SCIENCE

ANSWER AND SOLUTIONS

SECTION-A

1. Option (1)

displacement reaction

2. Option (1)

$2H_2O \rightarrow 2H_2 + O_2$

3. Option (3)

CuO gets oxidised.

4. Option (2)

pH = 8.6

5. Option (2)

$NaHCO_3$

6. Option (1)

CH_3COOH

7. Option (2)

$C_5H_{10}O$

8. Option (4)

9. Option (4)

10. Option (2)

11. Option (3)

12. Option (3)

13. Option (3)   **(1)**

The light ray travelling through centre of curvature goes undeviated from the mirror after reflection or traces its path back. The image formed this way is inverted in nature. The focal length of concave mirror is always negative.

14. Option (2)

The person suffers from myopia and a concave lens is required for its correction.

Far point = 2 m = 200 cm,

Focal length of concave lens (for myopia correction),

    f = – 200 cm = – 2 m

Power of corrective lens,

$$P = \frac{1}{f(\text{in m})} = \frac{1}{-2} = -0.5 \text{ D}$$

15. Option (2)

16. Option (3)

17. Option (1)

Galvanisation is the process of protecting iron from rusting by coating iron with zinc.

18. Option (2)

19. Option (1)   **(1)**
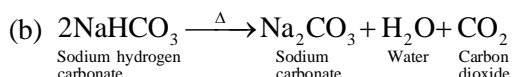
Explanation: When an electric current flows through a circular coil, it creates a magnetic field around it. The strength of this magnetic field depends on several factors, including the current in the wire, the radius of the coil, and the number of turns in the coil.

When the number of turns in the coil is increased, the total current passing through the coil also increases proportionally. As the current flows in the same direction through each turn of the coil, the magnetic fields produced by each turn add up, resulting in a stronger magnetic field at the center of the coil. This is known as the super position principle.

20. Option (3)

SECTION-B

21. (a) Sodium carbonate, water and carbon dioxide are formed on heating sodium hydrogen carbonate.

(b) $\underset{\substack{\text{Sodium hydrogen}\\\text{carbonate}}}{2NaHCO_3} \xrightarrow{\Delta} \underset{\substack{\text{Sodium}\\\text{carbonate}}}{Na_2CO_3} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{dioxide}}}{CO_2}$

22. (a) If there is an error in DNA copying or mutation, then newly formed DNA copies may not be identical a time.   **(1)**

(b) Seed coat develops from integuments and stalk of the seed develops from funicle of the ovule. **(1)**

23. (a) The blood vessel that carries blood towards the glomerulus is afferent arteriole and the blood vessel that carries blood away from it is efferent arteriole respectively.   **(1)**

(b) The purpose of making urine in the human body is to filter out nitrogenous waste products like urea and uric acid from the blood in humans.   **(1)**

OR

(a) Veins have thin walls because the blood is no longer under pressure and they have valves to ensure blood flow in one direction.   **(1)**

(b) The component of blood which transport   **(1)**

(i) Food, CO_2 & nitrogenous wastes - Plasma.

(ii) Oxygen - Red blood cell.

24. (i) The bending of light is more in the medium B because its refractive index is greater than that of medium A. The medium B is optically more denser than medium A.   **(1)**

(ii) The speed of light is more in the medium A which has the refractive index 1.31.   **(1)**

25. (i) If alpha particle is at rest in a magnetic field, it will experience no magnetic force.   **(½)**

(ii) If alpha particle moves parallel to magnetic field lines, it will experience no magnetic force in this case also.   **(½)**

(iii) If the alpha particle moves perpendicular to the magnetic field lines, it experiences maximum force of magnetic field on it and direction of the force on alpha particle can be identified using fleming's left hand rule. **(1)**
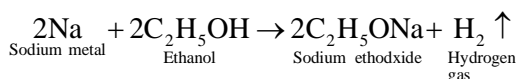
OR

Magnetic field can be produced or made available to a place wherever required by using **(any two)**

(i) a permanent magnet or artificial magnet (like bar magnet, Horse shoe magnet)

(ii) a straight current carrying conductor.

(iii) a flow of current in a solenoid. **(1+1=2)**

26. (a) The primary consumers are the organisms who directly feed on the producers. **(1)**

In the given food web, rabbits and mice are the primary consumers.

(b) The foxes feed on the rabbits and mice. If all the foxes are killed then there will be no direct predator of rabbits and mice, hence the number of rabbits and mice will increase in the given ecosystem, which will disturb its balance. **(1)**
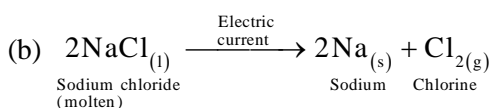
SECTION-C

27. (a) Hydrogen gas is evolved with the formation of sodium ethoxide.

$$\underset{\text{Sodium metal}}{2Na} + \underset{\text{Ethanol}}{2C_2H_5OH} \rightarrow \underset{\text{Sodium ethodxide}}{2C_2H_5ONa} + \underset{\substack{\text{Hydrogen} \\ \text{gas}}}{H_2} \uparrow$$

(b) Two members of a homologous series differ from each other by $-CH_2$ group. Hence, CH_4O and C_2H_6O belong to same series.

(c) Aldehydic group $\left(-\overset{\overset{\displaystyle O}{\|}}{C}-H\right)$ is the terminal functional group.

28. (a) $\underset{\text{Ammonia}}{NH_{3(g)}} + \underset{\substack{\text{Hydrogen} \\ \text{chloride}}}{HCl_{(g)}} \rightarrow \underset{\substack{\text{Ammonium} \\ \text{chloride}}}{NH_4Cl_{(s)}}$

(b) $\underset{\substack{\text{Sodium chloride} \\ (\text{molten})}}{2NaCl_{(l)}} \xrightarrow{\substack{\text{Electric} \\ \text{current}}} \underset{\text{Sodium}}{2Na_{(s)}} + \underset{\text{Chlorine}}{Cl_{2(g)}}$
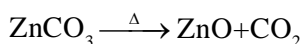
(c) This is because zinc is more reactive than hydrogen whereas copper is less reactive than hydrogen in the activity series.
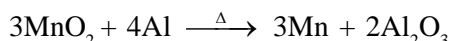
OR

(a) Roasting of sulphide ore:

$$2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2$$
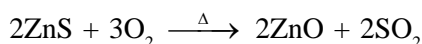
Calcination of carbonate ore:

$$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$$

(b) MnO_2 is reduced to Mn and Al is oxidised to Al_2O_3.

$$3MnO_2 + 4Al \xrightarrow{\Delta} 3Mn + 2Al_2O_3$$

29. Hypersecretion (more secretion) or hyposecretion (less secretion) of different hormones lead to various disorders in our body. **(3)**

The three common examples are:

(i) **Goitre** Iodine acts as the necessary component for the synthesis of thyroxine hormone from thyroid gland. This disorder is caused due to the deficiency of iodine that leads to hyposecretion of thyroxine.

(ii) Gigantism and dwarfism Hypersecretion of growth hormone results in gigantism (very tall individual).

On the contrary, the hyposecretion or deficiency of growth hormone at an early stage of life makes the person very short, i.e. causes dwarfism.

(iii) Diabetes mellitus Insulin secreted by pancreas helps to lower the blood glucose level. When it is secreted in less amount, the body suffers from diabetes. More and more glucose gets accumulated in the body.

30. (a) The ratio of chromosome number between an egg and its zygote is 1 : 2. **(1)**

(b) **(2)**

Sperm	Egg
It is smaller in size as it does not store food	It is larger in size as it store food
It is motile as it has tail	It is non-motile

31. (i) (a) The position of object AB would have been beyond $2F_1$. **(1)**

(b) Size of the object would have been bigger than the size of image. **(1)**

(ii) Given : $n_w = \dfrac{4}{3}$, $n_g = \dfrac{3}{2}$, $\angle i = 45°$, $\angle r = ?$ **(2)**

The refractive index of glass with respect to water,

$$n_{gw} = \frac{n_g}{n_w} = \frac{\left(\dfrac{3}{2}\right)}{\left(\dfrac{4}{3}\right)} = \frac{9}{8} \qquad ....(1)$$

Since, $n_{gw} = \dfrac{\sin i}{\sin r} = \dfrac{\sin 45°}{\sin r} = \dfrac{\left(\dfrac{1}{\sqrt{2}}\right)}{\sin r} \qquad ....(2)$

Therefore, using relation (1) and (2), we have

$$\frac{9}{8} = \frac{\left(\dfrac{1}{\sqrt{2}}\right)}{\sin r}$$

$\Rightarrow \sin r = 0.6284 \quad \Rightarrow \quad r = 38.9°$

32. (i) Effective resistance of the network, **(1½)**

$$R_{AB} = 2\Omega + 6\Omega \parallel 3\Omega = 2 + \frac{6 \times 3}{6+3} = 2 + \frac{18}{9} = 2 + 2 = 4\ \Omega$$

(ii) The main current in the network, $I = \dfrac{V}{R_{AB}} = \dfrac{12}{4} = 3\ A$ **(1½)**

Potential difference across 2 Ω resistor, $V_1 = I \times R_1 = 3 \times 2 = 6\ V$

So, potential difference across the parallel combination of 3 Ω and 6 Ω, $V_2 = 12 - 6 = 6\ V$

Therefore, current flowing through 6 Ω resistor, $I' = \dfrac{6V}{6\Omega} = 1\ A$

33. (a) Given that the magnetic field lines associated with current carrying vertical straight conductor is in anticlockwise direction, as seen by observer. It indicates two possible situation of current flow through the wire regarding two different observation's points.   **(1)**

Either, the observer is facing up and the anticlockwise magnetic field lines are seen by him. In this situation, the direction of current flow through vertical straight conductor is downwards (fig.1).

Or, the observer is facing down when he observes the anticlockwise magnetic field lines. In this situation, the current is flowing through the vertically straight conductor in upward direction (fig.2).

Fig (1)   Eye observation upwards   Fig (2)   Eye observation downwards
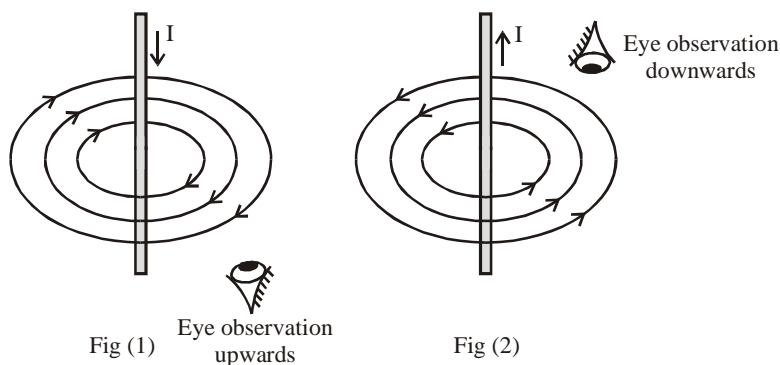
(1)

(b) Magnetic field (B) at the centre of the circular coil

   (i) increases if the current is increased, since $B \propto I$.   **(½)**

   (ii) reverses on reversing the current.   **(½)**

SECTION-D

34. (a) $CH_3–CH=CH_2$ (b) $CH_3C \equiv CH$

(c) $CH_3CH_2CH_2OH$ (d) CH_3CH_2CHO

(e) CH_3CH_2COOH

OR

(a) It is because heat is evolved during respiration.

(b) Oxidation is a process in which oxygen is added or hydrogen is removed. Reduction is a process in which hydrogen is added or oxygen is removed.

(c) (i) Zn   (ii) Mg   (iii) CO

35. (a) (i) Placenta is extremely essential for foetal development because it helps in nutrition, respiration, excretion, etc., of the foetus through the maternal supply.   **(1)**

(ii) Blocking of vas deferens prevents passage of sperms, hence, there is no fertilisation thus preventing pregnancy.   **(1)**

(b) (i) Sperm formation will be adversely affected because it requires a lower temperature than the body temperature.   **(1)**

(ii) When an egg is not fertilised in a human female, it lives for about one day. Then, the thickened lining of the uterus breaks leading to discharge of blood and mucus along with the unfertilised egg. This is called menstruation.   **(1)**

(iii) When prostate and seminal vesicles are not functional, they will not add secretions for nourishment and medium for the transport of sperms. **(1)**

OR

(a) The hormone responsible for bending of shoot towards the light is auxin. **(1+1)**

The hormone that increases the number & size of fruits is gibberellin.

(b) When a stimulus acts on the receptor a chemical reaction is set off which produces an electrical impulse in it. This impulse travels from the dendrite of sensory neurons to its cell body and then along its axon. **(3)**
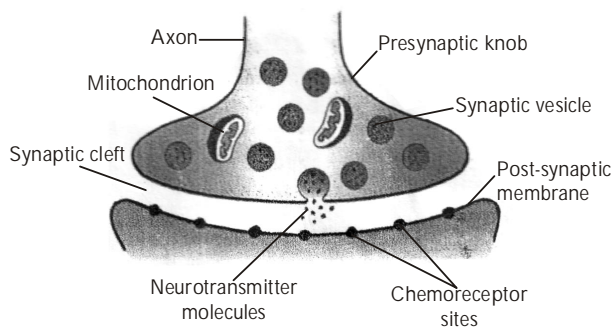
At the end of axon of sensory neuron, the electrical impulse releases tiny amount of a chemical substance in the synapse. This chemical substance crosses the gap and starts similar electrical impulse on the dendrite of next neuron. This process continues till the electrical impulse reach the relay neurons in brain and spinal cord. These relay neurons connect in a similar way from the brain and spinal cord to the effector muscles and glands via motor neuron.

36. (a) Given, distance of object, $u_1 = -60$ cm **(2)**

Magnification, $m_1 = \dfrac{1}{2}$

Distance of object, $u_2 = ?$

Magnification, $m_2 = \dfrac{1}{3}$

$\therefore$ $m_1 = \dfrac{-v_1}{u_1}$

$\Rightarrow$ $v_1 = -m_1 u_1 = \dfrac{-1}{2} \times (-60) = 30$ cm

Using mirror formula,

$$\dfrac{1}{f_1} = \dfrac{1}{v_1} + \dfrac{1}{u_1} = \dfrac{1}{v_1} + \dfrac{1}{(-60)} = \dfrac{1}{30} - \dfrac{1}{60} = \dfrac{1}{60}$$

$\Rightarrow$ $f_1 = 60$ cm

Again, $m_2 = \dfrac{-v_2}{u_2} \Rightarrow v_2 = \dfrac{-u_2}{3}$

Since, $f_1 = f_2$ [As the same mirror is used in both the cases]

$\therefore$ $\dfrac{1}{f_2} = \dfrac{1}{v_2} + \dfrac{1}{u_2} \Rightarrow \dfrac{1}{u_2} = \dfrac{1}{f_1} - \dfrac{1}{v_2}$
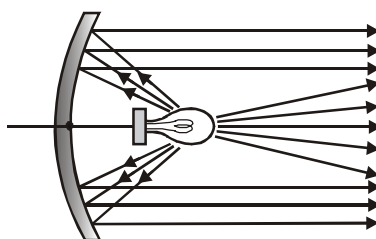
$$\Rightarrow \quad \frac{1}{u_2} = \frac{1}{60} + \frac{3}{u_2}$$

$$\Rightarrow \quad \frac{1}{u_2} - \frac{3}{u_2} = \frac{1}{60}$$

$$\Rightarrow \quad \frac{-2}{u_2} = \frac{1}{60}$$

$$\Rightarrow \quad u_2 = -120 \text{ cm}$$

(b) **(i) Concave mirror:** Concave mirror is used in the headlights of a vehicle because it produces powerful and almost parallel beam of light when the light source is placed at its principal focus. **(3)**
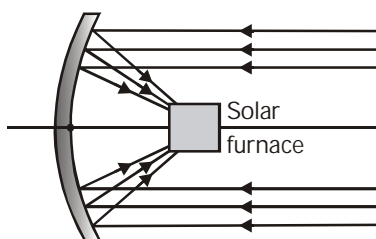

A bulb placed at the focus of a concave mirror produces a strong, almost parallel beam

(ii) Convex mirror: Convex mirror is used in rear-view mirror of a vehicle. Convex mirror gives a virtual, erect, and diminished image of the object placed in front of it. Because of this, it has a wide field of view. It enables the driver to see most of the traffic behind him.
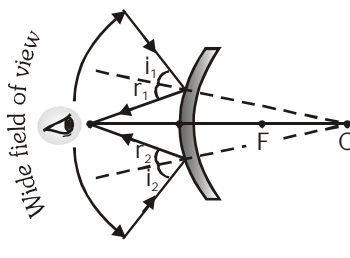
A convex mirror has a wide field of view

(iii) Concave mirror: Concave mirrors are converging mirrors. That is why they are used to construct solar furnaces. Concave mirrors converge the parallel light incident on them at a single point which is called principal focus. Hence, they can be used to produce a large amount of heat at that point.

A solar furnace placed at the focus of a concave mirror

OR

(a) The defect that arises due to ageing in which a person cannot read comfortably and distinctly without corrective eye glasses is called 'presbyopia'. **(1)**

Cause of presbyopia : **(1)**

The power of accommodation of the eye decreases with ageing. For most of the people, the near point recedes, this means, the least distance of distinct vision increases. This phenomenon arises due to the gradual weakening of ciliary muscles and decreasing flexibility of the crystalline eye lens.

Correction : **(1)**

Here, the cornea and lens together are not able to bring nearby objects into focus on the retina. The symptoms are the same as with hypermetropia or (farsightedness), and the condition can be corrected using a converging lens i.e., convex lens.

(b) Given : Near point = 0.5 m, Far point = 3 m **(2)**

For correction of Near sightedness,

$u = -\infty$, $v = -3$ m (Far point)

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{(-3)} - \frac{1}{(-\infty)} = -\frac{1}{3}$$

$\Rightarrow f = -3$ m $= -300$ cm

For correction of Far sightedness,

$u = -25$ cm $= -0.25$ m, $v = -0.5$ m (Near point)

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{(-0.5)} - \frac{1}{(-0.25)} = \frac{-100 + 200}{50} = \frac{100}{50}$$

$\Rightarrow f = +\frac{1}{2}$ m $= +50$ cm

SECTION-E

37. (a) Soil Y

(b) Sulphuric acid, ethonoic acid, ammonium hydroxide, potassium hydroxide.

OR

(b) Turns blue litmus to red.

38. (a) F_1 progeny of tall plants with round seeds and short plants with wrinkled seeds will be heterozygoous tall plant with round seeds (TtRr) as tall and round is the dominant traits. **(1)**

(b) The recessive traits short & wrinkled. **(1)**

(c) The different types of combination obtained in F_2 progeny are : **(2)**

F₁progeny   TtRr   self pollination

♂   ♀
TtRr   TtRr

Gametes (TR) (tR) × (Tr) (tr)
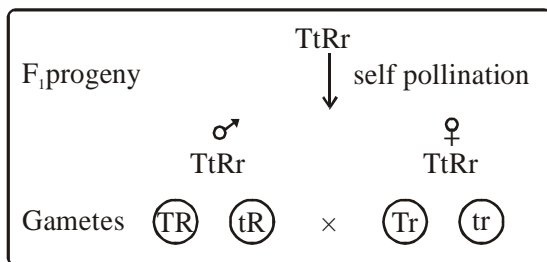
F₂progeny

♀ \ ♂	TR	tR	Tr	tr
TR	TTRR Tall Round	TtRR Tall Round	TTRr Tall Round	TtRr Tall Round
tR	TtRR Tall Round	ttRR short round	TtRr Tall Round	ttRr Short round
Tr	TTRr Tall Round	TtRr Tall Round	TTrr Tall wrinkled	ttrr Tall wrinkled
tr	TtRr Tall Round	ttRr Short Round	Ttrr Tall wrinkled	ttrr Short wrinkled

Tall plants with round seeds = 9

Short plants with round seeds = 3

Tall plants with wrinkled seeds = 3

Short plants with wrinkled seeds = 1

Phenotypic ratio = Tall round : short round : tall wrinkled : short wrinkled : 9 : 3 : 3 : 1

OR

If 1600 plants were obtained in F₂ progeny, the number of plants having traits will be: **(2)**

(i) Tall plants with round seeds = $\dfrac{9}{16} \times 1600 = 900$

(ii) Short plants with wrinkled seeds = $\dfrac{9}{16} \times 1600 = 100$

The conclusion of the above experiment states the "Law of independent assortment". This law states that the alleles of two (or more) different genes get sorted into gametes independently of one another.

39.   (a) $R_{eq} = 5 + 10 + 15 = 30 \ \Omega$

5 Ω   10 Ω   15 Ω

+ ‖⊢ −
30 V   Fig. (a)   K

$I = \dfrac{V}{R_{eq}} = \dfrac{30}{30} = 1 \ A$

Potential difference across 15 Ω resistor

$= I \times R_{15} = 1 \times 15 = 15 \ V$ **(1)**

(b) When resistors are connected in parallel,

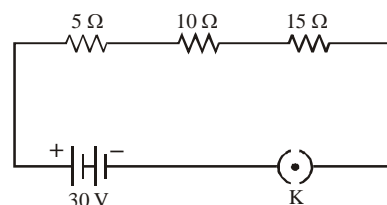Current through 5 Ω resistor, $I_1 = \dfrac{V}{R_1} = \dfrac{30}{5} = 6 \ A$ **(½)**

Current through 10 Ω resistor, $I_2 = \dfrac{V}{R_2} = \dfrac{30}{10} = 3$ A **(½)**

(c) $R_{AB} = 10\ \Omega + (20\ \Omega \parallel 20\ \Omega) = 10\ \Omega + \dfrac{20}{2}\Omega$

$= 10\ \Omega + 10\ \Omega = 20\ \Omega$ **(2)**

OR

$R_{AB} = (20\ \Omega + 10\ \Omega) \parallel 20\ \Omega = 30\ \Omega \parallel 20\ \Omega$

$= \dfrac{30 \times 20}{(30 + 20)} = \dfrac{600}{50} = 12\ \Omega$ **(2)**

5 Ω
10 Ω
15 Ω
30 V   K
Fig. (b)