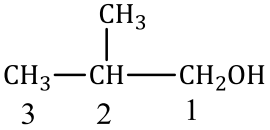
CBSE
Class X Science
Sample Paper 4 – Solution

Section A

1. IUPAC name of  is 2-methyl propane-1-ol.

2. Manganese (Mn) and magnesium (Mg) react with very dilute HNO_3 to evolve hydrogen gas.

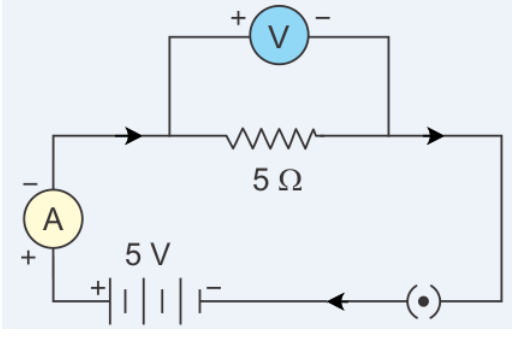
3.

(a) As the direction of electrons is from Y to X, the direction of the current will be from X to Y in the circuit.

(b) When the cell is not connected across the metal wire XY, the electrons in the wire XY flow randomly in all directions.

(c) The voltmeter and ammeter are incorrectly connected in the circuit. The voltmeter should be connected across the resistor to measure the PD across the conductor, and the ammeter must be connected in series with the resistor to measure the current flowing through it.

(d)



4.

(a) Richa's father and mother travel by private car.
Total distance travelled by her father and mother = 30 + 25 = 55 km
For every 10 km, 2.4 kg of CO_2 is produced.
So, for 55 km, the amount of CO_2 produced is 13.2 kg.
Thus, Richa's family adds 13.2 kg of CO_2 to the environment.

(b) 1 tree absorbs 7 kg of CO_2. Therefore, to absorb 13.2 kg of CO_2 produced by Richa's family, about 2 average-sized trees would be required.

(c) Richa's brother travels by bicycle. Hence, his fuel consumption is zero. Thus, Richa's brother saves a lot of fuel while commuting.

(d) While commuting, it is best to walk in case of short distances. One can even ride a bicycle. For longer distances, one can choose a bus or opt for car-pooling. This saves a lot of fuel and prevents pollution as burning of petroleum pollutes the environment.

5. ii) commutator

A device which reverses the direction of current through a circuit of an electric motor is called a commutator.

OR

iii) Reversing the direction of current

Reversing the direction of current does not affect the strength of an electromagnet.

6. i) Methane

Natural gas consists mainly of methane. It contains 95% of methane with small quantities of ethane and propane.

7. iv) retina

The image of an object is formed on the retina.

8. i) (a) and (d)

Sustainable development can be achieved if we aim for planned growth with minimum damage to the environment and which is acceptable to all stakeholders to avoid conflicts.

OR

i) Decrease in energy availability at higher trophic levels

As we go higher up, the amount of energy available decreases as per the 10% percent law of energy transfer. Hence, higher trophic levels have fewer organisms as compared to lower trophic levels.

9. iv) Development of the corpus luteum: Secretory phase and increased secretion of progesterone.

The corpus luteum is essential for establishing and maintaining pregnancy in females. It secretes progesterone which is responsible for the development of the endometrium and maintaining pregnancy.

10. iii) Sodium and potassium are extracted electrochemically.

11. iv) $HCOOCH_3$ and CH_3COOCH_3 are members of the same homologous series.

12. ii) Primary alcohols yield carboxylic acids on oxidation.

OR

ii) In the conversion from ethanol to ethene, concentrated sulphuric acid is used as a dehydrating agent.

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

14. iii) A is true, but R is false.

At the junction of the optic nerve and retina, there are no light-sensitive cells due to which there is no image formation at the spot. This spot is called the blind spot.

Section B

15.

(a) Hydrogen is liberated at the cathode and oxygen is liberated at the anode.

(b) The molecule of water contains two atoms of hydrogen and one atom of oxygen; hence, the volume of gas collected at one electrode is double the volume of gas collected at the other electrode.

(c) Water does not dissociate. So, to make it an electrolyte, dilute sulphuric acid is added.

16. Differences between asexual and sexual reproduction:

Asexual reproduction	Sexual reproduction
1. Only a single organism or one parent is involved.	1. One or two organisms or parents are involved.
2. No production or fusion of gametes.	2. Male and female gametes are produced.
3. Offspring produced are identical to parents.	3. Offspring produced have some characters from the male parent and some from the female parent.
4. No mixing of genetic material.	4. Mixing of genetic material occurs.
5. Not very useful for natural selection in the evolution of species.	5. Very useful for natural selection in the evolution of species.
6. Rapid process during favourable conditions.	6. Slower process.

OR

Functions:

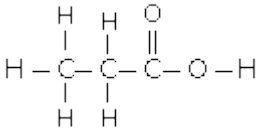
(a) Scrotum: It holds the testes outside of the body cavity because the spermatozoa need a temperature lower than the body temperature to mature.

(b) Testis: It is the male gonad and a part of the male genital tract. It produces sperms and testosterone, the male sex hormone.

(c) Vas deferens: It is a tube transporting spermatozoa from the epididymis to the prostate part of the urethra.

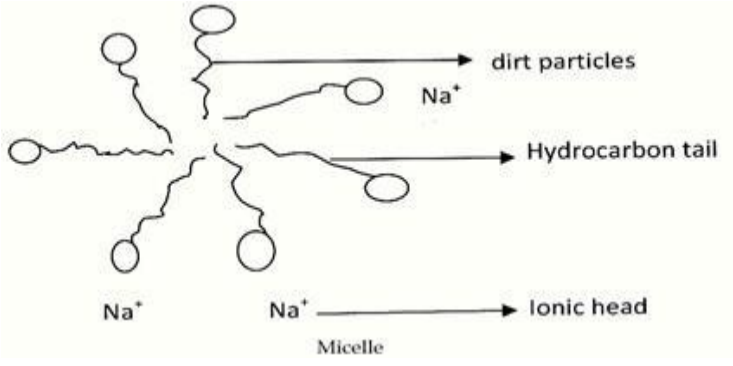
17.

(a) Propanoic acid



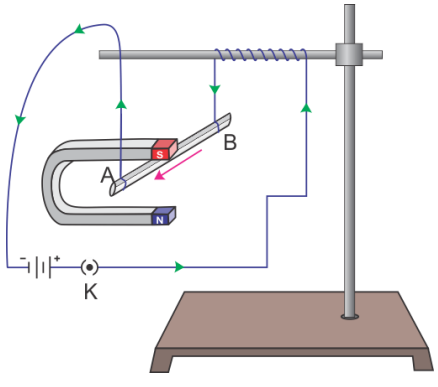
(b) A blackened cooking vessel indicates that the air holes of the burner are blocked and fuel is getting wasted. Blackening is mainly caused by incomplete combustion of fuel. Limiting the supply of air results in incomplete combustion of even saturated hydrocarbons, giving a sooty flame.

(c) Micelle is a structure formed when soap molecules get arranged and align along the surface of water with the ionic end in the water and the hydrocarbon tail protruding out of the water.



18. A magnetic field can be produced without a magnet by passing current through the conductor.

Consider a small aluminium rod suspended horizontally from a stand using two connecting wires. Place a strong horseshoe magnet in a way that the rod lies between the two poles with the magnetic field directed upwards. For this, put the North Pole of the magnet vertically below and the South Pole vertically above the aluminium rod. Connect the aluminium rod in series with a battery, a key and a rheostat. Pass a current through the aluminium rod from one end to the other (B to A). The rod is displaced towards the left. When the direction of current flowing through the rod is reversed, the displacement of the rod is towards the right. This experiment shows that a magnetic field exerts a force on a current-carrying conductor.



19.

(a) Atmospheric refraction makes the Sun visible to us before actual sunrise and after actual sunset.

(b) The Sun is actually visible to us 2 minutes before actual sunrise or after actual sunset.

(c) Thus, the day is lengthened by 2 + 2 = 4 minutes. If there was no atmosphere on the Earth, the day would have shortened by 4 minutes.

20. Object distance, u = −30 cm

Image distance, v = 60 cm

From the lens formula,

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

$$\therefore \frac{1}{f}=\frac{1}{60}-\frac{1}{-30}=\frac{1}{60}+\frac{1}{30}$$

$$\therefore \frac{1}{f}=0.05$$

$$\therefore f=20 \text{ cm}$$

Height of the object, h = 2 cm

From the magnification formula,

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

$$\therefore h'=\frac{v}{u}h=\frac{60}{-30}\times 2=-4 \text{ cm}$$

OR

Power of combination of lenses,

$P = p_1 + p_2$

$\therefore P = +2.5+(-1.5)$

$\therefore P = +1 \text{ D}$

Thus the power of this combination of lenses is +1.0 D

$$\text{Focal length} = \frac{1}{\text{Power}(P)}$$

$$\therefore f = \frac{1}{+1} = 1 \text{ m}$$

Thus the focal length of lenses in contact is 1m

21.

(a) X: Copper (Cu)

Y: Copper oxide (CuO)

(b) First - Oxidation of X; Second - Reduction of Y

(c) $2Cu + O_2 \rightarrow 2CuO$

$CuO + H_2 \rightarrow Cu + H_2O$

OR

(a) Double displacement reaction
(b) Combination reaction
(c) Decomposition reaction

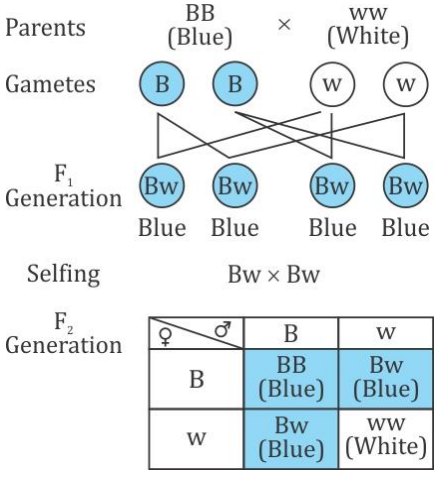
22. Chromosomes are thread-like structures found in the nucleus at the time of cell division. They are made of proteins and DNA.
In sexually reproducing organisms, the gametes undergo meiosis, and hence, each gamete contains only half a set of chromosomes. When two gametes fuse, the zygote formed contains the full set of chromosomes. Hence, the formation of gametes by meiosis helps to maintain the number of chromosomes in the progeny.

23. **<u>Significance of reproductive health in society:</u>**

(a) It prevents the spread of various sexually transmitted diseases such as AIDS and syphilis.
(b) Individuals with sound reproductive health produce better offspring which have better chances of survival.
(c) Better sex education and awareness help to maintain the population and prevent population explosion.
(d) Unwanted and teen pregnancies can be avoided. Reproductive health in India has improved tremendously over the past 50 years. Areas in which reproductive health have improved include

Family planning: Better family planning has led to reduction in family size.
Mortality rate: Mother and infant mortality rates have drastically reduced because of better healthcare facilities.

24.



(a) The F_1 progeny is expected to have plants with blue flowers.
(b) ¼ of the F_2 generation bears white flowers. So, 25% of the F_2 progeny bears white flowers in the F_2 generation when the flowers of F_1 plants were self-pollinated.
(c) The ratio of the genotype BB and Bw in the F_2 progeny is 1 (BB) : 2 (Bw).

Section C

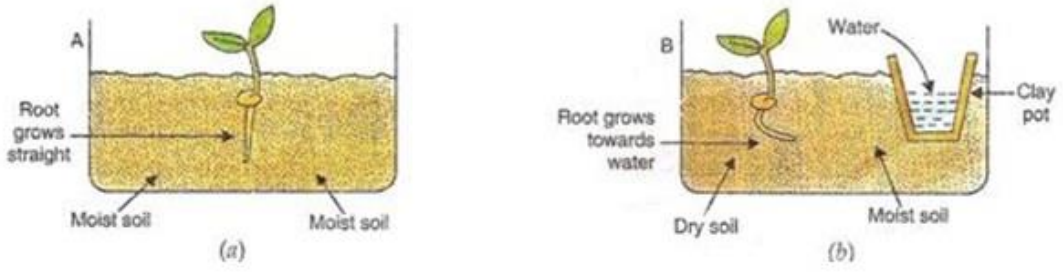
25.

(a) Plants do not have a nervous system, but they can sense things in the presence of stimuli such as light, touch, water etc. They respond to these stimuli by the effect of organic chemicals called hormones. In this way, plants control and coordinate their behaviour against environmental changes by using hormones. This is called chemical coordination. The hormones in plants coordinate their behaviour by affecting the growth of a part of the plant, resulting in the movement of that plant part in response to a stimulus. Both nervous system (nervous control) and endocrine system (hormonal control) are responsible for control and coordination in animals.

(b)

Stimulus	Type of tropic movement
Light	Phototropism
Gravity	Geotropism
Chemicals	Chemotropism
Water	Hydrotropism
Touch	Thigmotropism

(c) The movement of a plant part in response to water is called hydrotropism.



Hydrotropism

OR

The hypothalamus controls the secretion of hormones through a feedback mechanism as discussed in the following example:

- If the blood sugar level rises, the hypothalamus sends a signal to the pituitary gland which in turn secretes a hormone and sends a message to the pancreas to secrete insulin. This stimulates the liver cells to convert glucose to glycogen. Thus, the blood sugar level is maintained.
- If blood sugar decreases, the hypothalamus sends a signal to the pituitary gland which in turn sends the signal to the pancreas to secrete glucagon. This stimulates the breakdown of glycogen in the liver cells to glucose. Thus, the blood sugar level is maintained.

26. Myopia is a defect of vision due to which a person cannot see distant objects clearly.

Causes of myopia:

i) High converging power of the eye lens

ii) Elongation of the eyeball

Focal length of the lens used by the first student is f = +50 cm. Hence, the lens is a convex lens. Focal length of the lens used by the second student is f = –50 cm. Hence, the lens is a concave lens.

Power of lens 1 is $P_1 = \frac{1}{50 \times 10^{-2}} = 2\ \text{D}$

Power of lens 2 is $P_2 = \frac{1}{-50 \times 10^{-2}} = -2\ \text{D}$

A concave lens always gives a virtual, erect and diminished image. Hence, the lens used by the second student is the one which will give such an image.

27.

(a)

(i) Test the three solutions with blue litmus paper; one solution will change blue litmus to red. It is an acidic solution.

(ii) Test the remaining two solutions with red litmus [Changed in activity (i)]. One solution will change it again to blue. It is a basic solution.

(iii) The remaining third solution is distilled water.

(b) Plaster of Paris is prepared by heating gypsum to a temperature of 100°C.

Plaster of Paris is used in hospitals for setting fractured bones in the right position to ensure correct healing.

OR

(a)

(i) Washing soda: $Na_2CO_3.10H_2O$

(ii) Baking soda: $NaHCO_3$

(iii) Baking soda is an ingredient of antacids. It neutralises HCl released in the stomach and eases stomach ache.

$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$

(b)

Roasting	Calcination
1. Ore is heated in the presence of excess supply 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	4. Example: Balanced chemical equation for the calcination of

and Cu_2S: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$	$ZnCO_3$: $ZnCO_3 \rightarrow ZnO + CO_2$

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 much more easily than sulphides.
Oxides of a substance are easier to purify than 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) Resistance of a conductor depends on (i) its length, (ii) its area of cross-section and (iii) on the nature of its material.

(b) Power rating of the heater, P = 4 kW = 4000 W
Potential difference of the power supply, V = 220 V

(i) Power is

$$P = VI$$

$$\therefore I = \frac{P}{V} = \frac{4000}{220} = 18.18 \text{ A}$$

(ii) Resistance and power are related as

$$P = \frac{V^2}{R}$$

$$\therefore R = \frac{V^2}{P} = \frac{220^2}{4000} = 12.1\ \Omega$$

(iii) Energy consumed by the heater is

$$E = Pt$$

$$\therefore E = 4 \text{ kW} \times 2\text{h}$$

$$\therefore E = 8 \text{ kWh}$$

OR

Potential difference of 1 volt means that one joule of work is done to move a charge of one coulomb from one point to another.

(a) If bulb B_3 gets fused, then the other two bulbs will continue glowing with the same brightness.

(b) When the bulbs are in parallel, wattage will be added (4.5 W) and the ammeter reading would be 45/45 = 1.0 ampere.

(c) Because the ammeter reading is 1.0 ampere, the resistance of the combination is

$$\frac{4.5 \text{ V}}{1.0 \text{ A}} = 4.5\ \Omega$$

29. Fossils are the preserved remains or traces of animals, plants and other organisms from the remote past.

Formation of fossils:

- Fossils are generally found in the layers of sedimentary rocks.
- They are formed by a continuous process of burying and decomposition over a period of time.
- The hard parts of the body such as the skeleton, shell, teeth, and occasionally, the entire animal, are found embedded in the sediments. These sediments form rocks.

Methods to determine the age of fossils:

- If we dig into the Earth, we find that the fossils closer to the surface are more recent as compared to the fossils found in deeper layers.
- The fossils can also be dated by detecting the ratios of different isotopes of the same element in the fossil material. Radiocarbon dating is the most accurate, most studied and most verified of all radiometric dating schemes. When living organisms change into fossils, their rate of radioactive ^{14}C decay decreases slowly. In this way, the age of fossils can be determined with the help of radioactive ^{14}C. As the age of a fossil can be clearly established by the radioactive carbon dating technique, the exact period of formation of a species can also be ascertained.

Role of fossils in the study of evolution:

- Fossils of invertebrate animals are found in the deepest layers of rocks, whereas fossils of vertebrates (namely birds and mammals) are found in the recent layers of rocks.
- This palaeontological evidence suggests that invertebrates came into existence before vertebrates and reflects the order in which these animals appeared on the Earth.

30.

(a) H, Li and Na show similar properties because they have one electron in their valence shell and belong to the same group.

(b) Mg atom consists of three shells, whereas Be atom consists of 2 shells. This increases the distance between the outermost electrons and the nucleus. Hence, Mg atom is larger than Be atom.

(c) He, Ne and Ar are called noble gases because their outermost shell is complete and their combining capacity is zero, i.e. they are least or less reactive.

(d) Halogen family

(e) Non-metallic character increases from Na to Cl.

(f) Atomic size decreases as we move from Li to F in the second period of the periodic table.