Grade 10 Science Tamil Nadu 2021

Time: 1.5 Hours **Total Score: 40**

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.

Note: This question paper contains four parts.

Part-I

12*1=12

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.

Q1. To project the rockets which of the following principle(s) is/are required?

(a) Newton's third law of motion

(b) Newton's law of gravitation

(c) Law of conservation of linear momentum

(d) Both (a) and (c)

Correct answer: (d)

Solution:

Newton's Third Law of Motion – Every action has an equal and opposite reaction. When a rocket pushes hot gases downward, the gases push the rocket upward.

Law of Conservation of Linear Momentum – The total momentum before and after an event remains the same.

As the rocket burns fuel and ejects gases at high speed, it moves forward in response.

Q2. SI unit of resistance is _____

(a) Mho (b) Joule (c) Ohm (d) Watt

Correct answer: (c)

Solution:

Resistance is the opposition offered by a material to the flow of electric current.

The SI unit of resistance is the Ohm (Ω)

Q3. Sound waves travel in air with a speed of about_____ at NTP.

(a) 340×10^8 m/s (b) 340 m/s

(c) 3×10^8 m/s (d) 3×10^{-8} m/s

Correct answer: (b)

Solution:

The speed of sound in air at Normal Temperature and Pressure (NTP) is approximately 340 m/s. Sound travels through air as a longitudinal wave by compressions and rarefactions.

Q4. Unit of radioactivity is _____

(a) Roentgen (b) Curie

(c) Becquerel (d) All of the above

Correct answer: (d)

Solution:

Radioactivity is measured using different units:

Curie (Ci) – Measures the activity of a radioactive substance.

1 Curie = 3.7×10^{10} disintegrations per second.

Becquerel (Bq) – The SI unit of radioactivity.

1 Becquerel = 1 disintegration per second.

Roentgen (R) – Measures ionizing radiation exposure (used mainly for X-rays and gamma rays)

Q5. Alloy used in the manufacturing of pressure cooker is _____

(a) Brass

(b) Bronze

(c) Magnalium

(d) Duralumin

Correct answer: (c)

Solution:

(c) Magnalium

Magnalium (an alloy of aluminum and magnesium) is strong, lightweight, and corrosion-resistant, making it ideal for pressure cookers.

Q6. The IUPAC name of an organic compound is 3-methyl butan-1-ol. What type of compound it is?

(a) Aldehyde

(b) Carboxylic Acid

(c) Ketone

(d) Alcohol

Correct answer: (d)

Solution:

(d) Alcohol

The suffix **"-ol"** indicates it is an **alcohol**.

Q7. The concept of blood group is derived by _____

(a) Wiener

(b) Karl Landsteiner

(c) William Harvey

(d) His

Correct answer: (b)

Solution:

Karl Landsteiner discovered the ABO blood group system.

Q8. Syngamy results in the formation of _____

(a) Zoospores

(b) Conidia

(c) Zygote

(d) Chlamydospores

Correct answer: (c)

Solution:

Syngamy refers to the fusion of male and female gametes, forming a **zygote**.

Q9. The large, elongated cells that provide nutrition to developing sperms are _____

(a) Primary germ cells

(b) Sertoli cells

(c) Leydig ceIls

(d) Spermatogonia

Correct answer: (b)

Solution:

Sertoli cells support and nourish developing sperm cells in the testes.

Q10. Life originates from pre-existing life was showed by:

(a) Louis Pasteur

(b) Oparin

(c) Haldane

(d) Lamarck

Correct answer: (a)

Solution:

Louis Pasteur disproved spontaneous generation and proved biogenesis.

Q11. Pusa Komal is a disease resistant variety of _____

(a) Sugar cane

(b) Rice

(c) Cow pea

(d) Maize

Correct answer: (c)

Solution:

(c) Cowpea

It is resistant to bacterial blight.

Q12. _____ is a rice variety produced by mutation breeding that grows well in saline soil.

(a) Sharbati Sonora

(b) Atomita 2

(c) Pusa Gaurav

(d) Himgiri

Correct answer: (b)

Solution:

Atomita 2 variety was developed through mutation breeding to tolerate saline conditions.

Part-II

Note: Answer seven questions. Question No. 22 is compulsory. 7*2=14

Q13. When a sound wave travels through air, the air particles:

(a) vibrate along the direction of the wave motion.

(b) vibrate but not in any fixed direction.

(c) vibrate perpendicular to the direction of the wave motion.

(d) do not vibrate.

Solution:

Sound waves are longitudinal waves, meaning air particles vibrate back and forth in the same direction as the wave travels. This creates alternating regions of compression and rarefaction, allowing sound to propagate.

Q14. (a) What is the audible range of frequency?

(b) What is the minimum distance needed for an Echo?

Solution:

(a) The **audible range of frequency** for humans is **20 Hz to 20,000 Hz (20 kHz)**.

(b) The **minimum distance** needed for an **echo** to be heard is **17.2 meters** (for sound traveling at 344 m/s in air at room temperature).

Q15. Write any 2 uses of ethanol.

Solution:

Used as an **antiseptic** in hand sanitizers and disinfectants.

Used as a **fuel** (bioethanol) or in alcoholic beverages.

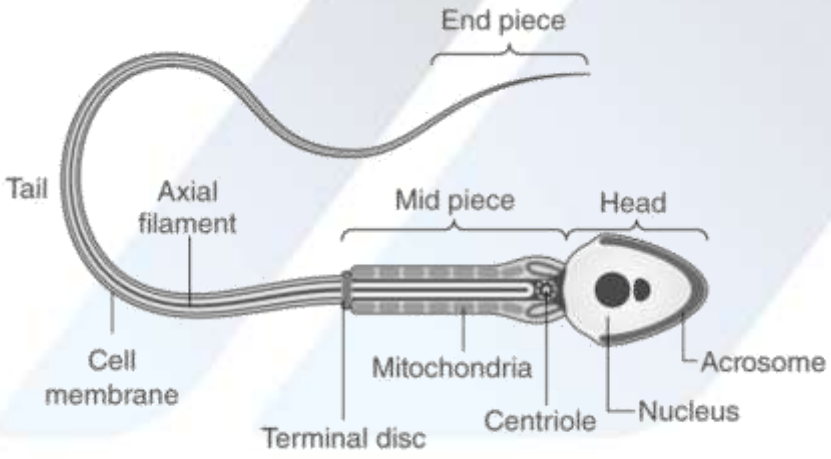
Q16. What is respiratory quotient?

Solution:

It is the ratio of **carbon dioxide (CO_2) produced** to **oxygen (O_2) consumed** during respiration.

Q17. Draw and label parts of sperm.

Solution:



Q18. What is evolution called?

Solution:

Evolution is the **gradual change in species over generations** due to genetic variations, natural selection, and environmental factors.

Q19. Distinguish between somatic gene therapy and germ line gene therapy.

Solution:

Feature	Somatic Gene Therapy	Germ Line Gene Therapy
Affects	Body(somatic) cells	Reproductive (germ) cells
Inheritance	Not passed to offspring	Passed to offspring
Example	Treating sickle cell anemia	Preventing genetic disorders in future generations

Q20. How is cancer cells different from normal cell?

Solution:

Cancer cells differ from normal cells in several ways. Normal cells grow, divide, and die in a regulated manner, following signals that control their lifecycle. They undergo programmed cell death (apoptosis) when damaged or aged. In contrast, cancer cells grow uncontrollably, ignoring signals that regulate cell division and apoptosis. They continue to divide even when not needed, forming tumors. Unlike normal cells, cancer cells can invade nearby tissues and spread to other parts of the body (metastasis). Additionally, they exhibit genetic mutations, altered metabolism, and the ability to evade the immune system, making them more aggressive and difficult to control.

Q21. How are e-waste generated?

Solution:

E-waste is generated when **electronic devices** like computers, mobile phones, and televisions become obsolete or discarded. It includes **damaged circuits, batteries, and toxic metals**.

Q22. State Avagadro's law.

Solution:

"Equal volumes of all gases, at the same temperature and pressure, contain an equal number of molecules."

$V \propto n$

where **V** = volume and **n** = number of moles.

Part-III

Note: Answer any seven questions. Question No.32 is compulsory. 7*4=28

Q23. (a) Write the symbol for the following component.

(i) Ground connection

(ii) Resistor

(iii) Light emitting diode

(iv) A diode

(b) A charge of 12 Coulomb flows through a bulb in 5 seconds. What is the current through the bulb?

Solution:

(a) (i) Ground connection - ⏚ or GND

(ii) Resistor - Ω or R

(iii) Light emitting diode - LED

(iv) A diode - D or Δ

(b) $I = \frac{Q}{t}$

where,

Q = 12 C (charge)

t = 5 s (time)

$I = \frac{12}{5} = 2.4\ A$

The current through the bulb is **2.4 A**.

Q24. (a) Define Atomicity.

(b) Calculate the molecular mass of CO_2.

Solution:

(a) Atomicity is the total number of atoms present in a molecule of an element or compound.

For example:

O_2 (Oxygen gas) → Atomicity = 2 (Diatomic)

P_4 (Phosphorus) → Atomicity = 4 (Tetraatomic)

(b) The molecular mass of CO_2 is calculated by adding the atomic masses of its elements:

Carbon (C) = 12 u

Oxygen (O) = 16 u (since there are 2 oxygen atoms, multiply by 2)

Molecular mass of CO_2= (12)+(16×2) =12+32=44u

The molecular mass of CO_2 is 44 u.

Q25. (a) How is rust formed? Give the equation for formation of rust.

(b) State 2 methods of preventing corrosion.

Solution:

Rusting is a slow chemical process in which iron reacts with oxygen and water to form hydrated iron oxide (rust). This weakens the metal and causes damage.

$4Fe+3O_2+6H_2O \rightarrow 4Fe(OH)_3$

$4Fe(OH)_3 \rightarrow 2Fe_2O_3 \cdot xH_2O$

(b) Painting or Coating: Applying paint, oil, or grease prevents direct contact of iron with air and moisture.

Galvanization: Coating iron with a thin layer of zinc to protect it from rusting.

Q26. (a) What is photosynthesis and where does it occur in a cell?

(b) Differentiate Aerobic and Anaerobic respiration.

Solution:

(a) Photosynthesis is the process by which green plants, algae, and some bacteria use sunlight to synthesize food (glucose) from carbon dioxide (CO_2) and water (H_2O), releasing oxygen (O_2) as a byproduct.

$$6CO_2+6H_2O \xrightarrow[Sunlight]{Chlorophyll} C_6H_{12}O_6+6O_2$$

Photosynthesis occurs in the chloroplasts of plant cells, which contain chlorophyll, the green pigment that captures sunlight.

(b) Aerobic vs Anaerobic respiration.

Feature	Aerobic respiration	Anaerobic respiration
Oxygen Requirement	Requires oxygen	Does not require oxygen
Location in Cell	Occurs in mitochondria	Occurs in cytoplasm
End Products	CO_2 and H_2O	Lactic acid (in animals) or ethanol and CO_2 (in yeast)
Energy Production	Produces more energy (38 ATP)	Produces less energy (2 ATP)
Example	Humans, plants and most animals	Some bacteria, yeast, muscle cells (during exercise)

Q27. Name the gaseous plant hormone. Mention any three of its physiological effects in plants.

Solution:

The only gaseous plant hormone is Ethylene (C_2H_4).

Physiological Effects of Ethylene in Plants:

- Fruit Ripening: Ethylene accelerates the ripening of fruits like bananas, mangoes, and tomatoes.
- Leaf Abscission: It promotes the shedding of leaves, flowers, and fruits.
- Breaking Seed Dormancy: Ethylene helps seeds germinate by breaking their dormancy.

Q28. (a) What is pollination?

(b) State the importance of pollination.

Solution:

(a) Pollination is the transfer of pollen grains from the anther (male part) of a flower to the stigma (female part) of the same or another flower. It is an essential step in the process of sexual reproduction in plants.

(b) Importance of pollination

- Essential for Fertilization: Pollination enables the fusion of male and female gametes, leading to seed formation.
- Promotes Genetic Variation: Cross-pollination introduces genetic diversity, making plants more adaptable to environmental changes.
- Enhances Crop Yield: It helps in the production of fruits and seeds, increasing agricultural productivity.

Q29. Explain the structure of chromosomes.

Solution:

Structure of a Chromosome:

A chromosome is a thread-like structure made up of DNA and proteins that carries genetic information. It is found inside the nucleus of a cell and is visible during cell division.

Parts of a Chromosome:

- Chromatid: A chromosome consists of two identical sister chromatids joined at a central point.
- Centromere: The region where the two chromatids are attached. It helps in the movement of chromosomes during cell division.
- Telomere: The end regions of a chromosome that protect the DNA from damage and prevent fusion with other chromosomes.
- Chromatin: The loose, thread-like form of DNA present in the nucleus when the cell is not dividing. During cell division, chromatin condenses to form chromosomes.

- Genes: Segments of DNA located on chromosomes that carry genetic instructions for traits and functions.

Q30. Discuss the importance of biotechnology in the field of medicine.

Solution:

Biotechnology plays a crucial role in medical advancements, helping in disease diagnosis, treatment, and prevention.

Some of its key contributions are:

1. Production of Medicines and Vaccines: Biotechnology enables the production of genetically engineered drugs like insulin, human growth hormone, and clotting factors for hemophilia.

2. Gene Therapy: Used to correct defective genes responsible for genetic disorders like cystic fibrosis and sickle cell anemia.

3. Diagnosis of Diseases: PCR (Polymerase Chain Reaction): Helps detect genetic disorders, infections, and cancer early.

4. Stem Cell Therapy: Biotechnology enables the use of stem cells to regenerate damaged tissues, offering hope for spinal cord injuries, Parkinson's disease, and diabetes.

5. Production of Artificial Organs: Tissue engineering and 3D bioprinting help create artificial skin, liver, and heart valves for transplantation.

6. Cancer Treatment: Biopharmaceuticals like monoclonal antibodies (e.g., Herceptin for breast cancer) help target and destroy cancer cells more precisely.

Q31. How do rainwater harvesting structures recharge ground water?

Solution:

Rainwater harvesting structures help in recharging groundwater by collecting and directing rainwater into the ground. The process involves the following steps:

1. Collection of Rainwater

Rainwater is collected from rooftops, open spaces, and catchment areas.

It is directed through pipes, drains, or channels to reach recharge structures.

2. Filtration of Water

The collected water passes through gravel, sand, and charcoal filters to remove impurities before infiltration.

3. Infiltration into the Ground

Water is guided into recharge pits, borewells, or percolation tanks to seep into deeper soil layers.

It refills underground aquifers, increasing groundwater levels.

4. Prevention of Surface Runoff

Harvesting structures slow down rainwater flow, reducing soil erosion and water wastage.

Q32. ${}_{92}U^{238}$ experiences α-decay. Find the number of neutrons in the daughter element.

Solution:

When uranium-238 ($92U^{238}$) undergoes α-decay, it emits an alpha particle (${}^{4}_{2}He$), which means:

Mass number decreases by 4

Atomic number decreases by 2

Step 1:

${}_{92}{}^{238}U \rightarrow {}_{90}{}^{234}Th + {}_{2}{}^{4}He$

The daughter element is thorium-234 ($_{90}Th^{234}$).

Step 2:

Number of neutrons=Mass number−Atomic number

=234−90= 234 - 90=234−90 =144= 144=144

Part-IV

Note: Answer all questions. Draw diagrams wherever necessary. 3*7=21

Q33. (a) State Newton's laws of motion.

(b) (i) Differentiate the eye defects: Myopia and Hypermetropia.

(ii) Write any 2 applications of concave lens.

Solution:

(a) Newton's Laws of Motion:

(1) First Law (Law of Inertia):

- A body remains in its state of rest or uniform motion in a straight line unless acted upon by an external force.
- Example: A stationary object remains at rest unless pushed or pulled.

(2) Second Law (Law of Acceleration):

- The force acting on a body is directly proportional to the rate of change of momentum, i.e., F=maF = maF=ma
- Example: A heavier object requires more force to accelerate than a lighter one.

(3) Third Law (Action-Reaction Law):

- For every action, there is an equal and opposite reaction.
- Example: When a rocket expels gases downward, it moves upward.

OR

(b) (i) Myopia vs Hypermetropia

Myopia (Nearsightedness)	**Hypermetropia (Farsightedness)**
Eyeballs are too long, or lens is too curved.	Eyeballs are too short, or lens is too flat.
Can see near objects clearly but distant objects appear blurry.	Can see distant objects clearly but near objects appear blurry.
Image forms before the retina.	Image forms behind the retina.
Use of a concave lens (diverging lens).	Use of a convex lens (converging lens).

(ii) Applications of Concave Lens:

1. Used in Correcting Myopia:
   - Concave lenses help people with nearsightedness by diverging light rays before they reach the retina.
2. Used in Optical Instruments:

- Binoculars, telescopes, and microscopes use concave lenses to spread out light and adjust focus.

Q34. (a) (i) What happens when $MgSO_4 \cdot 7H_2O$ is heated? Write the appropriate equation.

(ii) Explain hygroscopic substances and deliquescent substances with examples.

(b) (i) What are called thermolysis reactions?

(ii) Differentiate reversible and irreversible reactions.

Solution:

When magnesium sulfate heptahydrate ($MgSO_4 \cdot 7H_2O$) is heated, it loses its water of crystallization and forms anhydrous magnesium sulfate ($MgSO_4$).

$$MgSO_4 \cdot 7H_2O \xrightarrow{heat} MgSO_4 + 7H_2O$$

The released water evaporates, and the solid left behind is a white powder (anhydrous $MgSO_4$).

(ii) Hygroscopic substances and deliquescent substances

Hygroscopic Substances	Deliquescent Substances
Substances that absorb moisture from the air but do not dissolve.	Substances that absorb moisture from the air and dissolve into a solution.
Remains solid even after absorbing water.	Turns into a liquid due to excessive moisture absorption.
Concentrated sulfuric acid (H_2SO_4), anhydrous $CaCl_2$	Sodium hydroxide (NaOH), calcium chloride ($CaCl_2$)

OR

(b) (i) **Thermolysis** refers to the decomposition of a substance **by heat**. It is a type of thermal decomposition reaction where a compound breaks down into simpler substances when heated.

$$CaCO_3 \xrightarrow[heat]{} CaO + CO_2$$

(ii) Reversible vs irreversible reactions.

Reversible Reactions	Irreversible Reactions
Reactions that can proceed in both forward and backward directions.	Reactions that proceed only in one direction.
$N_2+3H_2 \rightleftharpoons 2NH_3$ (Haber's Process)	$C+O_2 \rightarrow CO_2$ (Combustion of carbon)
Attains dynamic equilibrium.	Goes to completion.
Often involves small energy changes.	Often releases a large amount of energy.

Q35. (a) (i) Enumerate the functions of blood.

(ii) Guard cells are responsible for opening and closing of stomata. Give reason for this statement.

(b) (i) Suggest measures to overcome the problems of an alcoholic.

(ii) What are the contributing factors for obesity?

Solution:

Blood performs several essential functions in the human body, including:

- **Transport of Oxygen and Nutrients** – Blood carries oxygen from the lungs to body tissues and transports nutrients from the digestive system to cells.
- **Removal of Waste** – It carries carbon dioxide from cells to the lungs for exhalation and removes metabolic waste through the kidneys.
- **Regulation of Body Temperature** – Blood helps in maintaining a stable body temperature by distributing heat.
- **Immunity and Defense** – White blood cells (WBCs) and antibodies in the blood help fight infections.
- **Blood Clotting** – Platelets and clotting factors help prevent excessive bleeding when injuries occur.
- **Hormone Transport** – Blood carries hormones from glands to target organs, regulating body functions.

(ii) Guard cells regulate the stomatal opening and closing to control gas exchange and water loss in plants. When the guard cells absorb water (due to osmosis), they swell and become turgid, causing the stomata to open. When the guard cells lose water, they shrink and become flaccid, leading to stomatal closure.

This mechanism helps in:

- Photosynthesis – Stomata open to allow CO_2 intake for photosynthesis.
- Water Conservation – Stomata close to reduce water loss during hot or dry conditions.
- Respiration – Oxygen exits and CO_2 enters through the stomata for cellular respiration.

OR

(b) (i) Overcoming alcoholism requires medical, psychological, and social interventions. Some measures include:

- Counseling and Therapy – Psychological support and behavioral therapy help individuals reduce dependency.
- Rehabilitation Programs – Detoxification and rehab centers provide structured support.
- Medication – Doctors may prescribe medicines to reduce cravings and withdrawal symptoms.
- Family and Social Support – Encouragement from loved ones helps in recovery.
- Avoiding Triggers – Identifying and staying away from situations that encourage drinking.

(ii) Obesity results from a combination of lifestyle, genetic, and environmental factors, including:

- Unhealthy Diet – Excess consumption of high-calorie, processed foods, and sugary drinks.
- Lack of Physical Activity – Sedentary lifestyles contribute to weight gain.
- Genetics – Some individuals inherit a tendency to store fat more easily.

- Hormonal Imbalance – Conditions like hypothyroidism and PCOS can cause weight gain.
- Emotional and Psychological Factors – Stress, depression, and emotional eating lead to obesity.
- Medications – Some drugs, like steroids and antidepressants, can contribute to weight gain.