CBSE
Class X Science

Time: 3 hrs **Total Marks: 80**

General Instructions:

1. The question paper comprises of two **Sections, A** and **B**. You are to attempt both the sections.
2. All questions are compulsory.
3. All questions of **Section A** and **Section B** are to be attempted separately.
4. There is an internal choice in **three** questions of **three** marks each, **two** questions of **five** marks each in Section A and in **one** question of **two** marks in Section B.
5. Question numbers **1** and **2** in **Section A** are **one mark** questions. These are to be answered in one word or in **one** sentence.
6. Question numbers **3** to **5** in **Section A** are **two marks** questions. These are to be answered in about **30 words each**.
7. Question numbers **6** to **15** in **Section A** are **three marks** questions. These are to be answered in about **50 words each**.
8. Question numbers **16** to **21** in **Section A** are **five marks** questions. These are to be answered in about **70 words each**.
9. Question numbers **22** to **27** in **Section B** are based on practical skills. Each question is a **two** marks question. These are to be answered in brief.

Section A

1. Give an example of a flower which contains both stamens and carpels. (1)

2. Mention any one point of difference between pepsin and trypsin. (1)

3. We often observe domestic waste decomposing in the by-lanes near our homes. List four ways to make residents aware that improper disposal of waste is harmful to the environment and their own health. (2)

4. How are dams useful for society? Mention any two points. (2)

5. An element 'X' has mass number 35, and the number of neutrons is 18. Identify the group number and period of 'X'. (2)

6. In the electrolysis of water, [3]

a) Name the gas collected at the anode and the cathode.

b) Why is the volume of the gas collected at one electrode double than that collected at the other?

c) What would happen if dil. H_2SO_4 is not added to water?

7. List three distinguishing features between sexual and asexual reproduction in tabular form. (3)

OR

State in brief the function of the following parts of the human male reproductive system:

(a) Scrotum

(b) Testes

(c) Vas deferens

8. A part of the modern periodic table is given below. Answer the following questions based on this table. (3)

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

(a) Why do H, Li and Na show similar properties?

(b) Mg atom is bigger than Be atom. Why?

(c) Why are He, Ne and Ar called noble gases?

(d) Write a common name of the family to which F and Cl belong.

(e) Write the trend of non-metallic character in the horizontal row from Na to Cl.

(f) How does the atomic size vary as we move from Li to F in the second period of the periodic table?

9. How can a magnetic field be produced without using a magnet? Describe an experiment to show that a magnetic field exerts a force on a current-carrying conductor. (3)

10. (3)

i) Which phenomenon makes us see the Sun a few minutes before and after the actual sunrise and sunset?

ii) How many minutes before sunrise or after sunset can we actually see the Sun?

iii) By how many minutes is the day lengthened? What would have happened if there was no atmosphere around the Earth?

11. The image of an object placed at 30 cm in front of a lens is obtained on a screen at a distance of 60 cm from it. Find the focal length of the lens. What would be the height of the image if the object is 2 cm high? (3)

OR

Two thin lens of power +2.5 D and −1.5 D are placed in contact. Find the power and focal length of the lens combination.

12. A brown substance 'X' on heating in air forms a compound 'Y'. When hydrogen gas is passed over 'Y', it changes to 'X' again. (3)

(i) Name substances 'X' and 'Y'.

(ii) Name the processes occurring during the two changes.

(iii) Write the chemical equations involved.

OR

Identify the following reactions:

(i) $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$

(ii) $CaO_{(s)} + H_2O \rightarrow Ca(OH)_2$

(iii) $2KCl_3 \xrightarrow{\Delta} 2KCl + 3O_2$

13. What are chromosomes? Explain how the number of chromosomes in the progeny of sexually reproducing organisms is maintained. (3)

14. List four points of significance of reproductive health in society. Name any two areas related to reproductive health which have improved over the past 50 years in our country. (3)

15. A pea plant with blue flowers denoted by BB is cross-bred with a pea plant with white flowers denoted by ww. (3)

(a) What is the expected flower colour in the F_1 progeny?

(b) What will be the percentage of plants bearing white flowers in the F_2 generation when the flowers of F_1 plants are self-pollinated?
State the expected ratio of the genotypes BB and Bw in the F_2 progeny.

16.

(i) How does control and coordination occur in plants? How does this function in plants differ from that in animals?

(ii) Name five stimuli which act on plants. Name the type of tropic movement produced by each of these stimuli.

(iii) Define hydrotropism with the help of an example. Explain hydrotropism with the help of a diagram. (5)

17. What is myopia? What are the causes of myopia?

One student uses a lens of focal length +50 cm and another of −50 cm. State the nature of each lens and find their powers. Which of the two lenses will always give a virtual, erect and diminished image irrespective of the position of the object? (5)

18. (5)

(a) You are provided with three test tubes A, B, C which contain distilled water, an acidic solution and a basic solution. If you are only given blue litmus paper, how will you identify the nature of the solutions in the three test tubes?

(b) How is Plaster of Paris prepared from gypsum? For what purpose is it used in hospitals?

OR

(a) Write the chemical formula of washing soda and baking soda. Which of these two is an ingredient of antacids? How does an antacid provide relief from a stomach ache?

(b) What is roasting and calcination? What is the difference between them?

19. (5)

(a) List the factors on which the resistance of a conductor depends.

(b) A 4-kW heater is connected to a 220-V power source. Calculate

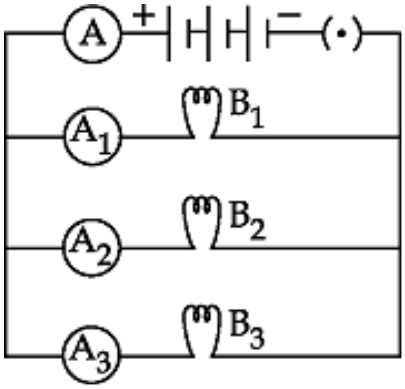
(i) Electric current passing through the heater.

(ii) Resistance of the heater.

(iii) Electric energy consumed in a 2-hour use of the heater.

OR

What is meant by the statement that the potential difference between two points is 1V? And Study the circuit shown in which three identical bulbs B1, B2 and B3 are connected in parallel with a battery of 4.5 V.



(i) What will happen to the glow of the other two bulbs if the bulb B_3 gets fused?

(ii) If the wattage of each bulb is 1.5 W, what reading will the ammeter A show when all the three bulbs glow simultaneously?

(iii) Find the total resistance of the circuit.

20. What are fossils? How are they formed? Describe in brief two methods of determining the age of fossils. State any one role of fossils in the study of evolution.(5)

21. (a) Draw the structure of propanoic acid (C_2H_5COOH).
(b) Why does the bottom of a cooking vessel blacken?
(c) What is a micelle? Draw a labelled diagram of a micelle.

Section B

22. You are given a potato, sweet potato, pea tendril and spinach. Which two are analogous structures and why? (2)

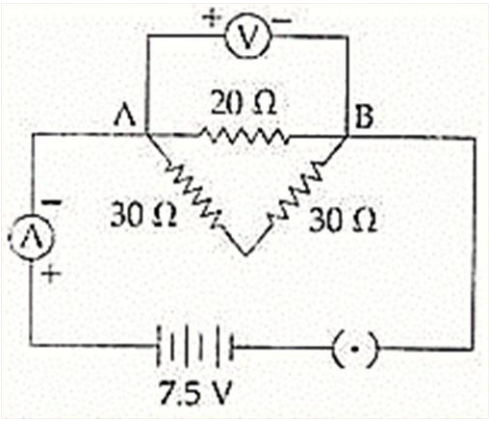
23. Students were asked to observe permanent slides showing different stages of budding in yeast under high power of a microscope. (2)
(a) Which adjustment screw (coarse/fine) would be moved to focus the slides?
(b) Draw three diagrams in correct sequence showing budding in yeast.

24. Why does the colour of copper sulphate solution change when an iron nail is kept immersed in it? (2)

25. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain. (2)

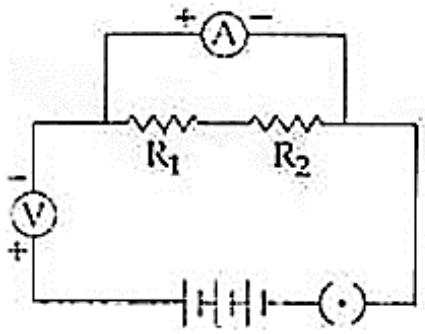
26. An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre 'O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical 'O', principal focus F and height of the image on the diagram. (2)

27. A student joined three resistances as shown in the circuit below. Calculate the current recorded by the ammeter (A). (2)



OR

To find the equivalent resistance of two resistors R_1 and R_2 connected in series, Rahul prepared a circuit as shown below. His friend observed the circuit and said that the circuit is incorrect. What is the mistake noted by Rahul's friend?



CBSE
Class X Science
Solution

Section A

1. *Hibiscus*

2. Pepsin is secreted by the gastric glands of the stomach, whereas trypsin is secreted by the exocrine glands of the pancreas.

3. Improper disposal of wastes is harmful to the environment and for our own health in the following ways:

(a) Accumulated wastes serve as breeding grounds for mosquitoes. This creates favourable conditions for the spread of several diseases.

(b) Decomposition of wastes emits harmful gases in the environment which results in unhygienic living conditions and loss of aesthetic beauty of a place.

(c) Some of the waste gets discharged to nearby water bodies along with rainwater and proves fatal for aquatic flora and fauna.

(d) Waste reduces soil fertility and results in soil pollution.

4.

(a) Dams ensure round the year water supply to crop fields and help increase agricultural production.

(b) Generation of electricity.

(c) They control flooding by slowing or stopping the flow of water in the river.

(d) Water from a dam is supplied to people in towns and cities through pipelines. In this way, construction of dams ensures continuous water supply in the region.

5. Atomic number of X = mass number of X – Number of neutrons

= 35 – 18 = 17

Therefore, electronic configuration of X = 2, 8, 7

Group no. = 17

Period no. = 3

Valency = 8 – 7 = 1

6.

(a) Hydrogen is liberated at the cathode and oxygen is liberated at the anode.

(b) The molecule of water contains two atoms of hydrogen and one atom of oxygen; hence, the volume of gas collected at one electrode is double the volume of gas collected at the other electrode.

(c) Water does not dissociate. So, to make it an electrolyte, dilute sulphuric acid is needed.

7. Differences between asexual and sexual reproduction:

Asexual reproduction	Sexual reproduction
1. Only a single organism or one parent is involved.	1. One or two organisms or parents are involved.
2. No production or fusion of gametes.	2. Male and female gametes are produced.
3. Offspring produced are identical to parents.	3. Offspring produced have some characters from the male parent and some from the female parent.
4. No mixing of genetic material.	4. Mixing of genetic material occurs.
5. Not very useful for natural selection in evolution of species.	5. Very useful for natural selection in evolution of species.
6. Rapid process during favourable conditions.	6. Slower process.

OR

Functions:

(a) Scrotum: It holds the testes outside of the body cavity since the spermatozoa need a temperature lower than the body temperature to mature.

(b) Testis: It is the male gonad and a part of the male genital tract. It produces sperms and testosterone, the male sexual hormone.

(c) Vas deferens: It is a tube transporting spermatozoa from the epididymis to the prostate part of the urethra.

8.

(a) H, Li and Na show similar properties because they have one electron in their valence shell and belong to the same group.

(b) Mg atom consists of three shells, whereas Be atom consists of 2 shells. This increases the distance between the outermost electrons and the nucleus. Hence, Mg atom is bigger than Be atom.

(c) He, Ne and Ar are called noble gases because their outermost shell is complete and their combining capacity is zero, i.e. they are least or less reactive.

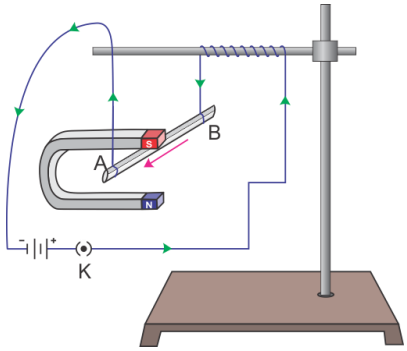
(d) Halogen family

(e) Non-metallic character increases from Na to Cl.

(f) Atomic size decreases as we move from Li to F in the second period of the periodic table.

9. A magnetic field can be produced without a magnet by passing current through the conductor.

Consider a small aluminium rod suspended horizontally from a stand using two connecting wires. Place a strong horseshoe magnet in a way that the rod lies between the two poles with the magnetic field directed upwards. For this, put the North Pole of the magnet vertically below and the South Pole vertically above the aluminium rod. Connect the aluminium rod in series with a battery, a key and a rheostat. Pass a current through the aluminium rod from one end to the other (B to A). The rod is displaced towards the left. When the direction of current flowing through the rod is reversed, the displacement of the rod is towards the right. This experiment shows that a magnetic field exerts a force on a current-carrying conductor.



10. i) Atmospheric refraction makes the Sun visible to us before actual sunrise and after actual sunset.

ii) The Sun is actually visible to us 2 minutes before actual sunrise or after actual sunset.

iii) Thus, the day is lengthened by 2 + 2 = 4 minutes. If there was no atmosphere on the Earth, the day would have shortened by 4 minutes.

11. Object distance, u = –30 cm

Image distance, v = 60 cm

From lens formula,

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

$$\therefore \frac{1}{f}=\frac{1}{60}-\frac{1}{-30}=\frac{1}{60}+\frac{1}{30}$$

$$\therefore \frac{1}{f}=0.05$$

$$\therefore f=20 \text{ cm}$$

Height of the object, h = 2 cm

From magnification formula,

$$m=\frac{v}{u}=\frac{h'}{h}$$

$$\therefore h'=\frac{v}{u}h=\frac{60}{-30}\times 2=-4 \text{ cm}$$

OR

Power of combination of lenses,

$P = p_1 + p_2$

$\therefore P = +2.5+(-1.5)$

$\therefore\ P=+1\ D$

Thus the power of this combination of lenses is +1.0 D

$$\text{Focal length} = \frac{1}{\text{Power(P)}}$$

$\therefore\ f = \frac{1}{+1} = 1\ m$

Thus the focal length of lenses in contact is 1m

12.

(a)

(i) X: Copper (Cu)

Y: Copper oxide (CuO)

(ii) First - Oxidation of X; Second - Reduction of Y

(iii) $2Cu + O_2 \rightarrow 2CuO$

$CuO + H_2 \rightarrow Cu + H_2O$

OR

(i) Double displacement reaction

(ii) Combination reaction

(iii) Decomposition reaction

13. Chromosomes are thread-like structures found in the nucleus at the time of cell division. They are made of proteins and DNA.

In sexually reproducing organisms, the gametes undergo meiosis, and hence, each gamete contains only half a set of chromosomes. When two gametes fuse, the zygote formed contains the full set of chromosomes. Hence, the formation of gametes by meiosis helps to maintain the number of chromosomes in the progeny.

14. <u>Significance of reproductive health in society:</u>

(a) It prevents the spread of various sexually transmitted diseases such as AIDS and syphilis.

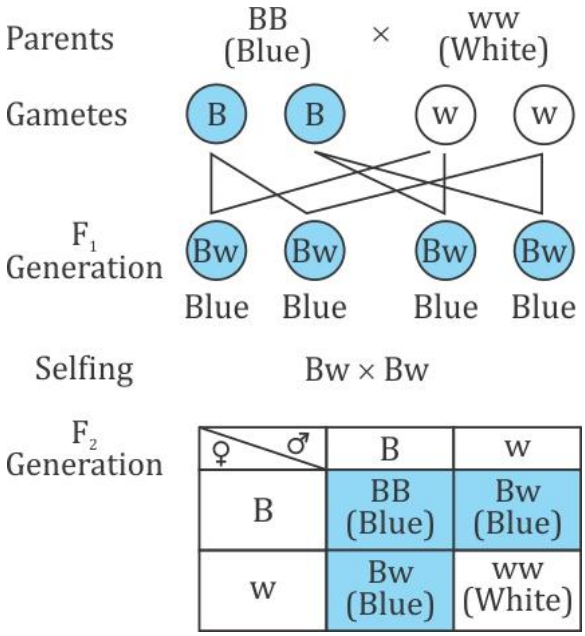
(b) Individuals with sound reproductive health produce better offspring which have better chances of survival.

(c) Better sex education and awareness helps to maintain the population and prevent population explosion.

(d) Unwanted and teen pregnancies can be avoided. The reproductive health in India has improved tremendously over the past 50 years. Areas in which reproductive health have improved include

Family planning: Better family planning has led to reduction in family size.
Mortality rate: Mother and infant mortality rates have drastically reduced because of better healthcare facilities.

15.



(a) The F_1 progeny is expected to have plants with blue flowers.

(b) ¼ of the F_2 generation bears white flowers. So, 25% of the F_2 progeny bears white flowers in the F_2 generation when the flowers of F_1 plants were self-pollinated.

(c) The ratio of the genotype BB and Bw in the F_2 progeny is 1 (BB) : 2 (Bw).

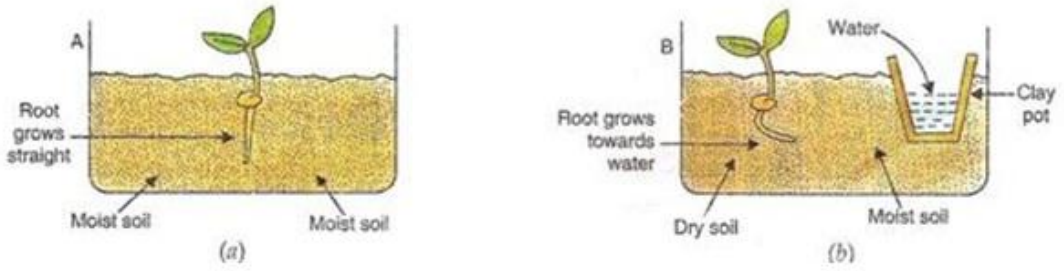
16.

(i) Plants do not have a nervous system, but they can sense things in the presence of stimuli such as light, touch, water etc. They respond to these stimuli by the effect of organic chemicals called hormones. In this way, plants control and coordinate their behaviour against environmental changes by using hormones. This is called chemical coordination. The hormones in plants coordinate their behaviour by affecting the growth of a part of the plant, resulting in the movement of that plant part in response to a stimulus. Control and coordination in animals takes place by both nervous system (nervous control) and endocrine system (hormonal control).

(ii)

Stimulus	Type of tropic movement
Light	Phototropism
Gravity	Geotropism
Chemicals	Chemotropism
Water	Hydrotropism
Touch	Thigmotropism

(iii) The movement of a plant part in response to water is called hydrotropism.



Hydrotropism

17. Myopia is a defect of vision due to which a person cannot see distant objects clearly.

Causes of myopia:

i) High converging power of the eye lens

ii) Elongation of the eyeball

Focal length of the lens used by the first student is f = +50 cm. Hence, the lens is a convex lens. Focal length of the lens used by the second student is f = –50 cm. Hence, the lens is a concave lens.

Power of lens 1 is $P_1 = \frac{1}{50 \times 10^{-2}} = 2\ \text{D}$

Power of lens 2 is $P_2 = \frac{1}{-50 \times 10^{-2}} = -2\ \text{D}$

A concave lens always gives a virtual, erect and diminished image. Hence, the lens used by the second student is the one which will give such an image.

18.

(a)

(i) Test the three solutions with blue litmus paper; one solution will change blue litmus to red. It is an acidic solution.

(ii) Test the remaining two solutions with red litmus [Changed in activity (i)]. One solution will change it again to blue. It is a basic solution.

(iii) Remaining third solution is distilled water.

(b) Plaster of Paris is prepared by heating gypsum to a temperature of 100°C.

Plaster of Paris is used in hospitals for setting fractured bones in the right position to ensure correct healing.

OR

(a)

(i) Washing soda: $Na_2CO_3.10H_2O$

(ii) Baking soda: $NaHCO_3$

(iii) Baking soda is an ingredient of antacids. It neutralises HCl released in the stomach and eases stomach ache.
$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$

(b)

Roasting	Calcination
1. Ore is heated in the presence of excess of oxygen or air.	1. Ore is heated in the absence of or limited supply of oxygen or air.
2. This method is employed in case of sulphide ores.	2. This method is employed in case of carbonate ores.
3. Sulphur dioxide is produced along with metal oxide.	3. Carbon dioxide is produced along with metal oxide.
4. Example: Balanced chemical equations for the roasting of ZnS and Cu_2S: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$	4. Example: Balanced chemical equation for the calcination of $ZnCO_3$: $ZnCO_3 \rightarrow ZnO + CO_2$

The roasting method is used in case of sulphide ores. It is advantageous to roast a sulphide ore to its oxide before reduction as metal oxides can be reduced to metal by carbon and hydrogen much more easily than sulphides.
Oxides of a substance are easy to purify than other forms. Hence, for purification, all the ores are first converted to their oxides. Thus, sulphide ores are converted to their oxides by roasting.

19.

(a) Resistance of a conductor depends on (i) its length, (ii) its area of cross-section and (iii) on the nature of its material.

(b) Power rating of the heater, P = 4 kW = 4000 W

Potential difference of the power supply, V = 220 V

(i) Power is

$$P = VI$$

$$\therefore I = \frac{P}{V} = \frac{4000}{220} = 18.18 \text{ A}$$

(ii) Resistance and power are related as

$$P = \frac{V^2}{R}$$

$$\therefore R = \frac{V^2}{P} = \frac{220^2}{4000} = 12.1\ \Omega$$

(iii) Energy consumed by the heater is

$$E = Pt$$

$$\therefore E = 4 \text{ kW} \times 2\text{h}$$

$$\therefore E = 8 \text{ kWh}$$

OR

Potential difference of 1 volt means that one joule of work is done to move a charge of one coulomb from one point to another.

(i) If the bulb B_3 gets fused, then the other two bulbs will continue glowing with the same brightness.

(ii) When the bulbs are in parallel, wattage will be added (4.5 W) and the ammeter reading would be 45/45 = 1.0 ampere.

(iii) Because the ammeter reading is 1.0 ampere, the resistance of the combination is

$$\frac{4.5 \text{ V}}{1.0 \text{ A}} = 4.5\ \Omega$$

20. Fossils are the preserved remains or traces of animals, plants and other organisms from the remote past.

<u>Formation of fossils:</u>

- Fossils are generally found in the layers of sedimentary rocks.
- They are formed by a continuous process of burying and decomposition over a period of time.
- The hard parts of the body such as the skeleton, shell, teeth, and occasionally, the entire animal, are found embedded in the sediments. These sediments form rocks.

Methods to determine the age of fossils:

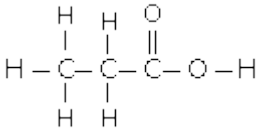
- If we dig into the Earth, we find that the fossils closer to the surface are more recent as compared to the fossils found in deeper layers.
- The fossils can also be dated by detecting the ratios of different isotopes of the same element in the fossil material. Radiocarbon dating is the most accurate, most studied and most verified of all radiometric dating schemes. When living organisms change into fossils, their rate of radioactive ^{14}C decay decreases slowly. In this way, the age of fossils can be determined with the help of radioactive ^{14}C. As the age of a fossil can be clearly established by the radioactive carbon dating technique, the exact period of formation of a species can also be ascertained.

Role of fossils in the study of evolution:

- Fossils of invertebrate animals are found in the deepest layers of rocks, whereas fossils of vertebrates (namely birds and mammals) are found in the recent layers of rocks.
- This palaeontological evidence suggests that the invertebrates came into existence before the vertebrates and reflects the order in which these animals appeared on the earth.

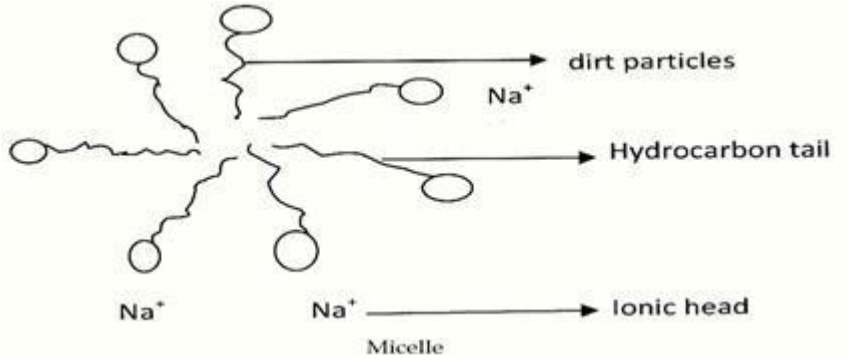
21.

(a) Propanoic acid



(b) A blackened cooking vessel indicates that the air holes of the burner are blocked and fuel is getting wasted. Blackening is mainly caused by incomplete combustion of fuel and limiting the supply of air results in incomplete combustion of even saturated hydrocarbons, giving a sooty flame.

(c) Micelle is a structure formed when soap molecules get arranged and align along the surface of water with the ionic end in water and the hydrocarbon tail protruding out of water.



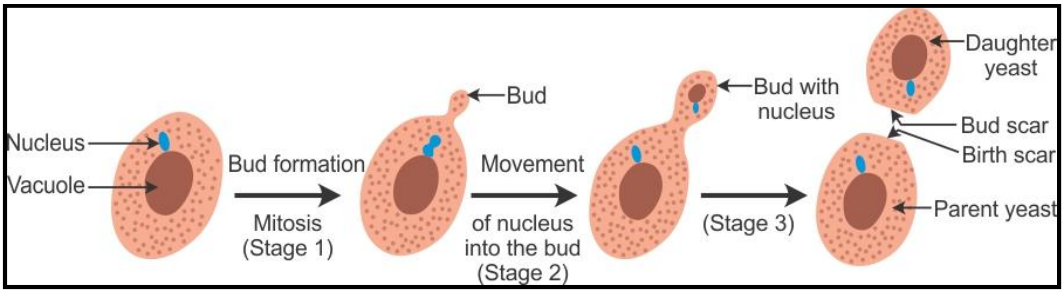
Section B

22. Analogous structures have similar functions but are different in their structural details and origin. Analogous structures indicate different ancestry. From the given plants, potato and sweet potato are analogous structures. They perform similar function but have different origins. Potato is a modified stem meant for the storage of food. Sweet potato is a modified root also meant for the storage of food. Therefore, potato and sweet potato are analogous structures in plants.

23.

(a) A fine screw is used to focus the slides of budding in yeast under high power of a microscope.

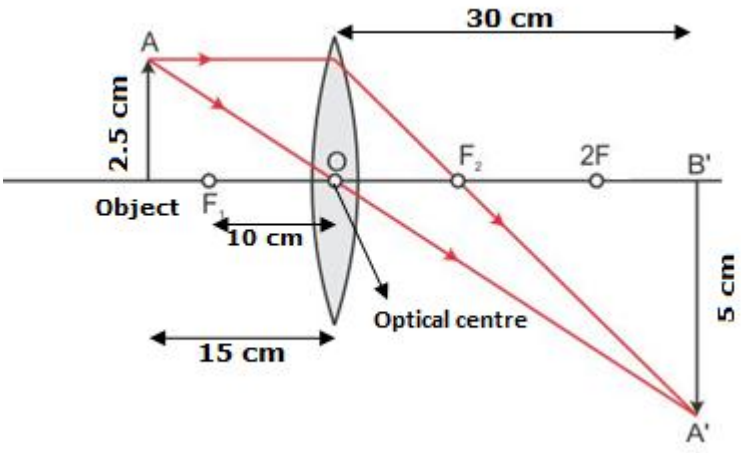
(b) Sequence showing budding in yeast:



24. The colour of copper sulphate solution changes when iron nail is kept immersed in it due to the displacement reaction taking place between iron and copper leading to formation of iron sulphate.

25. The pH of milk decreases from '6' as it turns into curd. Curd is more acidic than milk.

26. Ray diagram:



27. The series combination of two 30 Ω resistor is joined in parallel with 20 Ω resistance.

Equivalent resistance is given as

$$\frac{1}{R} = \frac{1}{20} + \left(\frac{1}{30 + 30}\right)$$

$$\frac{1}{R} = \frac{1}{20} + \frac{1}{60} = \frac{1}{15}$$

$R = 15\ \Omega$

$$I = \frac{V}{R} = \frac{7.5}{15} = 0.5\ A$$

OR

The two resistors have been connected correctly but not the voltmeter and the ammeter.

The ammeter must be connected in series between the battery and the series combination of the two resistors, and the voltmeter should be connected in parallel across the series combination of the two resistors.