Answers

1. Carbon dioxide is more soluble in water than oxygen and diffuses into the red blood cells. Hence, it is mostly transported in dissolved form in our blood. (1)

2. On heating sodium carbonate decahydrate, water of crystallisation is lost and the substance becomes anhydrous.

$$\underset{\text{Sodium carbonate decahydrate}}{Na_2CO_3 \cdot 10H_2O} \xrightarrow{\text{Heat}} \underset{\text{Sodium carbonate}}{Na_2CO_3} + 10H_2O \quad (1)$$

Or

Egg shells contain calcium carbonate. On reacting it with nitric acid, a brisk effervescence of cabon dioxide gas is produced. The reaction involved is

$$CaCO_3(s) + 2HNO_3(aq) \longrightarrow Ca(NO_3)_2(aq) + H_2O(l) + CO_2(g) \quad (1)$$

3. Since, magnification produced by a convex mirror is always less than 1, therefore a full length image of distant tall tree can definitely be seen by using a convex mirror. (1)

4. The element *C* is Al. It forms amphoteric oxide Al_2O_3. (1)

5. The generation which is produced by the offspring of F_1-generation, i.e. first generation as parent called F_2 or second generation. (1)

Or

Sexually reproducing organisms will show more variations as genetic material is exchanged between homologous pair of chromosomes during cross over. However, during asexual reproduction DNA replication is the only means of variation and DNA replication are not very common frequent which may lead to variation. (1)

6. (b) $Ca(NO_3)_2$ on heating gives CaO, $NO_2(g)$ and $O_2(g)$.

The balanced chemical equation is as follows :

$$2Ca(NO_3)_2 \xrightarrow{\Delta} 2CaO + 4NO_2(g) + O_2(g)$$

Hence, number of moles of reactant $Ca(NO_3)_2$ and products CaO, $NO_2(g)$ and $O_2(g)$ present are 2, 2, 4 and 1 respectively. (1)

7. Glycerine is the most optically denser medium amongst all the given media and hence have the largest refractive index. Therefore, ray of light bends most in glycerine. (1)

8. $BaCl_2(aq) + CuSO_4(aq) \longrightarrow \underset{\text{White ppt.}}{BaSO_4(s)} + CuCl_2(aq)$

It is a double displacement reaction. (1)

Or

Calcium oxide or quicklime is used for white washing. Hence, *X* is calcium oxide and its formula is CaO.

$$\underset{(X)}{CaO(s)} + H_2O(l) \longrightarrow \underset{\text{Slaked lime}}{Ca(OH)_2(aq)}$$ (1)

9. The refraction of light caused by the Earth's atmosphere (having air layers of varying optical densities) is called atmospheric refraction. (1)

10. Due to refraction of light, a ray of light bends when it travels from one medium to another. (1)

Or

Scattering is responsible for making the path of light visible. (1)

11. Mercury (Hg) is liquid at room temperature. (1)

12. Magnetic field of current carrying solenoid is used to make soft iron as an electromagnet. (1)

Or

Two ways to induce current in a coil are

(i) By moving a bar magnet towards or away from the coil.

(ii) By placing a closed coil near another coil connected across a battery. (1)

13. Because veins carry deoxygenated blood from all the body parts towards the heart. These blood vessels have thin, less elastic walls and their lumen possess valves which prevent the back flow of blood. Due to the presence of valves in veins, blood flows from legs to heart against gravity. (1)

14. (b) Rainbow is a natural spectrum appearing in the sky after a rain shower. It is caused by dispersion of sunlight by tiny water droplets, present in the atmosphere.

So, assertion is correct.

Now, scattering $\propto \frac{1}{(\text{wavelength})^4}$

Hence, light of shorter wavelength is scattered much more than light of larger wavelength.

Hence, Reason is also true but it is not the correct explanation of Assertion. (1)

15. (a) When we blow air in lime water, the CO_2 present in the exhaled air turns it milky. The milky colour is due to the formation of calcium carbonate. This activity demonstrates the presence of CO_2 in exhaled air.

Hence, both Assertion and Reason are true and Reason is the correct explanation of Assertion. (1)

16. (a) In the given food chain (Grass → Goat → Tiger), if the goat goes missing, then the population of tigers would decrease as they will not get food (goat) and the population of grass (producers) will increase as it will not be eaten up by goats. Hence, both Assertion and Reason is true and Reason is the correct explanation of Assertion. (1)

Or

(a) A both assertion and Reason are correct Reason is the correct explanation of Assertion. (1)

17. The electronic configuration of the given elements are :

$A = 2, 8, 8$

$B = 2, 8, 8, 1$

$C = 2, 8, 7$

$D = 2, 7$

$E = 2, 4$

17. (i) (c) The element '*E*' is carbon. It exhibits catenation as it can form long chain compound. Also carbon is present in 2nd period and 14th group as it have 2 shells and 4 electrons in last shell. (1)

17. (ii) (d) The electronic configurations are

$B = 2, 8, 8, 1$

$C = 2, 8, 7$

$D = 2, 7$

$\therefore$ Size of $D < C < B$

$\therefore$ Electronegativity of $B < C < D$

$\because$ Electronegativity $\propto \frac{1}{\text{Size}}$ (1)

17. (iii) (b) Element *B* can easily form an ionic bond with *C* by the loss of one electron. Option (b) is correct. (1)

17. (iv) (c) Both *C* and *D* elements have 7 electrons in last shell.

$\therefore$ They belong to same group. (1)

17. (v) (d) Element *D* is fluorine having heighest electronegativity.

Element *A* is argon, having completely filled last shell.

Element *B* is sodium, it will loose one electron to achieve stable electronic configuration

Hence, all the options are correct. (1)

18.

18. (i) (a) Umbilical cord and placenta. (1)

18. (ii) (c) As egg cells carry an *X* chromosome. There are two sends of sperms, one containg an *X* chromosome in their nuclous and other containing *Y* chromosome. (1)

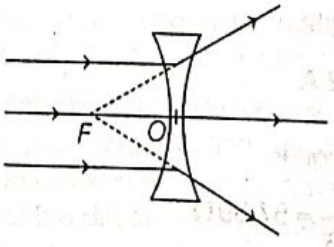
18. (iii) (a) Shock absorber is the main function of amniotic fluid. (1)

18. (iv) (b) Menstruation marks the beginning of the menstrual cycle and ovulation occurs 14 days after the onset of menstruation. (1)

18. (v) (b) Iron is essential for the formation of red blood cells. It is an important component of haemoglobin in red blood cells. (1)

19.

19. (i) (b) Concave lens is diverging lens. It diverges the parallel beam of light rays (as shown in figure) :



The ray parallel to principal axis is getting diverged in case of lens L_2 only. So, only lens L_2 is concave lens. (1)

19. (ii) (b) Given, $u = -12$ cm

$f = +8$ cm

From lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{8} = \frac{1}{v} - \frac{1}{-12} = \frac{1}{v} + \frac{1}{12}$$

$$\frac{1}{v} = \frac{1}{8} - \frac{1}{12} \Rightarrow \frac{1}{v} = \frac{3-2}{24} \Rightarrow v = 24 \text{ cm}$$

(1)

19. (iii) (a) A ray passing through the optical centre of a lens goes straight without any deviation. (1)

19. (iv) (a) When the object is placed at $2F_1$,

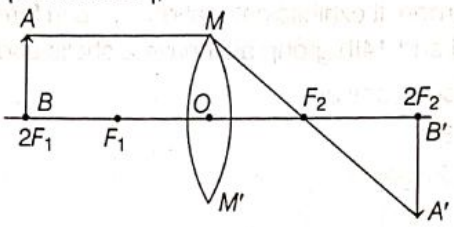


Image is formed at $2F_2$. (1)

19. (v) (d) A ray of light passing through principal focus, after refraction from a convex lens, will emerge parallel to the principal axis.

Hence, statement (a) is incorrect.

A ray of light passing through the optical centre of a convex lens will emerge without any deviation.

Hence, statement (b) is correct.

A ray of light passing through the lens parallel to principal axis, passes through the focus after refraction. Hence, statement (c) is correct. (1)

20.

20. (i) (a) Collecting duct (1)

20. (ii) (a) Urea is produced by deamination in here cells or hepatocytes. It is transported to kindney by renal artary where it is filtered from blood and temporaly stored in bladder as a constituent of urine before being expelled from the body. (1)

20. (iii) (c) Since, the kidneys remove urea from blood, the renal vein (C) has the lowest concentration. The highest would be heptatic vein (D). (1)

20. (iv) (d) Secretion → reabsorption → glomerualr filtration (1)

20. (v) (a) Uric acid < urea < ammonia (1)

21. When electricity is passed through an aqueous solution of sodium chloride, three products are obtained which are hydrogen, chlorine and sodium hydroxide. But this process is called chlor-alkali process because here, chlor stands for chlorine and alkali for sodium hydroxide. The amount of hydrogen obtained is very less, thus it is not given in the name of the process. (2)

22. We know that, the power input is $P = VI$

Current, $I = \frac{P}{V}$

When heating is at the minimum rate,

$$I = \frac{840 \text{ W}}{220 \text{ V}} = 3.82 \text{ A}$$

and the resistance of the electric iron is

$$R = \frac{V}{I} = \frac{220 \text{ V}}{3.82 \text{ A}} = 57.59 \Omega$$

When heating is at the minimum rate,

$$I = \frac{360\ \text{W}}{220\ \text{V}} = 1.64\ \text{A}$$

and the resistance of the electric iron is

$$R = \frac{V}{I} = \frac{220\ \text{V}}{1.64\ \text{A}} = 134.15\ \Omega$$

(2)

23. Properties of ionic compounds are:

(a) They are hard crystalline solids.

(b) These compounds have high melting and boiling points as large amount of energy is required to break strong electrostatic forces of attraction. (2)

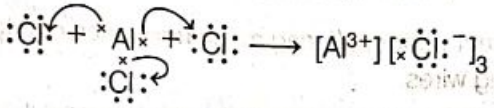
Al = 2, 8, 3

Cl = 2, 8, 7

Or

$Al \longrightarrow Al^{3+} + 3e^-$,

$3\,Cl + 3e^- \longrightarrow 3Cl^-$



(2)

24. The components of blood and their functions are as follows:

(i) **Plasma** It is the fluid component of blood, which is slightly alkaline, viscous and aqueous in nature. It transports food, carbon dioxide and nitrogenous wastes in the dissolved form. (1)

(ii) **Blood corpuscles** These cells are found in blood.

They are of following types:

(a) **Red blood cells** They carry oxygen present in the blood.

(b) **White blood cells** They are known as 'soldiers of the body' because they help the body to fight against harmful pathogens (disease-causing agents).

(c) **Platelets** They help in preventing the leakage of blood by forming a blood clot at the site of injury. (1)

Or

(i) Fertilisation of ovum by sperm occurs in Fallopian tubes. They act as oviduct in human females for fertilisation process. (1)

(ii) Embryo gets nutrition from mother's blood with the help of a special tissue called placenta. (1)

25. (i) (a) **Symptoms of Gonorrhoea**

- Discharge of pus from penis and vagina.
- Burning sensation, while urination.

(b) **Symptoms of Syphilis**

- Appearance of sores on body parts.
- Fever, ulcers, pain in bones, liver disease and anaemia. (1)

(ii) Full forms of AIDS and HIV are as follows

(a) AIDS - Acquired Immuno Deficiency Syndrome.

(b) HIV - Human Immunodeficiency Virus. (1)

26. (i) According to Fleming's left hand rule, if thumb, fore-finger and middle finger of left hand are stretched mutually perpendicular to each other, so that if fore-finger gives direction of magnetic field, and middle finger gives direction of current in conductor, then thumb points in the direction of force acting on the conductor. Hence, wire will tend to move vertically downward. (1)

(ii) When key is inserted, the magnetic field is produced due to current in the first coil. The emf is induced in the second coil due to change in magnetic lines of force passing through the second coil. Thus, there will be deflection in the galvanometer. However, when the key is removed again, the magnetic lines of force will decrease and the direction of induced current will be changed (reversed), so the galvanometer will show deflection in opposite direction. (1)

27. **Location** Human beings have a pair of kidneys found in the abdomen, one on either side of the backbone.

Structure Each kidney is a bean-shaped and reddish-brown coloured structure. The renal artery brings the impure blood containing waste substances into the kidneys, while renal vein carries the pure blood away from the kidneys. They contain nephrons as their structural and functional unit in large number. (1)

The main functions of kidney are:

(i) Nephrons remove harmful substances such as urea and other salts along with excess of water from the blood and form urine.

(ii) It helps to regulate the osmotic pressure/water balance of the blood.

(iii) It also regulates the appropriate pH of the blood.

28. (i) Zinc displaces copper from copper sulphate because zinc is more reactive than copper as it is placed above copper in the reactivity series of metals. (2)

(ii) This reaction will not occur as iron is less reactive than zinc. (1)

(iii) Zinc displaces iron because zinc is more reactive than iron. (1)

29. (i) Copper conducts the current without offering much resistance due to its high electrical conductivity. So, it is used in conducting wires. (1)

(ii) Nichrome is used to make the element of electric heater because it's an alloy with high resistivity and high melting point. (1)

(iii) The relation of resistance and power is $R = \frac{V^2}{P}$

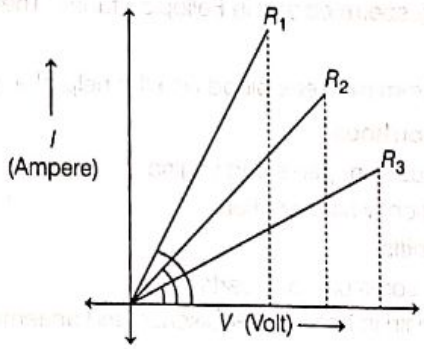
$$\Rightarrow \quad R \propto \frac{1}{P}$$

$\therefore$ Higher the power of a bulb, lesser is the resistance and so 500 W bulb will glow brighter than 200W bulb. (1)

Or

(i) As we know that, slope of *V-I* graph tells about the resistance and (slope of *V* and *I*) $\propto \frac{1}{\text{resistance}}$ (1)

i.e.,



So, $R_3 > R_2 > R_1$ (1)

(ii) Electrical resistivity ρ of a given metallic wire depends on number density of free electrons in the conductor which tells the nature of the material,

i.e., $\rho = \frac{1}{n}$

where, n = number of free electrons per unit volume. (1)

30. Generally, respiration consists of following two basic stages :

(i) **External Respiration**

(a) **Breathing** It is the process of taking in (inhaling) the required gas and giving out (exhaling) waste or unrequired gases, e.g. an aerobic organism such as human being takes in oxygen (O_2) and gives out carbon dioxide (CO_2). (1)

(b) **Gaseous exchange** It involves diffusion of O_2 from lungs to blood and CO_2 from blood to lungs. In plants, gaseous exchange takes place through stomata of leaf. (1)

(ii) **Internal Respiration** It refers to the gaseous exchange between arterial blood and the body cells. (1)

31. (i) The process is dialysis. This process becomes essential in an individual suffering from complete renal failures, i.e. both kidneys are damaged due to an infection, injury, high BP, etc. (1)

(ii) The dialysis machine, also known as artificial kidney, contains a number of tubes with a semipermeable lining suspended in a tank filled with a dialysing fluid. This fluid has the same osmotic pressure as that of blood except, it is devoid of nitrogenous wastes such as urea. During the procedure of dialysis, the patient's blood is passed through these tubes.

As the blood passes, the waste products from the blood move into dialysing fluid by diffusion and the purified blood is pumped back into the patient's body. The dialysis unit allows the blood to run along one side of a cellophane membrane and dialysis fluid in opposite direction. This is generally done to maintain the concentration gradient between the patient's blood and the dialysis fluid. (2)

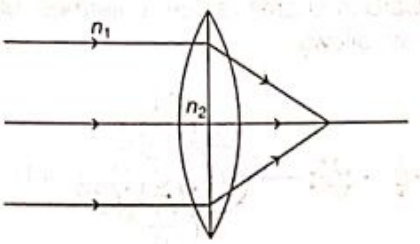
32. (i) The temperature of the reaction mixture rises when aluminium is added because it is an exothermic reaction and thus, heat gets liberated in these reactions. (1)

(ii) Reaction of sodium metal is found to be highly explosive because it is an exothermic reaction. (1)

(iii) When lead is treated with hydrochloric acid, bubbles of hydrogen gas are evolved.

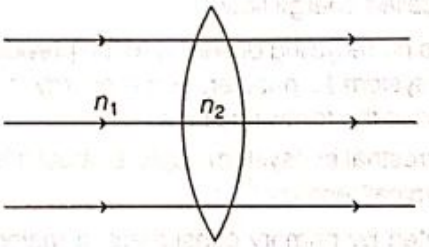
$$Pb(s) + 2HCl(aq) \longrightarrow PbCl_2(aq) + H_2(g)$$ (1)

33. (i) (a) When $n_1 < n_2$, light goes from rarer to denser medium. Thus, on passing through convex lens, it converges at a point after refraction as shown below



(1)

(b) When $n_1 = n_2$, this implies that there is no change in medium. Therefore, no bending or refraction of light occurs as shown below



(1)

(ii) If the magnification of the image formed by a mirror is negative, then it means that the image is real and inverted in nature. (1)

34. Hexane has the following five isomers :

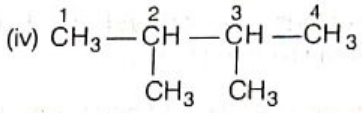
(i) $CH_3—CH_2—CH_2—CH_2—CH_2—CH_3$ (1)

(ii) $\overset{1}{C}H_3—\overset{2}{C}H(\overset{}{C}H_3)—\overset{3}{C}H_2—\overset{4}{C}H_2—\overset{5}{C}H_3$

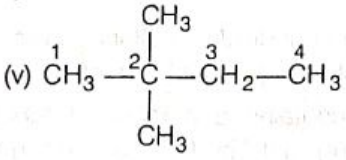
[Here, 5 carbon atoms are arranged in straight line, one is branch at 2 C-atom] (1)

(iii) $\overset{1}{C}H_3—\overset{2}{C}H_2—\overset{3}{C}H(\overset{}{C}H_3)—\overset{4}{C}H_2—\overset{5}{C}H_3$

[Here, branch is at 3C-atom] (1)

(iv) 

[Here, branches are at C-2 and C-3 atoms] (1)

(v) 

[Here, branches are at C-2 carbon atom only] (1)

Or

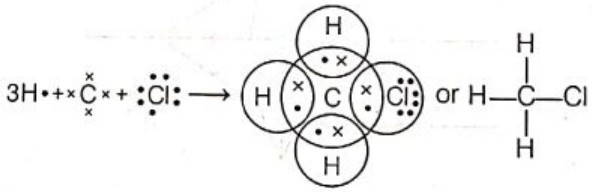
Carbon has 4 electrons in its valence shell. To complete its octet, it either needs to gain 4 electrons or lose 4 electrons to the other atom. Both these processes are impossible. Therefore, carbon atom achieve noble gas configuration by sharing 4 electrons with other atoms of itself or atoms of other elements. The bonds that are formed by sharing electrons are known as covalent bond. In covalent boding, both atoms share the valence electrons, i.e. the shared electrons belong to the valence shells of both the atoms. CH_3Cl is called chloromethane, which contains 1 carbon atom, 3 hydrogen atoms and 1 chlorine atom.

Electronic configuration of carbon, $6 = \overset{K}{2}, \overset{L}{4}$

Electronic configuration of hydrogen, $1 = \overset{K}{1}$

Electronic configuration of chlorine, $17 = \overset{K}{2}, \overset{L}{8}, \overset{M}{7}$ (2)

Carbon atom has four outermost electrons, each hydrogen atom has one electron and chlorine has seven outermost electrons. Carbon shares its four outermost electrons with 3 hydrogen atoms and 1 chlorine atom to form CH_3Cl as follows :



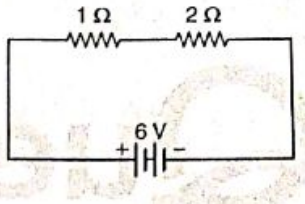
(3)

35. Energy is accumulated by the primary producers and is transferred through food chain to different trophic levels. This phenomenon is called energy flow. (1)

It is unidirectional and there is no recycling of energy to the previous level. Whenever energy is transferred from one form or from one system to another, some energy is always lost. The flow of energy in an ecosystem can be understood in the following steps :

- The green plants in a terrestrial ecosystem capture about 1% of the light energy (from the Sun) and convert it into food (chemical) energy. (1)
- The green plants are eaten by primary consumers, a major amount of the energy is lost as heat. Some amount goes into digestion and in doing work and rest goes towards growth and reproduction. An average of 10% of the energy of food eaten by an organism is turned into its own body and made available for the next level of consumers. This is known as the 10% law. (1)
- Therefore, 10% can be taken as the average value for the amount of organic matter that is present at each step and reaches to the next trophic level. (1)
- Since, only a little energy is available for the next level of consumers, food chains generally consist of three or four steps. The loss of energy at each step is very large. So, little usable energy is left after three or four trophic levels. Therefore, the length of food chains in an ecosystem is generally limited to three or four trophic levels. (1)

36. (i) (a) The circuit is shown in right;



Resistances are connected in series combination.

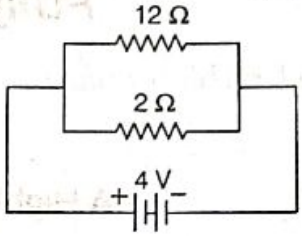
Current in the circuit,

$$I = \frac{V}{R_1 + R_2} = \frac{6}{3} = 2\text{ A}$$

$\therefore$ Power used $= I^2R = (2)^2 \times 2$

$= 2 \times 2 \times 2 = 8\text{W}$ (2)

(b) The circuit is shown in right;



In parallel combination, potential across each resistor is same and equal to the potential applied to the circuit.

Potential across 2 Ω resistor,

$V = 4\text{ V}$

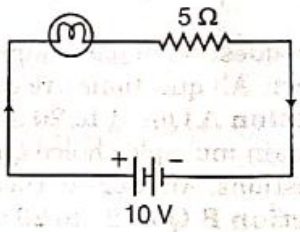
$$\text{Power used} = \frac{V^2}{R} = \frac{4 \times 4}{2} = 8\text{ W}$$

Power used in both the cases is same. (2)

(ii) Resistance is inversely proportional to the area of cross-section of the wire. Thus, if the wire is thick (large area of cross-section), then resistance is less. If the wire is thin (less area of cross-section), then resistance is large. (1)

Or

(i) Let the resistance of the lamp be R_1 and resistance of conductor be $R_2 = 5\Omega$.



$\therefore$ Total resistance in series, $R_S = R_1 + R_2 = R_1 + 5$

Current, $I = 1\text{A}$

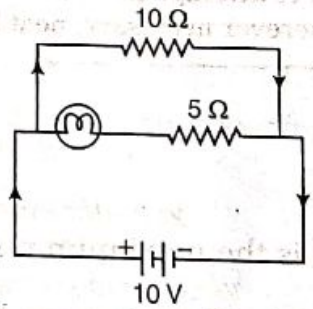
Voltage, $V = 10\text{ V}$

Using Ohm's law, $V = IR_S$

$$10 = 1(R_1 + 5) \Rightarrow R_1 = 5\Omega$$

Thus, the resistance of electric lamp is 5Ω. (2½)

(ii) Now, a resistance of 10 Ω is connected in parallel with the series combination. Therefore, the total resistance of the circuit is given by



$$\frac{1}{R_P} = \frac{1}{R_1 + 5} + \frac{1}{10}$$

$$\Rightarrow \quad \frac{1}{R_P} = \frac{1}{5+5} + \frac{1}{10}$$

$$\Rightarrow \quad \frac{1}{R_P} = \frac{1}{10} + \frac{1}{10}$$

$$\therefore \quad R_P = 5\Omega$$

Hence, current flowing in the circuit,

$$I = \frac{V}{R} = \frac{10}{5} = 2\text{ A}$$

Thus, 1 A current will flow through 10 Ω resistor and 1 A will flow through the lamp and conductor of 5 Ω resistance. Hence, there will be no change in current flowing through 5 Ω conductor. Also, there will be no change in potential difference across the lamp. (2½)