

CBSE-CLASS-X-SCIENCE -SOLUTIONS-2015
SECTION-A

1) C_nH_{2n} is the general formula for the alkene series. The second member of the alkene family is propene with the molecular formula C_3H_6 .

2) Two functions performed by the testis in human beings are as follows:

1. It secretes the hormone testosterone, which is responsible for the secondary sexual changes in males.
2. It produces sperms, which participate in fertilisation.

3) The function of the ozone (O_3) layer in the upper atmosphere is to prevent harmful ultraviolet (UV) rays from reaching the Earth's surface, as these UV rays cause various types of diseases including skin cancer.

4) Four characteristics of the images formed by plane mirrors are as follows:

1. The images are of the same size as that of the objects
2. The images are formed behind the mirrors at the same distance from the mirrors as that of the objects.
3. The images formed are virtual and erect.
4. The images are laterally inverted.

5) Forests are considered "biodiversity hot spots" because they contain a high level of species diversity threatened with extinction.

The following are the two ways in which a person can effectively contribute towards the management of forests and wildlife:

1. He/she can avoid throwing non-biodegradable wastes, such as plastic bottles, in forest-protected areas.
2. He/she can reduce the use of products directly derived from forests (such as wood) and animals (such as animal skin).

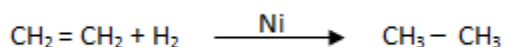
6) Sustainable Management

It is a pattern of management that promises the use of natural resources in such a way that they meet the human needs not only in the present but also in the future.

Advantage of Reuse over Recycling

Reusing a material is better than recycling it because recycling requires a large amount of energy and money. Reuse, on the other hand, preserves the embodied energy originally used in manufacturing an item. Reuse also creates less air and water pollution than recycling.

7) The process of adding hydrogen to an unsaturated compound is called hydrogenation. For example, the hydrogenation of ethene leads to the formation of ethane.



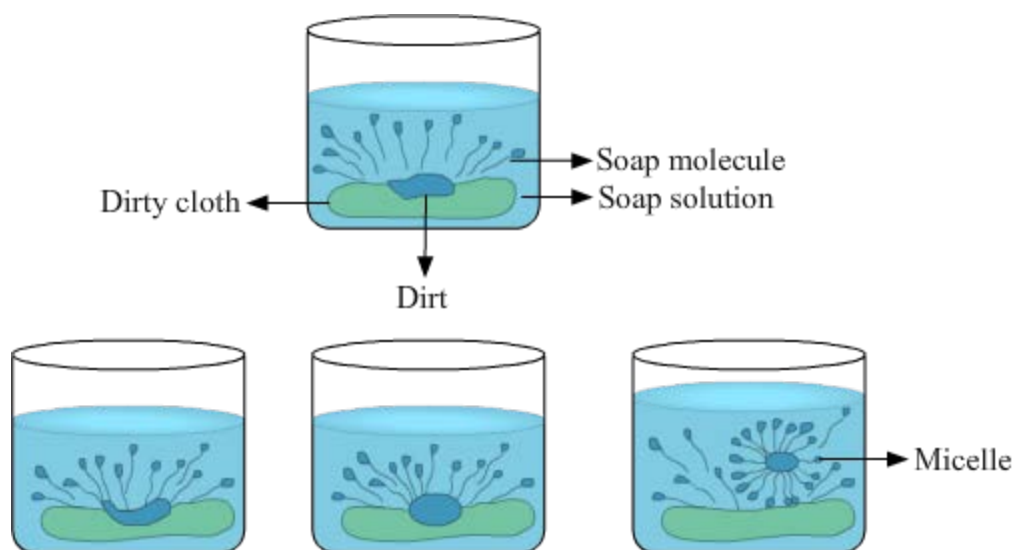
Conditions for Hydrogenation

- (i) Presence of an unsaturated compound (i.e. an unsaturated hydrocarbon)
- (ii) Presence of a catalyst such as finely divided palladium or nickel

In case of the hydrogenation of vegetable oils, liquid unsaturated fatty acids are converted into solid saturated fatty acids.

8) Soap molecules are sodium or potassium salts of long-chain carboxylic acids. They form scum upon reaction with calcium and magnesium ions present in hard water. Detergent molecules are ammonium or sulphonate salts of long-chain carboxylic acids. They do not form insoluble precipitates with calcium and magnesium ions.

Cleansing action of soaps: The dirt present on clothes is organic in nature and is insoluble in water. Therefore, it cannot be removed by only washing with water. When soap is dissolved in water, its hydrophobic ends attach themselves to the dirt and remove it from the cloth. Then, the molecules of soap arrange themselves in micelle formation and trap the dirt at the centre of the cluster. These micelles remain suspended in the water and thus, the dirt particles are easily rinsed away by water.



9) There are 18 groups and 7 periods in the modern periodic table.

(a) The atomic size and metallic character of elements increases down a group.

(b) The atomic size and metallic character of elements decreases from left to right in a period.

10) (i) Among the given elements, ${}_{19}\text{K}$ has one electron in the outermost shell. Its electronic configuration is 2, 8, 8, 1.

(ii) The elements ${}_{4}\text{Be}$ and ${}_{20}\text{Ca}$ belong to the same group, that is, Group 2. They both have two electrons each in their outermost shells.

Electronic configuration of ${}_{4}\text{Be}$ is 2, 2.

Electronic configuration of ${}_{20}\text{Ca}$ is 2, 8, 8, 2.

Atomic number of element X = 17

Electronic configuration of element X is 2, 8, 7.

Number of valence electrons in X = 7

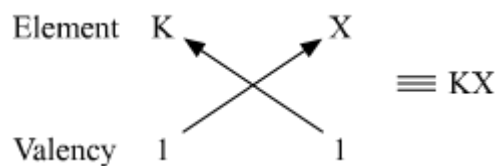
Valency of X = $8 - 7 = 1$

Atomic number of K = 19

Electronic configuration of K is 2, 8, 8, 1

Number of valence electrons in K = 1

Valency of K = 1



Therefore, the formula of the compound formed when K and element X combine is KX . The compound KX is of ionic nature.

11) DNA Copying

It is the process of production of a new DNA molecule from an already existing DNA molecule through chemical reactions.

It is accompanied with the creation of new cellular apparatus so that the daughter DNA and parent DNA can be separated.

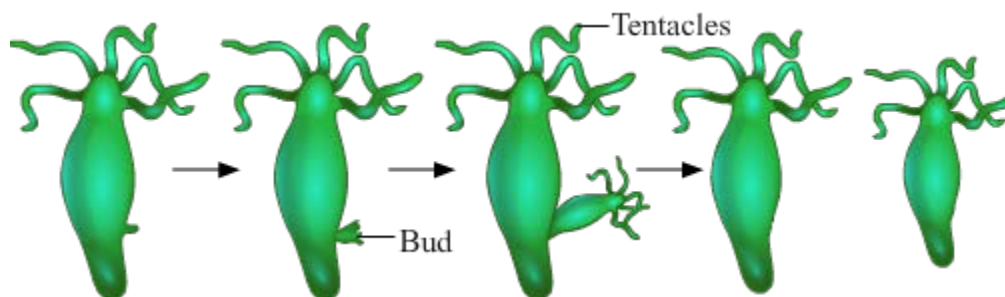
Importance of DNA copying

1. It helps in the transmission of characteristics from parents to offspring.
2. It helps in the formation of a new cell from the parent cell.

12) Budding

It involves the formation of a new individual from a protrusion called bud. It is very common in plants, yeasts and lower-level animals such as *Hydra*.

In *Hydra*, the cells divide rapidly at a specific site and develop as an outgrowth called bud. These buds, while attached to the parent body, develop into small individuals. When this individual becomes large enough, it detaches itself from the parent body to exist as an independent individual.



13) Four methods of contraception that can be used by humans are as follows:

- (i) **Natural method:** In this method, the sexual act is avoided from the 10th day to the 17th day of the menstrual cycle, as ovulation is expected during this period and the chances of fertilisation are very high.
- (ii) **Barrier method:** In this method, the fertilisation of the ovum and the sperm is prevented with the help of a barrier such as a condom.
- (iii) **Oral contraceptive method:** In this method, tablets or drugs are taken orally to prevent fertilisation.
- (iv) **Implants and surgical methods:** Contraceptive devices, such as a loop and a Copper-T rod, are placed in the uterus to prevent pregnancy. However, they can cause side effects to the uterus. Some surgical methods such as vasectomy (blocking of the vas deferens in the male body to prevent the transfer of sperms) and tubectomy (blocking of fallopian tubes in the female body to prevent the egg

from reaching the uterus) can also be used to block the gamete transfer.

The following are the 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.
- (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.

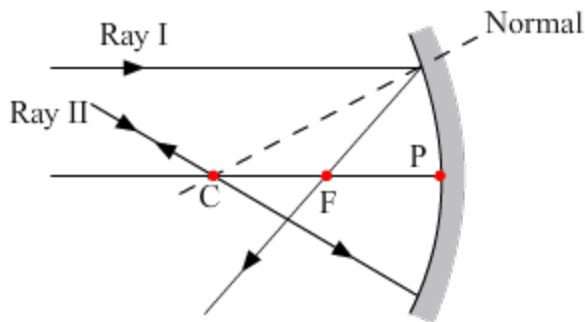
14) The experiences and qualifications that a person earns during his/her lifetime are examples of acquired traits. These traits cannot be inherited. For example, a wrestler develops large muscles because of his training programme; it does not mean that his offspring will necessarily have large muscles. These characters do not affect the DNA make-up of germ cells of an organism; thus, they are not passed on to the next generation.

On the other hand, inherited traits are the traits that are transferred from the parents to their offspring. Inherited traits are coded by genes present in the DNA of gamete cells from where they are transferred to the progeny. Examples of inherited traits are skin colour and eye colour.

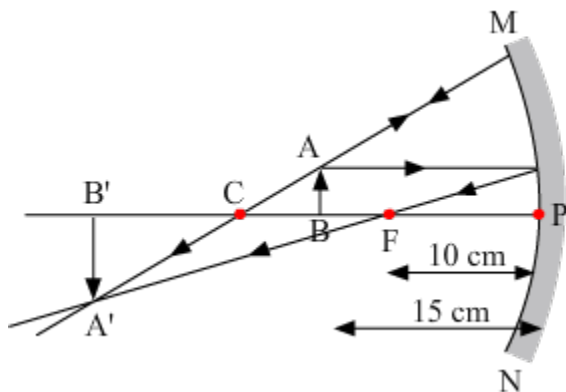
15) (i) The eyes seen in *Planaria*, insects, octopus and vertebrates vary greatly in their structure. These organisms can be used for studying the evolution of eyes as the eye of *Planaria* is simple without lens, insects have compound eyes and vertebrates have highly specialised eyes; however, all of them perform same function, that is, vision. Thus, a common evolutionary origin can be established on the basis of eyes.

(ii) Birds have evolved from reptiles as the connecting link between reptiles and birds is *Archaeopteryx* (flying dinosaur). Also, there are some similarities in birds and reptiles. Birds have four-chambered heart, which is also a feature of some reptiles; both birds and reptiles are oviparous and have separate sexes and internal fertilisation occurs in both birds and reptiles.

16) The two rays chosen to construct a ray diagram are shown in the ray diagram given below:

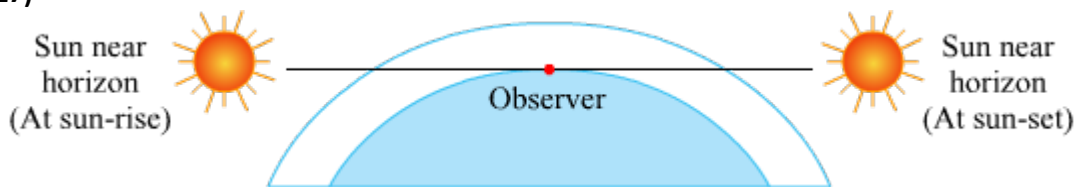


- (i) Ray I: When the incident ray is parallel to the principal axis, the reflected ray will pass through the focus of concave mirror or it appears to pass through the focus of convex mirror.
- (ii) Ray II: When the incident ray passes through or appears to pass through the centre of curvature, the light, after reflection from the spherical mirror, reflects back along the same path.



The image formed is real, inverted and magnified. It is formed beyond the centre of curvature.

17)



At sunrise and sunset, the Sun is near the horizon and its rays cover a larger part of the atmosphere. As the intensity of the scattered light is inversely proportional to the wavelength of the color, therefore, most of the blue light and other components of shorter wavelength are scattered away by the particles. The wavelength of the red color is the longest among all the components of white light; therefore, it is



least scattered and appears to come from the sun. Hence, the Sun looks red at the time of sunrise and sunset.

18) (a) Burning plastic is not an eco-friendly method of waste disposal because it causes air pollution by producing harmful gases. Rakesh's method of waste disposal is advantageous as the leftover food and peels of fruits are biodegradable material and can serve as manure, whereas plastic bags and cans should be disposed off in blue dustbins as they are non-biodegradable and can be recycled manually; thus, keeping the environment clean.

(b) We can keep the parks and roads clean by throwing the biodegradable waste in green dustbins and the non-biodegradable waste in blue dustbins stopping people from spitting on roads and parks.

19) Carbon has 4 electrons in its outermost shell and requires 4 more electrons to attain a noble gas electronic configuration. It cannot form a C^{4+} ion, as the removal of 4 valence electrons requires a huge amount of energy. The C^{4+} ion thus formed will have 6 protons and 2 electrons, which will make it highly unstable. Carbon cannot form a C^{4-} ion, as its nucleus with 6 protons cannot hold 10 electrons due to inter electronic repulsion. So, carbon achieves a noble gas electronic configuration only by sharing its 4 valence electrons with other elements. Thus, it forms compounds mainly by covalent bonds.

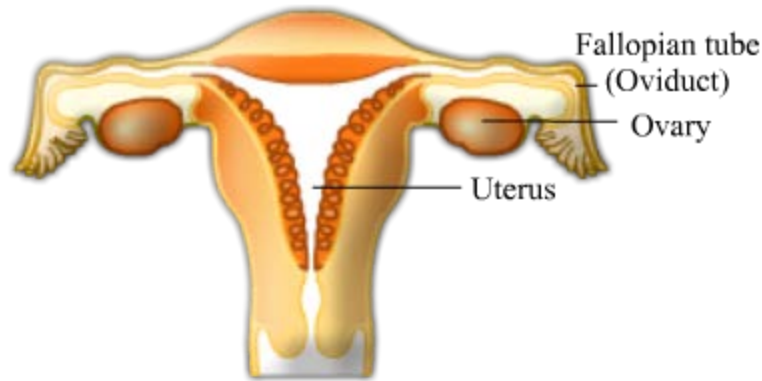
The two main reasons for carbon forming a large number of compounds are as follows:

(a) Catenation: It is the ability of carbon to form bonds with other carbon atoms; this results in compounds having long branched chains and rings.

(b) Tetravalency: Carbon has 4 valence electrons, so it is capable of forming covalent bonds with 4 other atoms.

Carbon forms strong bonds with most other elements. This is because the small atomic size of carbon enables its nucleus to strongly hold on to the shared pairs of electrons.

20)



Functions of the Ovary

It produces female gametes (ova).

It secretes female sex hormones.

It secretes inhibin involved in the feedback control of pituitary FSH production.

Functions of the Oviduct

Fertilisation takes place here.

The fertilised ovum travels towards the uterus through the fallopian tube.

Functions of the Uterus

It supports and nourishes the developing foetus.

It expands according to the growth of the baby.

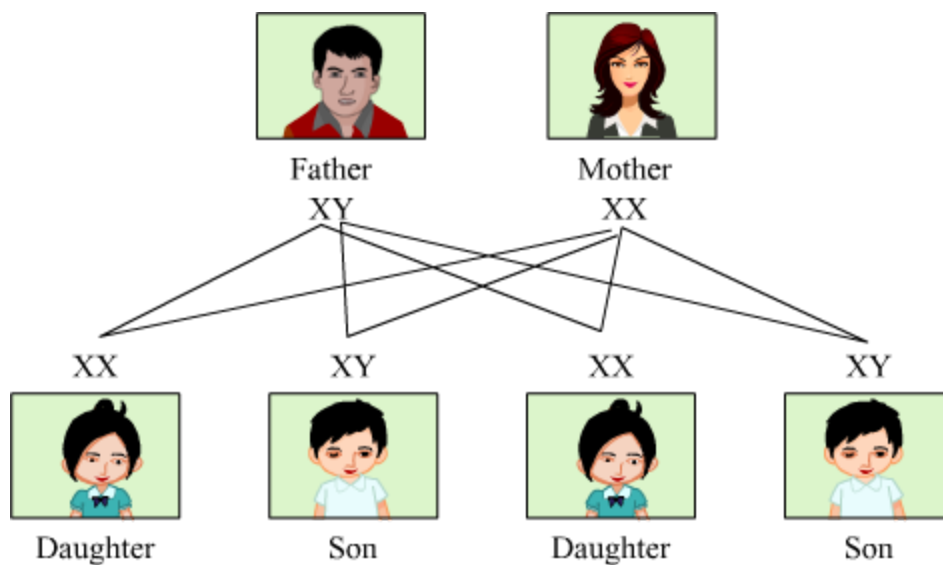
The embryo develops inside the mother's body for about nine months. Inside the uterus, the outer tissue surrounding the embryo develops finger-like projections called villi. These villi are surrounded by uterine tissue and maternal blood. They provide a large surface area for the exchange of oxygen and nutrients. There is a special tissue called placenta embedded in the uterine wall. The embryo receives the oxygen and nutrients from the mother's blood via the placenta. The waste material produced by the embryo is removed through the placenta.

21) Twenty-three pairs of chromosomes are present in human beings. Out of these, one pair is of sex chromosomes.

Two types of sex chromosomes are found in human beings: X and Y. Males contain one X chromosome and one Y chromosome (XY), while females contain two copies of X chromosomes (XX).

The sperm has either X or Y chromosome, while the egg has only X chromosome. So, if the sperm carrying Y chromosome fuses with the egg, it results in the formation of a male child; and if the sperm carrying X chromosome fuses with the egg, it results in the formation of a female child.

Thus, there is an equal chance of fusion of either X or Y chromosome with the egg. Therefore, we can say that the sex of a newborn child is a matter of chance and none of the parents are responsible for it. Sex determination in humans is shown below:



22) (a) Laws of Refraction:

- (1) The incident ray, the refracted ray and the normal to the interface of two media at the point of incidence all lie in the same plane.
- (2) For the light of a given color and for given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant. This is also known as Snell's Law.

Mathematically, it can be given as follows:

$$\frac{\sin i}{\sin r} = \text{constant} = {}_A\mu_B$$

Here, ${}_A\mu_B$ is the relative refractive index of medium B with respect to medium A.

The absolute refractive index is the value of refractive index of a medium with respect to the vacuum.

$$\mu_B = \frac{c}{v}$$

Where

c = Speed of light in vacuum

v = Speed of light in medium B

Here, μ_B is the absolute refractive index of medium B.

(b)

Absolute refractive index of medium 'A', $\mu_A = 2.0$

Absolute refractive index of medium 'B', $\mu_B = 2.0$

(i) For medium 'B',

$$1.5 = \frac{c}{(2 \times 10^8)}$$

$$\Rightarrow c = 2 \times 10^8 \times 1.5$$

$$\Rightarrow c = 3 \times 10^8$$

Speed of light in vacuum is $c = 3 \times 10^8 \text{ ms}^{-1}$

(ii) For medium 'A',

$$\mu_A = \frac{c}{v}$$

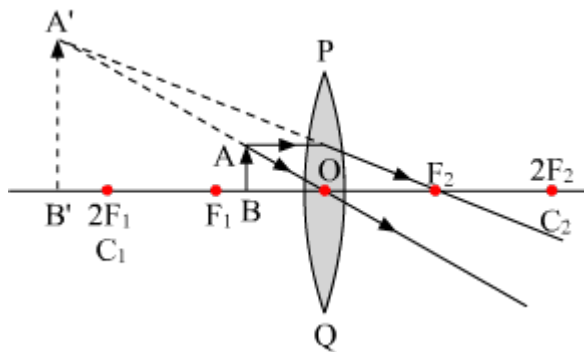
$$\Rightarrow v = \frac{c}{\mu_A}$$

$$v = \frac{3 \times 10^8}{2}$$

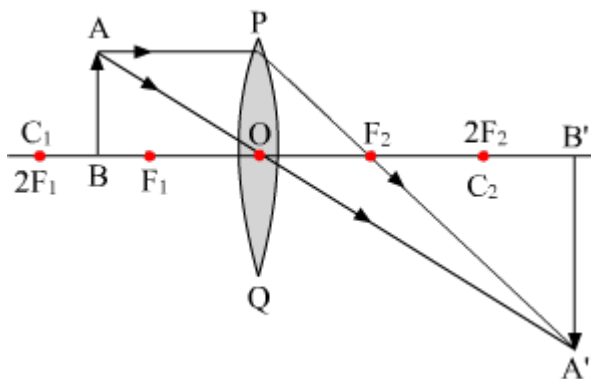
$$v = 1.5 \times 10^8$$

Thus, speed of light in medium 'A' is $1.5 \times 10^8 \text{ ms}^{-1}$.

23) (a) Magnified erect image (When the object is placed between O and F_1)



(b) Magnified inverted image (When the object is placed between F_1 and $2F_1$)



Object distance, $u = 20$ cm

Image distance, $v = ?$

Focal length, $f = 10$ cm

As per the sign conventions used,

$$f = -10 \text{ cm}$$

$$u = -20 \text{ cm}$$

According to the lens formula,

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

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

$$\frac{1}{v} = \frac{1}{-10} + \frac{1}{-20} = \frac{-3}{20}$$

$$\Rightarrow v = \frac{-3}{20} = -6.6 \text{ cm}$$

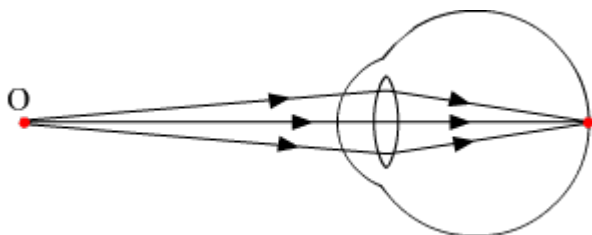
The image is formed at a distance of 6.6 cm from the lens at the same side where the object is placed.

24) As the student is not able to clearly see the words written on the blackboard that is at a distance of approximately 4 m from him, the student is suffering from the defect called myopia or near-sightedness. A myopic eye has its far point nearer than infinity. It forms the image of a distant object in front of its retina. To correct a myopic eye, concave lens of a suitable focal length is used. The image is allowed to form at the retina by using a concave lens of suitable power.

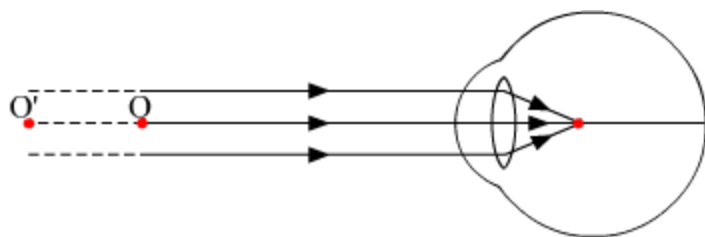
(i) A myopic eye

(ii) Correction of myopia using concave lens

(a)

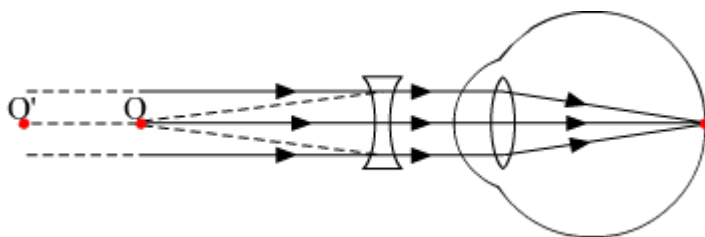


Far Point of Myopic Eye



Distant Vision of Myopic Eye

(b)



Correction of Myopic Eye

SECTION-B

25) Acetic acid dissolves completely in distilled water and gives a clear, colourless and transparent solution.

Hence, the correct option is A.

26) Sodium hydroxide is a base. It readily dissolves in water to form an alkaline solution, which turns red litmus paper blue. When sodium hydroxide is dissolved in water, a large amount of heat is evolved, as the process is exothermic in nature. Thus, the beaker containing the sodium hydroxide solution should feel hot when touched from the outside.

Hence, the correct option is D.

27) Hard water contains sulphates, chlorides and bicarbonates of calcium and magnesium. To make water hard, calcium chloride, calcium sulphate and magnesium sulphate should be added to it.

Hence, the correct option is C.

28) Plumule, radicle and cotyledon are the actual parts of the embryo of a gram seed. Testa and tegmen are the parts of the seed coat.

Hence, the correct option is B.

29) Homologous organs are the organs that have a similar origin and basic structure but different functions. Forelimbs of a cow, a duck and a lizard have a similar structure but different functions.

Hence, the correct option is D.

30) Because the light rays coming from infinity get reflected by the device 'X' and converge at a point at a distance 12 cm from it, the device 'X' is a concave mirror of focal length 12 cm.

Hence, the correct option is C.

31) In the given case, the student has obtained the point image of a distant object using a convex lens. According to the lens formula,

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

Here,

v = Image distance

u = Object distance

f = Focal length of the lens

Because the object is placed very far, the object distance is taken to be infinity. As $u = \infty$

Thus, $\frac{1}{u} = 0$ and $f = v$.

To find the focal length of the lens, the student should know the image distance, which is the distance between the lens and the screen.

Hence, the correct option is B.

32) The student R has performed the experiment methodically. The reason can be explained using Snell's law.

According to Snell's law,

$$\frac{\sin i}{\sin r} = \mu_g$$

Here,

i = Angle of incidence

r = Angle of refraction

μ_g = Refractive index for glass

The angle of refraction measured by student R is most appropriate as it verifies the Snell's law.

Given:

$$i = 40^\circ$$

The angle of refraction measured by student R, $r = 25^\circ$.

Also,

$$\sin 40^\circ = 0.642$$

$$\sin 25^\circ = 0.422$$

Now,

$$\frac{\sin 40^\circ}{\sin 25^\circ} = \frac{0.642}{0.422} = 1.52$$

The refractive index for glass is 1.5; it verifies the result derived above.

Hence, the correct option is C.

Disclaimer: The values of $\sin 40^\circ$ and $\sin 25^\circ$ can be obtained using trigonometric tables.

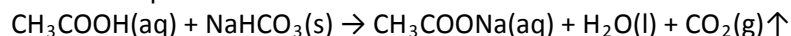
33) In the given diagram, the angle of incidence ($\angle i$) and the angle of emergence ($\angle e$) have been correctly marked.

Hence, the correct option is B.

Disclaimer: In the question paper the angle of emergence $\angle e$ is drawn incorrectly as it is shown between the normal and the surface of the prism.

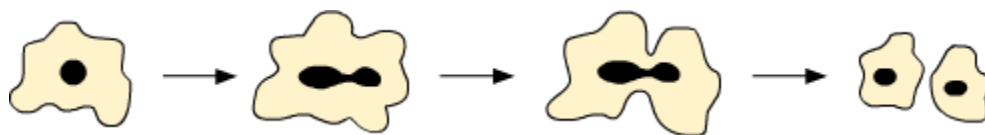
34) When a pinch of sodium hydrogen carbonate is added to acetic acid in a test tube, a brisk effervescence is observed due to colourless and odourless gas, which is CO_2 .

Chemical equation for the reaction:



35) 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



This reproduction starts with karyokinesis (division of nucleus).

36) (a) As the student moves the object towards the lens, the position of the image shifts away from the lens. To obtain a sharp image, he should move the screen away from the lens.

(b) The size of the image increases when the object is moved near the lens.

(c) When the object is placed very close to the lens, it can be considered to be placed between the focus and the optical centre. In this case, the image formed is virtual, erect and enlarged.