

**Part - III**  
**Science (English Version)**

Time allowed: 3:00 hours

[Maximum Marks: 75]

**Instructions:**

- (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
- (2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

**Part - I**

**Note:**

- (i) Answer **all** the questions.
- (ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. Magnification of a convex lens is always:

- A. Positive
- B. Negative
- C. Either positive or negative
- D. Zero

**Answer: C**

Since a convex lens can form virtual images as well as real images, therefore the magnification produced by a convex lens can be either negative (-) or positive (+).

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

- A.  $\alpha$  decay
- B.  $\beta$  decay
- C.  $\gamma$  decay
- D. neutron decay

**Answer: A**

When an alpha particle is emitted from the nucleus, the nucleus loses two protons and two neutrons. This means the atomic mass number decreases by 4 and the atomic number decreases by 2.

3. The gram molecular mass of water is:

- A. 2g
- B. 16g
- C. 18g
- D. 8g

**Answer: 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 H atoms and 1 O atom.

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

4. Which of the following is a universal solvent:

- A. Acetone
- B. Benzene
- C. Water
- D. Alcohol

**Answer: C**

Water is a universal solvent. Water is capable of dissolving a variety of different substances.

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

- 
- A. -ol
  - B. -oic acid
  - C. -al
  - D. -one

**Answer: C**

For aldehyde, the secondary suffix for an aldehyde is -al.

6. The heart of amphibians possess \_\_\_\_\_ chambers.

- A. 3
- B. 4
- C. 2
- D. 5

**Answer: A**

Amphibians have a three-chambered heart with two atria and a single ventricle.

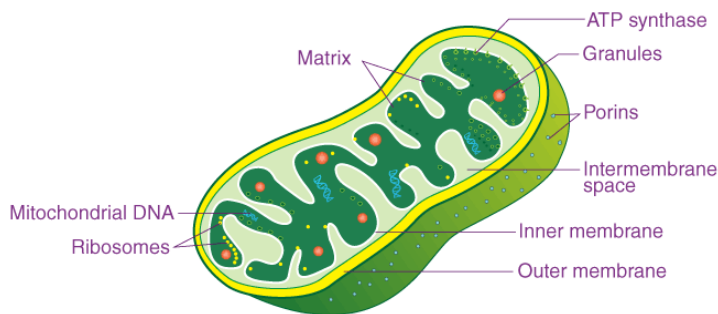
7. Kreb's cycle takes place in \_\_\_\_\_.

- A. Chloroplast
- B. mitochondrial matrix
- C. stomata
- D. inner mitochondrial membrane

**Answer: B**

#### MITOCHONDRION

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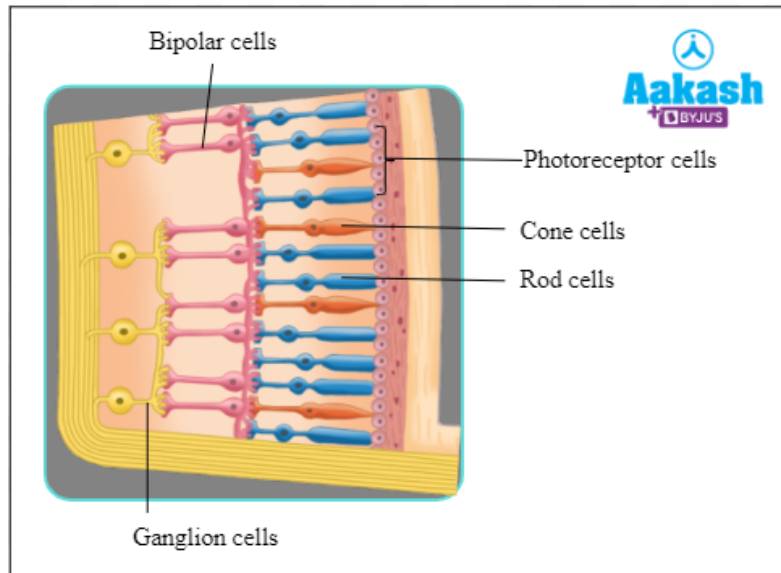


8. Bipolar neurons are found in:

- A. retina of eye
- B. cerebral cortex
- C. Embryo
- D. respiratory epithelium

**Answer: A**

Bipolar neurons are seen in the middle layer and receive the signal from photoreceptor cells. The bipolar cells synapse with both rods and cones and ganglion cells. They transmit the signal from photoreceptor cells to ganglion cells.



9. Syngamy results in the formation of \_\_\_\_\_.

- A. Zoospores
- B. Conidia
- C. Zygote
- D. Chlamydo spores

**Answer: C**

It refers to the process of the union of two gametes for the generation of a zygote.

10. Match the following :

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

**Answer:**

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

**11.** 9:3:3:1 ratio is due to:

- A. Segregation
- B. Crossing over
- C. Independent assortment
- D. Recessiveness

**Answer: C**

Mendelian ratio 9: 3: :3: 1 is due to the law of independent assortment. Consider two independent traits each governed by a dominant:recessive ratio of 3:1. If we cross those two ratios, the result of the cross is the 9:3:3:1 ratio that Mendel observed.

**12.** The term Ethnobotany was coined by:

- A. Khorana
- B. J. W. Harshberger
- C. Ronald Ross
- D. Hugo De Vries

**Answer: B**

The term “ethnobotany” was created in 1895 by the botanist Harshberger.

### Part - II

**Note:** Answer **any seven** questions. Question no. **22** is **compulsory**

**13.** Define inertia. Give its classification.

**Answer:** Inertia is defined as a property of matter by which it remains at the state of rest or in uniform motion in the same straight line unless acted upon by some external force.

Classification: (i) Inertia of rest. (ii) Inertia of motion. (iii) Inertia of direction.

**14.** Why does the sky appear blue in colour ?

**Answer:** When a white light (from the sun) enters the earth's atmosphere, it gets scattered away due to the atmospheric particles. Since, blue colour has the minimum wavelength, blue colour scatters the most. The scattered blue light enters our eyes and thus the sky appears blue.

**15.** Define one calorie.

**Answer:** One calorie of heat is defined as the amount of heat needed to raise the temperature of one gram of water by one degree Celsius (or one kelvin).

**16.** Mention any two applications of Avogadro's Law.

**Answer:**

- i. It explains Gay-Lussac's law.
- ii. It helps in the determination of the atomicity of gases.

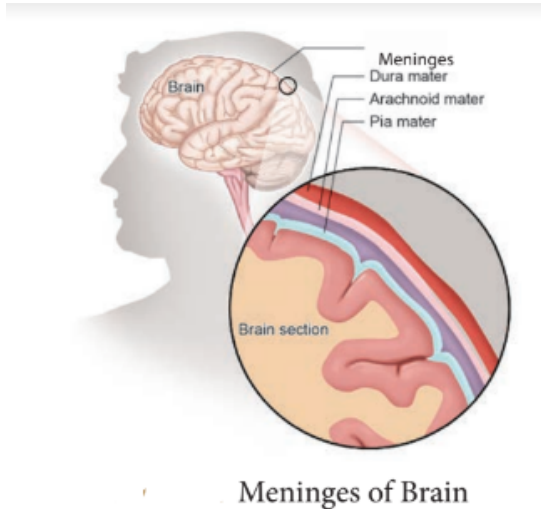
**17.** List out the parasitic adaptations in leech.

**Answer:**

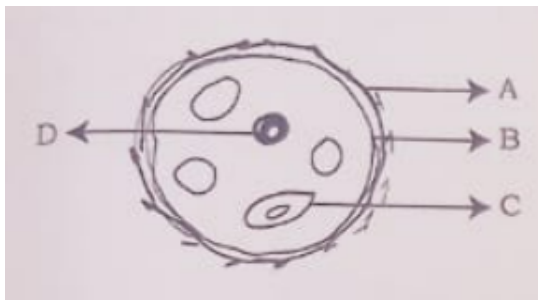
1. They are the segmented predatory or parasitic worms, which comprise the subclass Hirudinea and comes under the phylum Annelida.
2. They exhibit a parasitic mode of life, that is, by sucking the blood of vertebrates.
3. The organisms, which possess an internal backbone covered by bone are called vertebrates.

**18.** What are the structures involved in the protection of the brain?

**Answer:** The human brain is well protected within a bony box called cranium/skull. The brain is covered by cranial meninges, which is 3 layered. The space between these membranes is filled with cerebrospinal fluid. This fluid helps in absorbing shocks and maintains the constant pressure inside the cranium.



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



**Answer:**

A Exine

B Intine

C Generative Cell

D Vegetative Nucleus

20. Define genetic engineering.

**Answer:** Genetic engineering, also called genetic modification, is the direct manipulation of an organism's genome using biotechnology. It is a set of technologies used to change the genetic makeup of cells, including the transfer of genes within and across species boundaries to produce improved or novel organisms.

21. What is sprite?

**Answer:** The characters on the background of a Scratch window are known as Sprite. Usually a cat appears as a sprite when the Scratch window is opened. The software provides facilities to make alterations in sprite.

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

Answer:

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

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

By Einstein's equation,

Energy released,  $E = mc^2$

So,

$$E = 2 \times (3 \times 10^8)^2$$

$$= 1.8 \times 10^{17} \text{ J}$$

### Part - III

**Note:** Answer **any seven** questions. Question No. **32** is **compulsory**.

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

Answer:

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.

$$\Rightarrow p_1(\text{initial momentum}) = mu$$

$$p_2(\text{final momentum}) = mv$$

Therefore, (rate of change of momentum),

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

According to Newton's II<sup>nd</sup> law,  $F \propto \Delta p$

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

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

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

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

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

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

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

Force = mass  $\times$  acceleration

**24.** Differentiate the eye defects: Myopia and Hypermetropia.

**Answer:**

Myopia	Hypermetropia
Myopia is also called	Hypermetropia is also called

nearsightedness.	long-sightedness.
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.
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.
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.
A Concave Lens of adequate power is used to correct myopia.	A Convex Lens of appropriate power is used to correct hypermetropia.

**25. (a)** What do you understand by the term Ultrasonic Vibration?

**(b)** What is meant by reflection of sound?

**Answer:**

(a) 1. The vibrations whose frequencies are greater than 20,000 Hz are called ultrasonic vibrations.

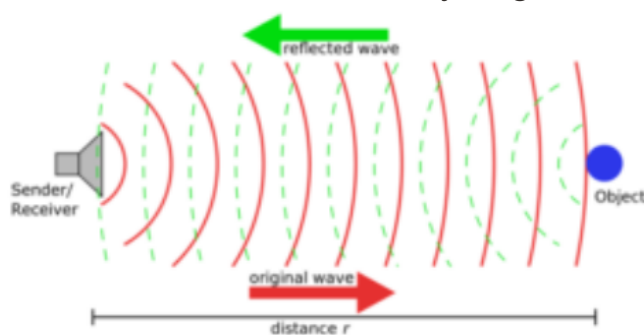
2. Uses of ultrasonic vibrations:

- Ultrasonic vibrations are used in SONAR to measure the depth of sea (or ocean) and to locate under water objects like submarines, sea-rocks and shipwrecks.
- It is used for scanning and imaging the position and growth of a foetus and presence of stones in the gall bladder and kidney.
- It is used for homogenising milk in milk plants where fresh milk is agitated with desired quantity of fat and powdered milk to obtain toned milk.

3. Bats can hear ultrasonic sounds having frequencies upto 1,20,000 Hz. Some animals like dogs and dolphins can hear sounds having frequencies upto 40,000 Hz.

## (b) Reflection of Sound

In simple terms, the reflection of sound is actually similar to the reflection of light. Sound abides different laws of reflection, in which the angle of incidence does prove equal to the angle of reflection. In addition, sound rebounds from the surface of either solid or liquid similar to a billiard ball. For successfully experiencing the reflection of sound, it is important that the surface should be polished or rough, and that too of a considerably large size.



The two laws concerned with sound reflection are as follows:

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

**26.** (a) What is amalgam? Give an example.

(b) Mention any two uses of copper.

**Answer:**

(a) An amalgam is an alloy of mercury with another metal. These alloys are formed through metallic bonding with the electrostatic force of attraction between the electrons and the positively charged metal ions.

Silver tin amalgam is used for dental filling.

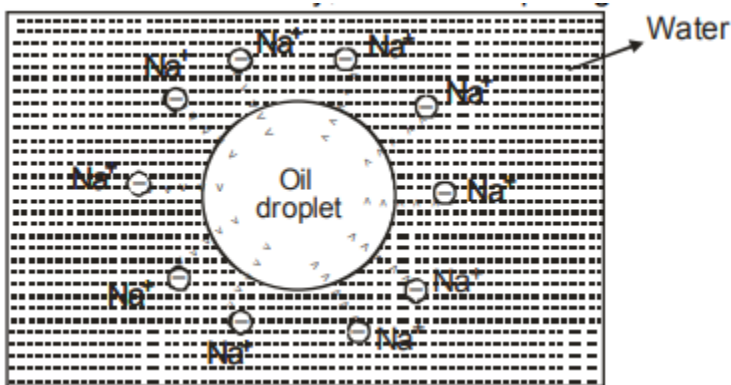
(b)i. It is extensively used in manufacturing electric cables and other electric appliances.

ii. It is used for making utensils, containers, calorimeters and coins

**27.** Explain the mechanism of cleansing action of soap.

**Answer:**

**Cleansing action of soap:** 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 –  $\text{COO}^- \text{Na}^+$  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.

28.

- Name the three basic tissue systems in a flowering plant.
- What are the factors affecting photosynthesis?

**Answer :**

(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:

1. Carbon dioxide: Increase in CO<sub>2</sub> concentration in air leads to an increase in the rate of photosynthesis.
2. Water: Less water in the soil reduces the rate of photosynthesis.
3. Sunlight: If the intensity of the sunlight increases, rate of photosynthesis also increases.
4. Chlorophyll: Presence of green colored chlorophyll pigment in the chloroplast.

**29.** Enumerate the functions of blood.

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

1. Transportation of oxygen from the lungs to the tissues.
2. Transportation of digested food from the small intestine to the tissues and cells around the body.
3. Carries cells and antibodies that fight infection.
4. Supplying the waste products to the kidneys and liver, which filter and clean the blood.
5. Its flow can regulate body temperature.

**30.** How do rainwater harvesting structures recharge groundwater?

**Answer:**

The rainwater is first collected from the rooftops or open spaces and is directed into the percolation pits through pipes for filtration. After filtration, the rainwater enters the recharge pits or ground wells.

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

(b) What are allosomes ?

**Answer:** (a) the genotype and phenotype sound similar but have differences. The phenotype is determined by an individual's genotype and expressed genes or by visible traits, for instance, hair colour or type, eye colour, body shape, and height. It depends on the genotype but is also influenced by environmental factors.

The human genetic code could be found by their genotype. It determines the traits which will be expressed. Organisms that look the same do not have the same genotype. Biological tests can determine genotype.

(b) Allosomes are a pair of chromosomes that play a role in determining a person's gender. The 23rd pair of chromosomes in humans are called allosomes. Allosomes in human females are XX. The allosomes in the human males are XY.

**32.** (a) Calculate the pH of 0.01 M solution of  $\text{HNO}_3$ .

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

**Answer:**

(a)  $\text{H}^+$  ion concentration in aqueous solution of  $\text{HNO}_3$  is  $0.01\text{M} = 10^{-2}\text{M}$

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

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

(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-

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

#### Part - IV

**Note:** Answer **all** the questions. Draw diagrams whenever necessary.

**[3 x 7 = 21]**

**33.**

(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 ?

**Answer:** (i) Joule's law of heating states that, when a current passes through a conductor of resistance for time then the heat developed in the conductor is equal to the product of the square of the current, the resistance and time.

Mathematically, it can be written as:

$$H = I^2 R t$$

(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) If heavy current flows through the wire, the fuse that has a low melting point melts and breaks the circuit and hence electrical appliances are safe. When a large current passes through the circuit, the fuse wire melts due to Joule's heating effect and hence the circuit gets disconnected. Therefore, the circuit and the electric appliances are saved from any damage.

**Or**

(b) (i) What is longitudinal wave?

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

**Answer:** (i) Longitudinal waves are waves where the displacement of the medium is in the same direction as the direction of the travelling wave. A sound wave is an example of a longitudinal wave and is produced by the vibrating motion of the particles that travel through a conductive medium. An example of sound waves in a longitudinal direction is the tuning fork.

**Characteristics of Longitudinal Waves**

**Compression:** In a longitudinal wave, compression is a region in which the particles of the wave are closest to each other.

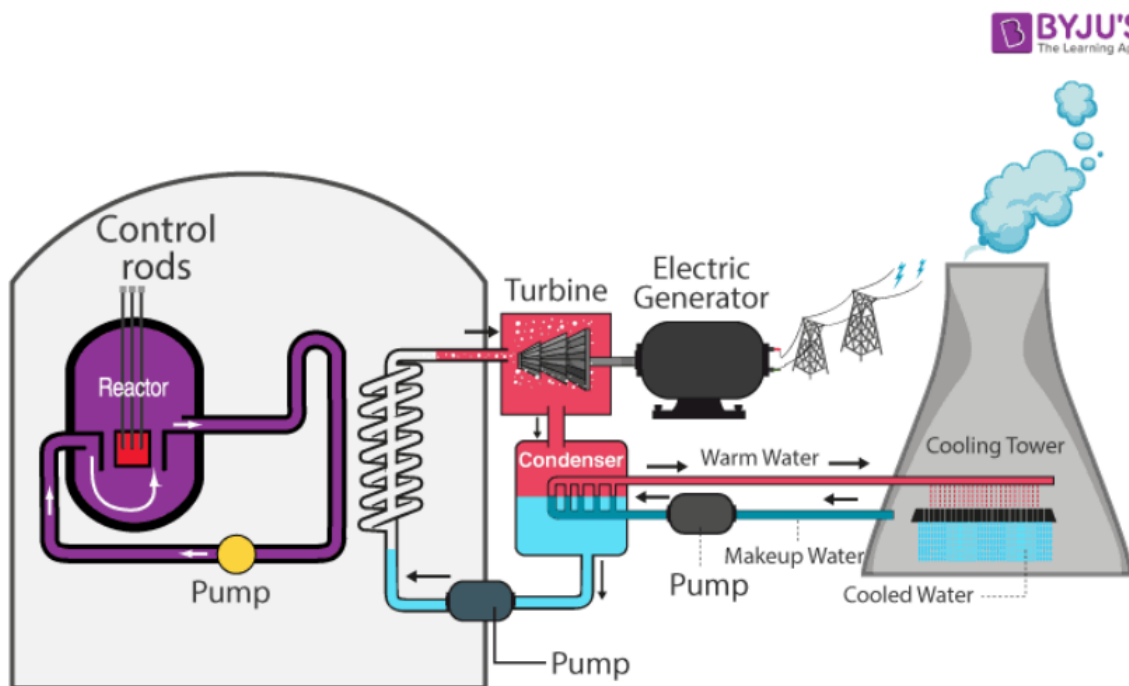
**Rarefaction:** Rarefaction in a longitudinal wave takes place when the particles are farthest apart from each other.

**Wavelength:** The distance between two consecutive points in a longitudinal wave is known as wavelength. These consecutive points can be between two compressions or between two rarefactions.

**Amplitude:** Amplitude is the maximum displacement of the particle from its rest point. In a longitudinal wave, the distance from the equilibrium position in the medium to compression or rarefaction is the amplitude.

**Period and Frequency:** The time taken by the wave to move one wavelength is known as the period. The frequency of the longitudinal wave is the number of wavelengths per second.

(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.



**Nuclear Reactor**



Components of a Nuclear Reactor: The essential components of a nuclear reactor are

- Fuel: A fissile material is used as fuel. The commonly used fuel material is uranium.
- Moderator: A moderator is used to slow down the high-energy neutrons to provide slow neutrons. Graphite and heavy water are commonly used moderators.
- Control rod: Control rods are used to control the number of neutrons in order to have a sustained chain reaction. Mostly boron or cadmium rods are used as control rods. They absorb the neutrons.
- Coolant: A coolant is used to remove the heat produced in the reactor core, to produce steam. This steam is used to run a turbine in order to produce electricity. Water, air, and helium are some of the coolants.
- Protection wall: A thick concrete lead wall is built around the nuclear reactor in order to prevent harmful radiations from escaping into the environment.

34. (a)

- (i) Define: atomicity.
- (ii) Calculate the percentage of sulphur in  $\text{H}_2\text{SO}_4$ .
- (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.

**Answer:**

(a)

(i) The number of atoms present in the molecule is called its 'atomicity'

(ii) We know that the molar mass of  $\text{H}_2\text{SO}_4 = 98 \text{ g}$

Mass of sulphur in  $\text{H}_2\text{SO}_4 = 32 \text{ g}$

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

(iii)

Hygroscopic substances	Deliquescence substances
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.
Hygroscopic substances do not change its physical state on exposure to air.	Deliquescent substances change its physical state on exposure to air.
Hygroscopic substances may be amorphous solids or liquids.	Deliquescent substances are crystalline solids.

OR

(b)

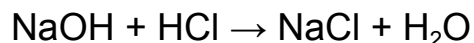
(i)

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

(ii) When the acid reacts with the base to form a salt and water. It is called 'neutralization reaction' as both acid and base neutralize each other.

Acid + Base  $\rightarrow$  Salt + Water

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)

(i) Each member of the series differs from the preceding or succeeding member by one methylene group ( $-\text{CH}_2$ ) and hence by a molecular mass of 14 amu

(ii) All members of a homologous series contain the same elements and functional group

(iii) Chemical properties of the members of a homologous series are similar.

**35. (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.

**Answer:** (a) (i) Auxin

(ii) Thyroxin is the main hormone secreted into the bloodstream by the thyroid gland. It plays vital roles in digestion, heart and muscle function, brain development, physical development and maintenance of bones. Your personality is dependent on this hormone. Your physical appearance/

physique play an important role to build your personality which is controlled by the thyroxin. That's why it is known as the "Personality Hormone."

### (iii) **Lamarck's Theory**

Lamarck's theory includes four main propositions:

#### **Change Through Use And Disuse:**

The organs which are used frequently by the organism develop and the characteristics that are used seldom are lost in the succeeding generations. For eg., a giraffe stretches its neck to eat leaves, a "nervous fluid" would flow in its neck and it enlarges. The organs which the organisms have stopped using would shrink with time.

#### **Organisms Driven To Greater Complexity:**

As the organisms adapted to their surroundings, they became increasingly complex from the simpler forms. Lamarck believed in the spontaneous generation of life.

#### **Inheritance of Acquired Characters:**

An individual acquires certain characteristics during its lifetime. These characters are inherited by their offspring as well. He explained this with an example of a blacksmith. A blacksmith has strong arms due to the nature of their work. He proposed that any children a blacksmith conceives will inherit the development of strong muscles.

#### **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 produces new structures and changes the habits of the organisms.

### **Examples of Lamarckism:**

#### **(i) Evolution of giraffe:**

The ancestors of the giraffe looked like horses with small necks and forelimbs. They lived in areas where there was no surface vegetation. Therefore, they had to stretch their neck and forelimbs to eat leaves from tall plants. Consequently, these parts got elongated. This trait was transmitted in the successive 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 called restriction endonucleases, recognize a specific sequence of nucleotides in double stranded DNA and cut the DNA at a specific location.

(ii) Shakti, Protina are maize hybrids rich in amino acid lysine.

(iii) Tobacco is smoked in the form of beedi, cigarette or cigar. Some people use tobacco as snuff whereas others chew it. Tobacco contains nicotine which causes harmful effects on human beings.

- I. Smoking of tobacco increases the risk of lung cancer.
- II. Tobacco chewing leads to oral cancer.
- III. Nicotine present in the tobacco causes constriction of blood vessels. This increases the blood pressure and also increases the risk of heart attacks.
- IV. Use of tobacco leads to accumulation of tar in the nose, throat and lungs which causes cough and irritation.
- V. The fumes given out by burning of tobacco contains poisonous gases like carbon monoxide which damages the health of smoker as well as non-smokers present nearby.

