CBSE-CLASS -X-Science

Section A

1. There are 18 vertical columns in the modern periodic table and these are known as groups.

Section B

2. (i) Genetics is the study of mechanism by which variations are created and inherited.
   (ii) Evolution is used for studying the development of new types of organisms from the existing ones.

3. Two ways of saving water:
   a. Turning-off the taps when not in use
   b. Checking the leaking water pipelines and getting them repaired

4. Vegetative propagation is an asexual mode of reproduction. It is the ability of the plants to reproduce by producing new plants from the vegetative parts such as leaf, stem, or roots under favourable conditions.

   Advantages of vegetative propagation:

   a. Only one parent is required, which eliminates the need for special mechanisms (pollination).
   b. Many plants are able to tide over unfavourable conditions because of the presence of vegetative reproductive parts like the tubers, corm, bulbs, etc.
   c. Plants that do not produce seeds are propagated by this method. For example: Sugar-cane, Potato, etc.
   d. Vegetative propagation is a cheaper, easier and rapid method of propagation in plants than growing them from their seeds. For example, when grown from their seeds, lilies grow very slowly and take 4 to 7 years to develop flowers, but flowers are produced only in a year or two when grown vegetatively.
   e. The trait (character) of the parent plant is preserved and the offsprings are genetically identical.

(Any four advantages can be written)

5.
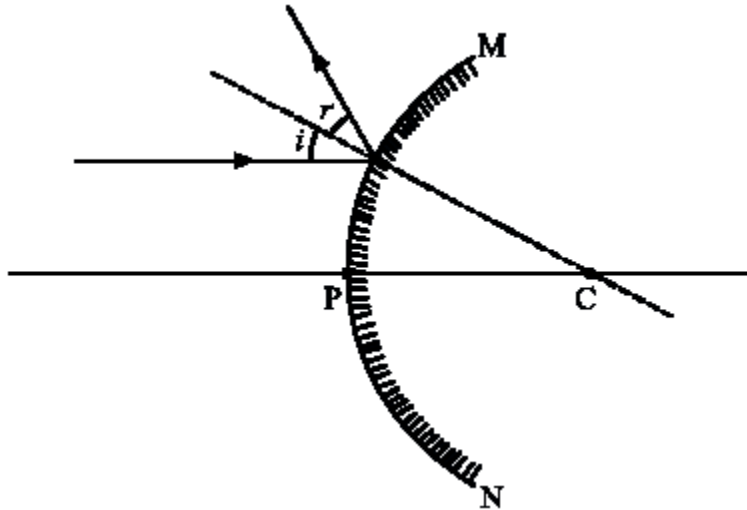
6. Government of India is imposing a ban on the use of polythene bags because they cannot be degraded naturally by the action of microorganisms. Because of their non-biodegradability, they stay in the soil for a long time and continue to poison it with toxic by-products that keep leaching from them. Also, they do not allow water to seep in, as they are waterproof. These polythene bags, when accidentally eaten by stray animals, can harm them and can even lead to their death.

Jute and cloth bags can be used in place of polythene bags.

The advantages of using cloth and jute bags are as follows:
   a. They are environment-friendly as they are biodegradable.
   b. They are renewable and can be easily recycled.
   c. They have more strength than polythene bags because they are thick and can be used again and again.

Thus, using jute and cloth bags will helps to reduce pollution

7. Biodiversity refers to the variety of living organisms present in the given ecosystem. It includes all the marine and terrestrial organisms. The biodiversity of an area is measured by counting the number of species found in that particular area.

Advantages of conserving forest:
(i) It prevents soil erosion and floods.
(ii) It helps to maintain the water cycle.
(iii) It produces huge amounts of raw materials for the industries.

(Any of the two advantages can be written)

Advantages of conserving wildlife:
(i) It protects the endangered species.
(ii) It preserves different kinds of species and thus, maintains the species diversity.
(iii) It helps in maintaining the ecological balance that is required for supporting life.

(Any of the two advantages can be written)

8. **Definition:**
   Functional group is an atom or a group of atoms that is bonded to a carbon chain. It defines the chemical property of the organic compound.

Compound	Functional Group	Structure
Ethanol	Hydroxy (-OH)	CH_3CH_2OH
Ethanoic acid	Carboxylic acid(-COOH)	CH_3COOH

9. **Name and general formula of hydrocarbons undergoing addition reaction with hydrogen:**

Name	General Formula
Alkene	C_nH_{2n}
Alkyne	C_nH_{2n-2}

**Essential conditions required for the addition reaction to occur:**

- Multiple bonds (double and triple bonds) must be present between carbon atoms in the chain of hydrocarbon.
- Addition of hydrogen should be carried out in the presence of catalyst such as nickel or platinum.

Chemical Equation:

$$CH_2 = CH_2 + H_2 \xrightarrow{Ni \ or \ Pt} CH_3 - CH_3$$
$$\text{Ethene} \qquad\qquad\qquad \text{Ethane}$$

$$CH \equiv CH + 2H_2 \xrightarrow{Ni \ or \ Pt} CH_3 - CH_3$$
$$\text{Ethyne} \qquad\qquad\qquad \text{Ethane}$$
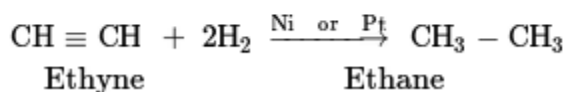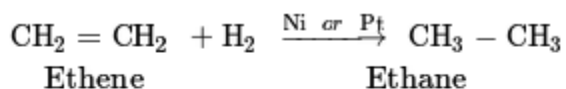
10. (i) Valency of group 1 elements: 1
Valency of oxygen: 2

Oxides of group 1 elements:

Element   M   O
                      $\equiv M_2O$
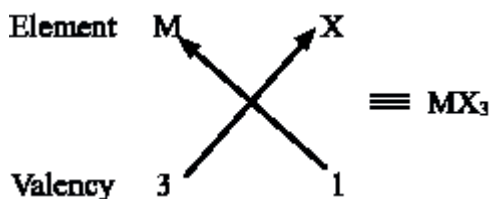Valency   1   2
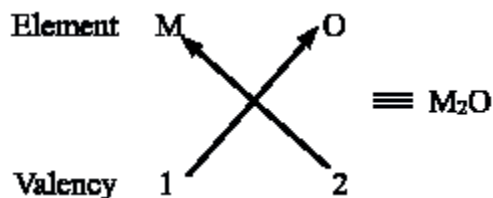
Formula of the oxides of group 1 is M_2O, where M is the group 1 element and O is oxygen.

(ii) Valency of group 13 elements: 3
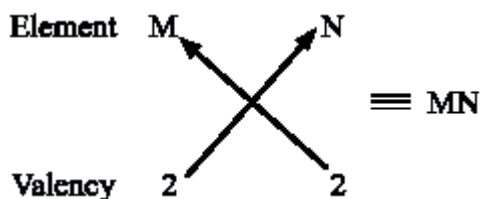Valency of halogens: 1

Halides of group 13 elements:

Element   M   X
                      $\equiv MX_3$
Valency   3   1

Formula of the halides of group 13 is MX_3, where M is the group 13 element and X is halogen.

(iii) Valency of group 2 elements: 2
Valency of group 16 elements: 2

Compounds of group 2 and group 16 elements:

Element   M   N
                      $\equiv MN$
Valency   2   2

Formula of the compounds of group 2 and 16 is MN, where M is the group 2 element and N is the group 16 element.

11. a. (i) **Valency**: The combining power or the combining capacity of an atom is called its valency. Valency of an atom is simply equal to the number of electrons gained, lost or

shared by an atom to achieve the nearest noble gas configuration.

   (ii) **Atomic size**: Atomic size or atomic radius is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

b. **Variation in valency**
On moving from left to right in the periodic table, valency increases up to 4 and then decreases.
   a. The electrons present in the last shell determine the valency of a particular element.
   b. If the number of valence electrons is less than or equal to 4, valency = number of valence electrons
   c. If the number of valence electrons is more than 4, valency = 8 - number of valence electrons

Variation in atomic size:
Atomic size decreases along a period. This is because on moving across a period, the number of valence shells remains the same and the electrons increase by one unit. As a result, the nuclear charge increases and thus, the atomic radius decreases.

12. *Planaria* is a type of flatworm. It has the amazing capacity to regenerate its lost body part. When the flatworm is cut horizontally, separating the head from the tail, the tail will regenerate the lost head and the head will regenerate the lost tail. This process is known as regeneration. The diagram illustrating the process of regeneration in *Planaria* is given below

Regeneration in *Planaria*
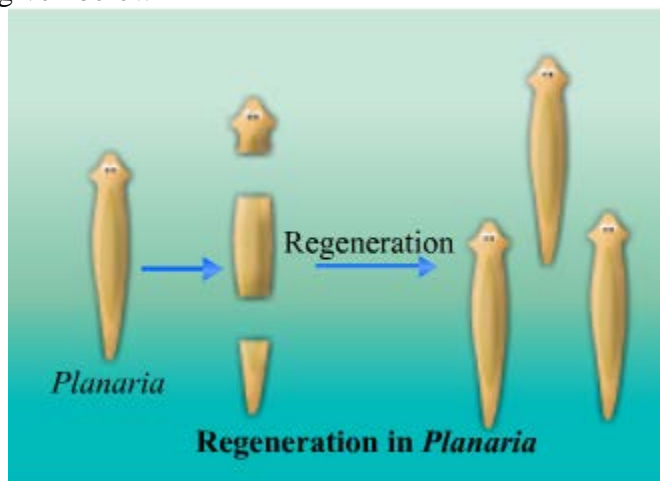
Regeneration is one of the methods of asexual reproduction, which can be observed in Hydra also.

13. The following are the four methods of contraception used by humans:

(i) Natural method: It involves avoiding the chances of meeting of the sperm and the ovum. In this method, the sexual act is avoided from day 10th to day 17th of the menstrual cycle because during this period, ovulation is expected; therefore, the chances of fertilisation are very high.

(ii) Barrier method: In this method, fertilisation of the ovum and sperm is prevented with the help of barriers. Barriers are available for both males and females. Condoms, which are made of thin rubber, are used to cover the penis in males and the vagina in females.

(iii) Oral contraceptives: In this method, tablets or drugs are taken orally. These contain small doses of hormones that prevent the release of eggs, thus preventing fertilisation.

(iv) Implants and surgical methods: Contraceptive devices such as the loop or copper-T are placed in the uterus to prevent pregnancy. Some surgical methods can also be used to block the gamete transfer. In vasectomy, the vas deferens is blocked to prevent the transfer of sperms. Similarly, in tubectomy, the fallopian tubes of the female can be blocked so that the egg does not reach the uterus.

Effects of contraception on the health and prosperity of a family:
(i) It helps in preventing unwanted pregnancies.
(ii) It prevents the chances of frequent pregnancies, which otherwise affect the health of females.
(iii) It helps in family planning by controlling the number of children in a family, thus reducing the chances of poverty.
(iv) It also reduces the chances of transmission of sexually transmitted diseases such as AIDS.

In this way, birth control methods play an important role in the health and prosperity of a family

14. (a) Fossils provide evidence of evolution. A fossil bird called *Archaeopteryx*, which lived in the Late Jurassic Period around 148–150 million years ago, had feathered wings like that of birds and a long bony tail, jaws with sharp teeth and various skeletal features like that of reptiles. Thus, *Archaeopteryx* is considered a connecting link between reptiles and birds.

Some dinosaurs had feathers that provide them insulation in cold weather; however, they could not fly using those feathers. Birds seem to have later used feathers to fly. This, of course, means that birds are very closely related to reptiles because dinosaurs were reptiles. Hence, it suggests that birds have evolved from reptiles.

(b) While making groups, we need to decide the characteristics that are responsible for the more fundamental differences among organisms. The characteristics that account for the broadest divisions among living organisms should be independent of any other characteristics in their effects on the forms and structural functions of organisms like cellularity, mode of nutrition and nature of cell.

Insects, octopus and *planaria* are invertebrates; they cannot be grouped together with vertebrates, as they lack an internal skeleton with a backbone. Also, all of them belong to different phyla on the basis of different characteristics they possess. Just on the basis of one characteristic, i.e., presence of eyes, these organisms cannot be grouped together.

15. (a) The cross was made between round, green seeds and wrinkled, yellow seeds. In the given cross, two traits were taken into account, which is a dihybrid cross.
Yellow colour and round shape is dominant over green colour and wrinkled shape.
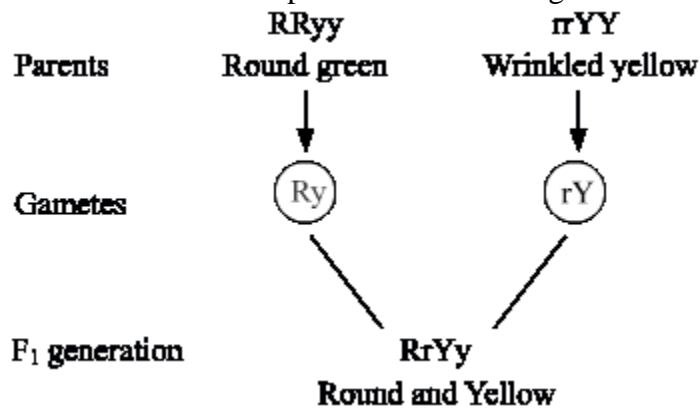
The above cross shows round and yellow seeds in the F1 generation. It occurs because dominant traits (round and yellow) express itself, whereas recessive traits (wrinkled and green) get suppressed.

(b) On selfing of F1 generation

F1 generation on selfing	Rr Yy Round yellow	✕	Rr Yy Round yellow

	RY	Ry	rY	ry
RY	RRYY Round yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	rrYy Wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy Wrinkled yellow	rryy Wrinkled green

Round yellow	:	Wrinkled yellow	:	Round green	:	Wrinkled green
9	:	3	:	3	:	1

Phenotypic ratio − 9:3:3:1
Round yellow − 9
Round green − 3
Wrinkled yellow − 3
Wrinkled green −1

16. (a) As magnification is negative, the image formed is real.
Hence, it is a concave mirror.
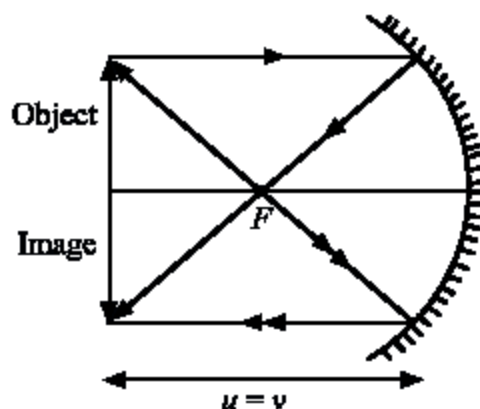
(b) $m = -\dfrac{v}{u} = -1$

$\therefore u = v = -50$ cm

Distance of the image from the object $= |u| + |v| = 100$ cm

(c) By using mirror formula:

$\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u} = \dfrac{1}{(-50)} + \dfrac{1}{(-50)} = -\dfrac{1}{25}$

$\therefore f = -25$ cm

(d)

17. **(**a) There are two laws of refraction:

First law of refraction:
The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant. This is known as Snell's law. Mathematically, it can be expressed as:

$$\frac{\sin i}{\sin r} = n_{12}$$

Here, n12 is the relative refractive index of medium 1 with respect to medium 2.

Second law of refraction:
The incident ray, the refracted ray and the normal to the interface of two media at the point of incidence lie on the same plane.
If a light ray goes from medium 1 to medium 2, then the refractive index of medium 1 with respect to medium 2 is expressed as:

$$n_{12} = \frac{\text{Speed of light in medium 2}}{\text{Speed of light in medium 1}} = \frac{v_2}{v_1}$$

Here, v1 and v2 are the speeds of light in medium 1 and medium 2, respectively.

(B)
Given:
Speed of light in vacuum = 3×10^8 ms−1
Refractive index of the medium:

$$n_m = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}}$$

$$\Rightarrow 1.5 = \frac{3 \times 10^8}{v}$$

$$\Rightarrow v = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s}$$

Hence, the speed of light in the medium of refractive index 1.5 is 2×10^8 m/s.

18. Sunlight reaches the Earth's atmosphere and is scattered in all directions by the gases and particles in the air. Blue light is scattered more than the other colours because it has the shortest wavelength. This is why the sky appears blue to an observer from the surface of the Earth.

For an astronaut staying in the international space station orbiting the Earth, the colour of the sky will be black because the light reaching it does not scatter.

19. A large number of pesticides and chemicals are used to protect our crops from pests and diseases. Some of these chemicals are washed down into the soil, while some enter in the water bodies. From the soil, they are absorbed by plants along with water and minerals; and from water bodies, they are taken up by aquatic plants and animals. This is how these chemicals enter the food chain. Because these chemicals cannot decompose, they accumulate progressively at each trophic level. As the food chain proceeds, the concentration of pesticides also increases. This increase in the concentration of harmful chemicals with each step of the food chain is called biomagnification. That is why food grains, such as wheat and rice, vegetables, fruits and even meat are found to contain pesticide residue.

20. Atomic number of carbon is six. This means that it has four electrons in its outermost shell and it needs four more electrons to attain noble gas electronic configuration. It does not form C^{4+} cation, as the removal of four valence electrons will require a huge amount of energy. The cation formed will have six protons and two electrons. This makes it highly unstable. Carbon is unable to form C^{4-} anion as its nucleus with six protons will not be able to hold ten electrons. Thus, carbon achieves noble gas electronic configuration by sharing its four electrons with other elements, i.e. it forms covalent compounds.

(i) Covalent compounds are bad conductors of electricity due to lack of free electrons.

(ii) Covalent compounds are formed by covalent bonds and it has been found that the intermolecular forces of attraction in covalent compounds are weak. Thus, their melting and boiling points are quite low.

21. (a) Unisexual flowers: Cucumber, pumpkin, water melon, papaya, etc.
Bisexual flowers: Hibiscus, rose, lily, etc.
(Any one example can be written).

(b) Changes in a flower after fertilisation:

The outer layers of the ovule become impervious and hard and function as a seed coat. An ovule with an embryo inside is called a seed.

The ovary enlarges and ripens to become a fruit. Other floral parts such as sepals, petals, stamens, styles and stigma may fall off. However, in some cases, they remain persistent in the fruit.

(c) Deoxyribonucleic acid (DNA) copying is an essential part of reproduction, as it passes genetic information from parents to offspring. The reproducing cells produce a copy of their DNA through some chemical reactions and result in two copies of DNA. The copying of DNA always takes place along with the creation of additional cellular structure. This process is then followed by the division of a cell into two cells. In this way, the amount of DNA remains constant through each new generation.
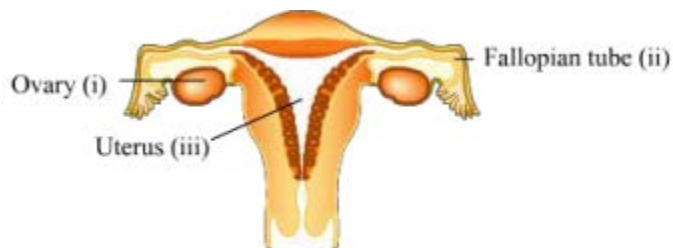
22. (a)

   (i) Ovary

   (ii) Fallopian tube

   (iii) Uterus

Diagram of the female reproductive system

(a) The zygote formed after fertilisation in the fallopian tube is implanted in the uterus. It divides repeatedly to form a mass of cells known as embryo. This embryo gets attached to the inner layer of the uterine cavity, i.e., endometrium. It thickens every month and is supplied with blood to nourish the embryo. Soon it gets covered by rapidly dividing uterine cells. This leads to pregnancy.
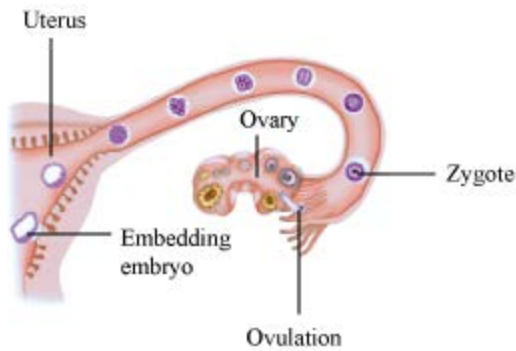
Within a span of some months, the embryo starts developing limbs and begins to resemble a miniature human being. When all body parts of the embryo can be recognised, it becomes a foetus. When this foetus is fully developed, the mother gives birth to the baby.

23. (a) He should use a convex lens as it forms real images.

(b) He should place the candle flame between F and $2F$ (the focus and centre of curvature of the lens) to get the magnified image on the wall while the diminished image is obtained when the object is located at a distance greater than $2F$.

(c) The ray diagram for the formation of the magnified image is shown below:
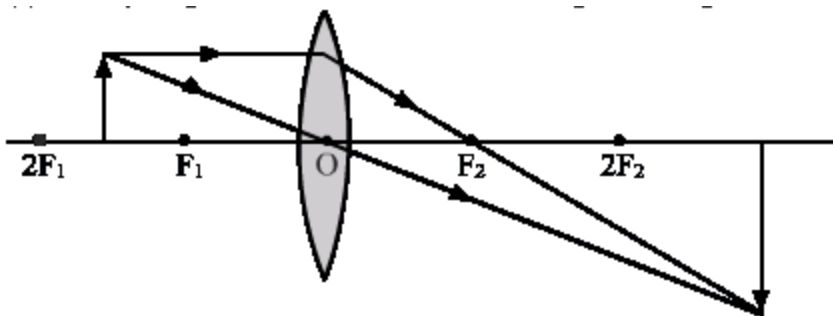
The ray diagram for the formation of the diminished image is shown below
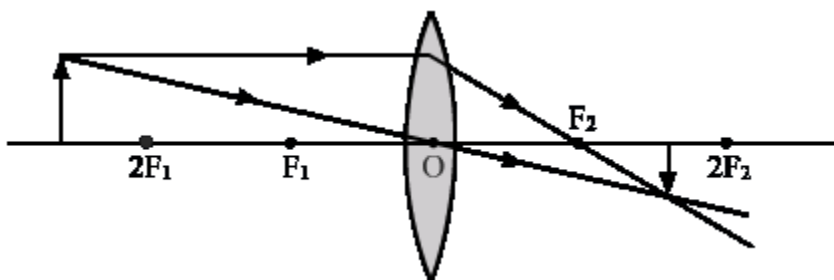
24. (a) The three common refractive defects of vision are as follows:

Myopia (short-sightedness): It is corrected by using spectacles having concave lenses of appropriate power.

Hypermetropia (far-sightedness): It is corrected by using spectacles having convex lenses of appropriate power.

Presbyopia: This defect is corrected using bifocal lenses of appropriate power in which the upper part consists of a concave lens (to correct myopia) and the lower part consists of a convex lens (to correct hypermetropia).

(b) Eyes of a dead person can be donated to the person having corneal blindness. It will help him/her see the world. We can also register ourselves to eye donation camps who can preserve our eyes after our death and donate them to the needy.

Section C

25. When acetic acid and distilled water are mixed, they form a clear solution because acetic acid is completely miscible with water.
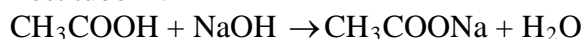
Hence, the correct option is B.

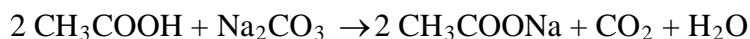26. The chemical reactions in test tubes X, Y and Z can be written as:

Test tube X:
$CH_3COOH + NaCl \rightarrow$ No reaction

Test tube Y:
$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

Test tube Z:
$2\,CH_3COOH + Na_2CO_3 \rightarrow 2\,CH_3COONa + CO_2 + H_2O$

Thus, the flame will be extinguished when test tube Z is brought near a burning splinter due to evolution of carbon dioxide gas, which does not support combustion.

Hence, the correct option is D.

27. Dissolution of sodium hydroxide in water evolves large amount of heat. Thus, it is an exothermic reaction. Since sodium hydroxide is a base, its solution in water will be alkaline when tested with litmus paper (red litmus turns blue).

Hence, the correct option is A.

28. Common salt is added in saponification reaction, as it helps in the precipitation of soap by decreasing the solubility of soap.

Hence, the correct option is D

29. Scum is formed by reaction of soap with calcium and magnesium salts in water. Test tubes R and S contain calcium chloride and magnesium chloride, respectively. Therefore, scum will be formed in these two tubes.

Hence, the correct option is C.

30. To measure the focal length of the mirror, the object should be taken at infinity. Therefore, the image formed by the concave mirror would be real, inverted, diminished and red in shade.

Hence, the correct option is C.

31. The lens is convex, as it forms real image. As mentioned in the second case, the image distance (v) is increasing; hence, the object distance (u) is decreasing.
The lens formula is

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

$$\Rightarrow F = \frac{uv}{u-v}$$

For convex lens, object distance = -u
Image distance = + v

$$\Rightarrow F = \frac{uv}{u+v}$$

where F is the focal length of the lens.
Therefore, F is lesser for the second lens of focal length F2.
Hence, F1 > F2

Hence, the correct option is C.

32. Experiment II will give the best result because it has the largest angle of incidence, due to which the lateral displacement between the incident ray and emergent ray will be maximum.

Hence, the correct option is B.

33. The correct conclusion is that the incident ray and emergent ray are always parallel to each other.
Hence, the correct option is D.

34. O is the angle of prism.

Angle of incidence is the angle made by the incident ray with the normal to the surface of the prism. Here, X represents the angle of incidence.

Angle of emergence is the angle made by the emerging ray with the normal to the surface of the prism. Here, M represents the angle of emergence.

Angle of deviation is the angle made by the emerging ray with the incident ray. Here, Z represents the angle of deviation.

Hence, the correct option is C.

35. When a ray of light enters a glass prism, it travels from a rarer medium to a denser medium. So, the ray of light bends towards the normal.

   When the ray of light emerges from the glass prism, it travels from a denser medium to a rarer medium. So, the ray of light bends away from the normal.

   Hence, the correct option is A.

36. Observation no. 3 is incorrect because the focal length of the lens in all other observations is 12 cm. In observation no. 3, the focal length comes out to be 13.26 cm.

   Hence, the correct option is B.

37. A convex lens converges the refracting ray. Therefore, rays I and III represent the path of the refracting ray from a convex lens(converging lens). As rays II and IV show the refracting ray being diverged, the ray diagrams are incorrect.

   Hence, the correct option is D.

38. During binary fission, the nucleus of the parent cell elongates and divides initially. A constriction starts appearing on the cell membrane. It starts widening and finally divides the parent cell into two almost equal halves (daughter cells). The daughter cells are identical to the parent cell.

   Hence, the correct option is B.

39. III, IV and I show the process of budding in a yeast.

During budding in a yeast, a single cell develops a protrusion wherein the nucleus divides to give rise to two daughter nuclei. One of the daughter nuclei migrates to the protrusion to form a bud. This bud then grows in size and may undergo budding while attached to the parent cell. Thus, budding results in a chain of cells.

Hence, the correct option is D.

40. Homologous structures are similar in origin, but they perform different functions. Carrot and radish are underground roots, so they represent homologous structures.

Hence, the correct option is B.

41. Organs that are different in origin but similar in function are known as analogous organs. Examples of analogous organs are:
(i) Wings of a parrot and wings of a butterfly
(ii) Wings of a bird and wings of a bat
Thus, the two students who have reported correctly are R and S.

Hence, the correct option is C.

42. First of all, take some dry gram seeds in a Petri dish. Now, soak the seeds in plain water and keep them overnight. Drain the excess water. After that, cover the soaked seeds with a wet cotton cloth and leave them for a day. Finally, cut open a soaked seed and observe its different parts.

Hence, the correct option is D.