CBSE
Class X Science
Sample Paper – 11 Solution

Section A

1. $P = \frac{V^2}{R}; P' = \frac{(3V)^2}{R} \Rightarrow P' = 9P$

2. The epiglottis prevents the entry of food in the windpipe by closing the glottis during the swallowing of food.

3.

(a) (i) Gallium (ii) Germanium
(b) 4th period
(c) Gallium: 13^{th} group; Germanium: 14^{th} group
(d) Gallium: Metal; Germanium: Metalloid

4.

(a) As the object is placed at C, the size of the image is the same as that of the object, i.e. 2 cm.

(b) Real and inverted
(c) Virtual and erect
(d) The image will be at the focus and point sized.

5. (c)Methane is the major component of biogas.

OR

(b)Moon is the cause of the rise in sea water during high tide.

6. (c) Hydrogen gas has the highest calorific value.

7. (c) An electrical impulse is picked up by the dendrites which then travels to the cell body, axon and finally reaches the axon endings.

8. (d) Steps such as breeding animals in captivity and then releasing them into their natural habitat as well as the establishment of nature parks and sanctuaries help in the conservation of wildlife.

OR

(a) Rechargeable batteries help in reducing the use of new resources.

9. (c) Self-pollination is seen in bisexual flowers because the anther and stigma are closely located in them.

10. (d) The atomic number of the second element in Group 2 is 12.

11. (b) Oxides of alkaline earth metals are basic in nature.

12. (a) Gene flow results in the reduction of genetic variation in two sub-populations. This does not favour variations and the formation of new species through speciation.

OR

(c) Gene → mRNA → Protein → Phenotypic expression. A gene is transcribed to mRNA which is translated to proteins. Proteins control the phenotypic expression of a particular character.

13. Both A and R are true, but R is not the correct explanation of the assertion. Food chains are limited to 4–5 trophic levels because energy losses between trophic levels restrict the length of food chains and the biomass of higher trophic levels. As we pass from one trophic level to the next, only 10% of energy is transferred from the first trophic level to the next. This is because a lot of energy is lost to the surroundings and the rest is utilised by the organism.

14. Both A and R are true, and R is the correct explanation of the assertion.
The stick appears to be bent because of refraction of light when it passes from water into air.

Section B

15.

(a) Blue litmus changes to red when dipped in a solution of hydrogen chloride gas.
(b) When red litmus is introduced into a solution of ammonia in water, it changes to blue.
(c) Red litmus changes to blue when dipped in caustic soda solution.

OR

Common salt is required in the manufacture of sodium hydroxide, baking soda, washing soda, bleaching powder and many other chemicals.

1) Bleaching powder is produced by the action of chlorine [which is produced during the electrolysis of aqueous sodium chloride (brine)] on dry slaked lime [$Ca(OH)_2$]. Bleaching powder is represented as $CaOCl_2$.

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

2) Baking soda which has the chemical name sodium hydrogen carbonate ($NaHCO_3$) is produced using sodium chloride as one of the raw materials.

$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

3) Washing soda ($Na_2CO_3.10\ H_2O$) is another chemical which can be obtained from sodium chloride. Sodium carbonate can be obtained by heating baking soda; recrystallisation of sodium carbonate gives washing soda.

16.

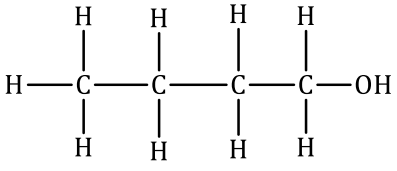
(a) Mucus: It protects the inner lining of the stomach from HCl.

(b) Bicarbonate: It makes the acidic food alkaline so that pancreatic enzymes act on it.

(c) Trypsin: It digests proteins into amino acids.

17.

(a) $C_5H_{12}O$ or $C_5H_{11}OH$



(b) (i) Aldehyde group
(ii) Alcohol group
(iii) Carboxylic acid group
(iv) Ketone group
(v) Halo group

(c) When a candle is lit, the wax melts, rises up the wick and gets converted to vapour. In a candle, there is no provision for the proper mixing of oxygen (of air) for burning wax vapour. So, the wax vapour burns in an insufficient supply of oxygen (of air) which leads to incomplete combustion of wax. This incomplete combustion of wax produces small unburnt carbon particles. These solid carbon particles rise in the flame, get heated and glow to give out yellowish light. This makes the candle flame yellow and luminous.

18. (i) An electric motor works on the principle of the magnetic effect of electric current.
(ii) When a rectangular coil is placed in the magnetic field and current is passed through it, a force acts on the coil which rotates it continuously.
(iii) The electric motor converts electric current to mechanical energy.

19. The ratio of the speed of light in vacuum to the speed of light in a medium is called the refractive index of the medium.

$$n = \frac{\text{speed of light in air}}{\text{speed of light in glass}}$$

$$1.5 = \frac{3 \times 10^8}{\text{speed of light in glass}}$$

$$\text{speed of light in glass} = \frac{3 \times 10^8}{1.5}$$

Thus, the speed of light in glass is 2.5×10^8 m/s.

20. Object distance, u = –40 cm

Image distance, v = 100 cm

From the lens formula,

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

$$\therefore \frac{1}{f} = \frac{1}{100} - \frac{1}{-40} = \frac{1}{100} + \frac{1}{40}$$

$$\therefore \frac{1}{f} = \frac{140}{4000} = 0.035$$

$$\therefore f = 28.57 \text{ cm}$$

Height of the object, h = 4 cm

From the magnification formula,

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

$$\therefore h' = \frac{v}{u}h = \frac{100}{-50} \times 4 = -8 \text{ cm}$$

OR

Magnification (m) = −2 (image is real)

Object distance (u) = −10 cm (object is to the left of the mirror)

To find: Image distance (v)

Magnification of spherical mirrors is given as

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

$$-2 = \frac{-v}{-10}$$

v = - 20 cm

Thus, the image is located at a distance of 20 cm in front of the mirror.

21. The reaction between quick lime (CaO) and water is a combination reaction which is highly exothermic; hence, the mixture started boiling even when it was not being heated. The reaction occurs as

$CaO + H_2O \rightarrow Ca(OH)_2 + Heat$

Calcium hydroxide
(slaked lime)

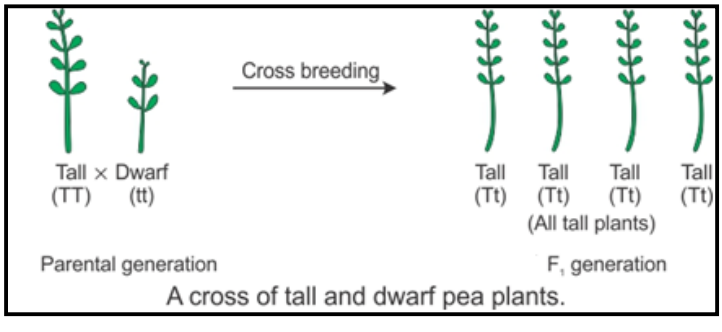
22. It is necessary to separate oxygenated blood and deoxygenated blood in mammals and birds because such a separation allows a highly efficient supply of oxygen to the body cells which is required for producing a lot of energy needed by them.

OR

Acid is formed in the mouth after sugary food (chocolates and sweets) has been consumed. This acid lowers the pH in the mouth. Tooth decay starts when the pH of acid formed in the mouth falls below 5.5. This is because the acid becomes strong enough to attack the enamel of our teeth and corrode it.

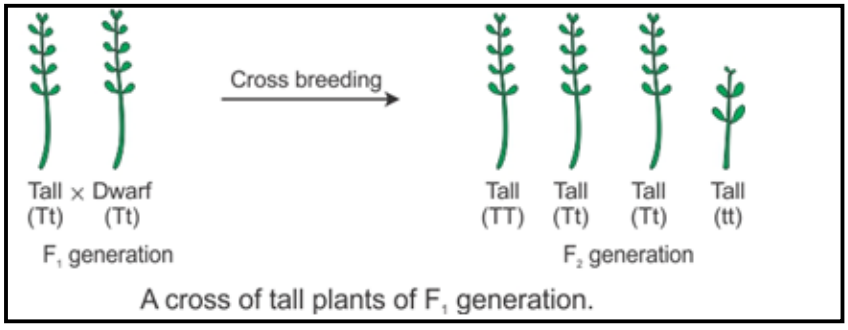
23.

(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.



A cross of tall and dwarf pea plants.

He then crossed the tall pea plants obtained in the first generation (F_1 generation) and found that both tall plants and dwarf plants were obtained in the second generation (F_2 generation) in the ratio 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.



A cross of tall plants of F_1 generation.

(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.

24. The approach of society is baseless. The sex of the child is determined by the type of chromosomes present in the sperm (X and Y) which fuses with the ovum at the time of fertilisation.

Associated value: Improved mindset which will help stop gender inequality and female foeticide.

Section C

25.

(a) Steps which take place inside the chloroplast during photosynthesis:

i. Absorption of sunlight energy by chlorophyll.

ii. Conversion of light energy to chemical energy, and splitting of water into hydrogen and oxygen by light energy.

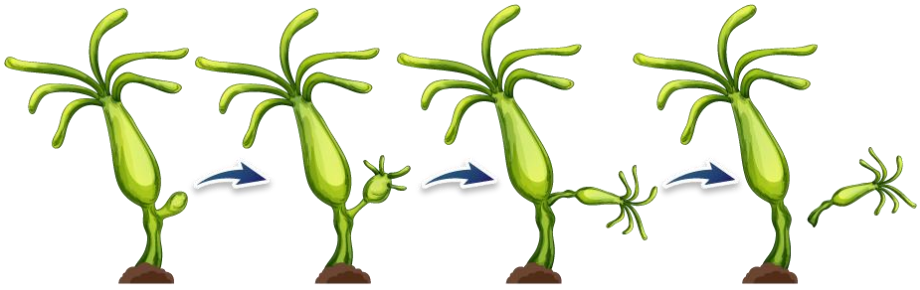
iii. Reduction of carbon dioxide by hydrogen to form carbohydrates like glucose by utilising chemical energy.

(b) The opening and closing of stomata is controlled by guard cells. When water flows into the guard cells, they swell, become curved and cause the stomata to open. When the guard cells lose water, they shrink, become straight and the stomata close.

(c) Carbon dioxide is made available to plants when stomata are open.

OR

In Hydra, a bud develops as an outgrowth due to repeated cell divisions at one specific site. These buds develop into tiny individuals, and when fully mature, they detach from the parent body and become new independent individuals.



26. The ratio of the height of the image to the height of the object is known as linear magnification.

$$\text{Magnification} = \frac{\text{height of image}}{\text{height of object}}$$

Magnification does not have a unit. As it is the ratio of the same quantities (image size and object size), it does not have a unit.

If magnification is positive, then the image is virtual and erect.

If magnification is negative, then the image is real and inverted.

OR

(a)

i. The principal focus of a convex lens is a point on its principal axis to which light rays parallel to the principal axis converge after passing through the lens.

ii. The centre point of the lens is known as the optical centre.

(b) Lens formula: $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

where f is the focal length of the lens
v is the image distance
u is the object distance

(c) Magnification of the lens $= -1$

Since magnification is negative, the image formed is real and inverted.

Value 1 indicates that the size of the image is equal to the size of the object.

Such an image can be formed by a convex lens. Hence, it is a convex lens.

27.

(i) Hydrogen gas

(ii) Downward displacement of water

(iii) Insoluble in water

(iv) Hydrogen is lighter than air
(v) Most reactive metal: Sodium (Na)
Least reactive metal: Platinum (Pt)

OR

(a) The given compound X is prepared from gypsum and has the property of hardening when mixed with a proper quantity of water. So, it is Plaster of Paris. Its chemical name is calcium sulphate hemihydrate, and it has the chemical formula $CaSO_4.1/2\ H_2O$.

(b) Preparation of Plaster of Paris:

$$CaSO_4.2H_2O \xrightarrow[373K]{\text{Heat}} CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O$$

(c) Uses of Plaster of Paris:
1) Plaster for supporting fractured bones
2) For making toys, statues and decorative items

28.

(a) According to Joule's law of heating, heat produced in a wire is directly proportional to
(i) square of current (I^2)
(ii) resistance of the wire (R)
(iii) time for which current flows

Heat produced is directly proportional to the square of current:
$H \alpha I^2$
Heat produced is directly proportional to resistance.
$H \alpha R$
Heat produced is directly proportional to time for which the current is flowing in the circuit.
$H \alpha t$
Thus, $H = I^2Rt$ … (Joule's law of heating)

(b) Potential difference of 220 V is applied across a resistance of 400 ohm.

Potential difference of the power supply, V = 220 V
Resistance = 400 ohm
R = V/I
Substituting the values in the above equation, we get
400 = 220/I
I = 220/400 = 0.55 A
Heat energy produced for t = 5 s
$H = I^2Rt$
$H= (0.55)^2 \times 400 \times 5 = 605$ J

29.

(a)

(i) Underground water does not evaporate.

(ii) Underground water percolates, which enriches the water table and reaches groundwater resources.

(iii) Water stored underground is protected from contamination by human and animal wastes and does not promote breeding of pests.

(b) Since forests are useful to animals as well as humans, it is the responsibility of every individual to conserve forests and not just the legislation. Some examples where locals have taken the initiative are as follows:

(i) Chipko Movement: It prevented workers from felling trees. The Chipko Movement quickly spread across communities and media and forced the government to rethink their priorities in the use of forest produce. This type of participation by people led to efficient forest management.

(ii) Another example of people's participation in the management and conservation of forests was seen in the Sal forests of West Bengal. A.K. Banerjee, a forest officer, got the villagers involved in protecting 1.272 hectares of badly degraded forests. Due to this active participation of locals, the Sal forests underwent a remarkable recovery.

30.

(a) 20 hexagons

(b) 12 pentagons

(c) Buckminsterfullerene burns on heating to form carbon dioxide and nothing is left behind. This shows that it is made of carbon only like diamond and graphite.

(d) Diamond is used for making cutting tools but graphite is not. This is because diamond is a very hard substance and graphite is a soft substance.

(e) Graphite is used for making dry cell electrodes but diamond is not. This is because graphite is a good conductor of electricity, whereas diamond is a bad conductor of electricity.