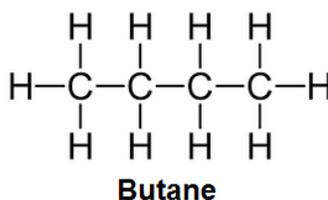


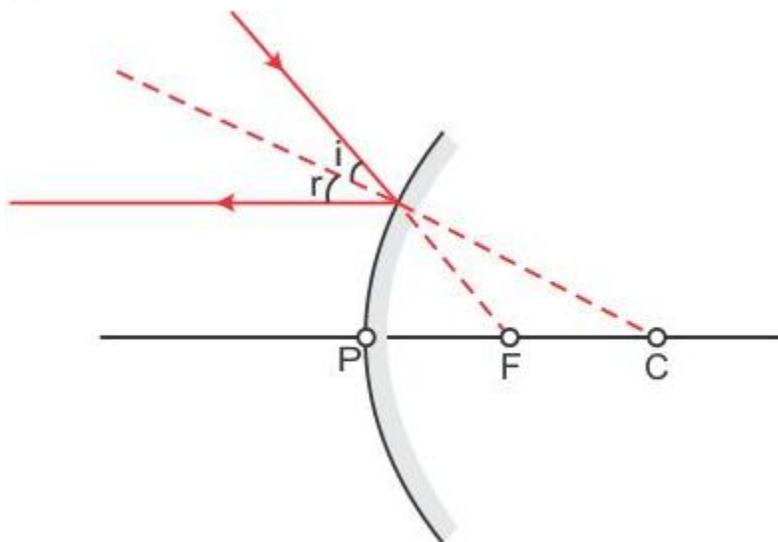
CBSE
Class X Science
Board Paper - 2015 (Set 3) Solution
Term II

SECTION A

1. There are thirteen covalent bonds—ten C-H and three C-C bonds—present in a molecule of butane.



2. Hydra and Planaria have the ability of regeneration.
3. Primary consumers (green plants) are always at the second trophic level.
4. A light ray is incident on a convex mirror parallel to the principal axis. The ray diagram is shown below.



In the above diagram, 'i' is the angle of incidence and 'r' is the angle of reflection.

5. Sustainable management of natural resources is necessary to preserve the natural resources for the future generations and also to control environmental pollution. Reusing is better than recycling because recycling requires a large amount of energy and money, but reusing creates lesser air and water pollution.

6. The existence of many different kinds of plants and animals in an environment is called biodiversity.

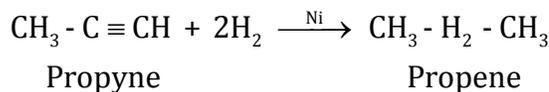
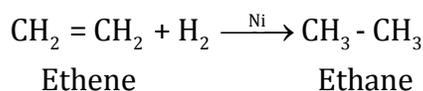
Two advantages of conserving forests and wild life:

- i. They add to the natural beauty of the environment.
- ii. They provide valuable things which are required for our survival.

7. The addition of hydrogen is possible in alkenes and alkynes. This is because of the presence of double and triple bonds, respectively. The general formula of alkenes is C_nH_{2n} and that of alkynes is C_nH_{2n-2} .

Conditions for addition reactions are

- Presence of an unsaturated compound, i.e. an unsaturated hydrocarbon.
- Presence of a species to be added to an unsaturated compound.
- Presence of a catalyst such as finely divided palladium or nickel.



8. Carboxylic acid can be distinguished from an alcohol by performing the following tests:
- i. **Test with $NaHCO_3$ solution in water.**

On adding carboxylic acid to baking soda, carbon dioxide is liberated with brisk effervescence.

On adding a solution of baking soda to alcohol, no brisk effervescence occurs.

- ii. **Test with blue litmus solution.**

Carboxylic acid turns blue litmus red.

There is no change in colour when a blue litmus solution is added to alcohol.

9.

(a) Element D (19) has one electron in its outermost shell. Its electronic configuration is 2, 8, 8, 1.

(b) Elements A (4) and E (20) have two electrons in their outermost shells.

Electronic configuration of A: 2, 2

Electronic configuration of E: 2, 8, 8, 2

Since they both have a valency of two, they belong to group 2 of the periodic table.

(c) Elements A (4) and B (9) belong to the second period, and elements D (19) and E (20) belong to the fourth period of the periodic table.

Since the effective nuclear charge which pulls the outermost electron closer to the nucleus increases from left to right in a period, the atomic radii of the elements decreases. A (4) has a bigger atomic radius than B (9) and D (19) has a bigger atomic radius than E (20).

10. Atomic number of the element = 16

Electronic configuration = 2, 8, 6

The period number is equal to the number of shells which starts filling up in it.

The atom of an element has three shells. So, the period number is 3.

The atom of an element has six valence electrons in the outermost shell. So, the group number of the element will be 16 (6 + 10).

The valency of an element is determined by the number of valence electrons present in the outermost shell. The atom of an element has six valence electrons in the outermost shell, so the valency of the element is 2.

11. A - Stigma

Function: Pollen lands and germination starts

B - Pollen tube

Function: It carries the pollen to the egg cell for fertilisation.

C - Egg cell

Function: It fuses with the male gamete to form a zygote.

12. Four methods of contraception used by humans—intrauterine devices, oral contraceptive methods, surgical methods and natural methods (coitus interruptus)

Two advantages of adopting such preventive methods:

- i. Helps in preventing unwanted pregnancies
- ii. Reduces the chance of getting STDs such as AIDS

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.

(a) Speciation: The process by which new species develop from the existing species is known as speciation.

The factors which could lead to speciation are

- i. Geographical isolation of population caused by various types of barriers such as mountain ranges, rivers and seas. This leads to reproductive isolation because of which there is no flow of genes between separated groups of population.
- ii. Genetic drift caused by drastic changes in the frequencies of particular genes by chance alone.
- iii. Variations caused in individuals because of natural selection.

(b) Natural Selection: Natural selection is the process of evolution of a species whereby characteristics which help individual organisms to survive and reproduce are passed on to their offspring, and those characteristics which do not help are not passed on.

Charles Darwin proposed the theory of natural selection. According to him, nature selects the fittest.

There are always changes in the progeny when an animal reproduces by sexual reproduction. Example: If one of the progeny of deer is tall and the other is short, then the tall one with long legs will survive. Because the progeny with short height cannot reach the leaves of tall trees and cannot get food, they will starve and hence die. Thus, it proves the theory of natural selection.

15.

(a) Homologous organs: Organs which have the same basic structure but different functions are called homologous organs.

Example: The forelimbs of a man, lizard, frog, bird and bat have the same basic design of bones, but they perform different functions. The forelimbs of a man are used for grasping, the forelimbs of a lizard are used for running, the forelimbs of a frog are used to prop up the front ends of the body when at rest and the forelimbs of a bird and bat are modified for flying. Hence, all these organisms use their forelimbs for performing different functions, but the forelimbs have originated from the same structural pattern.

(b) Analogous organs: Organs which have different basic structure but similar appearance and perform similar functions are called analogous organs.

Example: The wings of an insect and a bird have different structures, but they perform the same function of flying. Because the wings of insects and birds have different structures but perform similar functions, they are analogous organs.

(c) Fossils: The remains of dead animals or plants which lived in the remote past are known as fossils. The fossils provide evidence for evolution. For example, a fossil bird called *Archaeopteryx* looks like a bird, but it has many other features which are found in reptiles. It has feathered wings like those of birds but teeth and tail like those of reptiles. Therefore, *Archaeopteryx* is a connecting link between the reptiles and birds and hence suggests that birds have evolved from reptiles.

16. At the time of sunrise and sunset, when the Sun is near the horizon, sunlight travels a greater distance through the atmosphere to reach us. During this time, most of the shorter wavelengths present in it are scattered away from our line of sight by the molecules of air and other fine particles in the atmosphere. So, light reaching us directly from the rising or setting Sun consists mainly of the longer wavelength red colour because of which the Sun appears red. Thus, at sunrise and sunset, the Sun and the surrounding sky appear red.

At noon, the Sun is overhead. So, the sunlight has to travel a relatively shorter distance. Hence, there is only slight scattering of shorter wavelengths of blue and violet colour. Therefore, the Sun appears mostly white.

17. Given:

Height of the object = $h = 5$ cm

Focal length of the concave lens = $f = -10$ cm

Object distance = $u = -20$ cm

Using the lens formula, we get

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

$$\therefore \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{-10} - \frac{1}{20} = \frac{-2-1}{20} = \frac{-3}{20}$$

$$\therefore v = -6.67 \text{ cm}$$

Hence, the image is formed 6.67 cm in front of the lens on the same side as the object.

Because v is negative, we can say that the image is virtual.

From the magnification formula for the lens, we get

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

$$\therefore h' = \frac{vh}{u} = \frac{-6.67 \times 5}{-20} = 1.67 \text{ cm}$$

Hence, the size of the image is $h' = 1.67$ cm.

Because the height of the image is positive and smaller than the height of the object, the image is erect and diminished.

So, we can conclude that the image is virtual, erect and diminished.

18.

Biodegradable wastes	Non-biodegradable wastes
(a) Waste materials which can be broken down to non-poisonous substances in nature in due course of time by the action of microorganisms such as certain bacteria are called biodegradable wastes.	(a) Waste materials which cannot be broken down into non-poisonous or harmless substances in nature are called non-biodegradable wastes.
(b) Examples: Cattle dung, wool, paper, compost	(b) Examples: Plastics, polythene bags, metal articles, glass objects

The changes which people must adopt to dispose non-biodegradable wastes for saving the environment are

- (a) Household waste, chemical waste and hospital waste should be disposed of by dumping them in the low-lying areas of the ground called a landfill.
- (b) Broken plastic articles such as buckets, bowls, cups, plates etc. should be sent to plastic processing factories.

19. The curvature of the eye lens can be adjusted by the ciliary muscles. This changes the focal length of the lens. The defect which arises because of the gradual weakening of the ciliary muscles is known as presbyopia. A bifocal lens can be used to correct presbyopia.

Answers to the context questions:

- (a) Akshay is not able to see from a far distance, so he is suffering from myopia or near-sightedness. A concave lens should be used to correct this defect.
- (b) The teacher displayed presence of mind and pro-activeness, and she is of a considerate nature.
Salman displayed the virtue of friendship and is caring in nature.
- (c) Akshay should thank the teacher and Salman in front of the entire class.

20. The power of a lens is defined as the reciprocal of its focal length. It is represented by the letter P. The power P of a lens of focal length f is given as

$$P = \frac{1}{f}$$

The SI unit of power is dioptre (D).

Given:

Focal length of lens A, $F_A = +10 \text{ cm} = +0.1 \text{ m}$

Focal length of lens B, $F_B = -10 \text{ cm} = -0.1 \text{ m}$

To calculate the power of lens A:

The power of lens A, $P = \frac{1}{F_A \text{ (in metres)}}$

$$P = \frac{1}{+0.1}$$

∴ P = +10 dioptre or +10 D

The positive sign indicates that it is a converging or convex lens.

To calculate the power of lens B:

$$\text{The power of lens B, } P = \frac{1}{F_B(\text{in metres})}$$

$$P = \frac{1}{-0.1}$$

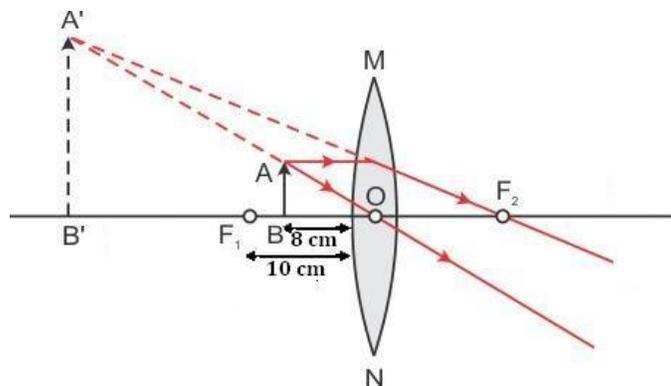
∴ P = -10 dioptre or -10 D

The negative sign indicates that it is a diverging or concave lens.

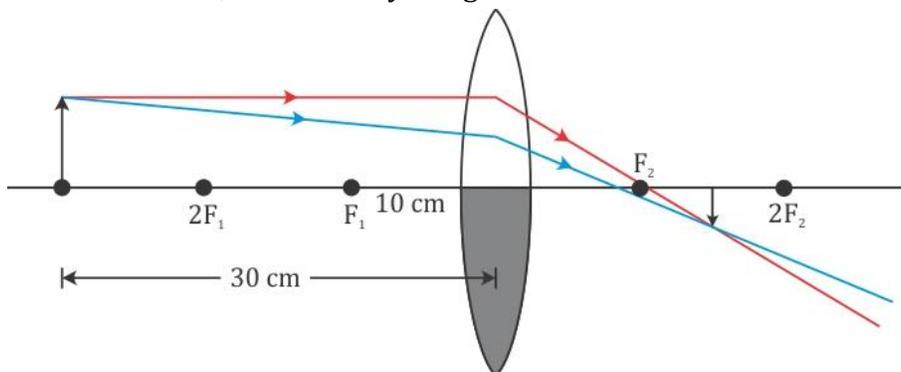
In a convex lens, when the object is placed between the pole and focus, the image formed is always virtual and magnified. On the other hand, a concave lens produces virtual, erect but diminished image.

Here the object is placed 8 cm from the lens which is at a distance less than the focal length, i.e. less than 10 cm. Thus, the 8 cm position of the object placed in front of the convex lens will produce a virtual and magnified image.

The diagram for the same is as shown below:



21. A convex lens can produce the complete image of the object even though half of the lens is covered. This is because light coming from the object can be refracted from the other half of the lens. However, the intensity of light will be reduced.



Given:

Height of the object = $h = 4$ cm

Focal length of the convex lens = $f = 20$ cm

Object distance = $u = -15$ cm

Using the lens formula, we get

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

$$\therefore \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{20} - \frac{1}{15} = \frac{3-4}{60} = \frac{-1}{60}$$

$$\therefore v = -60 \text{ cm}$$

Hence, the image is formed 60 cm in front of the lens on the same side as the object.

Because v is negative, we can say that the image is virtual.

From the magnification formula for the lens, we get

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

$$\therefore h' = \frac{vh}{u} = \frac{-60 \times 4}{-15} = 16 \text{ cm}$$

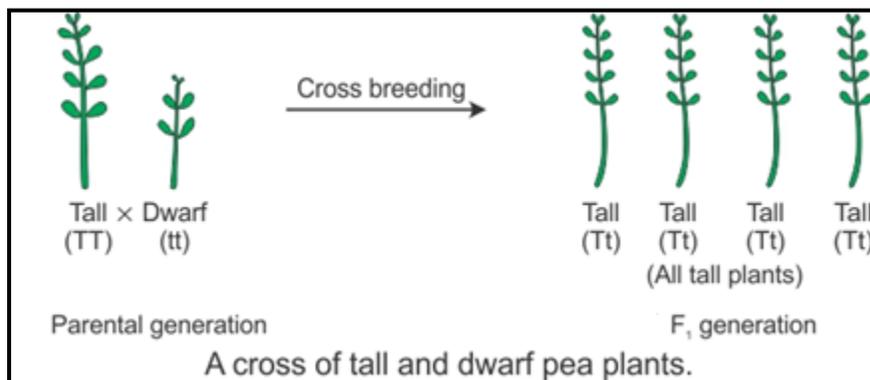
Hence, the size of the image is $h' = 16$ cm.

Because the height of the image is positive and greater than the height of the object, the image is erect and magnified.

So, we can conclude that the image is virtual, erect and magnified.

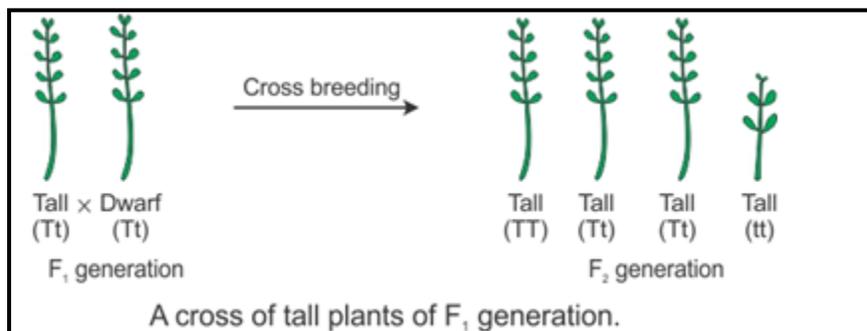
22.

(a) Mendel crossed pure bred tall pea plants with pure bred dwarf pea plants and found that only tall pea plants were produced in the first generation and there were no dwarf pea plants. He concluded that the first generation showed the traits of only one of the parent plants—tallness. The trait of the other parent plant—dwarfness—did not show up in the progeny of the first generation.



He then crossed the tall pea plants obtained in the first generation (F₁ generation) and found that both tall plants and dwarf plants were obtained in the second generation (F₂ generation) in the ratio of 3:1. Mendel noted that the dwarf trait of

the parent pea plant which disappeared in the first generation progeny reappeared in the second generation. In this way, Mendel's experiments with tall and dwarf pea plants showed that the traits may be dominant and recessive.



(b) When Mendel crossed pure-bred tall pea plants with pure-bred dwarf pea plants, he found that only tall pea plants were produced in the F₁ generation. When he further crossed the tall pea plants of the F₁ generation, he found that the tall plants and dwarf plants were obtained in the ratio 3:1 in the F₂ generation. Mendel noted that all the pea plants produced in the F₂ generation were either tall or dwarf. There were no plants with intermediate height (or medium height) in between the tall and dwarf plants. In this way, Mendel's experiment showed that the traits (like tallness and dwarfness) are inherited independently. This is because if the traits of tallness and dwarfness had blended (or mixed up), then medium-sized pea plants would have been produced.

23.

(a) Testes produce sperms and secrete a hormone called testosterone.

The function of testosterone is to control the development of male sex organs and male features such as a deeper voice, moustache, beard and more body hair as compared to females.

(b)

i. Fertilisation takes place in the oviduct or fallopian tubes.

ii. Implantation of the fertilised egg occurs in the uterus.

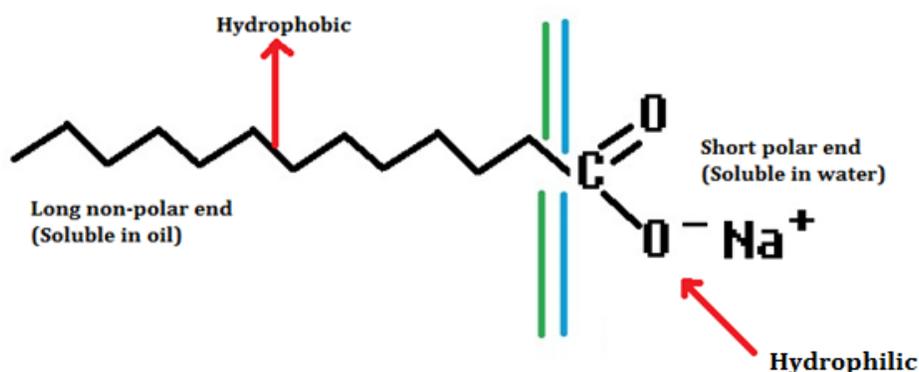
After implantation, a disc-like special tissue called placenta develops between the uterus wall and the embryo. The placenta helps in the exchange of nutrients, oxygen and waste products between the embryo and the mother. Thus, it provides nourishment to the growing embryo.

24. Difference between soap and detergent:

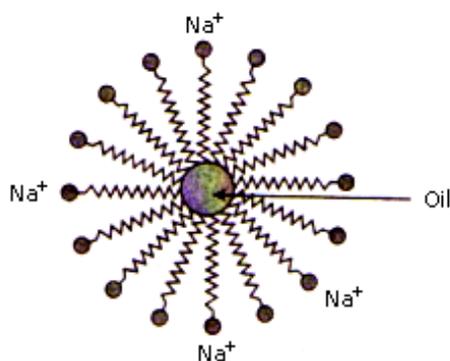
The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids.

Cleansing action of soap can be described as follows:

- A soap molecule has a tadpole-shaped structure.
- At one end (long non-polar end) of the soap molecule is a hydrocarbon chain which is insoluble in water but soluble in oil.
- At the other end (short polar end) of the soap molecule, there is a carboxylate ion which is hydrophilic, i.e. water soluble but insoluble in oil.



- Soap on mixing with water forms a concentrated solution and causes foaming.
- The long non-polar end of soap gravitates towards and surrounds the dirt and absorbs the dust in it.
- The short polar end with the carboxylate ion repels the water away from the dirt.
- A spherical aggregate of soap molecules is formed in the soap solution in water and is called a micelle.
- Thus, the soap molecule dissolves the dirt and our clothes get clean.



Formation of Micelles

Soaps do not form lather in hard water because

Hard water contains calcium and magnesium salts. Soap molecules react with calcium and magnesium salts to form an insoluble precipitate called scum.

Two problems arise because of the use of detergents instead of soap:

- i. Soaps are biodegradable, while detergents are non-biodegradable; hence, detergents accumulate in the environment and cause problems.
- ii. Certain phosphate additives are added to detergents. These phosphate additives act as nutrients for algae which form a thick green scum over the river water and upset the animal life in the river.

SECTION B

25.(A) $\angle i = \angle e < \angle r$

In refraction through a rectangular slab, the angle of incidence is equal to the angle of emergence. Also, the angle of refraction should be smaller than the angle of incidence.

26.(B) The emergent ray bends at an angle to the direction of the incident ray.

In refraction of light through a glass prism, there is deviation or change in the path of light passing through the prism.

27.(B) MS

The focal length of a concave mirror is the distance between its pole and principal focus. That is, the distance of the image formed (screen) from the concave mirror will be equal to the focal length of the concave mirror.

28.(D) This device is a convex lens of focal length 8 cm.

The incident rays after passing through the lens converge at the focus. So, the device 'X' is a converging or a convex lens. The distance between the lens and the screen gives the focal length of the lens.

29.(B) Radish and carrot

Radish and carrot are homologous structures as these are modifications of the root. Tomato and okra are fruits. Potato is a modification of the stem.

30.(C) III, IV and V

An embryo has two large cotyledons and one embryo axis or tigellum. The upper end of the embryo axis is the plumule, and the lower end of the embryo axis which projects beyond the cotyledons is the radical. The testa is the thick outer seed coat, and the tegmen is the inner transparent seed coat of seeds.

31.(D) To favour the precipitation of the soap

During saponification, the soap formed remains in a suspended form in the mixture. It is precipitated as a solid from the suspension by adding common salt to the suspension. This process is called salting out of soap.

32.(A) P and Q

Lather (foam) is formed by the reaction of soap solution with sodium sulphate and potassium sulphate in the test tubes P and Q, respectively. They are dissolved in water to give a neutral solution.

Sulphates, chlorides and bicarbonates of calcium and magnesium make the water hard. Thus, the lather is not formed in the test tubes R and S.

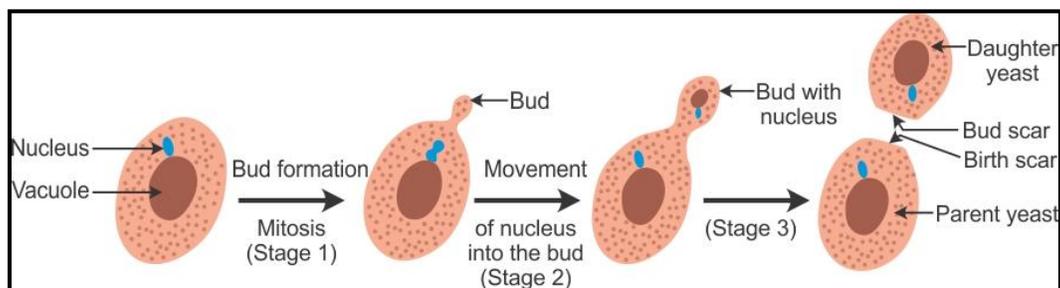
33.(A) Red litmus remains red and blue litmus turns red.

Acids turn blue litmus paper red. They have no effect on red litmus paper.

34.

(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:



35. Carbon dioxide gas gets liberated.

When a pinch of sodium hydrogen carbonate is added to acetic acid in a test tube, a brisk effervescence is produced because of the liberation of carbon dioxide gas.

When this gas is passed through the lime water, it turns lime water milky. This shows that the gas liberated is carbon dioxide gas.

The chemical reaction can be represented as



36. Given that

Object distance, $u = -12$ cm

Image distance, $v = 24$ cm

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

$$\frac{1}{f} = \frac{1}{24} - \frac{1}{(-12)}$$

$$\frac{1}{f} = \frac{1}{8}$$

$$\therefore f = 8 \text{ cm}$$

The focal length of the lens is 8 cm.

Now if the object is moved away from the lens, the screen has to be moved towards the lens. This is because when we move the object away from the lens, the object distance is increased. Hence, by the lens formula, the image distance decreases.

Magnification is given as

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

Because the image distance (v) decreases, the value of magnification also decreases.