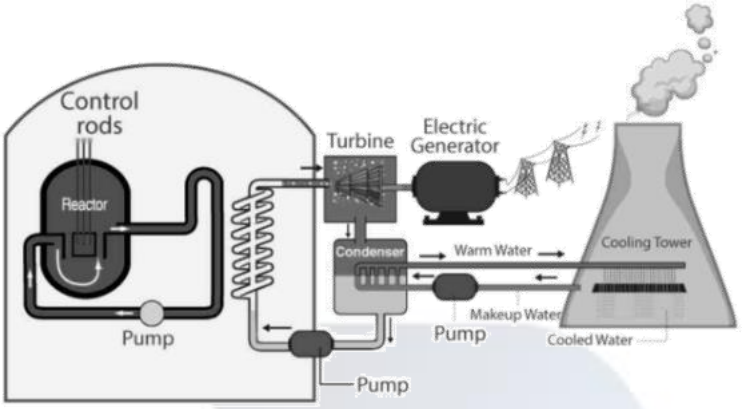
Rarefaction: This is the area where the particles are farthest apart.

Wavelength: The distance between two consecutive points, like two compressions or two rarefactions, is called the wavelength.

Amplitude: Amplitude is the maximum displacement of a particle from its resting position. In longitudinal waves, it is the distance from the equilibrium point to either compression or rarefaction.

(ii) Nuclear reactor:

A Nuclear reactor is a device in which the nuclear fission reaction takes place in a self-sustained and controlled manner to produce electricity.



Components of a Nuclear Reactor:

The following are the essential components of a nuclear reactor are

Fuel: The material used to produce energy, usually uranium.

Moderator: Slows down fast-moving neutrons to make them effective for the reaction. Common moderators are graphite and heavy water.

Control Rods: These are used to control the number of neutrons and maintain a steady chain reaction. They are typically made of boron or cadmium, which absorb neutrons.

Coolant: A substance used to carry away the heat produced in the reactor and convert it into steam. This steam powers a turbine to generate electricity. Water, air, and helium are some examples.

Protection Wall: A thick concrete or lead wall around the reactor to prevent harmful radiation from escaping into the environment.

Q34. (a)

(i) Define: atomicity

(ii) Calculate the percentage of sulphur in H_2SO_4.

(iii) In what way hygroscopic substances differ from deliquescent substances.

(OR)

(b)

(i) Differentiate reversible and irreversible reaction.

(ii) What is neutralisation reaction? Give an example.

(iii) Give any three characteristics of homologous series.

Solution:

(a)

(i)Atomicity is the number of atoms present in a single molecule of an element or compound. It indicates how many atoms are chemically bonded together in the molecule.

(ii) We know that the molar mass of $H_2SO_4 = 98$ g

Mass of sulphur in $H_2SO_4 = 32$ g

$$\% \text{ of S} = \frac{\text{Mass of } S}{\text{Mass of compound}} \times 100 = \frac{32}{98} \times 100 = 32.65\%$$

(iii)

S.NO	Hygroscopic substances	Deliquescence substances
1.	When exposed to the atmosphere at ordinary temperature, they absorb moisture and do not dissolve.	When exposed to the atmospheric air at ordinary temperature, they absorb moisture and dissolve.
2.	Hygroscopic substances do not change its physical state on exposure to air.	Deliquescent substances change its physical state on exposure to air.
3.	Hygroscopic substances may be be amorphous solids or liquids.	Deliquescent substances are crystalline solids.

(0R)

(b) (i)

	REVERSIBLE REACTION	IRREVERSIBLE REACTION
1	It can be reversed under suitable conditions.	It cannot be reversed.
2	Both forward and backward reactions place simultaneously.	It is unidirectional. It proceeds only in forward direction.
3	It attains equilibrium.	Equilibrium is not attained.
4	The reactants cannot be converted completely into products.	The reactants can be completely converted into products.

(ii) When an acid reacts with a base to produce a salt and water, it is called a neutralization reaction.

General Equation:

Acid + Base → Salt +Water

Example:
The reaction between sodium hydroxide (NaOH) and hydrochloric acid (HCl) is a typical neutralization reaction:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

In this reaction:
Sodium (Na) replaces the hydrogen (H) from hydrochloric acid to form sodium chloride (NaCl), which is a neutral and soluble salt.
Water (H_2O) is also formed as a byproduct.
Reaction of sodium hydroxide with hydrochloric acid is a typical neutralization reaction. Here, sodium replaces hydrogen from hydrochloric acid forming sodium chloride, a neutral soluble salt.
(iii)

- Each member of the series differs from the preceding or succeeding member by one methylene group ($-CH_2$) and hence by a molecular mass of 14 amu
- All members of a homologous series contain the same elements and functional group
- Physical properties like boiling point, melting point, and density change gradually as the molecular mass increases.
- Chemical properties of the members of a homologous series are similar.

Q35.

(a)
(i) Which hormone induces parthenocarpy in tomatoes?
(ii) Why is thyroid hormone referred as 'personality hormone?
(iii) Explain Lamarck's theories of evolution.

(OR)

(b)
(i) Which enzyme cuts DNA at specific sites?
(ii) Name two maize hybrids rich in amino-acid, lysine.
(iii) Explain smoking hazards and the harmful effects of tobacco.

Solution:

(a)
(i) Auxin

(ii) The thyroid hormone is often referred to as the "personality hormone" because of its significant influence on an individual's physical, mental, and emotional well-being. Thyroxine is the primary hormone released by the thyroid gland into the blood. It is essential for digestion, heart and muscle function, brain development, physical growth, and bone health. This hormone also influences your personality and physical appearance.

(iii)
Lamarck's Theory
Lamarck's theory includes four main propositions:

1) Change through use and disuse:
Organs that are frequently used by an organism grow and develop, while those that are rarely used gradually disappear in future generations.
For example, a giraffe stretches its neck to reach leaves, causing it to grow longer over time. On the other hand, organs that are no longer needed shrink over time.
2) Organisms driven to greater complexity:
As organisms adapted to their environment, they evolved from simpler forms to more complex ones. Lamarck believed that life could arise spontaneously.
3) Inheritance of acquired characters:
An individual develops certain traits during their lifetime, which are passed on to their offspring. For example, a blacksmith, due to their work, has strong arms. It was suggested that the blacksmith's children would inherit these strong muscles.
4) Effect of environment and new needs:
The environment influences all the organisms. A slight change in the environment brings about changes in the organisms. This gives rise to new needs which in turn produce new structures and changes the habits of the organisms.
Examples of Lamarckism:
Evolution of giraffe:
The ancestors of giraffes resembled horses with short necks and forelimbs. They lived in places without surface plants, so they stretched their necks and forelimbs to eat leaves from tall trees. Over time, their necks and forelimbs became longer, and this trait was passed on to future generations.
Aquatic Birds with Webbed Toes:
Aquatic birds such as ducks are believed to have evolved from terrestrial animals.

(OR)

(b)
(i) Restriction enzymes, also known as restriction endonucleases, are proteins that identify specific sequences in double-stranded DNA and cut the DNA at those exact points.
(ii) Shakti and Protina are hybrid varieties of maize that are rich in the amino acid lysine, which is essential for human nutrition.
(iii) Tobacco is consumed in different forms, such as beedi, cigarette, or cigar. Some people use it as snuff, while others chew it. Tobacco contains nicotine, which has harmful effects on health.

(1) Smoking tobacco raises the risk of lung cancer.
(2) Chewing tobacco can cause oral cancer.
(3) Nicotine in tobacco narrows blood vessels, raising blood pressure and increasing the risk of heart attacks.

(4) Tobacco use leads to the buildup of tar in the nose, throat, and lungs, causing coughing and irritation.
(5) The smoke from burning tobacco releases harmful gases like carbon monoxide, which can damage the health of both smokers and those around them.