

CBSE
Class X Science
Sample Paper 2 – Solution

SECTION A

1. Nichrome, an alloy, is used to make the heating element of electrical appliances.
2. Genetics
3.
 - (a) Zinc sulphide, ZnS
 - (b) $2\text{ZnS} + 3\text{O}_2 \xrightarrow[\text{Roasting}]{\Delta} 2\text{ZnO} + 2\text{SO}_2$
 - (c) Reduction
 - (d) Brass
4.
 - (a) Calorific value of a fuel indicates the amount of heat produced due to the burning of a unit mass of the fuel completely.
 - (b) Higher the calorific value, better is the fuel. As the calorific value of hydrogen gas is greatest, it can be termed 'extremely good fuel'.
 - (c) The statement means that if 1 gram of the alcohol is burnt completely, then it will produce 30 kJ of heat energy.
 - (d) High ignition temperature is not a characteristic of a good fuel.
5. (iii) at 12 cm
For magnification of -1, the object must be placed at $2F' = 2 \times 6 = 12 \text{ cm}$

OR

 - (i) Concave lens
A concave lens always forms a virtual and diminished image.
6. (ii) 4 minutes
Sunrise appears 2 minutes before actual sunrise and 2 minutes after actual sunset.
Thus, the day is lengthened by $2 + 2 = 4$ minutes.
7. (ii) Osmotic pressure
Substances like sucrose is transferred into the phloem tissue using energy from ATP. This increases the osmotic pressure of the tissue causing water to move into it.

8. (iii) Recessive trait can only be expressed in the homozygous condition.

Dominant traits are traits which are expressed even in the presence of one copy of an allele for a particular trait in the gene, i.e. even in the heterozygous condition.

However, recessive traits are those which are expressed only when two copies of an allele are present in the gene, i.e. only in the homozygous condition.

OR

(ii) Self-pollination

Cross-pollination is the cross between two plants. The same plant self-fertilising will have the same DNA, and hence, testing of inheritance on these plants would be pointless.

In order to test how different traits are inherited, it requires different plants with different traits. Hence, Mendel cross-pollinated the plants to obtain the F_1 progeny.

However, when he allowed the hybrid F_1 plants to self-pollinate, the hidden traits would reappear in the second-generation (F_2) hybrid plants.

9. (ii) *Chlamydomonas*

A movement of a plant or plant part in response to a stimulus generated within the plant is called an autonomic or spontaneous movement. This type of movement is seen in *Chlamydomonas* which is due to flagellar movement.

10. (i) When an acid reacts with metal oxide, salt and water are formed.

11. (ii) Sodium chloride is an ionic compound, and it conducts electricity.

12. (ii) Man

Man (being a tertiary consumer) is the last consumer in the food chain. So, the concentration of harmful chemicals entering the food chain will be maximum in man.

OR

(iv) Detritivores feed at all trophic levels except the producer level.

Detritivores feed at the last trophic level of the food chain.

13. (ii) Both A and R are true, but R is not the correct explanation of the assertion.

The 22 pairs of homologous chromosomes contain the same genes but code for different traits in their allelic forms since one was inherited from the mother and one from the father. Therefore, genes are equally distributed because they are located on pairs of homologous chromosomes.

Acquired traits which occur in somatic cells are due to changes in lifestyle, injury, loss of body parts and disuse of some body parts. Changes in the somatic cells are not passed on to the offspring of the next generation. Hence, acquired traits cannot be passed on to the next generation.

14. (i) Both A and R are true, and R is the correct explanation of the assertion.

SECTION B

15. A reflex action is an involuntary, automatic and nearly instantaneous response to a stimulus.

Steps involved in reflex action:

- (a) The sense organ (skin) is stimulated with a prick, and the stimulus is received by skin receptor cells.
- (b) Sensory nerves send this impulse to the spinal cord.
- (c) An association neuron transmits this impulse to the motor neuron.
- (d) The motor neuron relays the impulse to the muscles of the effector organ (hand).

16. Natural selection is the process whereby organisms better adapted to their environment tend to survive and produce more offspring, whereas other less favourable traits tend to get eliminated. Continuous competition between individuals for environmental resources creates a struggle for existence, and this struggle makes sure that certain organisms fail to survive or reproduce.

Examples:

- (a) Galapagos finches all have different types of beaks. During drought, the finches with the larger beaks survived better than those with the smaller beaks. During rainy times when more small seeds were produced, the finches with smaller beaks fared better.
- (b) A habitat has red and green bugs. Birds prefer the taste of red bugs, so soon there are many green bugs and few red bugs. Green bugs reproduce and make more green bugs, and eventually, there are no more red bugs.
- (c) In one ecosystem, lizards which had long legs could climb better to avoid floods and reach the food.

OR

Biodegradable substances: Substances which can be broken down by microorganisms such as bacteria and fungi are called biodegradable substances. Examples: Paper, vegetable and fruit peels, human excreta

Non-biodegradable substances: Substances which cannot be broken down by microorganisms into simpler and harmless substances are called non-biodegradable substances. Examples: Polythene bags, aluminium cans and DDT
Effects of biodegradable substances:

- They produce a foul smell causing air pollution. If thrown in water, they cause water pollution.
- They serve as a breeding ground for flies and mosquitoes which are carriers of malaria.

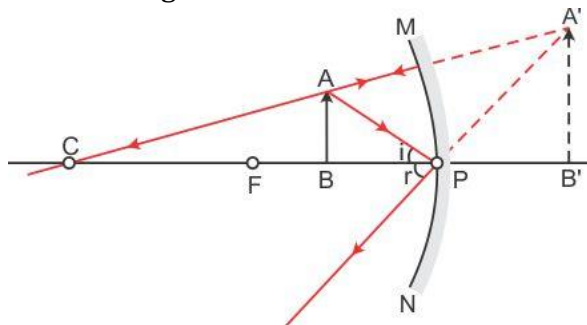
Effects of non-biodegradable substances:

- Non-biodegradable pesticides and fertilisers run off with rain water into water bodies and cause water pollution and affect the soil making it acidic or alkaline.
- Some non-biodegradable pesticides enter the food chain and badly affect humans and other organisms.

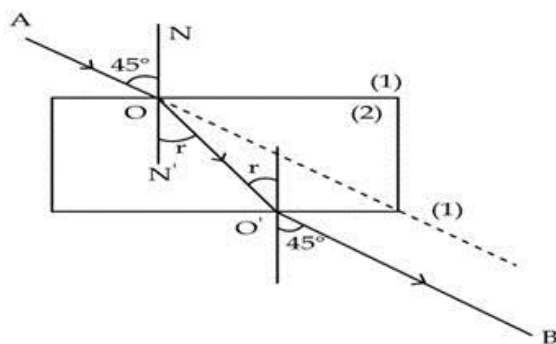
17. $R = -12$ cm (Radius of curvature of a concave mirror)

We know, $f = R/2 = -12/2 = -6$ cm.

The image formed by a concave mirror when an object is placed between the focus and pole is virtual, erect and magnified.



OR



Using Snell's law, the refractive index of medium (2) with respect to medium (1) is given as

$$n_{21} = \frac{\sin i}{\sin r} = \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{1/\sqrt{2}}{1/2} = \sqrt{2} = 1.414$$

If the second medium is water in place of medium (2), the angle of refraction will decrease because water is rarer than medium (2).

18.

- Elements which belong to Period 3 of the modern periodic table are Na, Mg and Al.
- Elements which belong to Group 1 of the modern periodic table are Li, Na and K.
- Al shows a valency of +3.

19.No, it is not true that when a new species emerges, the old species is eliminated. Because when there is a change in any species, the change is only in a part or a few members of the species population. If the newly generated species after genetic change is better in any way, it will get more opportunity to survive; if the genetic change is against the environment, it will die. Thus, unchanged members of other species may also remain and tend to live in the changed environment.

20.Organic evolution occurs because of changes in a species which appear generation after generation and accumulate to form a new species.

The embryology of different vertebrates provides very strong evidence of different vertebrates which show striking similarities. There is an obvious similarity between embryos of fish, amphibians, reptiles, birds and mammals. A comparison of embryos of vertebrates shows that all have gill slits even though they do not remain later in life (except in fish). This indicates a fundamental step which is common to all vertebrates and supports the idea of a common ancestor. Other features which do not exist in the adult form but appear in the embryo include limb buds in dolphins and the tail bud in humans.

This shows that species share an ancestor. So, their developmental processes occur similarly regardless of other changes which have occurred because of their divergence.

21. $\text{CaCO}_3 + \text{dil. H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

A

B

$\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$

(Lime water)

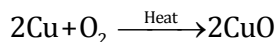
A

A: CaCO_3 (Limestone)

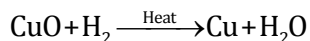
B: CO_2 (g)

OR

(a) Oxidation: Gain of oxygen by a substance.



Reduction: Loss of oxygen by a substance.



(b) Sodium (Na) is oxidised to sodium oxide as it gains oxygen, and oxygen reduces.

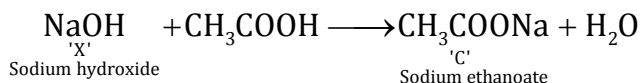
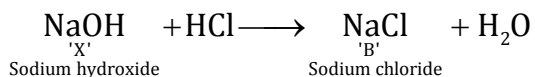
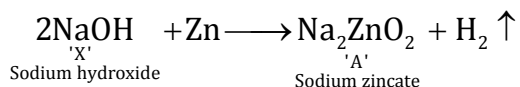
22. The phenomenon of generating an electric current in a circuit by changing the magnetic flux linked with it is called electromagnetic induction.

Changes in the magnetic flux of a coil occur due to

- i) Relative motion between a coil and a magnet placed near it.
- ii) Relative motion between a coil and a current-carrying conductor placed near it.

iii) Change of current in the conductor placed near the coil.

23. 'X' is sodium hydroxide (NaOH).



24.

- Recycling reduces the amount of garbage sent to landfills and thereby prevents land pollution.
- Recycling prevents faster depletion of resources.
- It also reduces pollution as fewer raw materials are utilised.
- It saves space in landfills.
- By curbing deforestation, we can cut down the amount of CO₂ being added as a greenhouse gas. Thus, we can slow down global warming.

SECTION C

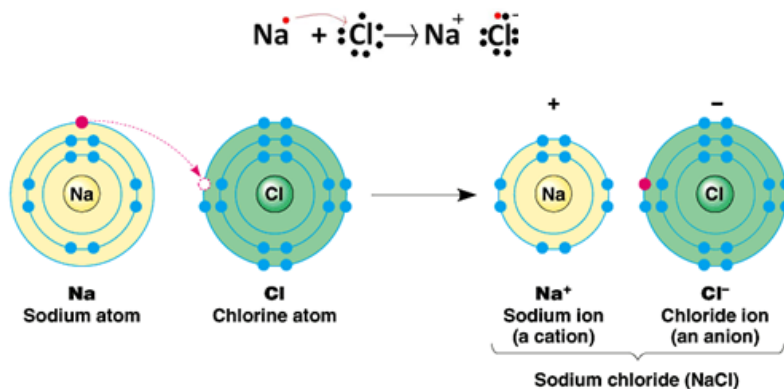
25. Metals in the low reactivity series are obtained by heating their oxides alone.

Mercury is obtained by heating mercurous oxide. Metals high up in the reactivity series are obtained by electrolytic reduction. Sodium is obtained by the electrolysis of its molten chlorides.

(a) Electronic configuration of sodium (Na) = 2, 8, 1

Electronic configuration of chlorine (Cl) = 2, 8, 7

Formation of sodium chloride by the transfer of electrons



(b) (i) Highly exothermic; (ii) the metal starts floating

26. Photosynthesis occurs in two phases—light reaction and dark reaction.

Light Reaction:

This phase occurs in the thylakoids of the chloroplast. Various events occurring in photosynthesis:

- Absorption of light energy
- Splitting of water molecules into hydrogen and oxygen atoms
- Formation of ATP and NADPH₂

Dark Reaction:

This phase occurs simultaneously with the light-dependent reaction. In this phase, carbon dioxide is converted to glucose by using ATP and NADPH produced during the light reaction.

Factors which affect the rate of photosynthesis:

Light:

- Rate of photosynthesis increases when light gets brighter.
- Rate of photosynthesis increases linearly with increasing light intensity.

Carbon dioxide concentration:

- Increase in the concentration of carbon dioxide increases the rate of photosynthesis.
- Rate of photosynthesis increases linearly with increasing carbon dioxide concentration.
- Increased carbon dioxide concentration is beneficial for greenhouse crops such as tomatoes.

Temperature

- Higher the temperature, greater is the rate of photosynthesis.
- Rate of photosynthesis slows down when the temperature is more than 40°C because the enzymes involved in the chemical reactions of photosynthesis are temperature-sensitive and are destroyed at higher temperatures.

Water

- Water stress causes leaves to wilt, thereby reducing their surface area and metabolic activity.

OR

(a) Steps which take place in chloroplasts during photosynthesis:

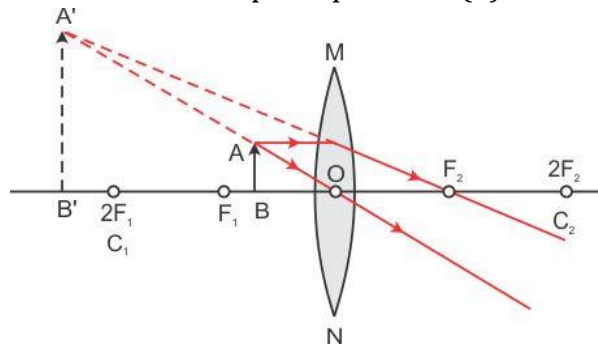
- Absorption of light energy by chlorophyll
- Conversion of light energy to chemical energy, and splitting of water into hydrogen and oxygen using light energy
- Reduction of carbon dioxide by hydrogen to form carbohydrates like glucose by utilising chemical energy

(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 flaccid and straight, thus closing the stomata.

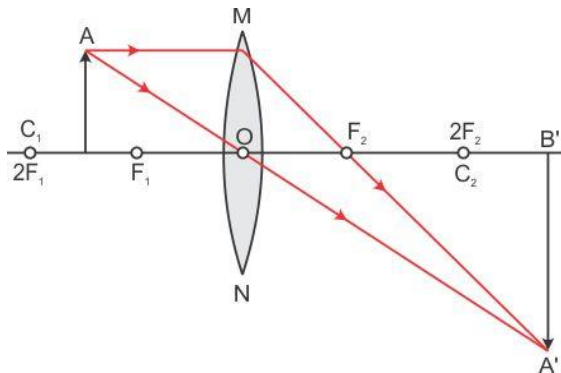
(c) Carbon dioxide is made available to plants when stomata are open.

27.

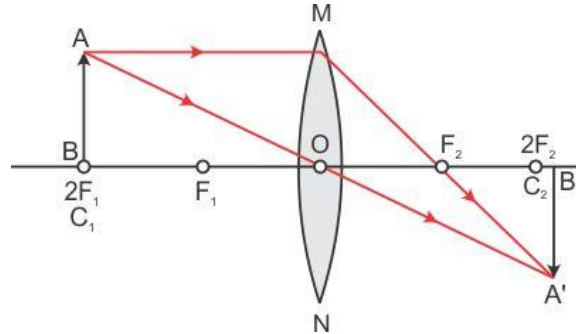
(a) Between the optical centre and the principal focus (F)



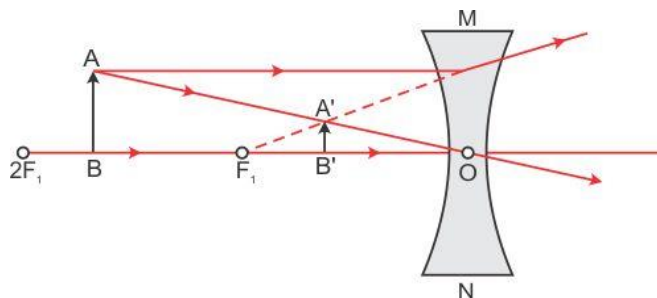
(b) Between F and 2F



(c) At 2F



For a concave lens, the image formed is virtual, erect and diminished for all distances between infinity and the optical centre. Hence, for cases (i) and (ii), the image will be virtual, erect and diminished.



CASE	CONVEX	CONCAVE
(i)	Virtual, erect and magnified	Virtual, erect and diminished
(ii)	Real, inverted and magnified	Virtual, erect and diminished

28.

(a) A conductor offers resistance to the flow of current. Hence, work must be continuously done by the current to keep itself flowing.

When an electric charge Q moves against a potential difference V , the work done is $W = QV$.

From the definition of current,

$$I = \frac{Q}{t}$$

$$\therefore Q = It$$

From Ohm's law,

$$V = IR$$

$$\therefore W = It \times IR = I^2 Rt$$

Assuming that all this work goes in producing heat energy.

Therefore, the heat produced in a conductor of resistance ' R ' when current ' I ' is flowing for time ' t ' is

$$H = I^2 Rt$$

(b) When resistors are connected in series:

$$R_s = R + R = 2R$$

$$\therefore H_s = \frac{V^2}{R_s} = \frac{V^2}{2R} \quad \dots\dots (1)$$

When resistors are connected in parallel:

$$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$$

$$\therefore R_p = \frac{R}{2}$$

$$\therefore H_p = \frac{V^2}{R_p} = \frac{2V^2}{R} \quad \dots\dots (2)$$

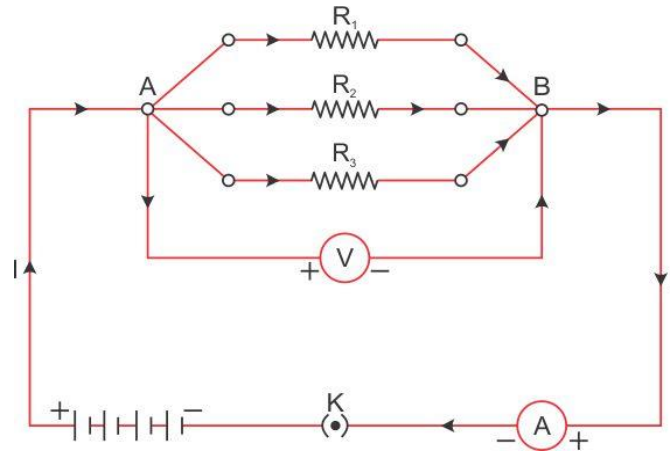
From (1) and (2),

$$\frac{H_s}{H_p} = \frac{V^2}{2R} \times \frac{R}{2V^2} = \frac{1}{4}$$

$$\therefore H_p = 4H_s$$

OR

- (a) When two or more resistors are joined to the same end, they are connected in parallel.



Potential difference in a parallel circuit remains the same across all resistors.
The current is the sum of the currents across all the individual resistors.

$$I = I_1 + I_2 + I_3 \quad \dots\dots (1)$$

Let R_p be the resultant resistance of the circuit.

On applying Ohm's law to the entire circuit,

$$I = \frac{V}{R_p} \quad \dots\dots (2)$$

Applying Ohm's law to individual resistors,

$$\left. \begin{aligned} I_1 &= \frac{V}{R_1} \\ I_2 &= \frac{V}{R_2} \\ I_3 &= \frac{V}{R_3} \end{aligned} \right\} (3)$$

From equations (1), (2) and (3),

$$\begin{aligned} \frac{V}{R_p} &= \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} \\ \therefore \frac{1}{R_p} &= \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \end{aligned}$$

- (b) For the given circuit,

- (i) The resultant resistance is

$$R_{eq} = 7 + 5 || 10$$

$$\therefore R_{eq} = 7 + \frac{10 \times 5}{10 + 5} = 7 + \frac{50}{15}$$

$$\therefore R_{eq} = \frac{105 + 50}{15} = \frac{155}{15} = 10.33 \, \Omega$$

(ii) The total current is

$$I = \frac{V}{R_{eq}}$$

$$\therefore I = \frac{6}{10.33} = 0.58 \text{ A}$$

(iii) Voltage across the $7\text{-}\Omega$ resistor is

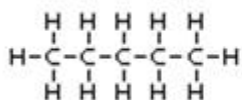
$$V_7 = IR_7 = 0.58 \times 7 = 4.06 \text{ V}$$

29.

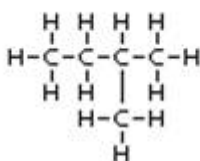
(a) In covalent compounds, electrons are shared between atoms and no charged particles are formed. Hence, they are poor conductors of electricity.

(b) Carbon dioxide is evolved. It turns lime water milky.

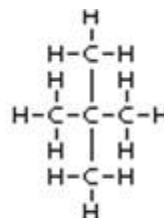
(c) Structural isomers of pentane:



Pentane



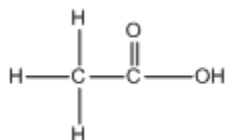
Isopentane



Neopentane

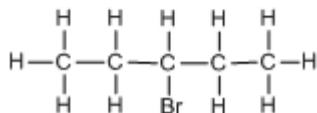
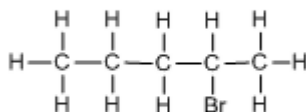
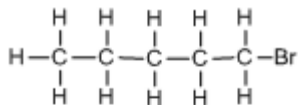
OR

(a) Ethanoic acid: CH_3COOH

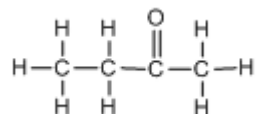


(b) Bromopentane: $\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$

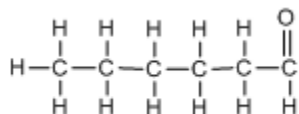
Many structural isomers are possible for bromopentane. Among them, the structures of three isomers are



(c) Butanone: $\text{CH}_3\text{CH}_2\text{COCH}_3$

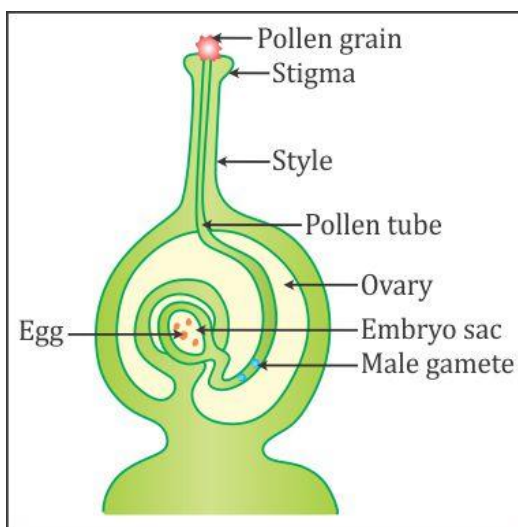


(d) Hexanal



30.

(a)



(b) The ovule becomes a seed, the ovary thickens to form a fruit, and the zygote develops into the embryo of the seed.