

CBSE
Class X Science
Board Paper – 2017 (Set 3) Solution
Term II

Section A

1. The molecular formula of the 2nd and 3rd members of a homologous series where the first member is ethyne (C₂ H₂) is formed by adding – CH₂ -:

2nd member of alkyne series = propyne (C₃ H₄) CH₃ – C H₂ – C ≡ CH

3rd member of alkyne series = butyne (C₄ H₆) CH₃ – C H₂ – C ≡ CH

2. Variation increases the chances of survival of a species in a constantly changing environment.
3. According to the 10% law, 2 J of energy will be available for the man in this chain.
4. Given,

U = -15 cm (It is to the left of the lens)

f = -30 cm (It is a concave lens)

Using the lens formula

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

$$\rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{(-30)} + \frac{1}{1(-15)}$$

$$\therefore \frac{1}{v} = \frac{-3}{30} = \frac{-1}{10}$$

$$\therefore v = -10 \text{ cm}$$

The negative sign of the image distance shows that the image is formed on the left side of the concave mirror. Thus, the image formed by a mirror is virtual, erect and on the same side of the object.

5. Four activities which can be done as an environmentalist to conserve natural resources are
- 1) Using public transport for commuting instead of using a personal vehicle.
 - 2) Avoid using clothes, accessories or articles made of animal skin.
 - 3) Using energy-efficient electrical appliances to save electricity.
 - 4) Ensuring no leakage of water taps and pipes at home.

6.

- Coal and petroleum have been formed by natural processes. They have been formed by the degeneration of dead plant and animal biomass buried deep in the earth several million years ago.
- It has taken millions of years for the formation of these fossil fuels, and the present rate of consumption of these fossil fuels far exceeds the rate at which they are formed.
- If exhausted, these resources will not be available for use in the near future, and hence, they should be used judiciously.

7.

Esterification	Saponification
1. Carboxylic acid reacts with alcohols in the presence of a little conc. sulphuric acid to form esters.	1. On treating an ester with a base such as NaOH, it is converted back to alcohol and sodium salt of carboxylic acid.
2. Example: Ethanoic acid reacts with ethanol in the presence of a little conc. sulphuric acid to form esters.	2. Example: Ethyl ethanoate on reaction with sodium hydroxide gives ethanol and sodium ethanoate.
$\begin{array}{c} \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} \\ \downarrow \text{Conc. H}_2\text{SO}_4 \\ \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O} \end{array}$	$\begin{array}{c} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \\ \downarrow \\ \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COONa} \end{array}$

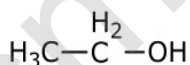
Use of esters:

Esters are used in synthetic flavours, perfumes, cosmetics, lacquers, paints and varnishes.

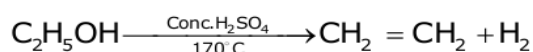
Use of saponification reaction:

It is used in the preparation of soaps on a commercial basis.

8. Structural formula of ethanol:



On adding conc. sulphuric acid to ethanol and heating the mixture up to 443 K (443 K – 273 = 170°C) gives ethene.



The role of conc. H₂SO₄ in the above reaction is that it is used as a dehydrating agent and causes dehydration of ethanol.

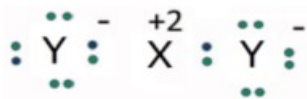
9. Properties which reappear at regular intervals or in which there is gradual variation at regular intervals are called **periodic properties**, and the

phenomenon is known as the periodicity of elements.

Elements in the same group or column have the same number of electrons in their outermost shell. Hence, elements of the same group have similar properties.

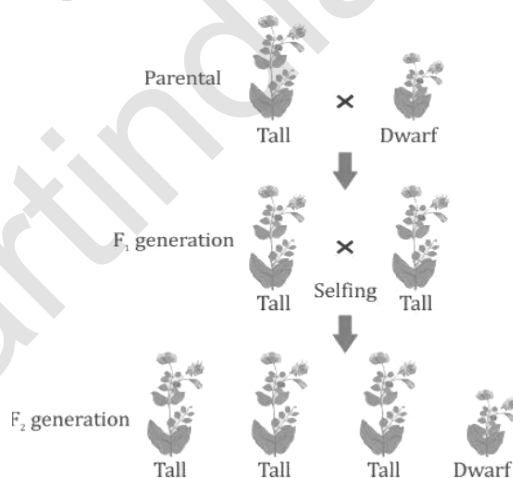
On moving across a period from left to right, the tendency to gain electrons increases. This is due to an increase in the nuclear pull and a decrease in atomic size.

10. Atomic number of X = 20, electronic configuration = 2, 8, 8, 2
Atomic number of Y = 17, electronic configuration = 2, 8, 7
Molecular formula of the compound = XY_2
Electron-dot structure of the compound:



An ionic bond is formed between the two elements.

11. Mendel explained that it is possible that a trait is inherited but not expressed in an organism with the help of a monohybrid cross.



An illustration of monohybrid cross

- He crossed pure-bred tall plants (TT) with pure-bred dwarf plants (tt).
 - The progeny he received in the first filial generation was tall. The dwarfness did not show up in the F₁ generation.
 - He then crossed the tall pea plants of the F₁ generation and found that the dwarf plants were obtained in the second generation. He obtained three tall plants and one dwarf plant.
12. Organic evolution can be defined as the slow, progressive, natural and sequential development in primitive organisms to form more complex

organisms or a new species.

13. Two types of reproduction:

- Sexual reproduction
- Asexual reproduction
- Sexual reproduction is responsible for bringing in more variations in its progeny.
- It takes place by the combination of male and female gametes.
- Gametes are formed from one cell which involves copying of DNA and the cellular apparatus. DNA copying is not absolutely accurate, and errors result in new variations. With every DNA copied, a new variation is introduced, and this DNA copy may already have several variations accumulated from the previous generations.

14. Vegetative propagation is a type of reproduction in which several plants are capable of producing naturally through their roots, stems and leaves.

Advantages of vegetative propagation:

- Plants not capable of producing sexually are produced by this method.
- It is a fast and certain method to obtain plants with desired features.

Disadvantages of vegetative propagation:

- There is no possibility for variation.
- The new plant grows in the same area as the parent plant which leads to competition for resources.

15. Techniques to prevent pregnancy:

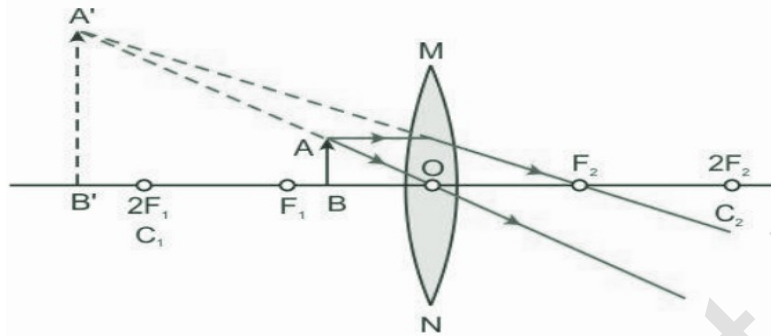
- Use of intra-uterine devices such as Lippes loop and Copper T
- Use of condoms
- Surgical methods (e.g. tubectomy)
-

Use of intra-uterine devices is not meant for males.

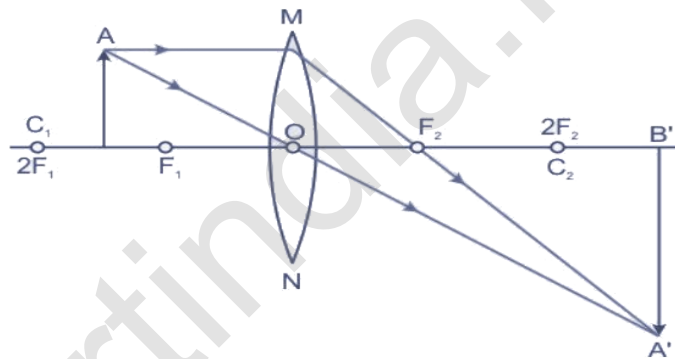
The use of these techniques will keep the mother in good health. With a small family size, parents will be able to provide quality resources to the child such as food, clothes and education. This will improve the overall mental and physical well-being of the family.

16. Convex lens can form a magnified erect image as well as a magnified inverted image of an object placed in front of it.

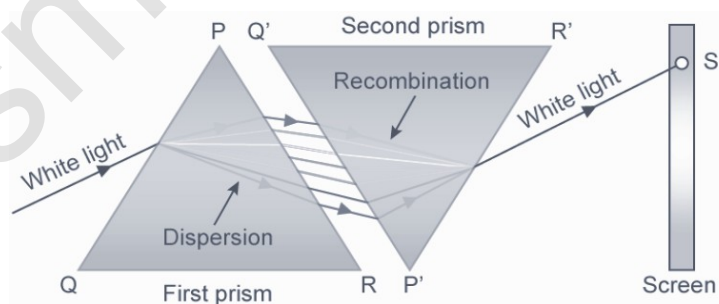
Position of object	Position of image	Size of image	Nature of image
Between focus F_1 and optical centre O	On the same side of the lens as the object	Magnified	Virtual and erect



Position of object	Position of image	Size of image	Nature of image
Between F_1 and $2F_1$	Beyond $2F_2$	Magnified	Real and inverted



17. The phenomenon of splitting of white light into its constituent seven colours on passing through a glass prism is called dispersion of light.



It is essential to place the two identical prisms in an inverted position with respect to each other because the refraction produced by the second prism is equal and opposite to that produced by the first prism.

18. Two ways by which awareness on how to save water can be created in the

neighbourhood:

- By bringing to notice the current situation of drought in rural areas and its dreadful effects on humans and animals
- Making people realise the importance of water in life and the shortage of water and its consequences in the near future
- Khadin is one way of recharging groundwater.
- A khadin consists of a 100–300-m long embankment called bund made of earth. The bund is built across the lower edge of the sloping farmland.
- Rainwater from the catchment area flows down the slope and collects in front of the bund forming a reservoir.
- Pathways through the bund allow excess water to flow through and collect in shallow wells dug behind the bund.
- The water which collects in the reservoir and wells seeps into the land and recharges the groundwater.

19.

Acquired Trait	Inherited Trait
A trait or characteristic which develops in response to the environment and cannot be inherited.	A characteristic feature inherited from the previous generation.
Example: A person learns to swim.	Example: A girl has brown eyes just like her mother.

- Only those traits are inherited which are developed because of changes in genes.
- An acquired trait or experience is developed as a response to the environment; it is not inherited. These are not developed due to the changes in genes.
- Example: Human beings experiencing weight loss due to starvation. There will be reduction in weight as a response to starvation. This will result in the reduction in the number of body cells or overall body–mass ratio of the individual. It will not have any effect on the genetic constitution of the individual. Because there is no change in the gene of the individual, it is not an acquired trait.

20.

- (i) Ovary: It produces female gametes. One ovum is released by one ovary every month. It also secretes hormones oestrogen and progesterone.
- (ii) Uterus: It protects and nourishes the developing embryo.
- (iii) Fallopian tube: It passes down the ovum towards the uterus released by the ovary.

Structure of the placenta in human female:

- The placenta is a disc which is embedded in the uterine wall.
- It contains villi on the embryo side. The mother's end of the placenta has blood spaces which surround the villi.

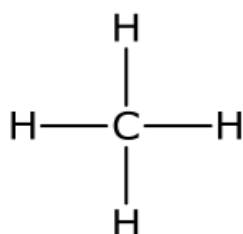
Functions of the placenta in human female:

- Nutrients and oxygen are received by the foetus from the mother's blood.
- The foetus gives away waste products and carbon dioxide to the mother's blood for excretion.

21. Certain compounds contain only carbon and hydrogen. So, these organic compounds are called hydrocarbons.

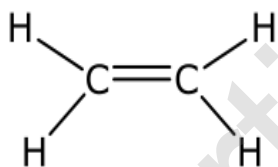
General formula for the homologous series of alkanes = $C_n H_{2n+2}$

First member of the alkane family is methane.



General formula for the homologous series of alkenes = $C_n H_{2n}$

First member of the alkene family is ethene.

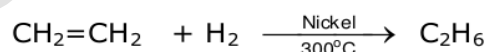


General formula for the homologous series of alkynes = $C_n H_{2n-2}$

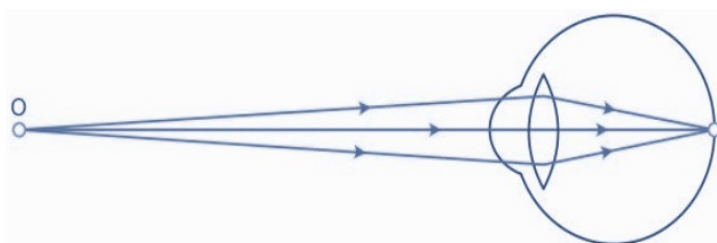
First member of the alkyne family is ethyne.



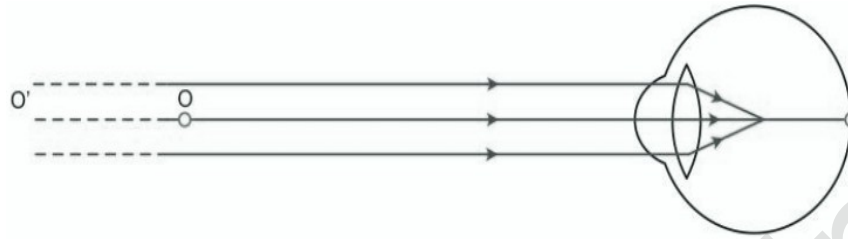
Catalytic hydrogenation is the reaction used to convert alkenes to alkanes.



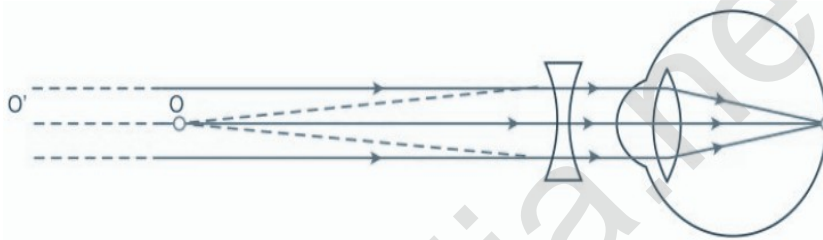
22. (a) This defect may arise due to excessive curvature of the eye lens or elongation of the eyeball.
- (i) A person with this defect has the far point nearer than infinity. Such a person may see clearly up to a distance of a few metres.



In a myopic eye, the image of a distant object is formed in front of the retina and not at the retina itself.



- (ii) This defect can be corrected by using a concave lens of suitable power. A concave lens of suitable power will bring the image back onto the retina and thus the defect is corrected.



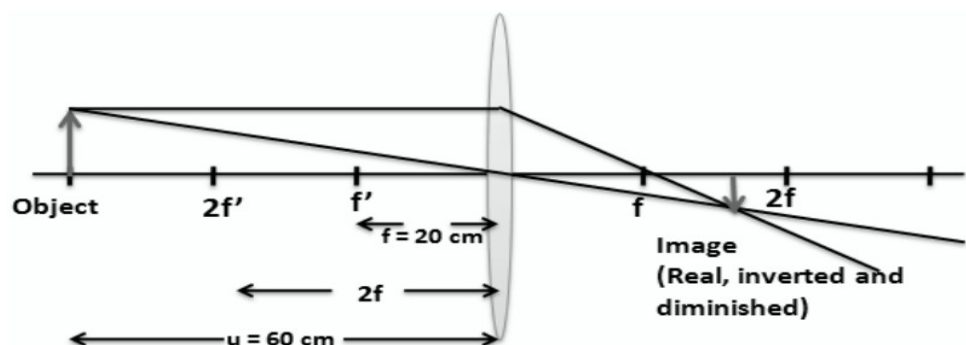
- (b) Given: Focal length $f = -5 \text{ m}$ (\because it is a concave lens)

$$P = \frac{1}{f \text{ (in m)}} = \frac{1}{(-5)} = -0.2\text{D}$$

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

23.

- (a) When the object distance and the image distance are the same, it means that the object is placed at $2f$ or the image is formed at $2f$. From the table, it is clear that $2f = 40 \text{ cm}$. Therefore, the focal length of the convex lens is 20 cm .
- (b) Serial number 6 is incorrect. Given that the object is placed at 15 cm which is between the focal length and the lens. Thus, the image should be formed on the same side as the object. The data given in the observation serial number 6 does not satisfy the condition.
- (c)



$$\text{Magnification, } m = \frac{v}{u}$$

Let us consider the third observation where
 $u = -40 \text{ cm}$ and $v = 40 \text{ cm}$

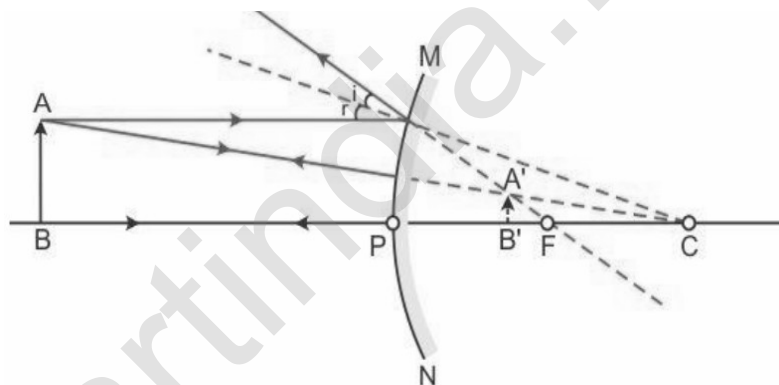
$$\therefore m = \frac{40}{-40} = \frac{v}{u}$$

$$\therefore m = -1$$

24.

- (a) A convex mirror always forms a diminished, erect and virtual image of the object placed in front of it.

Position of object	Position of image	Size of image	Nature of image
Between infinity and the pole of the mirror	Between P and F behind the mirror	Diminished	Virtual and erect



use of a convex mirror:

- i. Convex mirrors are commonly used as rear view mirrors in vehicles.
 - ii. They are preferred because they always give an erect image, although diminished. Also, they have a wider field of view as they are curved outwards. Thus, convex mirrors enable the driver to view a much larger area than would be possible with a plane mirror.
- (b) The radius of curvature of a spherical mirror is the radius of the sphere of which the reflecting surface of the spherical mirror is a part and represented by R.

Radius of curvature $R = 24 \text{ cm}$

Radius of curvature = $2 \times$ focal length

i.e. $R = 2f$

$$24 = 2 \times f$$

$$f = \frac{24}{2} = 12$$

$$f = 12 \text{ cm}$$

Section B

25. (A) y, p, z

The angle between the incident ray and the normal is known as the angle of incidence, and the angle between the emergent ray and the normal is known as the angle of emergence. The emergent ray is bent at an angle with the direction of the incident ray. This angle is called the angle of deviation.

26. (B) $\angle i = \angle e > \angle r$

Because the emergent ray is parallel to the incident ray, the angle of incidence is equal to the angle of emergence. The refracted ray travels from a rarer medium to a denser medium (considering the first refraction); it bends towards the normal. Thus, the angle of incidence is greater than the angle of refraction. If we consider the second refraction, then light travels from a denser medium to a rarer medium, due to which it bends away from the normal after refraction. So, in this case, the angle of refraction is again less than the angle of emergence.

27. (D) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively.

Device X is a convex lens and device Y is a concave mirror whose focal lengths are 20 cm and 25 cm, respectively. A parallel ray of light incident on a concave mirror gets reflected, and the image is seen on a screen placed before it. A parallel ray of light incident on a convex lens converges to a point.

28. (B) Inverted and diminished

When the object is at infinity, the distance of the image from the lens will be equal to the focal length of the lens.

29. (C) The outer surface of the beaker has become hot.

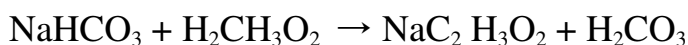
When 20% NaOH solution was added to the beaker containing vegetable oil, it was observed that the beaker's surface was warm when touched.

A whitish suspension was formed by heating the mixture of vegetable oil and 20% NaOH solution.

30. (D) Formation of bubbles of a colourless and odourless gas.



There is double displacement in which acetic acid reacts with Sodium bicarbonate to form Sodium acetate and Carbonic acid.



Carbonic acid is unstable and undergoes a decomposition reaction to produce carbon dioxide gas.



Carbon dioxide escapes from the solution as bubbles.

31. (D) Calcium sulphate, calcium chloride

Hard water can be prepared by dissolving sulphates, chlorides or bicarbonate salts of Ca^{2+} or Mg^{2+} ions.

32. (B) Gram, Groundnut, Pea

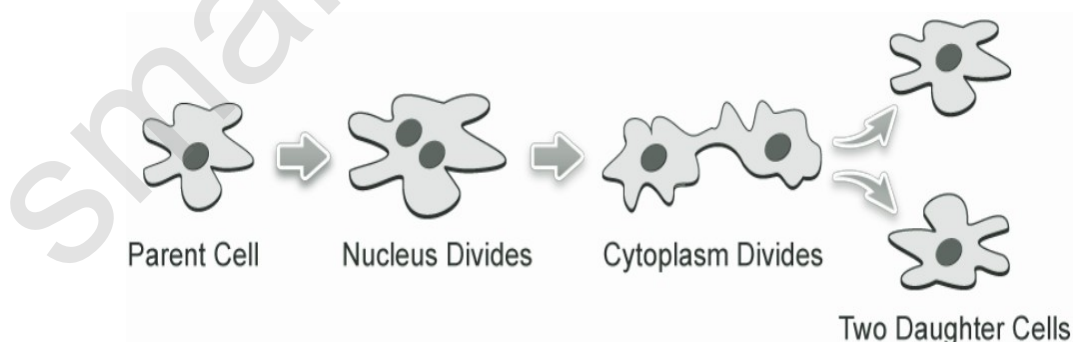
Dicot seeds have two cotyledons.

33. (C) Radish and Carrot

The structures which are same in structure and origin but are modified to perform different functions are called homologous structures.

Although radish and carrot store food and are used as food, the nutrients which each provide are different.

34. Binary fission in amoeba:



- 35.

- (a) As the candle is moved towards the lens, the image distance increases. Thus, the student moves the lens away from the screen to focus the image.
- (b) The size of the image increases when the object is moved towards the lens.
- (c) Intensity decreases.

(d) When the candle is moved very close to the lens, no image is formed on the screen. A virtual image is formed behind the candle on the same side of the screen.

36. Chemicals required: Vegetable oil, common salt and 20% sodium hydroxide solution

When a red litmus paper is dipped in the reaction mixture, the paper changes its colour to blue. Hence, the reaction mixture of the saponification reaction is basic in nature.

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