CBSE Science - Grade X
Solution for 2023-24 Examination

Question paper Code: 31/5/3

विज्ञान
SCIENCE

निर्धारित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 80

Maximum Marks : 80

	नोट		NOTE
(I)	कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं ।	(I)	Please check that this question paper contains **27** printed pages.
(II)	कृपया जाँच कर लें कि इस प्रश्न-पत्र में **39** प्रश्न हैं ।	(II)	Please check that this question paper contains **39** questions.
(III)	प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।	(III)	Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(IV)	**कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**	(IV)	**Please write down the serial number of the question in the answer-book before attempting it.**
(V)	इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।	(V)	15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i) *This question paper comprises **39** questions. **All** questions are compulsory.*

(ii) *This question paper is divided into **five** sections **A, B, C, D,** and **E**.*

(iii) ***Section A** - Questions No. **1** to **20** are multiple-choice questions. Each question carries **1** mark.*

(iv) ***Section B**-Questions No. **21** to **26** are very short answer type questions. Each question carries **2** marks. Answers to these questions should be in the range of 30 to 50 words.*

(v) ***Section C** - Questions No. **27** to **33** are short answer type questions. Each question carries **3** marks. Answers to these questions should be in the range of 50 to 80 words.*

(vi) ***Section D** - Questions No. **34** to **36** are long answer-type questions. Each question carries **5** marks. Answers to these questions should be in the range of 80 to 120 words.*

(vii) ***Section E** - Questions No. **37** to **39** are of 3 source-based/case-based units of assessment carrying **4** marks each with sub-parts.*

(viii) *There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such questions.*

SECTION A

*Select and write the most appropriate option out of the four options given for each of the questions no. **1** to **20.*** ***20×1=20***

1. *Select from the following the conditions responsible for the rapid spread of bread mould on a slice of bread:*

(i) *Formation of large number of spores*

(ii) *Presence of moisture and nutrients in bread*

(iii) *Low temperature*

(iv) *Presence of hyphae*

(A) *(i) and (ii)*
(B) *(ii) and (iv)*
(C) *(ii) and (iii)*
(D) *(iii) and (iv)*

Solution: (A) (i) and (ii).
Explanation: The factors responsible for the rapid spreading of bread mould on slices of bread are the presence of a large number of spores in the air and the presence of moisture and nutrients in bread that act as food for the fungi.

2. *The incorrect statement about placenta is:*
(A) *It is a disc embedded in the uterine wall.*
(B) *It contains villi on the embryo's side of the tissue.*
(C) *It has a very small surface area for glucose and oxygen to pass from mother to the embryo.*
(D) *The embryo gets nutrition from the mother's blood through it.*

Solution: (C) It has a very small surface area for glucose and oxygen to pass from mother to the embryo.
Explanation: Placenta has a large surface area for glucose and oxygen to pass from mother to the embryo.

3. *An aqueous solution 'A' turns phenolphthalein solution pink. When another aqueous solution 'B' is added to the pink solution, the pink colour disappears. Now when a few drops of solution 'A' are added to this reaction, the mixture appears pink again. The respective changes in the nature of the solution are from:*
(A) *acidic → basic → basic*
(B) *basic → acidic → acidic*
(C) *acidic → basic → acidic*
(D) *basic → acidic → basic*

Solution: (D) basic → acidic → basic.
Explanation: Phenolphthalein shows pink color in basic solution and is colorless in acidic solutions.

4. *The correct sequence of events when someone's hand touches a hot object unconsciously:*

(A) Receptors in skin → Motor neuron → Relay neuron → Sensory neuron → Effector muscle in arm

(B) Receptors in skin → Relay neuron → Sensory neuron → Motor neuron → Effector muscle in arm

(C) Receptors in skin → Sensory neuron → Relay neuron → Motor neuron → Effector muscle in arm

(D) Receptors in skin → Sensory neuron → Effector muscle in arm → Motor neuron → Relay neuron

Solution: The correct sequence of events when someone's hand touches a hot object unconsciously is:

(C) Receptors in skin → Sensory neuron → Relay neuron → Motor neuron → Effector muscle in arm

Explanation: This sequence accurately represents the process of detecting the heat stimulus through receptors in the skin, transmitting the sensory information via sensory neurons to relay neurons in the spinal cord or brain, then relaying the signal to motor neurons, which ultimately cause the muscle in the arm to contract, pulling the hand away from the hot object.

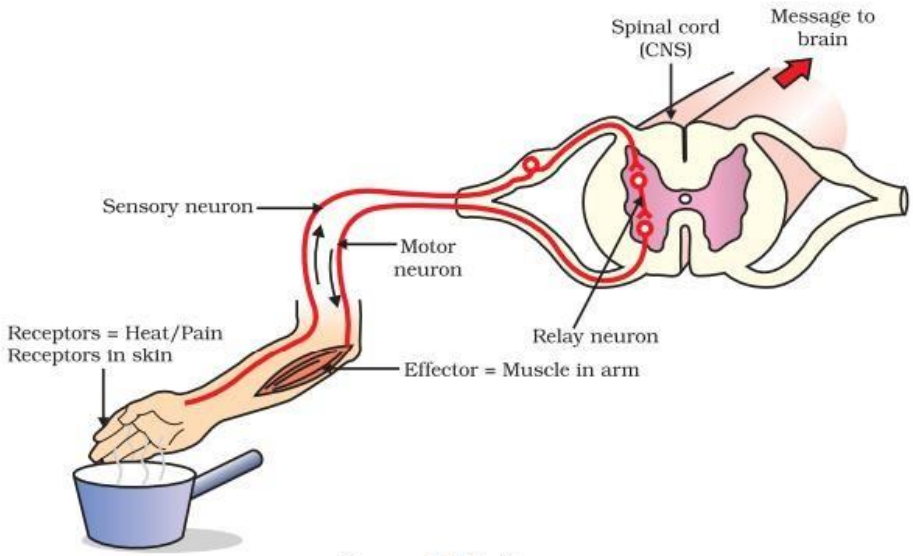


Figure 7.2 *Reflex arc*

5. *To balance the following chemical equation, the values of the coefficients x, y and z must be respectively:*

$$x\ Zn(NO_3)_2 \rightarrow y\ ZnO + z\ NO_2 + O_2$$

(A) 4, 2, 2
(B) 4, 4, 2
(C) 2, 2, 4
(D) 2, 4, 2

Solution: (C) 2, 2, 4

Explanation: Chemical equations are balanced when the number of atoms on the reactant and product sides is equal. This is in accordance with the law of conservation of mass.

6. *Which of the following is a redox reaction, but not a combination reaction?*

(A) $C + O_2 \rightarrow CO_2$
(B) $2H_2 + O_2 \rightarrow 2H_2O$
(C) $2Mg + O_2 \rightarrow 2MgO$
(D) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Solution: (D) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
Explanation:
In the above reaction, the oxidation number of Fe decreases from +3 to zero, which shows that Fe_2O_3 is reduced to Fe and the oxidation number of C increases from +2 to +4, which shows that CO is oxidized to CO_2. Hence, it is a redox reaction. Also, this is not a combination reaction.

7. *An aqueous solution of sodium chloride is prepared in distilled water. The pH of this solution is:*
(A) 6
(B) 8
(C) 7
(D) 3

Solution: (C) 7
Explanation:
Sodium Chloride solution is neutral in nature. So, the pH of its solution in distilled water is 7.

8. *A metal 'X' is used in thermite process. When 'X' is heated with oxygen, it gives an oxide 'Y', which is amphoteric in nature. 'X' and 'Y' respectively are:*

(A) Mn, MnO_2
(B) Al, Al_2O_3
(C) Fe, Fe_2O_3
(D) Mg, MgO

Solution: (B) Al, Al_2O_3
Explanation:
The metal A is Aluminium. When aluminum reacts with Oxygen, it forms an Aluminum oxide Al_2O_3 which is an amphoteric oxide.

9. *The process in which transport of soluble products of photosynthesis takes place in plants is known as:*
(A) Transpiration
(B) Evaporation
(C) Conduction
(D) Translocation
Solution: (D) Translocation
Explanation:
The transport of soluble products of photosynthesis is called translocation, which occurs in the part of vascular tissue called Phloem.

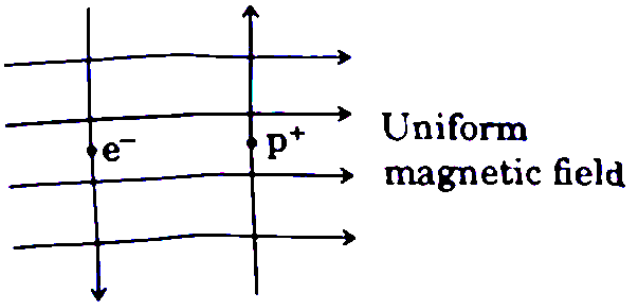
10. *Sense organ in which olfactory receptors are present is:*
(A) Nose
(B) Skin
(C) Tongue
(D) Inner ear
Solution: (A) Nose
Explanation:
The olfactory receptors which detect smell are located in the nose.

11. *Which one of the following is not a natural ecosystem?*

(A) *Pond Ecosystem*
(B) *Grassland Ecosystem*
(C) *Forest Ecosystem*
(D) *Cropland Ecosystem*

Solution: (D) Cropland Ecosystem
Explanation: The Cropland ecosystem is an artificial ecosystem. An ecosystem forms the basic building block of an environment which consists of both biotic and abiotic components and their continuous interactions with each other

12. *A uniform magnetic field exists in the plane of paper as shown in the diagram. In this field, an electron (e-) and a positron (p+) enter as shown. The electron and positron experience forces:*



(A) *both pointing into the plane of the paper.*
(B) *both pointing out of the plane of the paper.*
(C) *pointing, into the plane of the paper and out of the plane of the paper respectively.*
(D) *pointing out of the plane of the paper and into the plane of the paper respectively.*

Solution: a) Both pointing into the plane of the paper

Explanation: A uniform magnetic field exists in the plane of the paper, pointing from left to right, as shown in the figure. In the field, an electron and a proton move perpendicular to the field, as shown. We know that the direction of motion of an electron is opposite to the direction of current flow (which is the direction of motion of protons). Here, both the proton and the electron are moving in opposite directions to each other. Therefore, the current for both the electron and proton will be in the direction of motion of the proton. So, by Fleming's left-hand rule, the forces for both of them will point into the plane of the paper.

13. *How will the image formed by a convex lens be affected, if the upper half of the lens is wrapped with Black paper?*

(A) the size of the image formed will be one-half of the size of the image due to complete lens.
(B) the image of upper half of the object will not be formed.
(C) the brightness of the image will reduce.
(D) the lower half of the inverted image will not be formed.

Solution: (C) the brightness of the image will reduce.
Explanation-When the upper half of a convex lens is wrapped with black paper, it effectively blocks the light rays from passing through that portion of the lens. As a result, only the lower half of the lens contributes to the formation of the image. However, the image formed will still have the same size and orientation as it would without the paper blocking the upper half of the lens. The reduction in brightness occurs because less light is entering the lens to form the image.

14. *The phenomena of light involved in the formation of Rainbow are*

(A) Refraction, Reflection and Dispersion
(B) Refraction, Dispersion and Internal Reflection
(C) Reflection, Dispersion and Internal Reflection
(D) Refraction, Dispersion, Scattering and Total internal reflection

Solution: (B) Refraction, dispersion and internal reflection
Explanation: The formation of the rainbow involves all three phenomena: refraction, dispersion, and internal reflection.
The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the raindrop.

15. *The colour of Light for which the refractive index of glass is minimum is:*

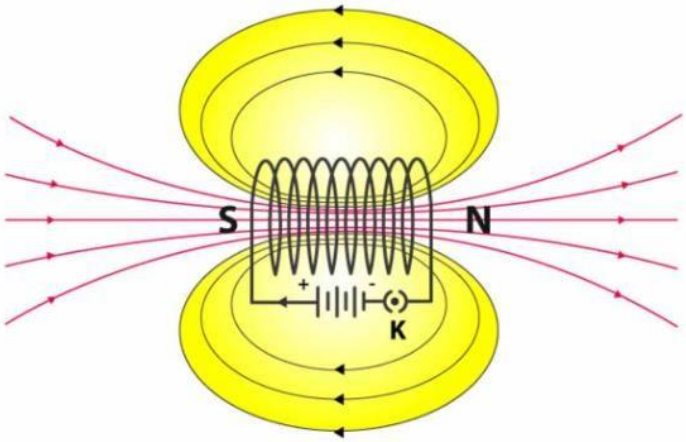
(A) Red
(B) Yellow
(C) Green
(D) Violet

Solution: (A) Red
Explanation: For red light, the wavelength is maximum, hence the refractive index is minimum. As a result, it refracts the least.

16. *The current carrying device which produces a magnetic field similar to that of a bar magnet is:*

(A) A straight conductor
(B) A circular loop
(C) A solenoid
(D) A circular coil

Solution: (C) A solenoid
Explanation: A solenoid produces a magnetic field similar to that of a bar magnet when current flows through its coils.



For Question number 17 to 20, two statements are given- one labeled as Assertion (A) and the other labeled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true and Reason (R) is ***not*** *the correct explanation of the Assertion (A).*
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.

17. *Assertion (A): Electrons move from lower potential to higher potential in a conductor.*
Reason (R): A dry cell maintains electric potential difference across the ends of a conductor.

Solution: (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

Explanation: As current flows from higher potential to lower potential, electron flow is opposite to that of current. Also, a dry cell maintains electric potential difference across the ends of a conductor. But this is not the reason for the former.

18. *Assertion (A): Some vegetable oils are healthy.*
Reason (R): Vegetable oils generally have long unsaturated carbon chains.

Solution: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Explanation: Vegetable oils generally have long unsaturated carbon chains, because they can improve blood cholesterol levels, ease inflammation, stabilize heart rhythms, and play a number of other beneficial roles.

19. *Assertion (A): Sex of the children will be determined by what they inherit from their mother.*
Reason (R): Women have XX sex chromosomes.

Solution: (D) Assertion is false and reason is true.
Explanation: Both parents play a significant role in the reproductive process but the determination of the offspring's sex is notably influenced by the father. The heterozygous nature of the father's sex chromosomes (XY) allows for a diverse range of sex chromosome combinations, making his contribution pivotal in shaping the sex of the offspring. Therefore, it can be concluded that the sex of the children is determined more directly by the father's heterozygosity for sex chromosomes than by the mother's homozygosity (XX).

20. *Assertion (A): Green plants trap only 1% of the energy of sunlight that falls on their leaves.*
Reason (R): All Green plants are producers in a food chain.

Solution: (B) Both assertion and reason are true but reason is not the correct explanation of assertion.
Explanation: According to the 10% law given by Lindemann, green plants in a terrestrial ecosystem capture about 1% of the energy of sunlight that falls on their leaves and convert it into food. Furthermore, only 10% of this energy is transferred from one trophic level to another, while the remaining 90% is lost to the environment during various physiological activities like respiration, reproduction, etc.

Yes, all green plants are producers in the food chain because they convert inorganic substances into food, which is then consumed by heterotrophs. Every organism is directly or indirectly dependent on plants for their food. However, it's not correct to say that only 1% of solar energy is converted into food simply because they are producers. The reason for this low conversion rate is more complex and involves various factors.

SECTION B

*Questions no. **21** to **26** are very short answer type questions.*

21. *(a) Sometimes while running, the athletes suffer muscle cramps. Why? How is the respiration in this case different from aerobic respiration?*

OR

(b) Write the other name given to lymph. State its two functions. *[2]*

Solution:

(a) During running or excessive exercise, muscle cramps can start due to the accumulation of lactic acid. When exercising excessively, muscle cells start respiring anaerobically, and lactic acid is formed. This lactic acid accumulates in muscle cells and causes muscle cramps.

This type of respiration is different from aerobic respiration. In aerobic respiration, respiration occurs in the presence of oxygen gas and its last step takes place in the mitochondria. Aerobic respiration produces carbon dioxide, energy, and water. On the other hand, anaerobic respiration (which can lead to muscle cramps) produces lactic acid and a smaller amount of energy.

OR

(b) Lymph is also known as tissue fluid. Some of its functions are:

- It is responsible for the removal of interstitial fluid from tissues.
- It absorbs and transports fatty acids and fats as chyle from the digestive system.
- It transports white blood cells to and from the lymph nodes into the bones.

22. *Write the formula and the molecular mass of the third homologue of alcohols. State how the boiling point changes as one moves from lower to higher homologues.[2]*

Solution: The third homologue of alcohol is propanol.

Formula- $CH_3CH_2CH_2OH$

Molecular formula= 3 x (mass of C)+ 8 x (mass of H)+ 1 x (mass of O)

= 3 x 12+ 8 x 1 + 1 x 16 = 60 u

As we move from lower to higher homologue in alcohols, the boiling point increases as there is increase in molecular formula and weight which leads to strong Van der Waals force of attraction.

23. *(a) Copper powder is taken in a china dish and heated over a burner. Name the product formed and state its colour. Write the chemical equation for the reaction involved.* *[2]*

OR

(b) Write the chemical equation for the reaction which occurs when the aqueous solutions of barium chloride and sodium sulphate react together. Write the symbols of the ions present in the compound precipitated in the reaction. *[2]*

Solution: (a) When copper powder is taken in a china dish and heated over a burner, it gets oxidized to form copper(II)oxide which is black in colour.
The chemical equation involved for the reaction is-

$2Cu(s) + O_2(g) \rightarrow 2CuO$
(Copper) (Oxygen) (Copper Oxide)

(b) Whenever an aqueous solution of barium chloride and sodium sulphate react together they form a white precipitate of barium sulphate and sodium chloride. The equation for the chemical reaction is:
$BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(ppt) + NaCl(aq)$
(Barium Chloride) (Sodium Sulphate) (Barium Sulphate) (Sodium Chloride)
Ions that precipitated in the reaction are Ba^{+2} and SO_4^{-2}.

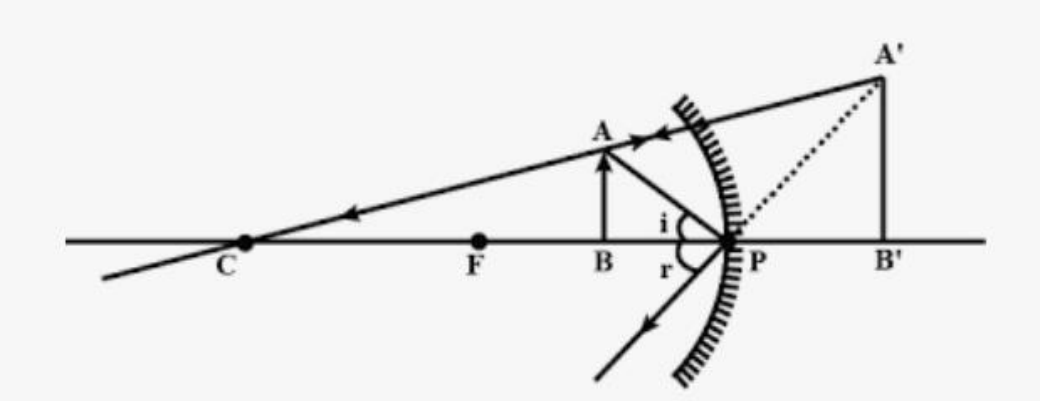
24. *Identify the organ in the human female reproductive system where the sperm encounters the egg cell. What will happen if it is blocked? Name the technique by which it can be blocked.* *[2]*

Solution: The sperm encounters the egg cell in the oviduct or fallopian tube.
If the fallopian tube in the female is blocked, the egg will not be able to reach the uterus. In that case fertilization will not take place. The technique by which fallopian tube can be blocked is tubal sterilization or tubectomy.

25. *"The linear magnification produced by a spherical mirror is +3". Based on this statement answer the following questions:*

(a) What is the type of mirror?
(b) Where is the object located?
(c) List two properties of the image formed (other than size/magnification). *[2]*

Solution: (a) Concave mirror.
(Hint :+ sign in magnification shows that the image is virtual and erect, 3 is greater than 1 so, the image is magnified. In a concave mirror, when an object is placed between F and P, the image formed is virtual and magnified).



(b) Between pole and focus
(c) 1.Virtual
2. Erect

26. *The filament of an electric lamp draws a current of 0.5A, which lights for 2 hours. Calculate the charge that flows through the circuit.* *[2]*

Solution: Given, electric current, I = 0.5 A
Time for which the current flows, t = 2 hours
= 2 × 60 × 60 seconds
= 7200 s
As we know,
Electric current, I = Charge(Q) / Time(t)
⇒ Q = I × t
= 0.5 A × 7200 s
= 3600 C

SECTION C

Questions no. ***27*** *to* ***33*** *are short answer type questions.*

27. *Answer the following questions in the context of electrolysis of water:* *[3]*
(a) Why is this reaction /process called a decomposition reaction?
Solution: Electrolysis of water is a decomposition reaction because the water breaks down into two substances, i.e. oxygen and hydrogen.

(b) Giving reason state whether this reaction is exothermic or endothermic?
Solution: This reaction is an endothermic reaction because energy is given to water so that it can decompose into oxygen and hydrogen. As there is absorption of energy, the process is endothermic.

(c) Name the gas collected at the anode and cathode?
Solution: Oxygen is collected at the anode.
Hydrogen gas will be collected at the cathode

(d) What is the mass ratio of the gases collected at the anode and cathode?
Solution: Mass ratio of oxygen : hydrogen is 8:1 .

28. *Differentiate between food chain and food web. In a food chain consisting of deer, grass and tiger, if the population of deer decreases, what will happen to the population of organisms belonging to the first and third trophic levels? [3]*
Solution:

Difference Between Food Chain And Food Web	
Food Chain	**Food Web**
A linear pathway showing the flow of energy	A multitude of networks showing the flow of energy
An organism of higher level trophic feeds on a specific organism of lower trophic level	An organism of a higher trophic level has access to more members of a lower trophic level.
Does not affect the adaptability and competitiveness of organisms.	It has a role in improving the adaptability and competitiveness of an organism.

If the population of deer decreases from the given food chain, the population of tigers will decrease as they will not have deer for their food and will starve to death. The density of grass will increase as there is no organism to consume it as food.

29. *Name a plant growth hormone synthesized at the shoot tip. Explain its effect on the growth of a plant in response to light. [3]*
Solution: Auxin is a plant growth hormone that is synthesized at the shoot tip.
Yes, it is true that the shoot of a plant bends towards light during its growth and it is due to the presence of growth hormone, Auxin. In the presence of sunlight, the Auxin present in the stem starts accumulating in the region away from sunlight ,due to which the concentration of auxin in this region of the stem increases, resulting in growth, while, in

the region towards sunlight where auxin concentration is low there is no growth. Apparently, a growth or bending towards sunlight.

30. *Name the ore of mercury and state the form in which it is found in nature .Write the chemical equations along with the condition required for the reactions involved in the extraction of mercury from its ore.* *[3]*

Solution: The ore of mercury is Cinnabar, HgS, which is a sulphide of Mercury.

$2HgS(s) + 3O_2(g) \xrightarrow{Roasting} 2HgO(s) + 2SO_2(g)$

$2HgO(s) \xrightarrow{Heating\ at\ 300\,^{\circ}C} 2Hg + O_2(g)$

31. *Mendel crossed pure tall pea plants (TT) with pure short pea plants (tt) and obtained F_1 progeny. When the plants of F_1 progeny were self-pollinated, plants of F_2 progeny were obtained.*

(a) What did the plants of F_1 progeny look like? Give their genotype combination.

(b) Why could the gene for shortness not be expressed in plants of F_1 progeny?

(c) Write the ratio of the plants obtained in F_2 progeny and stake the conclusion that can be drawn from this experiment. *[3]*

Solution: (a) The plants of the F_1 progeny would all look tall and their gene combination would be Tt. This is because tallness (T) is dominant over shortness (t).

(b) The gene for shortness could not be expressed in the plants of the F_1 progeny because it is recessive. In the presence of the dominant gene (T), the recessive gene (t) does not get expressed.

(c) In the F_2 progeny, the ratio of the plants would be 3:1 (3 tall:1 short). This is known as the phenotypic ratio. The genotypic ratio would be 1:2:1 (1 TT: 2 Tt: 1 tt). The conclusion that can be drawn from this experiment is that traits are inherited independently according to Mendel's laws of inheritance. This is also known as Mendelian inheritance.

32. *A 2000 W heater has a resistance of about 25 Ω, whereas a 100 W bulb has a resistance of 500 Ω. When 220 V is applied on these, then which of the two*

(a) Can carry large currents?

(b) May be used with an electrical circuit having 1.0 A rating?

(c) Will be fitted with a 15A electric board and not with a 5A electric board? Justify your answer in each case. *[3]*

Solution:

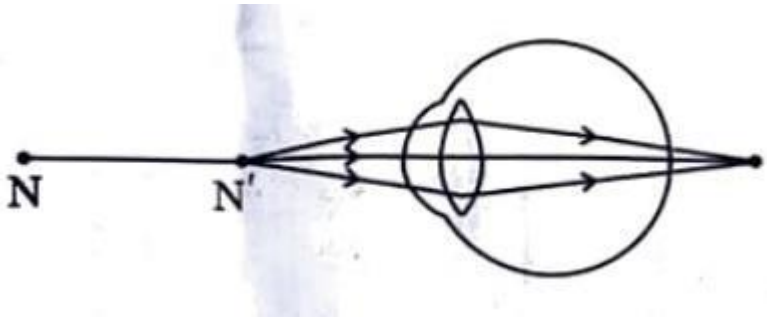
(a) $V = IR$

$\Rightarrow I = V/R$

In case of heater,
I = 220/25 = 8.8 A
In case of bulb,
I = 220/500 = 0.44 A
Hence, the heater can carry large currents.

(b) Since the bulb draws 0.44 A current, it can be connected to a circuit having 1.0 A rating.
(c) Since the heater draws a current of 8.8 A, it cannot be connected with 5A electric board, but it can be connected to 15 A electric board.

33. *(a) Study the diagram given below and answer the questions that follow:*



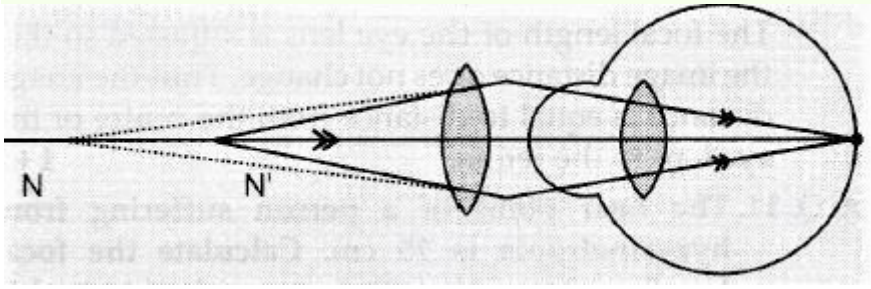
(i) Name the defect of vision depicted in this diagram stating the part of the eye responsible for this condition.
(ii) List two causes of this defect.
(iii) Name the type of lens used to correct this defect and state its role in this case. *[3]*

OR

(b) What is 'dispersion of white light' ? State its cause. Draw a ray diagram to show the dispersion of white light by a glass prism. *[3]*

Solution: (a)

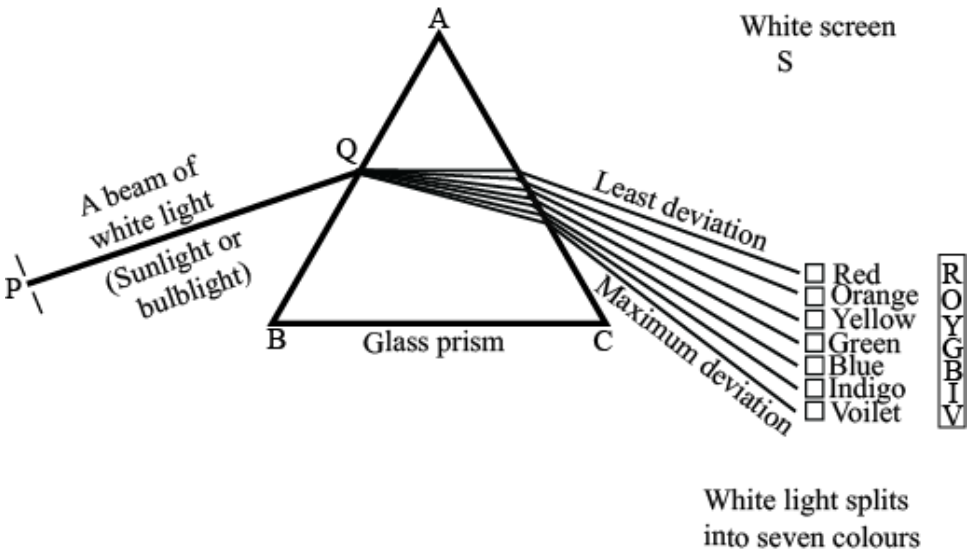
(i) Hypermetropia - Ciliary muscles are responsible for this defect when they are not able to decrease focal length of the eye lens sufficiently
(ii) The focal length of the eye lens is too long.
The eyeball has become too small.
(iii) The defective eye is corrected by using a **convex lens** such that the lens will bring the image back to the retina. Depending on how much the focal length has been altered due to the effects of hypermetropia, powered convex lenses can correct this problem by converging the light rays sufficiently before they enter the eye.



Solution: (b)

The splitting of a beam of white light into its seven constituent colours (violet, indigo, blue, green, yellow, orange and red, i.e., VIBGYOR), when it passes through a glass prism, is called the dispersion of light.

Dispersion of white light happens because light of different colors bends through different angles with respect to incident rays, as they pass through the prism due to differences in their refractive indices. The red light bends the least while the violet light bends the most. As a result, we obtain a coloured spectrum with red and violet colours at its extremes.



SECTION D

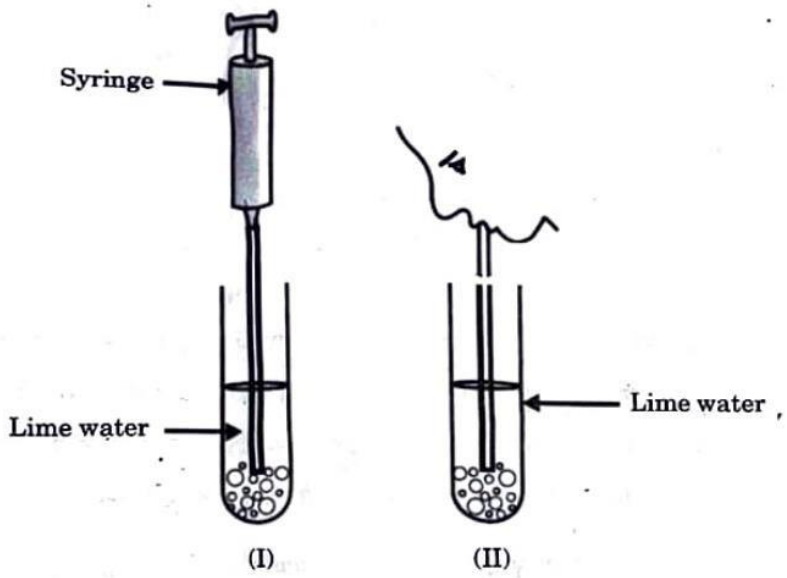
Questions no. ***34*** *to* ***36*** *are long answer type questions.*

34. *(a) Design an experiment to demonstrate that carbon dioxide is essential for photosynthesis. Write the observation and conclusion of the experiment.* *[5]*

OR

(b)

(i)



In the experimental set-up shown above in diagram (I) atmospheric air is being passed into lime water with a syringe while in diagram (II) air is being exhaled into lime water. The time taken for the lime water to turn milky in both the test tubes is different. Give reason.

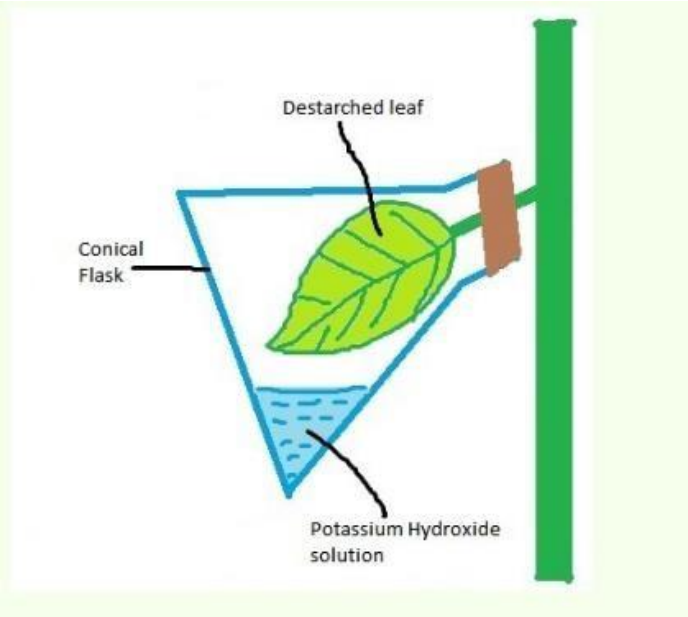
(ii) Draw the diagram of an open stomatal pore and label (I) Guard cells, and (II) Chloroplast on it. Mention two functions performed by stomata. *[5]*

Solution: (a)

For proving the necessity of carbon dioxide for photosynthesis, the following steps are performed:

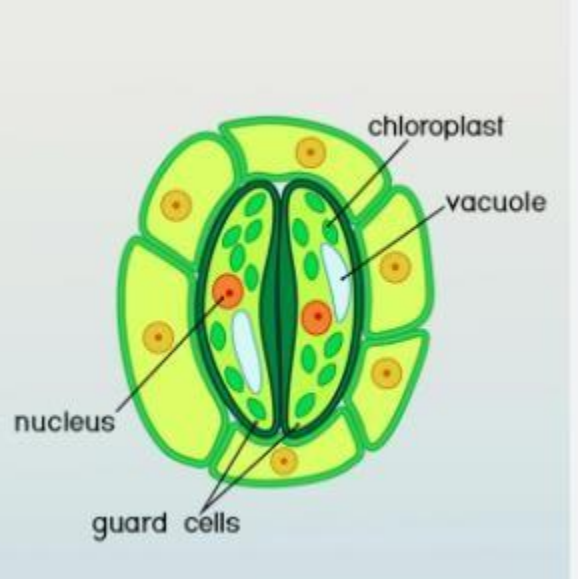
- A potted plant is taken and placed in complete darkness for 24 to 72 hours to de-starch it.
- Take potassium hydroxide in a conical flask stoppered with a rubber cork. Insert one leaf (still attached to the parent plant) through a hole in the rubber cork. Potassium hydroxide absorbs all the leftover carbon dioxide from the flask.
- The entire arrangement is exposed to sunlight for 6 hours.
- The leaf placed in the conical flask with potassium hydroxide solution is tested with iodine solution. This does not turn blue-black.

Inference: The leaf trapped inside the conical flask did not perform photosynthesis as it did not receive any carbon dioxide. This is the reason why it did not answer a positive test for starch.



(b) (i) Atmospheric air has less than 1% carbon dioxide in its composition. But the exhaled air has around 4% carbon dioxide. Hence, lime water turns milky when carbon dioxide is passed in case of exhaled air.

(ii)



Functions of stomata:

- Its prime function is to exchange the gases by closing and opening the pores in the leaves.
- It assists in eradicating excess water from the leaves.
- It removes oxygen and takes in carbon dioxide at the time of photosynthesis.
- It assists in monitoring the movement of water via transpiration.

35. *a) A few crystals of ferrous sulphate were taken in a dry boiling tube and heated. Tiny water droplets were observed in the tube after some time.*

(i) From where did these water droplets appear? Explain.

(ii) What colour change will be observed during heating?

(iii) How many molecules of water are attached per molecule of $FeSO_4$ crystal? Write the molecular formula of crystalline forms of (I) Copper sulphate, and (II) Sodium carbonate.

(iv) State how Plaster of Paris obtained from gypsum. Write two uses of Plaster of Paris. [5]

OR

(b) An acid X' present in tamarind when mixed with Y', produces a mixture 'Z'. 'Z' on addition to a dough when heated makes cakes soft and spongy. 'Y' is prepared from common salt and helps in faster cooking.

(i) Write the common names of 'X', 'Y and 'Z', and the chemical formula of 'Y.

(ii) How is 'Y' prepared and how does it help in making cakes soft and spongy? Illustrate the reaction with a suitable chemical equation.

(iii) Write the name and chemical formula of a mild base other than 'Y used as an antacid. [5]

Solution: (a)

(i) Ferrous sulphate has 7 molecules of water of crystallization. When heated it loses its water of crystallization which can be observed as water droplets.

(ii) Ferrous sulphate is green in color. When heated It loses its water of crystallization and its green color fades.

(iii) 7 molecules of water are attached per molecule of $FeSO_4$ crystal.

Molecular formula of Copper Sulphate: $CuSO_4.5H_2O$

Molecular formula of Sodium Carbonate: $Na_2CO_3.10H_2O$

(iv) Gypsum ($CaSO_4.2H_2O$) is heated at 120 degrees Celsius to get it partially dehydrated to form Plaster of Paris ($CaSO_4.\frac{1}{2}H_2O$)

(b)

(i) X is tartaric acid. Y is baking soda. Z is baking powder. Chemical formula of baking soda is $NaHCO_3$.

(ii) Solvay process is used for the production of sodium bicarbonate industrially. In this process carbon dioxide, water, ammonia and brine solution in its concentrated form, are used as raw materials. This process is used mainly because it is inexpensive and less raw materials are used to produce necessary chemicals. The important chemical reaction that is used in the production of baking soda is:

$$CO_2 + H_2O + NH_3 + NaCl \rightarrow NaHCO_3 + NH_4Cl$$

When baking soda is heated, it gives out carbon dioxide. Release of CO_2 gas leaves gaps or bubbles in cakes making them spongy.

The chemical reaction involved is:

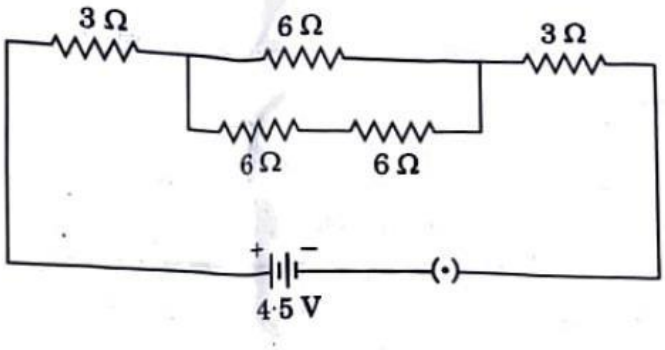
$$2\,NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$$

(iii) Magnesium hydroxide, also known as milk of magnesia, is used as an antacid. Its chemical formula is $Mg(OH)_2$.

36. *(a)*

(i) Which type of circuits- series or parallel, should be used when you have to operate different electrical gadgets in your house? List two reasons for your answer.

(ii) Find the current flowing through the following electric circuit: *[5]*



(b) The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are given in the following table:

I (Amperes)	0·5	1·0	2·0	3·0	3·5
V (Volts)	1·5	3·0	6·2	9·3	10·8

(i) Plot the graph between V and I.

(ii) Calculate the resistance of the resistor with the help of the graph.

(iii) What does the graph represent?

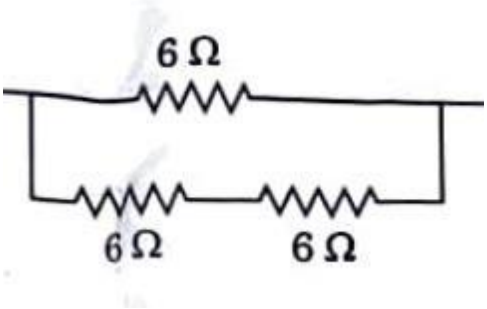
(iv) Why should this graph pass through the origin? *[5]*

Solution:

(a) (i) In households, parallel circuits are generally used to operate different electrical gadgets. There are many reasons for this such as:

- All devices in parallel circuits get the same voltage.
- In case any device gets damaged, the rest of the devices can still work.
- All devices can be switched on and off separately.

(ii) The resistance in the following circuit is:



$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6+6}$$

$$\frac{1}{R} = \frac{2+1}{12}$$

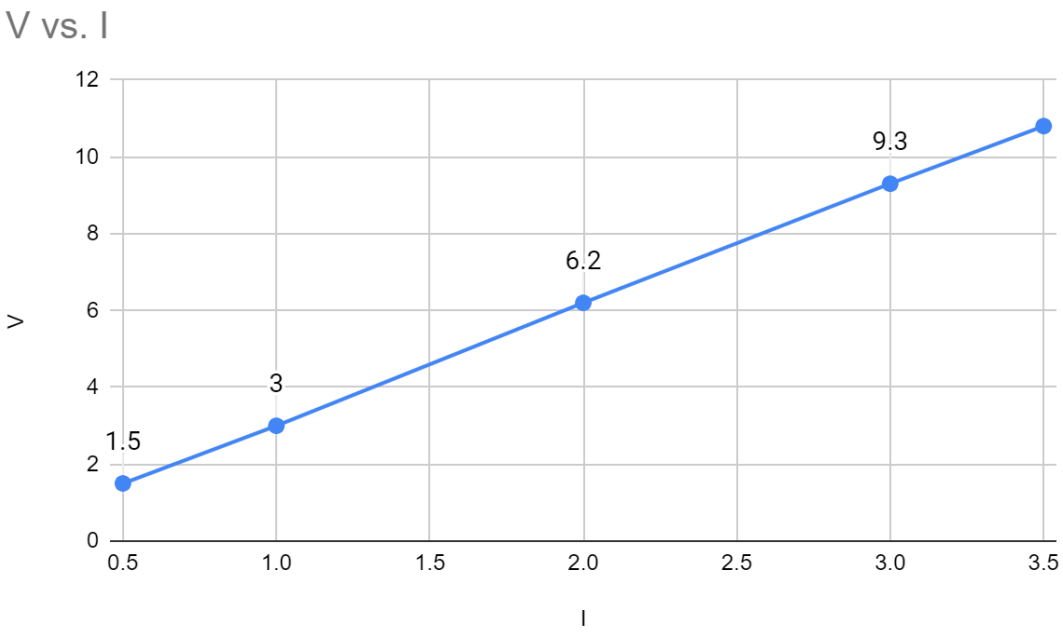
R = 4 Ω

The above combination is in series with two 3 Ω resistors.

So, total resistance will be = 3 + 4 + 3 = 10 Ω

Current in the circuit = $\frac{Voltage}{Resistance} = \frac{4.5}{10} = 0.45\ A$

(b) (i)



(ii) R = $\frac{10.8-1.5}{3.5-0.5} = \frac{9.3}{3} = 3.1\ ohm$

(iii) The graph roughly represents a straight line, the slope of which gives the resistance.

(iv) The graph should pass through the origin because when the voltage applied is zero, no current should flow through the circuit.

SECTION E

*Questions no. **37** to **39** are case-based/data-based questions with 3 short sub-parts. Internal choice is provided in one of these sub-parts.*

37. *A highly polished surface such as a mirror reflects most of the light falling on it. In our daily life we use two types of mirrors — plane and spherical. The reflecting surface of a spherical mirror may be curved inwards or outwards. In concave*

mirrors, reflection takes place from the inner surface, while in convex mirrors reflection takes place from the outer surface.

(a) Define the principal axis of a concave mirror. [1]

(b) A ray of light is incident on a concave mirror, parallel to its principal axis. If this ray after reflection from the mirror passes through the principal axis from a point at a distance of 10 cm from the pole of the mirror, find the radius of curvature of the mirror. [1]

(c) (i) An object is placed at a distance of 10 cm from the pole of the convex mirror of focal length 15 cm. Find the position of the image. [2]

OR

(ii) A mirror forms a virtual, erect and diminished image of an object. Identify the type of this mirror. Draw a ray diagram to show the image formation in this case. [2]

Solution:

(a) Principal axis of a concave mirror is a straight, imaginary line passing through the pole and centre of curvature of the concave mirror.

(b) A ray parallel to the principal axis of a concave mirror passes through the focus after reflection.

So, as per the given data, focal length, f = 10 cm

We know that the radius of curvature is twice the focal length.

So, radius of curvature, R = 2 × 10 cm = 20 cm

(c) (i) Given, u = -10 cm

f = +15 cm (f is positive for convex mirror)

According to mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

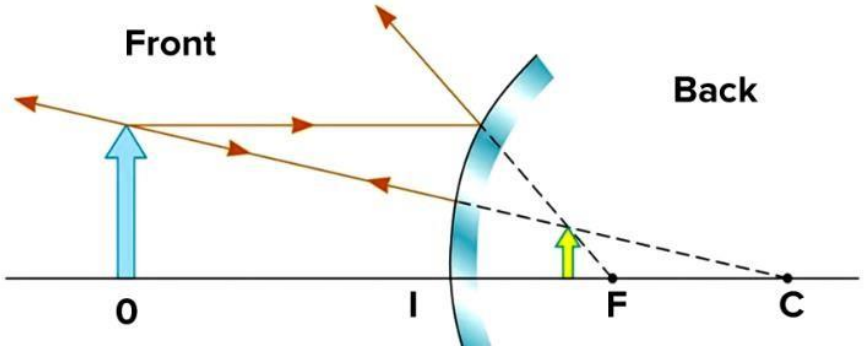
$$\frac{1}{15} = \frac{1}{v} + \frac{1}{(-10)}$$

$$Solving\ this\ equation, we\ get\ v = +6\ cm$$

So, the image is formed at a 6 cm distance from the pole behind the convex mirror.

OR

(ii) A convex mirror forms a virtual, erect and diminished image of an object, irrespective of the position of the object. Image formation by the convex mirror is shown in the diagram below:



38. *Carbon is a versatile element that forms the basis of all living organisms and many of the things we use. A large variety of compounds is formed because of its tetravalency. Compounds of carbon are formed with oxygen, hydrogen, nitrogen, sulphur, chlorine and many other elements.*

Answer the following questions:

(a) What are hydrocarbons? *[1]*

(b) List two properties by virtue of which carbon can form a large number of compounds. *[1]*

(c) (i) Write the formula of the functional group present in (1) aldehydes, and (2) ketones. Write a chemical equation for the reaction that occurs between ethanoic acid and ethanol in the presence of a catalyst. *[2]*

OR

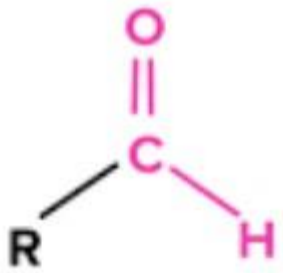
(ii) What are structural isomers? Write the structures of two isomers of butane (C_4H_{10}) *[2]*

Solution:

(a) All these carbon compounds which contain only carbon and hydrogen are called hydrocarbons.

(b) Carbon can form a large number of compounds due to its tetravalency and catenation properties.

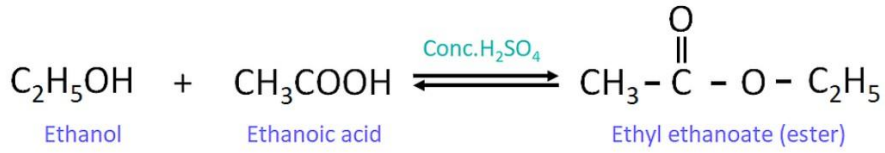
(c) (i)



Aldehyde:

Ketone:

Ethanol and ethanoic acid react in the presence of conc. Sulphuric acid to form ethyl ethanoate.



(ii)

39. *Pollination is an important process in sexual reproduction of plants. It is an essential process that facilitates fertilisation in plants. Pollinating agents can be wind, water, insects and birds. Several changes take place in the flower after the fertilization has taken place.*

(a) Write the main difference between self-pollination and cross-pollination.[1]

(b) Name the part of the flower which attracts insects for pollination. What happens to this part after fertilization? [1]

(c) (i) Define fertilization. What is the fate of ovules and the ovary in a flower after fertilization? [2]

OR

(ii) In a germinating seed, which parts are known as future shoot and future root? Mention the function of cotyledon. *[2]*

Solution: (a) Self-pollination occurs when the pollen from the anther is deposited on the stigma of the same flower or another flower on the same plant. Cross-pollination occurs when pollen is transferred from the anther of one flower to the stigma of another flower on a different plant of the same species.

(b) The part of the flower which attracts insects for pollination is usually the petal due to its bright color and sometimes scent. After fertilization, this part typically withers and falls off as it has served its purpose.

(c) (i) Fertilization is the process in which the male germ-cell produced by pollen grain fuses with the female gamete present in the ovule to form a zygote. After fertilization, the ovules develop into seeds and the ovary develops into a fruit to protect and nourish the seeds.

OR

(c) (ii) In a germinating seed, the radicle is known as the future root and the plumule is known as the future shoot. The function of the cotyledon is to store food and nutrients for the seedling until it is capable of photosynthesis on its own.