Grade 10 Science Karnataka 2014

Time: 3 hours 15 mins. **Max. Marks: 100**

General Instructions:

- The Question-cum-Answer Booklet consists of objective and subjective types of questions having 55 questions.
- This question-cum-answer booklet contains two Parts. Part – A contains the questions of Physics and Chemistry and Part – B contains Biology questions.
- The question-cum-answer booklet has 36 questions in Part – A and 19 questions in Part – B.
- Follow the instructions given against both the objective and subjective types of questions.
- Candidates have extra 15 minutes for reading the question paper.

Part-A

(Physics & Chemistry)

Four alternatives are given for each of the following questions / incomplete statements. Only one of them is correct or most appropriate. Choose the correct alternative and write the complete answer along with its alphabet in the space provided against each question. **10x1=10**

Q1. The silicon compound used in calico printing is

(A) Quartz (B) Silicon carbide

(C) Sodium silicate (D) Silica.

Correct answer: (C)

Solution:

Sodium silicate, also known as water glass, is used in calico printing as a fixing agent for dyes. It helps bind the dye to the fabric, making the colors more permanent.

Q2. The device that uses solar energy in the form of heat is

(A) solar light
(B) solar panel used in artificial satellites
(C) solar cell
(D) solar cooker.

Correct answer: (D)

Solution:

A solar cooker uses solar energy to generate heat, which is used for cooking food. It absorbs sunlight and converts it into thermal energy.

Q3. A body A is moving in a straight line with a constant speed of 10 ms – 1. Another body B having same mass as that of A is moving in a circular path with a constant speed of 10 ms – 1. The correct statement related to their acceleration is

(A) the acceleration of body A is more than the acceleration of body B

(B) the acceleration of body B is zero

(C) only B has acceleration

(D) the accelerations of both A and B are same.

Correct answer: (C)

Solution:

Body A moves in a straight line with a constant speed, so there is no change in velocity and its acceleration is zero.

Body B moves in a circular path. Even though its speed is constant, its direction keeps changing, which means it has acceleration (centripetal acceleration).

So, only B has acceleration, making option (C) the correct answer.

Q4. The different stages of preparing amorphous silicon are given below:

I. Silica is finely powdered.

II. The product is washed with hydrochloric acid.

III. The mixture of powdered silica and magnesium is heated in a fire-clay crucible.

IV. The product is washed with hydrofluoric acid to remove unchanged silica. The correct arrangement of the above stages is

(A) I, III, II and IV
(B) I, II, III and IV
(C) IV, I, II and III
(D) I, IV, III and II.

Correct answer: (A)

Solution:

To prepare amorphous silicon, the steps are:

Powder the silica (Step I) – This makes it easier to react.

Heat the powdered silica with magnesium (Step III) – This reaction helps form silicon.

Wash the product with hydrochloric acid (Step II) – This removes unwanted substances.

Wash with hydrofluoric acid (Step IV) – This removes any leftover silica

Q5. Which of the following measures do you take to conserve water?

(A) Washing utensils in a pond.

(B) Using detergents to wash clothes.

(C) Disposing idols painted with artificial colours in a pond.

(D) Using water after washing vegetables for plants.

Correct answer: (D)

Solution:

(D) Using water after washing vegetables for plants.

To conserve water, we should reuse it whenever possible because using leftover water from washing vegetables for plants prevents wastage.

Q6. In a group of hydrocarbons, the ratio between the carbon and hydrogen atoms is 1:2. These hydrocarbons belong to which class?

(A) Alkanes (B) Alkenes

(C) Alkynes (D) Aromatic hydrocarbons.

Correct answer: (B)

Solution:

Hydrocarbons in which the ratio of carbon to hydrogen atoms is 1:2 belong to the alkene group. Their general formula is C_nH_{2n}. For example, ethylene (C_2H_4) follows this pattern, where each carbon is double-bonded to another carbon.

Q7. Four metals P,Q,R and S react with water as given below:

I. P reacts with cold water

II. Q reacts with hot water

III. R reacts with steam

IV. Red hot S reacts with steam.

Then, highly reactive metal is

(A) P (B) Q (C) R (D) S

Correct answer: (A)

Solution:

(A) A highly reactive metal reacts easily with cold water (e.g., sodium, potassium).

(B) A moderately reactive metal needs hot water (e.g., magnesium).

(C) A less reactive metal reacts only with steam (e.g., iron, zinc).

(D) A least reactive metal reacts with red-hot steam (e.g., lead).

Since P reacts with cold water, it is the most reactive metal. So, the correct answer is (A) P.

Q8. In which of the following cases a listener experiences Doppler effect?

(A) The listener and the source of sound are stationary.

(B) The listener and source of sound are moving with same velocity.

(C) The listener is moving towards the source of sound.

(D) The listener is with the source of sound.

Correct answer: (C)

Solution:

When the listener moves towards the source of sound, the frequency of the sound waves increases, resulting in a higher-pitched sound. This is the classic example of the Doppler Effect.

Q9. Which of the following is the best measure to save energy?

(A) Each individual uses his own vehicle.

(B) Four colleagues residing in the same colony travel to the office together by the same car.

(C) Using vehicles to travel small distances.

(D) Keeping the vehicle engine 'on' during traffic jam.

Correct answer: (B)

Solution:

Sharing a car reduces fuel consumption and air pollution, making it an energy-saving choice.

Q10. The dopant to be added to make silicon an n-type of semiconductor is

(A) Boron (B) Antimony

(C) Indium (D) Gallium

Correct answer: (B)

Solution:

Antimony (Sb) has 5 valence electrons, so it donates extra electrons, making silicon an n-type semiconductor (negative charge carriers).

Fill in the blanks: **3x1=3**

Q11. The device used to measure the distance and direction of underwater substances using ultrasonic waves is _____.

Solution:

SONAR (Sound Navigation and Ranging) is a device used to detect underwater objects and measure sea depth. It has two main parts: a transmitter and a detector. The transmitter sends out ultrasound waves, and the detector receives the reflected waves, converting them into electrical signals.

Q12. The basic source of wind energy, hydro energy, and fossil fuel energy is _____.

Solution:

The basic source of wind energy, hydro energy, and fossil fuel energy is the **Sun**.

Q13. In a radio receiver, the device that separates AF signals from RF signals is _____.

Solution:

In a radio receiver, the device that separates AF (Audio Frequency) signals from RF (Radio Frequency) signals is called a **detector** or demodulator.

Q14. Match the components of nuclear power reactor given in Column-A with their functions given in Column-B. **4x1=4**

Column-A	Column-B
(a) Enriched Uranium	(i) causes nuclear fusion
(b) Liquid Sodium	(ii) turns turbines
(c) Cadmium Rods	(iii) nuclear fuel
(d) Concrete building with lead sheets	(iv) acts as coolant
	(v) produces steam
	(vi) absorbs neutrons
	(vii) stops radiation.

Solution:

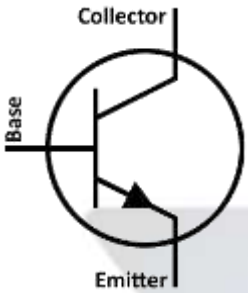
Column-A	Column-B
(a) Enriched Uranium	(iii) nuclear fuel
(b) Liquid Sodium	(iv) acts as coolant
(c) Cadmium Rods	(vi) absorbs neutrons
(d) Concrete building with lead sheets	(vii) stops radiation.

- Enriched uranium is the fuel used in nuclear reactors.
- Liquid sodium is a coolant that absorbs heat from the reactor.
- Cadmium rods control the reaction by absorbing neutrons.
- Concrete with lead sheets protects from harmful radiation.

Answer the following questions: **6x1=6**

Q15. Draw the circuit symbol of n-p-n transistor.

Solution:



Q16. Why Ethyl mercaptan is added to liquid petroleum gas?

Solution:

Ethyl mercaptan is added to liquid petroleum gas (LPG) to help detect gas leaks. Since LPG is naturally odorless, it is difficult to notice a leak. However, ethyl mercaptan has a strong, distinct smell, making it easy to detect the presence of gas.

Q17. Define solar luminosity.

Solution:

The energy emitted by the Sun in all directions per second is known as solar luminosity. It is a unit of radiant flux (the power released as photons) and is commonly used by astronomers to measure the brightness of stars.

Q18. Write an application of Radiocarbon.

Solution:

Radiocarbon is used to determine the age of fossils and archaeological specimens through carbon dating and rock dating. The ratio of C_{14} to C_{12} is measured in both fresh and dead samples to estimate their age.

Q19. Write the balanced chemical equation for the following chemical reaction:
Zinc reacts with dilute nitric acid.

Solution:

When zinc reacts with dilute nitric acid, it produces zinc nitrate and hydrogen gas. The balanced chemical equation for this reaction is:

$$Zn + 2HNO_3 \rightarrow Zn(NO_3)_2 + H_2 \uparrow$$

Q20. Define centripetal force.

Solution:

A force that acts on an object moving in a circular path, directing it toward the center of the circle is known as centripetal force.

The expression for centripetal force.

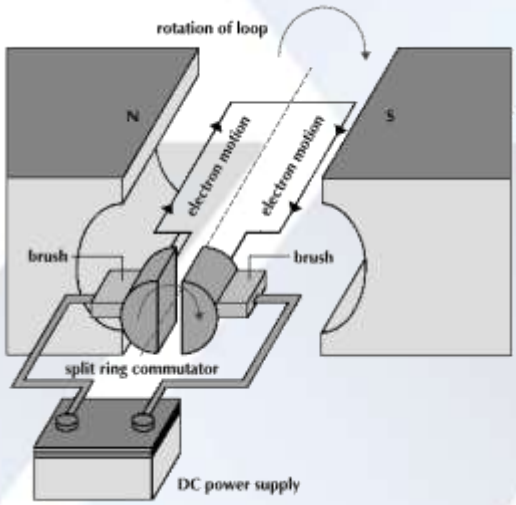
$$F = mv^2/r = mrw^2 = mwv$$

Answer the following questions: **9x2=18**

Q21. Draw the diagram of a DC motor and label the parts.

Solution:

The following diagram shows a basic DC motor.



Q22. What are geostationary satellites? Write any one use of them.

Solution:

A geostationary satellite is a satellite that orbits the Earth in 24 hours, matching the Earth's rotation period.

Uses:

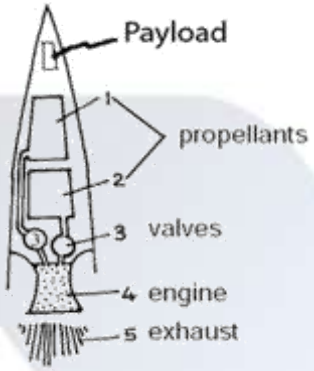
1) Weather forecasting

2) Global telecommunication

Q23. Draw the diagram of a single stage rocket and label the parts.

Solution:

The following diagram shows a single stage rocket.



Q24. List the uses of detergents.

Solution:

Uses of Detergents:

1) Used for washing clothes and utensils

2) Helps clean floors and surfaces

3) Found in shampoos and liquid soaps

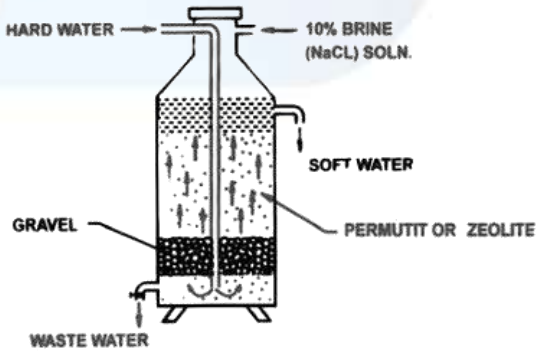
4) Used to sanitize medical tools

5) Aids in removing oil spills from water bodies

6) Cleans vehicles like cars and bikes

Q25. Draw the diagram of Permutit column used in softening hard water and label the parts.

Solution:



Q26. The wavelength of electromagnetic radiations A,B and C are given below:

Electromagnetic radiation	Wavelength
A	4×10^{-9} m
B	0.1×10^{-9} m
C	10×10^{-9} m

Which of the above electromagnetic radiations causes photoelectric effect in most number of metals? Give scientific reason for this.

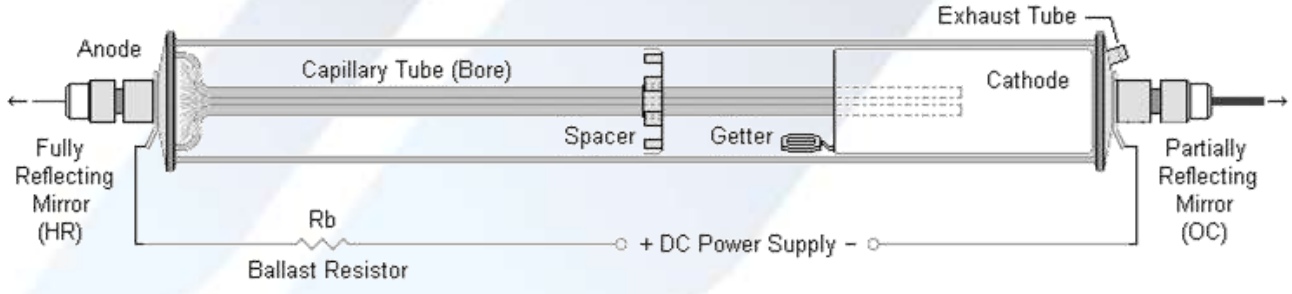
Solution:

Electromagnetic radiation B induces the photoelectric effect in the highest number of metals.

Reason: Radiation B has the shortest wavelength, meaning it has the highest frequency and energy. As a result, it can trigger the photoelectric effect in multiple metals with different threshold frequencies.

Q27. Draw the diagram of a Helium-Neon laser tube and label the parts.

Solution:



Typical HeNe Laser Tube Structure and Connections

Q28. State Faraday's laws of electromagnetic induction.

Solution:

Faraday's First Law: The changing magnetic field linked with a conductor induces an electromotive force in the conductor.

Faraday's Second Law: The induced electromotive force is proportional to the rate of change of magnetic field linked with the conductor.

Q29. A radioactive element Y emits an alpha particle and a beta particle successively and changes into an element ${}_{82}X^{206}$. Find the atomic mass and atomic number of radioactive element Y.

Solution:

Element Z emits a beta particle and transforms into element X. This means that Z's atomic number is one less than that of X.

$$ {}_{81}Z^{206} \overset{-\beta}{\rightarrow} {}_{82}\mathrm{X}^{206} + {}_{-1}e^{0} $$

When element Y emits an alpha particle, it transforms into element Z. As a result, Y's atomic number is 2 higher and its mass number is 4 greater than that of Z.

$$ {}_{83}\mathrm{Y}^{210} \overset{-\alpha}{\rightarrow} {}_{81}\mathrm{Z}^{206} + {}_{2}\mathrm{He}^{4} $$

Therefore, element Y has an atomic mass of 210 and an atomic number of 83.

Answer the following questions: **4x3=12**

Q30. Imagine a planet M having mass same as the earth and having radius 3 times that of the earth.

a) Calculate the ratio of acceleration due to gravity on the surface of the planet M to the acceleration due to gravity on the surface of the earth.

b) If the average value of acceleration due to gravity on the surface of the earth is 9.8 ms^{-2} then find the value of average acceleration due to gravity on the surface of planet Name the alkane having 4 carbon atoms and write the two distinct structural formula of the same.

Solution:

a) Acceleration due to gravity on the earth

$$ g_E = \frac{GM_E}{R_E^2} $$

Acceleration due to gravity on the planet, M

$$g_M = \frac{GM_M}{R_M^2}$$

$$g_M = \frac{GM_M}{(3R_E)^2} \because R_M = 3R_E$$

$$\frac{g_M}{g_E} = \frac{\frac{GM_E}{9R_E^2}}{\frac{GM_E}{R_E^2}} \because M_E = M_M, \ ^2$$

$$\frac{g_M}{g_E} = \frac{GM_E}{9R_E^2} \times \frac{R_E^2}{GM_E} \because M_E = M_M$$

$$\frac{g_M}{g_E} = \frac{1}{9} \therefore \frac{g_M}{g_E} = 1:9$$

Thus, the ratio of acceleration due to gravity on Planet M to Earth is 1:9.

b) $\frac{g_M}{g_E} = \frac{1}{9} \therefore g_M = 1.08 \text{ ms}^{-2}$

$$g_M = \frac{g_E}{9}$$

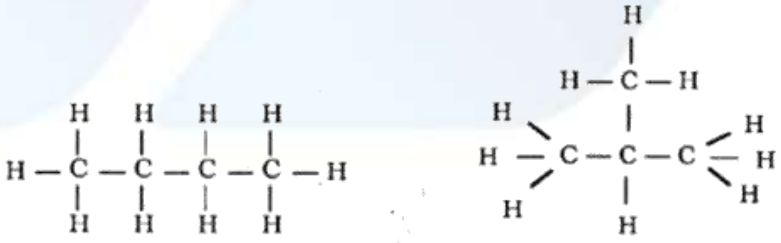
$$g_M = \frac{9.8}{9} = 1.09 \text{ ms}^{-2}$$

Q31. Name the alkane having 4 carbon atoms and write the two distinct structural formula of the same.

Solution:

The alkane with 4 carbon atoms is butane. It has two isomers: n-butane and isobutane. Their distinct structural formulas are shown below.

Molecular formula of Butane is C_4H_{10}



n-butane

Iso-butane

Q32. (a) A spectrum is obtained by emitting light from sodium vapour. Name the type of the spectrum.

(b) A monochromatic light is passed through benzene. What change can be observed in the wavelength of scattered light? Write one application of this phenomenon.

Solution:

(a) When light is emitted from sodium vapor, it produces a line emission spectrum.

(b) When monochromatic light passes through benzene, the scattered light contains wavelengths that are both shorter and longer than the original light, along with the incident wavelength. As a result, the scattered light displays multiple colors in addition to the original one. This effect is useful in analyzing molecular structures.

Q33. (a) Differentiate between thermoplastics and thermosetting plastics with an example each.

(b) Write the monomer unit of Teflon and write any one use of Teflon.

Solution:

(a) Thermoplastics vs thermosetting plastics

Thermoplastics	Thermosetting plastics
These plastics soften when heated and can be reshaped multiple times.	These plastics become rigid after heating and cannot be reshaped.
Can be melted and remolded repeatedly.	They cannot be reshaped once they harden.
Polyvinyl chloride (or) polystyrene	Bakelite (or) silicones (or) epoxy resins

(b) The monomer unit of Teflon is Tetrafluoroethene, $CF_2 = CF_2$. Teflon is used in the parts of electrical devices or coating vessels.

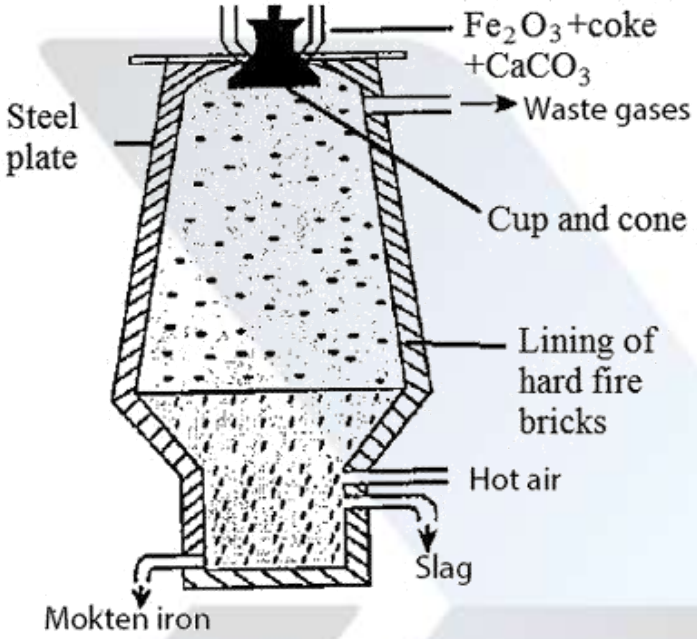
Answer the following questions: **3x4=12**

Q34. Draw the diagram of a blast furnace used in the extraction of iron and label the following parts:

(a) Molten iron

(b) Cone cup arrangement.

Solution:



Q35. (a) Explain how a protostar is formed.

(b) The mass of a red giant staged star is less than 1.4 solar mass. Name the last two stages of that star and explain them.

Solution:

(a) Formation of a Protostar: The formation of a protostar occurs in the following steps:

A massive cloud of gas contracts due to gravitational force.

This leads to an increase in density and pressure within the cloud.

Eventually, the cloud stabilizes with a central spherical core composed mainly of hydrogen, marking the birth of a protostar.

(b) Final Stages of a Star:

The last two stages in the life cycle of a star are:

White Dwarf: The star undergoes gravitational collapse, increasing its temperature.

The core generates internal pressure, causing it to shine due to its high temperature.

Black Dwarf:

Over time, the star loses internal energy and heat.

Nuclear reactions stop, and the star eventually fades out, forming a black dwarf.

Q36. Explain the following stages in the working cycle of an internal combustion engine.

(a) Intake stroke

(b) Power stroke.

Solution:

(a) Intake Stroke:

1) The piston moves downward, increasing the space inside the cylinder.

2) This creates low pressure, causing the inlet valve to open.

3) The fuel-air mixture from the carburetor enters the cylinder.

4) The outlet valve remains closed during this process.

(b) Power Stroke:

1) The compressed fuel-air mixture ignites due to a spark from the spark plug.

2) Combustion generates heat, leading to the rapid expansion of gases.

3) The products of combustion, such as carbon dioxide and water vapor, expand suddenly.

4) The piston is pushed downward with great force.

5) During this stroke, both the inlet and outlet valves remain closed.

PART-B

(Biology)

Four alternatives are given for each of the following questions / incomplete statements. Only one of them is correct or most appropriate. Choose the correct

alternative and write the complete answer along with its alphabet in the space provided against each question. **5x1=5**

Q37. In which group of plants, cotyledons appear above the soil during germination?

(A) Ragi and mustard

(B) Mustard and beans

(C) Groundnut and jowar

(D) Wheat and paddy

Correct answer: (B)

Solution:

Epigeal germination – The seed leaves (cotyledons) come above the soil (e.g., mustard and beans).

Q38. The ghee packet should have which of the following stamps?

(A) CFTRI

(B) ISI

(C) FPO

(D) AGMARK

Correct answer: (B)

Solution:

AGMARK is a quality certification mark for agricultural products in India

Q39. Which is one of the functions of adrenaline?

(A) It increases the heartbeat

(B) It decreases the heartbeat

(C) It excretes water from kidneys

(D) It regulates growth

Correct answer: (A)

Solution:

Adrenaline is a hormone released during stress or emergency situations (also called the "fight or flight" hormone). One of its main functions is to increase the heartbeat and blood flow, helping the body respond quickly to danger.

Q40. A new variety plant can be produced by which of the following techniques?

(A) Tissue culture

(B) Recombinant DNA technology

(C) DNA fingerprinting

(D) Cloning

Correct answer: (A)

Solution:

Tissue culture is a technique used to grow new plant varieties from a small group of cells in a laboratory. It allows the production of genetically identical plants quickly and in large numbers

Q41. Which of the following tissues in mammals show least capacity for regeneration?

(A) Blood

(B) Bone

(C) Nerve

(D) Cartilage

Correct answer: (C)

Solution:

Nerve tissue has the least regeneration capacity because neurons do not divide easily, unlike blood, bone, and cartilage, which can repair or regenerate to some extent.

Q42. Match the names of Endocrine glands given in Column 'A' with their functions and symptoms of disorders given in Column 'B'. Write the correct answer in the space provided: **4X1=4**

Column-A	**Column-B**
(a) Pituitary gland	(i) development of uterus, irregular menstrual cycle

(b) Thyroid gland	(ii) co-ordination of rate of respiration and heartbeat, spongy bones
(c) Parathyroid gland	(iii) excretion of water from kidneys, protruded jaws
(d) Ovary	(iv) controls the amount of glucose, rapid pulse rate
	(v) promotes growth, protruded tongue
	(vi) controls the amount of salts in the bone, soft bones
	(vii) increases the rate of metabolism, high blood glucose level

Solution:

Column-A	Column-B
(a) Pituitary gland	(v) promotes growth, protruded tongue
(b) Thyroid gland	(vii) increases the rate of metabolism, high blood glucose level
(c) Parathyroid gland	(vi) controls the amount of salts in the bone, soft bones
(d) Ovary	(i) development of uterus, irregular menstrual cycle

Answer the following in a sentence each:

Q43. A student observes the footprints of an animal and groups it under Amphibia. Justify. **4X1=4**

Solution:

The footprints of the animal observed by the student are categorized as amphibians based on the following characteristics:

i) The forelimbs of the animal possess four digits.

ii) The hind limbs of the animal contain five digits.

Q44. How do bilirubin pigments increase in human blood?

Solution:

Damaged red blood cells or those that have completed their life cycle move to the liver, where they are broken down to produce bile pigments, bilirubin and biliverdin. If liver cells are harmed due to infection or injury, bilirubin levels in the blood rise, leading to yellowing of tissues, a condition known as jaundice.

Q45. Decomposition also has a role to play during photosynthesis. Support the statement.

Solution:

Plants carry out photosynthesis to produce food by absorbing nutrients from the soil, taking in carbon dioxide from the air, and utilizing sunlight. When a plant dies, soil microbes break it down, returning nutrients to the soil and recycling carbon dioxide back into the environment. This decomposition plays a crucial role in sustaining the process of photosynthesis.

Q46. What is Bio-technology?

Solution:

Biotechnology is the use of living organisms, cells, or biological systems to develop useful products for medicine, agriculture, and industry. It includes techniques like genetic engineering, tissue culture, and microbial fermentation.

Answer the following questions in two to three sentences each: 6X2=12

Q47. Explain an experiment to detect the presence of argemone oil in edible oil.

Solution:

1) Take 5 ml of cooking oil and add an equal amount of concentrated nitric acid (HNO_3) to it.

2) Mix the solution well using a glass rod.

3) The presence of argemone oil in the edible oil is confirmed if a reddish-brown color appears at the bottom of the test tube.

Q48. While observing a micro-organism under an electron microscope, there is a confusion between two students as to whether it is a bacterium or a diatom. Help them to overcome their confusion.

Solution:

A bacterium is a prokaryotic cell, whereas a diatom is eukaryotic. Under a microscope, a bacterium shows genetic material scattered in the cytoplasm without a nuclear membrane. In contrast, a diatom has a well-defined nucleus with a nuclear membrane enclosing its genetic material.

Q49. HIV is dreadful due to the enzyme present in it. Justify.

Solution:

HIV contains an enzyme called reverse transcriptase, which converts viral RNA into DNA. This newly formed viral DNA integrates into the human DNA, making it difficult for the immune system to recognize it as foreign. As a result, antibodies are not produced against the viral DNA. Individuals in the final stage of HIV infection develop AIDS.

Q50. Differentiate between gaseous and sedimentary cycles.

Solution:

Gaseous cycle	**Sedimentary cycle**
It involves the circulation of elements through the atmosphere and living organisms.	Involves the movement of elements through the Earth's crust, rocks, soil, and living organisms
It occurs through processes like respiration, photosynthesis, and combustion.	It occurs through weathering, erosion, and sedimentation.
Examples: Carbon cycle, nitrogen cycle, oxygen cycle.	Examples: Phosphorus cycle, sulfur cycle.

Q51. Write the steps involved during effluent treatment.

Solution:

The process of wastewater treatment involves multiple steps to eliminate harmful substances. These steps include:

i) Eliminating hazardous chemicals such as dyes and pharmaceuticals.

ii) Balancing the pH by neutralizing acids and bases.

iii) Facilitating the precipitation of metallic compounds.

iv) Lowering the temperature of wastewater discharged from power plants.

(v) Wastewater treatment is carried out through three main stages: primary, secondary, and tertiary treatment.

Q52. What changes bring about transformation of meristem to sclerenchyma?

Solution:

The transformation of meristematic tissues into sclerenchymatous tissues occurs due to two major changes:

i) During secondary growth, lignin is deposited on the cell walls.

ii) The cells lose their nucleus and protoplasm.

iii) Sclerenchymatous cells lose their ability to divide.

Answer the following questions: **2X3=6**

Q53. Explain the structure of neuron.

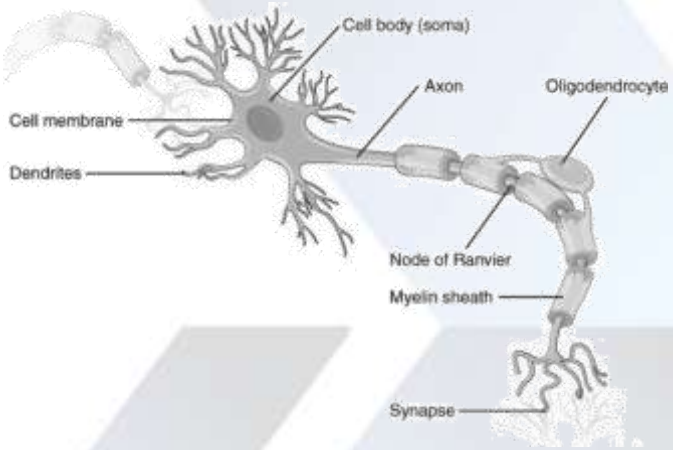
Solution:

Structure of a Neuron:

Neurons, also known as nerve cells, serve as the structural and functional units of the nervous system. A neuron consists of three primary components: the cell body, dendrites, and axon.

- Cell Body: The cell body has an irregular or polyhedral shape and contains cytoplasm along with Nissl's granules, which are responsible for protein synthesis due to their ribosome content.
- Dendrites: These are short, branched extensions that emerge from the cell body. They function by transmitting electrical impulses toward the cell body (cyton).

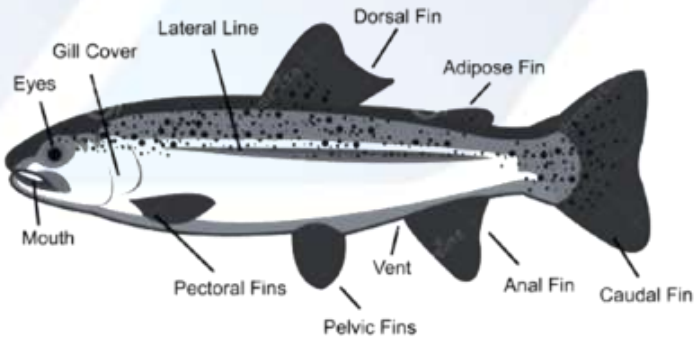
- Axon: The axon is a long fiber extending from the cell body with multiple branches at its distal end. It terminates in a synaptic knob, which contains neurotransmitters. Parts of the Axon:
  a) Axoplasm: The cytoplasm within the axon.
  b) Myelin Sheath: A protective covering formed by multiple layers of Schwann cells.
  c) Neurilemma: The outermost layer of Schwann cells.
  d) Nodes of Ranvier: Small gaps between sections of the myelin sheath.



Q54. Draw a diagram showing the external features of a fish and label any two parts.

Solution:

The picture shows the outer body of a fish with its different parts labeled.



Q55. Draw a diagram of vertical section of human brain and label the following parts.

a) Cerebrum

b) Cerebellum

Solution:

A vertical section of human brain showing cerebrum and cerebellum.