CBSE
Class X Science

Time allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. The question paper comprises two **Sections, A** and **B**. You are to attempt both 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. How is the brain protected from shocks and injuries? **[1]**

2. Define esterification reaction. **[1]**

3. The wattage of a bulb is 24 W when it is connected to a 12 V battery. Calculate its effective wattage if it operates on a 6 V battery (Neglect the change in resistance due to unequal heating of the filament in the two cases). **[2]**

4. $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
Identify the oxidising and reducing agents. Give reason. **[2]**

5. Differentiate between biodegradable and non-biodegradable waste materials. **[2]**

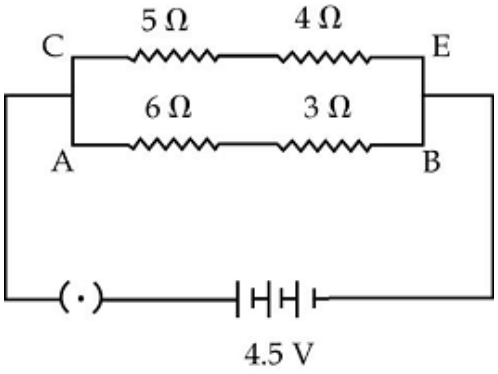
6. How are the alveoli designed to maximise the exchange of gases? **[3]**

7. Describe the concept of trophic levels. **[3]**

OR

Which part of the brain controls involuntary actions? Write the function of any of its two regions.

8. Study the circuit and find the **[3]**



(i) Total resistance in arm CE

(ii) Current in arm AB

(iii) Potential difference across the 4 ohm resistor

9. An element 'M' has atomic number 12. **[3]**

(a) Write its electronic configuration.

(b) State the group to which 'M' belongs.

(c) Is 'M' a metal or a non-metal?

(d) Write the formula of its oxide.

10. **[3]**

(a) How did the 'Chipko Andolan' ultimately benefit the local population?

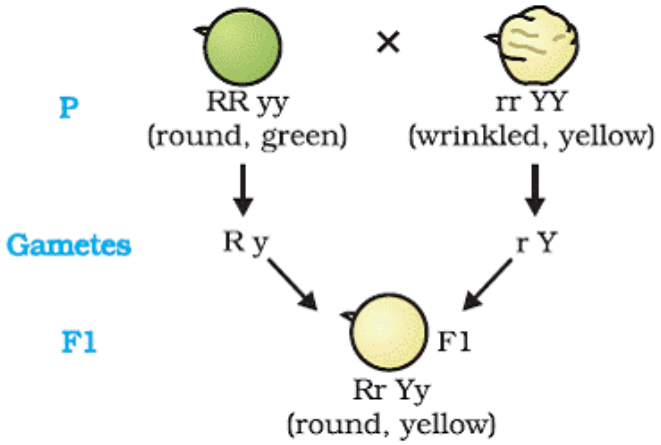
(b) Why should we conserve wildlife?

(c) Expand the term IUCN.

11.

(a) How many characters are transmitted in the following cross? Name them. **[3]**

(b) Define dominant and recessive trait.



12. Name: **[3]**

(a) Compound formed when acetic acid and ethanol react together

(b) Reducing agent used to convert acetic acid to ethanol

(c) Substance used to change acetic acid to acetic anhydride

OR

Acetic acid is a typical acid. Write the equation in each case for its reaction with a

(a) Metal

(b) Base/alkali

(c) Carbonate

13. How does the strength of the magnetic field at the centre of a circular coil of a wire depend on **[3]**

(a) Radius of the coil

(b) Number of turns of wire in the coil

(c) Draw the magnetic lines of force in case of a circular coil of a wire

OR

(a) Mention the factors on which the direction of force experienced by a current-carrying conductor placed in a magnetic field depend.

(b) Under what condition is the force experienced by a current-carrying conductor placed in a magnetic field maximum?

(c) A proton beam is moving along the direction of a magnetic field. What force is acting on the proton beam?

14. Why are parents advised to discourage their children from eating chips and junk food? **[3]**

15. **[3]**

(a) For what position of the object does a convex lens form an erect and virtual image?

(b) What is regular reflection of light?

(c) What type of mirror is used as a shaving mirror? Support your answer with a reason.

16. **[5]**

(a) Name a metal which is placed low in the activity series and exists as a liquid at room temperature.

(b) Write the name and formula of its ore.

(c) How is the metal extracted from this ore?

(d) Write the chemical equation for the reaction involved.

17. **[5]**

(a) Draw a neat diagram of the respiratory system and label the following parts:
(i) Lungs, (ii) Trachea, (iii) Bronchus, (iv) Diaphragm

(b) Name the respiratory pigment in human beings and discuss its role.

(c) Why is the rate of breathing in aquatic organisms faster than that in terrestrial organisms?

OR

(a) What is regeneration of an organism? With a neat diagram, describe regeneration in Planaria.

(b) How does the embryo get nourishment inside the mother's body?

(c) List the changes seen in the ovule and ovary after fertilisation.

18. **[5]**

(a) How has the method of artificial selection by humans helped in the evolution of different vegetables? Explain in brief with the help of an example.

(b) Mention some of the tools for tracing evolutionary relationships among species.

19. **[5]**

(a) State the rule to determine the direction of a
(i) Magnetic field produced around a straight conductor carrying current
(ii) Force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it
(iii) Current induced in a coil due to its rotation in a magnetic field

(b) Differentiate between AC and DC. Write one advantage of AC over DC.

20. **[5]**

(a) An element X is placed in group 14. State the formula and the nature of bonding in its chloride salt. Draw the electron dot structure of its chloride salt.

(b) With the help of electron dot representation, explain the formation of the O_2 molecule.

(c) How many covalent bonds does a molecule of ethane (C_2H_6) have? Draw its structure to justify your answer.

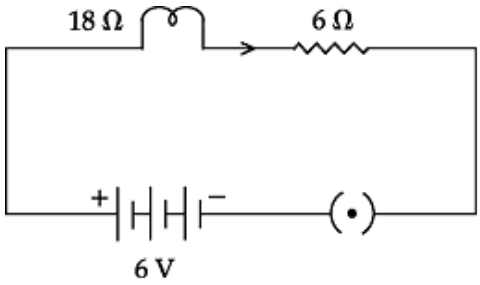
21. **[5]**

(a) What is electromagnetic induction?

(b) Describe the various methods of producing induced current.

(c) A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is held stationary inside the coil?

OR



In the given circuit, calculate

(i) Total resistance of the circuit

(ii) Current flowing through the circuit

(iii) Potential difference across the lamp and the resistor

SECTION B

22. Draw the electron dot structure of **[2]**

(i) C_2H_2

(ii) C_2H_5OH

23. Salt A, commonly used in bakery products, on heating gets converted to Salt B, which is used for removal of hardness of water, and Gas C is evolved. Gas C turns lime water milky. Identify A, B and C. **[2]**

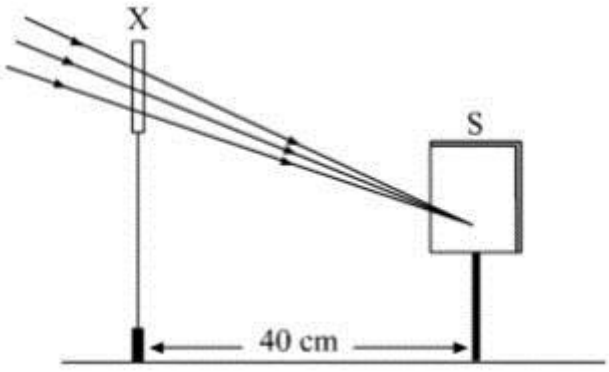
24. A student observed a permanent slide showing asexual reproduction in yeast. Draw diagrams of the observation he must have made from the slide. Also name the process. **[2]**

25. Name the type of asexual reproduction in which two individuals are formed from a single parent and the parental identity is lost. Draw the initial and final stages of this type of reproduction. State the event with which this reproduction starts. **[2]**

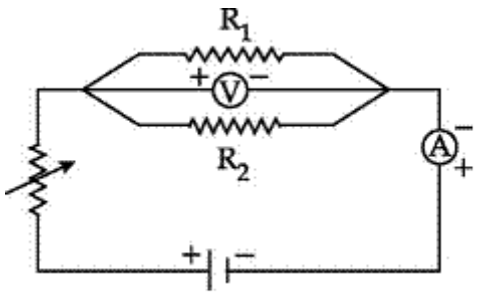
OR

Mention the four events which occur during binary fission in *Amoeba*.

26. A student focused the image of a distant object using Device **X** on a white screen **S** as shown in the figure. If the distance of the screen from the device is 40 cm, find the focal length of Device **X** and state whether it is a concave mirror/lens or convex mirror/lens. **[2]**



27. A circuit to determine the equivalent resistance of two resistors in a parallel combination is shown below. The terminals of which component are connected incorrectly? How can this be corrected? **[2]**



CBSE
Class X Science
Solution

SECTION A

1. The brain box, called the cranium, protects the brain and has shock-absorbing fluid which prevents the brain from shocks and injuries.

2. The reaction of an alcohol with a carboxylic acid in the presence of an acid to produce an ester is known as an esterification reaction.
Reaction:

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$$

3. Given, P = 24 W, V = 12 V

$$P = \frac{V^2}{R} \Rightarrow 24W = \frac{(12V)^2}{R} \text{ or } R = \frac{(12)^2}{24}$$

Let the effective wattage (i.e. power) be P_1 when it operates on a 6 V supply, then

$$P_1 = \frac{(6V)^2}{R} = \frac{(6V)^2}{(12V)^2} \times 24W = \frac{24W}{4} = 6W$$

The effective wattage when it operates on a 6 V battery is 6 W.

4. Copper sulphate is the oxidising agent as it gives oxygen to zinc, and zinc is the reducing agent as it accepts oxygen.

5.

Biodegradable waste	Non-biodegradable waste
Waste substances are easily decomposed by microorganisms.	Waste substances are not decomposed by microorganisms.
These substances easily mix with the soil after a short interval of time. Example: Paper	These substances are not able to mix with soil even after a long interval of time. Example: Plastic

6. A large number of alveoli in the lungs provides a large surface area for the exchange of gases. Walls of alveoli contain an extensive network of blood vessels. The walls are extremely thin and made of a single layer of cells.

7. In a food chain, trophic levels are consecutive steps followed in the process of energy flow and each step or level is dependent on the other for food. Different trophic levels are

- Producers: They form the first trophic level and are able to manufacture their own food (green plants).
- Primary consumers: They form the second trophic level and are generally plant eaters (herbivores).
- Secondary consumers: They form the third trophic level and are flesh eaters (carnivores).
- Tertiary consumers: They form the fourth trophic level and feed on secondary consumers.

OR

The hindbrain controls involuntary actions. It consists of pons, medulla and cerebellum. Functions of the medulla and cerebellum:

- The medulla helps in controlling involuntary actions such as blood pressure, salivation and vomiting.
- The cerebellum is responsible for the precision of voluntary actions and maintaining the posture and balance of the body.

8.

(i) Total resistance in arm CE

$$CE = 5\Omega + 4\Omega = 9\Omega$$

(ii) Current in arm AB

$$= \frac{4.5V}{9\Omega} = 0.5A$$

(iii) Current in arm CE =

$$\frac{4.5\ A}{9\ \Omega}$$

= 0.5 A

So, the potential difference across the 4 Ω resistor

$$= 4\Omega \times 0.5A = 2V$$

9. (a) Electronic configuration of M is 2, 8, 2.

(b) M belongs to the 2nd group.

(c) M is a metal.

(d) MO

10.

(a)

i. The quality of the environment was maintained due to conservation of forests.

ii. The local people could use the forest resources in suitable ways.

(b) Conservation of wildlife helps in maintaining the ecological balance of the biosphere and provides a gene bank for improvement of domesticated plants and animals.

(c) IUCN stands for 'International Union for Conservation of Nature and Natural Resources'.

11.

(a) Two characters.

They are shape of seed and colour of seed.

(b) A dominant trait is a genetic trait which is considered dominant if it is expressed in a person who has only one copy of that gene.

A recessive trait is a genetic trait which is expressed only when two copies of the same gene are present.

12. (i) Test the three solutions with blue litmus paper; one solution will change blue litmus 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) The remaining third solution is distilled water.

OR

(a) $2CH_3COOH + Zn \rightarrow (CH_3COO)_2Zn + H_2$

(b) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

(c) $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$

13.

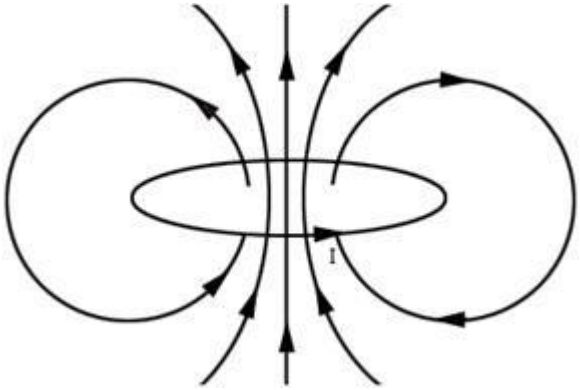
(a) The strength of the magnetic field (B) is inversely proportional to the radius of the circular loop (r).

$$B \propto \frac{1}{r}$$

(b) The strength of the magnetic field (B) is directly proportional to the number of turns in the coil (N).

$$B \propto N$$

(c) The magnetic field lines will be as shown below.



OR

(a) Factors on which the direction of force experienced by a current-carrying conductor placed in a magnetic field depend are
(i) Direction of the current and (ii) direction of the magnetic field.

(b) The force acting on a current-carrying conductor placed in a magnetic field is maximum when the direction of the current is at right angles to the direction of the magnetic field.

(c) Because the proton beam is moving parallel to the direction of the magnetic field, no force acts on it.

14. (i) Junk food makes a person obese.
(ii) It causes loss of appetite.
(iii) It may cause problems related to physical or mental growth.
(iv) It is expensive and leads to wastage of money.
Associated value: Children will be able to understand the benefits of healthy food habits.

15.

(a)When the object lies between the optical centre and the focus of the lens, a convex lens forms an erect and virtual image.

(b)When a parallel beam of light falls on a smooth and highly polished surface, the reflected beam is also parallel and directed in a fixed direction. Such reflection of light is called regular reflection.

(c)Concave mirrors are used as shaving mirrors to see a large image of the face. This is because when the face is held within the focus of a concave mirror, an enlarged image of the face is seen in the concave mirror. This helps in getting a smooth shave.

16. (a) Hg - Mercury
(b) HgS - Cinnabar

(c) When heated in air, cinnabar is first converted to mercuric oxide (HgO) which is reduced to mercury on further heating.

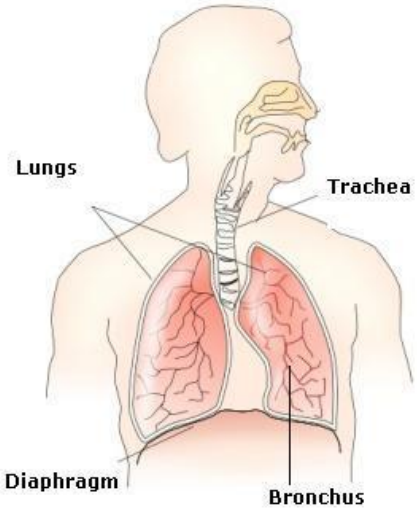
$$2HgS + 3O_2 \xrightarrow{\Delta} 2HgO + 2SO_2$$

(d)

$$2HgO \rightarrow 2Hg + O2$$

17.

(a) Respiratory system:



(b) Haemoglobin.

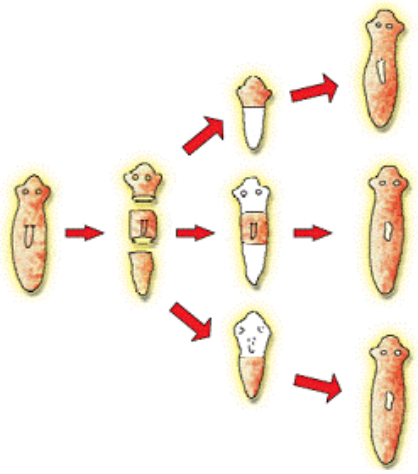
Role of haemoglobin → It is an iron–protein compound in red blood cells which gives blood its red colour and transports oxygen and carbon dioxide.

(c) The rate of breathing in aquatic organisms is much faster than that in terrestrial organisms because the amount of dissolved oxygen in water is fairly low compared to the amount of oxygen in the air.

OR

(a) Planaria can be cut into any number of pieces and each piece grows into a complete organism. This process is called regeneration. It is carried out by specialised cells in the organism.

Regeneration in Planaria



(b) The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta. It provides a large space area for glucose and oxygen to pass from the mother to the embryo. The developing embryo also produces waste substances which can be moved by transferring them into the mother's blood through the placenta.

(c) The ovule develops a tough coat and is gradually converted to a seed. The ovary grows rapidly and ripens to form a fruit.

18.

(a) Humans have cultivated wild cabbage and produced different vegetables. Example:

i. Some farmers wanted a short distance between the leaves of wild cabbage and produced the common variety of cabbage.
ii. When farmers opted for the arrested flower development of the wild cabbage plant, it led to the production of broccoli.
iii. Some farmers went in for sterile flowers of wild cabbage and developed another variety of cabbage called cauliflower.
iv. When farmers opted for the swollen part of wild cabbage, it led to the production of kohlrabi.
v. Finally, the farmers wanted to grow large leaves of wild cabbage and ended up producing the leafy vegetable kale.

(b) Tools used to trace evolutionary relationships among species:

i. Excavating
ii. Time-dating
iii. DNA sequencing
iv. Fossil study

19.

(a)

(i) Right-hand thumb rule: If one holds a wire carrying current in the right hand in such a way that the thumb indicates the direction of current, then the folded fingers indicate the direction of the magnetic field surrounding the wire.

(ii) Fleming's left-hand rule: If we stretch the first three fingers of the left hand mutually perpendicular to each other such that the forefinger points along the direction of the magnetic field and the middle finger points along the direction of the current, then the thumb indicates the direction of the force experienced by the conductor.

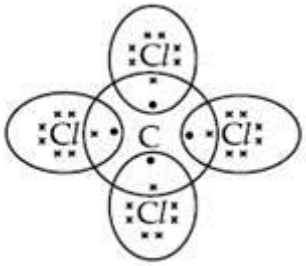
(iii) Fleming's right-hand rule: If the forefinger, second (central) finger and thumb of the right hand are stretched at right angles to each other, with the forefinger in the direction of the field and the thumb in the direction of the motion of the wire, then the induced current in the wire is in the direction of the second or central finger.

(b)

The direction of AC changes after equal intervals of time. The direction of DC does not change. Advantage of AC over DC is that AC can be transmitted over long distances without much loss of energy.

20. (a) Formula of chloride = XCl_4 or one can say X = C, so the formula = CCl_4

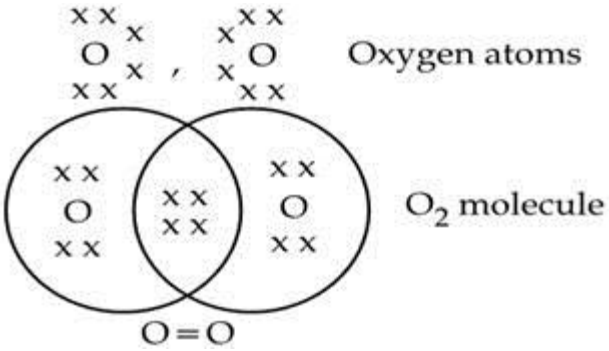
It shows covalent bonding.



(b) Atomic no. of oxygen = 8

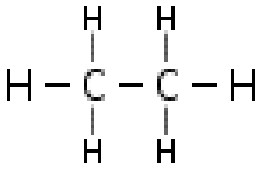
Electronic configuration = 2, 6

So, no. of valence electrons = 6



A double covalent bond is formed between two oxygen atoms.

(c) Ethane has 7 covalent bonds. It has one C–C and six C–H bonds.



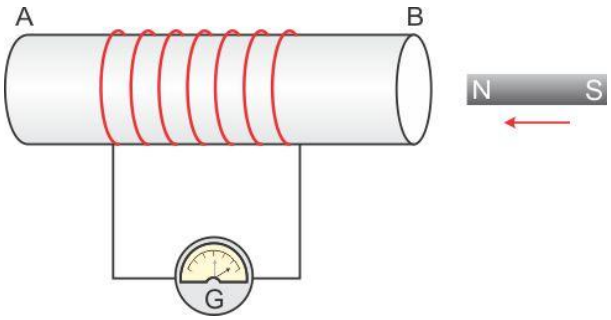
21.

(a) The process by which a changing magnetic field in a conductor induces a current in another conductor is called electromagnetic induction.

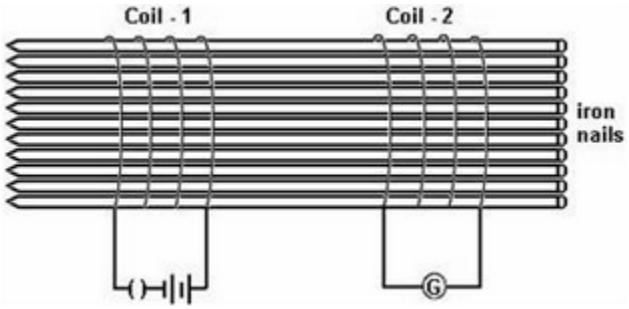
(b)

(i) By moving a magnet towards or away from a coil.

We take a coil with several turns and it is connected to a sensitive galvanometer. When a bar magnet is moved towards the coil, we see a deflection in the galvanometer. This deflection dies down after some time. The deflection is because of the induced current.



(ii) By varying current in one coil, an induced emf is produced in the other coil.



Two coils of insulated copper wire are wrapped on few long iron rods. Coil-1 is connected to a battery through a switch and Coil-2 is connected to a galvanometer. Now, the current is switched on in Coil-1. A momentary deflection is seen in the galvanometer attached to Coil-2. The deflection is due to current induced in Coil-2 momentarily as the magnetic field builds up along the axis of Coil-1 when the current is switched on.

(c) When a bar magnet is held stationary inside the coil, there will be no deflection in the galvanometer indicating that no current is produced in the coil.

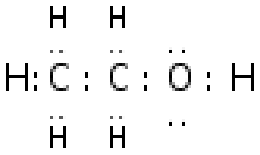
OR

(i) Total resistance R = R1 + R2 = $18\ \Omega + 6\ \Omega = 24\ \Omega$
(ii) Current flowing through the circuit, I = V/R =6/24 = 0.25 A
(iii) Potential difference across the lamp, V1 = IR1 = 0.25 × 18 = 4
Potential difference across the resistor R2, V2 = IR2 =0.25 × 6 = 1.5 V

SECTION B

22. (i)

(ii)



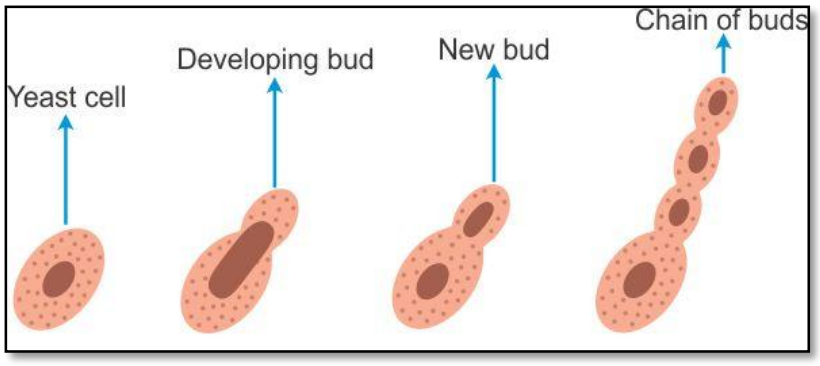
23. Baking powder ($NaHCO_3$), i.e. Salt A, is commonly used in bakery products. On heating, it forms sodium carbonate (Na_2CO_3), i.e. B, and CO_2 gas, i.e. C, is evolved. When CO_2 gas is passed through lime water, it forms calcium carbonate ($CaCO_3$), which is slightly soluble in water making it milky.

A - $NaHCO_3$

B - Na_2CO_3

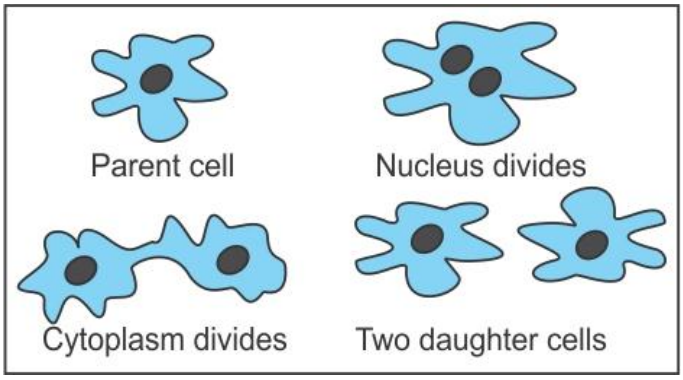
C - CO_2 gas

24. The process of reproduction in yeast is budding.



25. Binary fission is the type of asexual reproduction in which two individuals are formed from a single parent and the parental identity is lost.

Initial and Final Stages of Binary Fission



OR

<u>Events which occur during binary fission in *Amoeba*</u>:

- Elongation of the cell
- Division of the cytoplasm
- Division of the nucleus
- Formation of two daughter cells

26.

Device X is a convex lens of focal length 40 cm.

The parallel rays from the distant object fall on the convex lens and converge at its second principal focus (i.e. where the screen is placed). The distance between the screen and the convex lens gives the approximate focal length of the lens, i.e. 40 cm.

27.

The positive terminal of the ammeter should be connected to the positive terminal of the cell, and the negative terminal should be connected to the negative terminal.