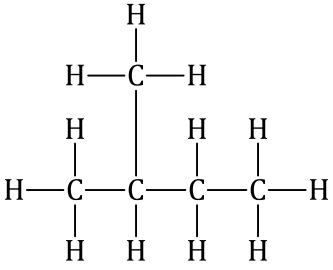
CBSE
Class X Science
Sample Paper 10 – Solution

Section A

1. The unsymmetrical isomer of C_5H_{12} is as follows:



2-methyl butane

2. Oils and fats react with oxygen and become oxidised or turn rancid. This process is called rancidity.

3.

(a) If the two 4 Ω resistors are connected in parallel, then the equivalent resistance is 2 Ω, and when four 4 Ω resistors are connected in parallel, the equivalent resistance is 1 Ω. Thus, when these two combinations are connected in series, we get an equivalent resistance of 3 Ω.

Explanation:

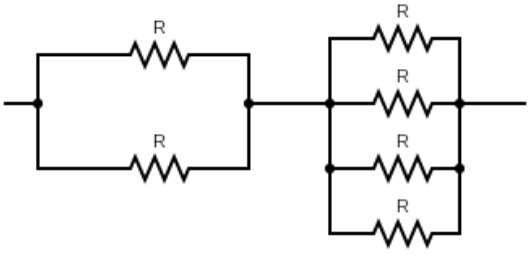
$$\frac{1}{R_{p_1}} = \frac{1}{4} + \frac{1}{4}$$

$$R_{p_1} = \frac{4}{2} = 2\ \Omega$$

$$\frac{1}{R_{p_2}} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{4}{4} = 1\Omega$$

$$R_{p_2} = 1\ \Omega$$

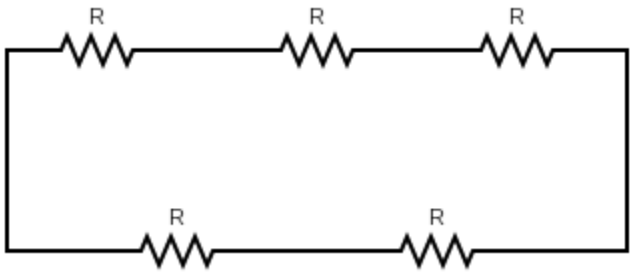
$$R_s = 2 + 1 = 3\ \Omega)$$



(b) Five 4 Ω resistors are used to obtain a 14 Ω resistance.

(c) When three 4 Ω resistors are connected in series, the equivalent resistance is 12 Ω, and when two 4 Ω resistors are connected in series, the equivalent resistance is 8 Ω. When these two combinations are connected in parallel, we get 14 Ω.

Explanation:



(d) The current drawn from the power supply is high as every appliance draws the required amount of current according to their power rating for their proper functioning. Thus, the current across each appliance connected in parallel is different.

4.

(a) The given data talks about a food chain comprising green plants, fish and eagles. From the data, it can be inferred that the concentration of chemicals goes on increasing from plants to fish and then from fish to eagles.

(b) The process of concentration of harmful chemicals at each successive trophic level in a food chain is called biological magnification or biomagnification.

(c) Chemicals which get accumulated in a food chain include DDT, mercury and heavy metals.

(d) Due to biomagnification, organisms at the top of the food chain are affected by a variety of persistent organic pollutants which are carcinogenic and toxic to the reproductive, nervous and immune systems.

5. ii) 0.18 A

$P = VI$

$I = 40/220 = 0.18$ A

OR

iii) remains the same

The resistivity of the substance does not depend on its length or thickness. It depends only on the nature of substance and temperature.

6. i) Cow dung cake

Cow dung cake is not a fossil fuel.

7. iii) between O and F

When the object is placed between the optical centre and the focus of a converging or convex lens, the image formed is magnified, virtual and erect.

8. ii) may have similar evolutionary histories

Comparative biochemistry shows that the more similar the DNA of two species, the more closely they are related, and the more recently they have evolved separately. This is evident from the fact that humans and apes have more than 99% similar DNA sequences.

OR

iii) Ability to adapt to the environment in the niche it occupies.

According to Darwin, during the struggle for existence, only those individuals can survive which have advantageous variations. The individuals without these variations will be routed out. This is the idea of survival of the fittest. Nature selects only those variations which are suitable. This is called natural selection.

9. ii) Yeast

Amitosis is cell division by simple cleavage of the nucleus and division of the cytoplasm without spindle formation or appearance of chromosomes.

In budding in yeast, the nucleus divides amitotically and enters a small bud.

10. iv) The acid which contains four hydrogen atoms is acetic acid.

11. ii) Impure iron is purified by the process of oxidation.

12. ii) Elements P and R both belong to Group 14 of the modern periodic table. They have the same valence electrons, i.e. 4 electrons in their outermost shell.

OR

i) In Mendeleev's periodic table, aluminium (Al) and silicon (Si) are not in the order of atomic mass.

13. The assertion is false, but the reason is true. Iron is more reactive than copper; hence, it displaces copper to form ferrous sulphate.

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

Section B

15. Period of X = 3

Group of X = 13

Atomic number of X = 13

Electronic configuration: 2, 8, 3

(a) Number of valence electrons = 3 and valency = 3

(b) Atomic number of Y = 8

Electronic configuration = 2, 6

Valency of Y = 2

Molecular formula of the compound formed when 'X' reacts with an element 'Y' is X_2Y_3.

(c) Atomic number of Cl = 17

Electronic configuration = 2, 8, 7

Valency of Y = 1

Molecular formula of the compound formed when 'X' reacts with an element 'Y' is XCl_3.

OR

(a) Elements B and C belong to the same group of the modern periodic table.

(b) Decreasing order of atomic size: B > C > D > A

(c) The formula of the oxide of B is B_2O.

(d) Element D is a metalloid.

16.

(a) We boil the leaf in alcohol while testing for the presence of starch to remove all the chlorophyll present in the leaf. The presence of chlorophyll in the leaf interferes in the test for starch due to its green colour.

(b) Carbon monoxide binds very strongly with haemoglobin in the blood and prevents it from carrying oxygen to the brain and other parts of the body. Due to lack of oxygen, the person becomes unconscious and can even die due to oxygen starvation. Hence, it is dangerous to inhale air containing carbon monoxide.

(c) Plants excrete carbon dioxide as a waste only at night because carbon dioxide produced during respiration in the day is used up by the plant itself for the process of photosynthesis.

17.

(a) When ethanol reacts with chromic anhydride (CrO_3), only partial oxidation occurs and ethanal is formed. On the other hand, when ethanol is heated with alkaline potassium permanganate ($KMnO_4$), it produces ethanoic acid due to complete oxidation.

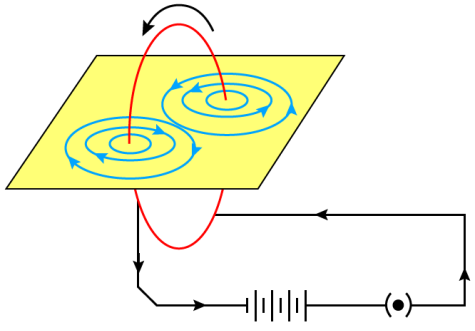
(b) When propanone reacts with hydrogen cyanide, a molecule of H–CN is added across the carbon–oxygen double bond of propanone. Hence, an addition reaction occurs.

(c) To prevent the misuse of alcohol supplied for industrial purposes, it is made unfit for drinking. This can be done by mixing it with poisonous substances such as copper sulphate, methanol and pyridine. The alcohol thus obtained is called denatured alcohol.

18. Electric current is produced in a magnetic field by electromagnetic induction. When a conductor is moving in a magnetic field or if the magnetic field is changing around a fixed conductor, electric current is induced in the conductor.

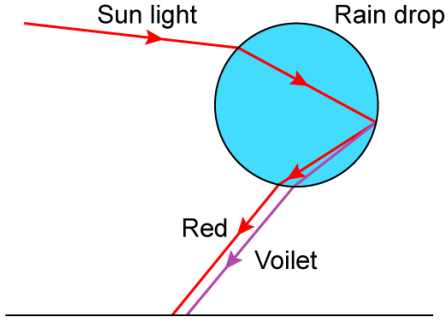
Let us take a rectangular cardboard having two holes and insert a circular coil having a large number of turns through them, normal to the plane of the cardboard. Let us connect the ends of the coil in series with a battery and key as shown in the figure. Sprinkle iron filings uniformly on the cardboard and plug the key.

Tap the cardboard gently a few times. We can see the pattern of iron filings which emerges on the cardboard. This pattern of iron filings indicates the magnetic field lines.



19. Due to the density difference in the atmosphere, when light rays are travelling from a region of less density to a region of more density, refraction takes place in the atmosphere. This is known as atmospheric refraction.

(i) Blue light undergoes more scattering, while (ii) red light undergoes less scattering.



20. Object distance, u = –15 cm

Image distance, v = 30 cm

By the lens formula,

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

$$\therefore \frac{1}{f}=\frac{1}{30}-\frac{1}{-15}=\frac{1}{30}+\frac{1}{15}$$

$$\therefore \frac{1}{f}=\frac{3}{30}=\frac{1}{10}$$

$$\therefore f = 10 \text{ cm}$$

Height of the object, h = 2 cm

By the magnification formula,

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

$$\therefore h' = \frac{v}{u}h = \frac{30}{-15} \times 2 = -4 \text{ cm}$$

OR

Focal length of a convex mirror, f = 200 cm

Distance of the scooter from the mirror, u = –600 cm

By the mirror formula,

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

$$\therefore \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{200} - \frac{1}{-600} = \frac{1}{200} + \frac{1}{600}$$

$$\therefore \frac{1}{v} = \frac{4}{600}$$

$$\therefore v = 150 \text{ cm}$$

Hence, the image is located 150 cm from the mirror. As the image distance is positive, it is a virtual image.

Magnification produced by the mirror is

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

$$\therefore m = \frac{-150}{-400} = +0.375 \text{ cm}$$

21.

(a) Sodium hydrogen carbonate and tartaric acid.

(b) Baking powder is a mixture of baking soda and tartaric acid, whereas baking soda is only sodium hydrogen carbonate.

(c) When baking powder mixes with water, sodium hydrogen carbonate reacts with tartaric acid to evolve carbon dioxide gas which gets trapped in the wet dough and bubbles out slowly making the cake soft and spongy.

22. Fish is an aquatic animal, while dog is a terrestrial animal. Aquatic organisms obtain oxygen dissolved in water, while terrestrial organisms use oxygen present in the air for respiration. As compared to air, the availability of oxygen in water is low. Hence, aquatic organisms like fish have to breathe faster as compared to terrestrial organisms like dog. A faster rate of breathing provides more oxygen to aquatic animals.

OR

Deficiency of haemoglobin in our body results in a condition called anaemia. In anaemia, the blood is unable to transport sufficient amount of oxygen required by the body. As a result, respiration will be less, and hence, less energy will be available for the body. A haemoglobin-deficient person will feel weak, pale, lethargic and will not be able to do heavy physical work.

23.

(a) A pea plant with axial flowers (AA; dominant) was crossed with a pea plant with terminal flowers (aa, recessive). All the F_1 progeny would bear axial flowers because the trait for axial flowers is dominant over the trait for terminal flowers.

(b) In the F_2 generation,

Parents → Aa × Aa

Gametes → A, a A, a

	A	a
A	AA (Axial)	Aa (Axial)
a	Aa (Axial)	aa (Terminal)

Phenotypic ratio → Axial : Terminal = 3 : 1

(c) F_1 plants are heterozygous (Aa), and hence, only the dominant trait is visible in the F_1 generation. In the F_2 generation, factors responsible for the two traits are segregated and recombined to form a homozygous recessive trait for terminal flowers (aa).

24.

(a) The placenta is responsible for providing nutrition from the mother to the growing embryo. Exchange of nutrients, oxygen and waste products between the embryo and the mother takes place through the placenta.

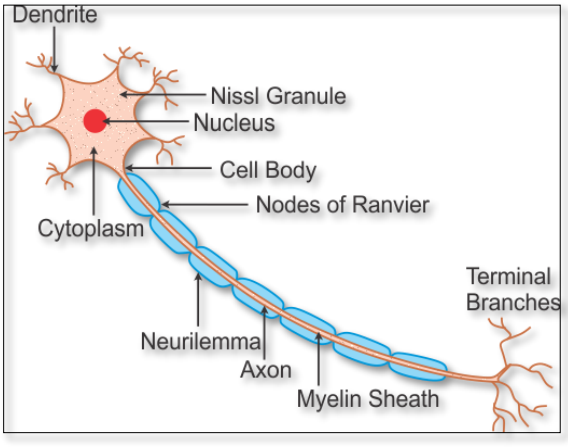
(b) <u>Measures a woman can take to maintain health during pregnancy:</u>

- Consume a balanced diet
- Take food or medicinal supplements as required
- Be careful about diet and hygiene
- Exercise regularly
- Stop bad habits like smoking and drinking alcohol
- Take adequate rest

Section C

25.

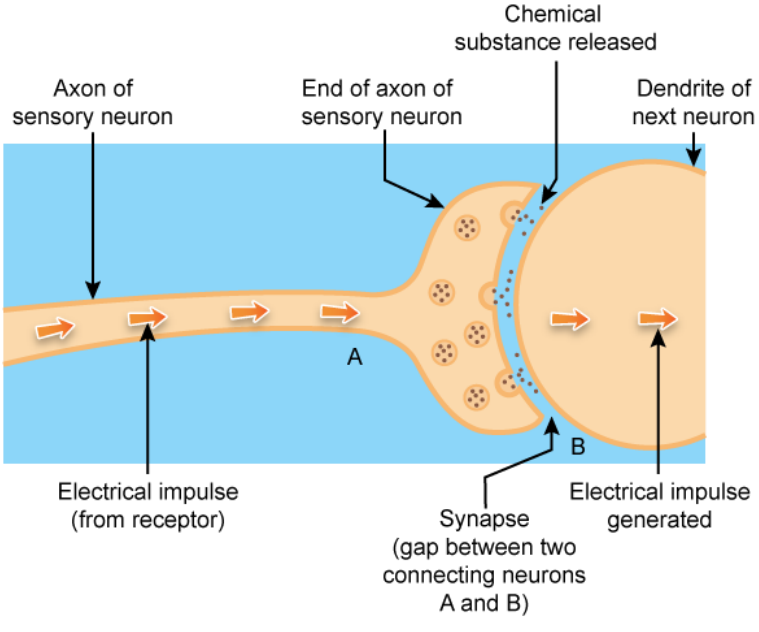
(a) The unit which constitutes the nervous system is called a neuron. The neuron is the structural and functional unit of the nervous system.



Structure of neuron

(b) A microscopic gap between a pair of adjacent neurons over which nerve impulses pass while going from one neuron to another is called a synapse. The synapse between two neurons acts as a one-way valve which allows electrical impulses to pass in one direction only. This happens as follows:

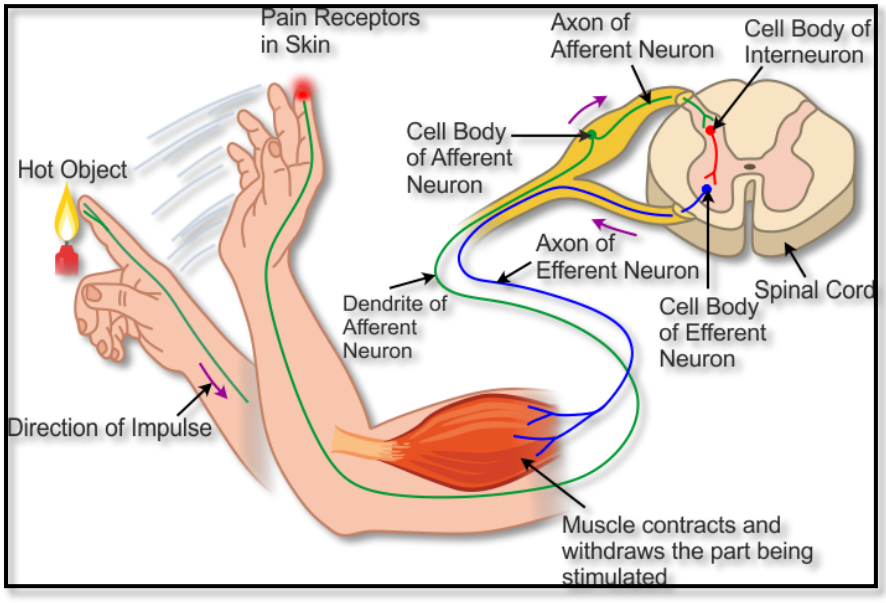
When an electrical impulse coming from the receptor reaches the end of the axon of a sensory neuron, the electrical impulse releases a small amount of a chemical substance (called neurotransmitter) into the synapse between two adjacent neurons. This substance crosses the synapse and starts a similar electrical impulse in the dendrites of the next neuron. In this way, the electrical impulses are passed from one neuron to another through the synapse.



OR

(a) The spinal cord controls the reflex arcs.

(b) Receptors in the skin → Sensory neuron → Spinal cord → Relay neuron (Interneuron/Association neuron) → Motor neuron → Effectors



(c) Dendrites of a neuron acquire information. This information travels in the form of electrical impulses or electrical signals.

26. When light travels from one transparent medium to another transparent medium, deviation of its path takes place at the boundary. When light rays enter from a rarer medium to a denser medium (e.g. air to glass), they deviate towards the normal drawn at the point of incidence on the boundary. When light rays emerge out of a denser medium to a rarer medium (e.g. glass to air), they deviate away from the normal drawn at the point of incidence on the boundary. This is known as refraction of light.

In medium A: Refractive index $\mu_A = \sin(40°)/\sin(25°) = 1.521$

In medium B: Refractive index $\mu_B = \sin(40°)/\sin(23°) = 1.645$

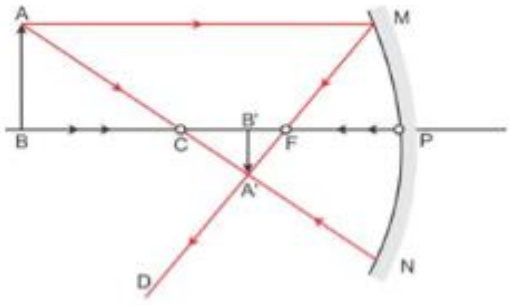
Refractive index μ of a medium = $\frac{c}{v} = \frac{Velocity\ in\ air}{Velocity\ in\ medium}$

Hence, velocity in a medium is inversely proportional to the refractive index.

So, light travels faster in medium A compared to medium B.

OR

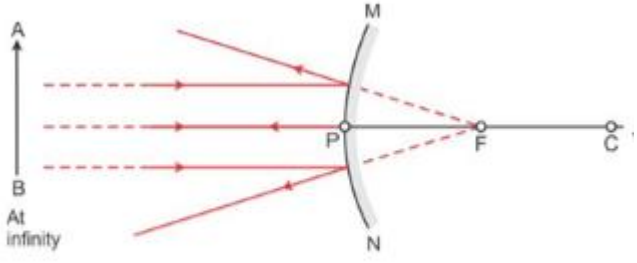
(a) Object placed beyond the centre of curvature in front of a concave mirror:



Object beyond C

Position of object	Position of image	Size of image	Nature of image
Beyond C	Between F and C	Diminished	Real and inverted

(b) Object placed at infinity in front of a convex mirror:



Object at infinity

Position of object	Position of image	Size of image	Nature of image
At infinity	At focus F behind the mirror	Highly diminished, point sized	Virtual and erect

27.

(a) $ZnCO_{3(s)} \xrightarrow{\Delta} ZnO_{(s)} + CO_{2(g)}$

(b) $2ZnS_{(s)} + 3O_2 \xrightarrow{\Delta} 2ZnO_{(s)} + 2SO_{2(g)}$

(c) $ZnO_{(s)} + C_{(s)} \xrightarrow{\Delta} Zn_{(s)} + CO_{(g)}$

(d) $2HgS_{(s)} + 3O_{2(g)} \xrightarrow{\Delta} 2HgO_{(s)} + 2SO_{2(g)}$

$2HgO_{(s)} \xrightarrow{\Delta} 2Hg_{(l)} + O_{2(g)}$

(e) $3MnO_{2(s)} + 4Al_{(s)} \xrightarrow{\Delta} 3Mn_{(l)} + 2Al_2O_{3(s)}$

OR

(a)

(i) Ionic compounds have very strong inter-ionic attractive forces, whereas covalent compounds have comparatively weaker attractive forces between the constituent elements.

(ii) Ionic compounds are soluble in water and not in organic solvents. Covalent compounds are insoluble in water and soluble in organic solvents. Some covalent compounds are soluble in water which can form H-bonding with water molecules.

(iii) Ionic compounds conduct electricity as they dissociate into ions, while covalent compounds do not conduct electricity as they do not dissociate into ions. Graphite is an exception and can conduct electricity despite being covalent in nature.

(b)

Roasting	**Calcination**
1. Ore is heated in the presence of excess of oxygen or air.	1. Ore is heated in the absence of or limited supply of oxygen or air.
2. This method is employed in case of sulphide ores.	2. This method is employed in case of carbonate ores.
3. Sulphur dioxide is produced along with metal oxide.	3. Carbon dioxide is produced along with metal oxide.
4. Example: Balanced chemical equations for the roasting of ZnS and Cu_2S: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$	4. Example: Balanced chemical equation for the calcination of $ZnCO_3$: $ZnCO_3 \rightarrow ZnO + CO_2$

The roasting method is used in case of sulphide ores. It is advantageous to roast a sulphide ore to its oxide before reduction as metal oxides can be reduced to metal by carbon and hydrogen more easily than sulphides.
Oxides of a substance are easier to purify compared to their other forms.
Hence, for purification, all the ores are first converted to their oxides. Thus, sulphide ores are converted to their oxides by roasting.

28.

(a) Power consumed by an electrical appliance depends on (i) current drawn by the appliance and (ii) its resistance.

$$P = I^2R$$

(b)

(i) Power is

$$P = VI = 230 \times 5.5 = 1265W$$

Resistance of the heater

$$R = \frac{V}{I} = \frac{230}{5.5} = 41.82\ \Omega$$

Running cost or cost of consumption for 20 hours

$$\text{Cost} = 1.265 \times 20 \times 4 = \text{Rs.}101.20$$

29.

(a) Ways to help reduce the problem of waste disposal:

(i) Segregating biodegradable and non-biodegradable wastes

(ii) Reusing and recycling non-biodegradable wastes

(b) Threats to wildlife:

- Irrational hunting of animals
- Cutting of trees/deforestation
- Excess of pollution
- Urbanisation

Steps to conserve wildlife:

- Natural habitats like forests should be protected.
- Laws should be maintained to check irrational hunting of animals and cutting of trees.

30.

(a) Copper

(b) Silver nitrate

(c) Silver

(d) Copper nitrate

(e) Displacement reaction