

**Meghalaya Board
Class X
Science and Technology
Sample Paper 2 – Solution**

SECTION A

PHYSICS

1. Moving water possesses kinetic energy, while stationary water possesses potential energy.
2. Potential difference between two points in an electric field is the amount of work done to move a unit charge from one point to other
3. The least distance of distinct vision is 25 cm for a normal eye. Since, the book was placed at 10 cm from the eye, Hari could not read anything.
4. Image formed by a concave lens is virtual and diminished.
5. Refractive index of a medium is

$$\mu = \frac{c}{v}$$

$$\therefore \mu_w = \frac{c}{v_w}$$

$$\therefore v_w = \frac{c}{\mu_w} = \frac{3 \times 10^8}{1.33}$$

$$\therefore v_w = 2.26 \times 10^8 \text{ m/s}$$

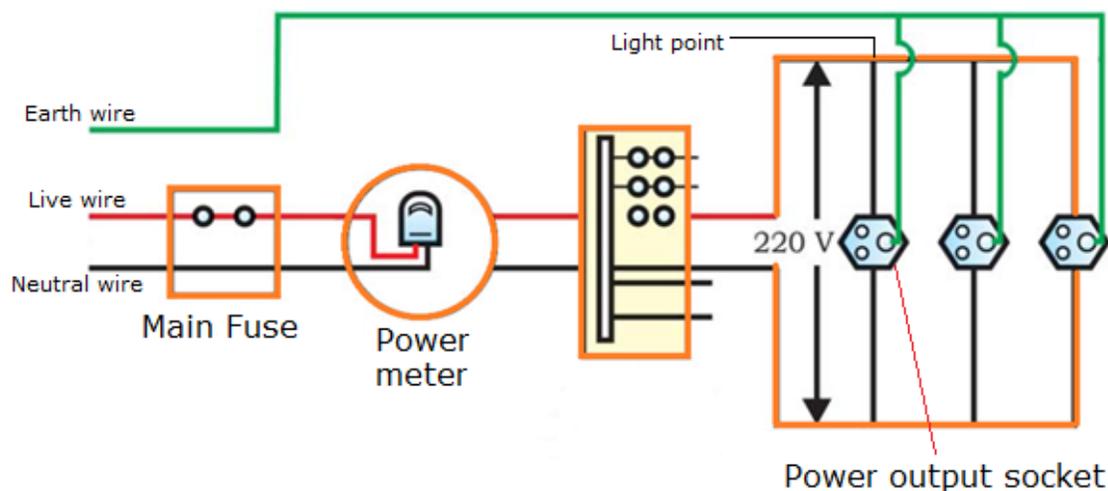
6. The pupil regulates and controls the amount of light entering the eye. In bright sunlight the size of the pupil is small and when we enter the cinema hall it takes some time for the pupil to expand in size due to dim light.
7. $V = 230V$
 $I = 6A$
 $t = 5 \text{ minute} = 5 \times 60 \text{ seconds} = 300 \text{ seconds}$

$$\begin{aligned} H &= I^2Rt = VIt \\ &= 230 \times 6 \text{ A} \times 300 \text{ s} \\ &= 414000J \end{aligned}$$

8. The principle behind working of electric motor is that any current carrying coil experiences a rotational force or torque in a magnetic field. The direction of rotation depends on flow of current and the magnetic field.

9.

(a) Domestic wiring circuit:



(b) The on/off switch of the mains is connected to the live wire.

10.

(a) As the resistors are connected in parallel, the voltage across each resistor is the same. Hence, current through each resistor is

$$I_5 = \frac{V}{5} = \frac{12}{5} = 2.4 \text{ A}$$

$$I_{10} = \frac{V}{10} = \frac{12}{10} = 1.2 \text{ A}$$

$$I_{20} = \frac{V}{20} = \frac{12}{20} = 0.6 \text{ A}$$

(b) Total current in the circuit is

$$I = I_5 + I_{10} + I_{20}$$

$$\therefore I = 2.4 + 1.2 + 0.6$$

$$\therefore I = 4.2 \text{ A}$$

(c) Total resistance in the circuit is

$$V = IR_{\text{eq}}$$

$$\therefore R_{\text{eq}} = \frac{V}{I} = \frac{12}{4.2}$$

$$\therefore R_{\text{eq}} = 2.85 \Omega$$

Or

Rating of the electrical appliance is 200 V–100 W.

Therefore, the resistance of the appliance is

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

$$\therefore R = \frac{V^2}{P} = \frac{200^2}{100}$$

$$\therefore R = 400 \Omega$$

Total power consumed by 5 bulbs will be 500 W.

Hence, for a four-hour operation, the energy consumed is

$$E = Pt$$

$$\therefore E = 500 \times 4 = 2000 \text{ Wh} = 2 \text{ kWh}$$

Cost of electricity per unit is Rs 4.60.

Hence, the total cost is

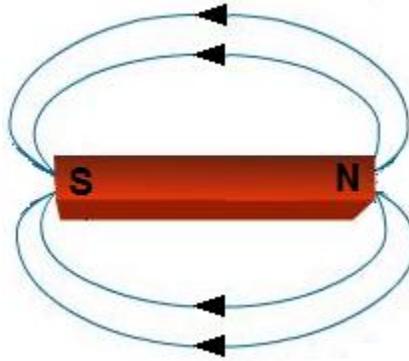
$$\text{Cost} = 2 \times 4.60 = \text{Rs. } 9.2$$

11.

- (a) When we enter a darkened room from bright sunlight, we are unable to see at first. This is because the size of the pupil is small. When we enter the dark room, the pupil expands and more light enters the eye enabling us to see.
- (b) The iris controls the size of the pupil. So, when our eye encounters bright light, the iris contracts the pupil and protects the retina from damage.
- (c) A person is wearing spectacles of power +1.5 D. So, the lens has a positive focal length which indicates that he is wearing a convex lens. Hence, he is suffering from hypermetropia or long-sightedness. For a person wearing spectacles of power –1.5 D, the lens has a negative focal length which indicates that he is wearing a concave lens. Hence, he is suffering from myopia or short-sightedness.

12.

- (a) The space around a magnet in which the force of attraction and repulsion due to the magnet can be detected is called the magnetic field. The direction of the magnetic field is taken to be the direction in which a North Pole of the compass needle moves inside it.
- (b) Magnetic field lines around a magnet:

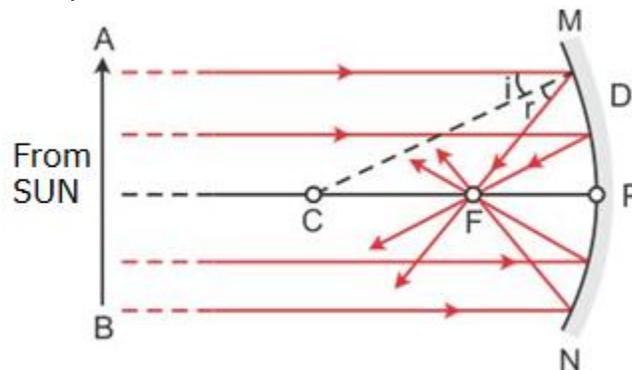


(c) Properties of magnetic field lines:

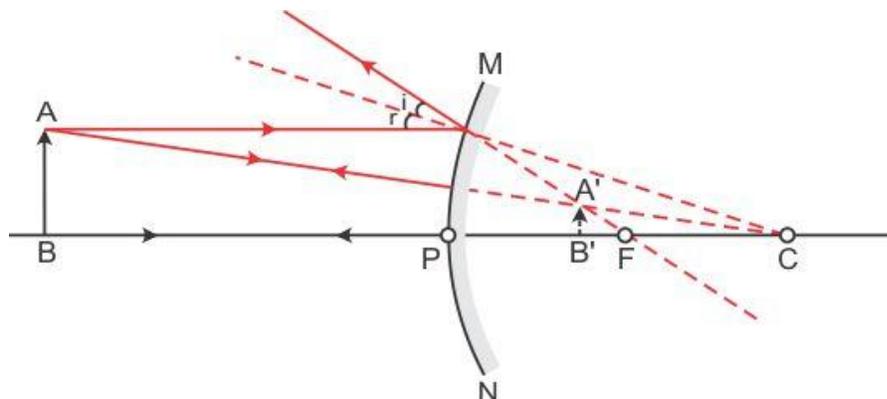
- (i) Field lines originate from the North Pole and end at the South Pole.
- (ii) Magnetic field lines come closer to one another near the poles of a magnet, but they are widely separated at other places.
- (iii) Field lines do not intersect each other.

Or

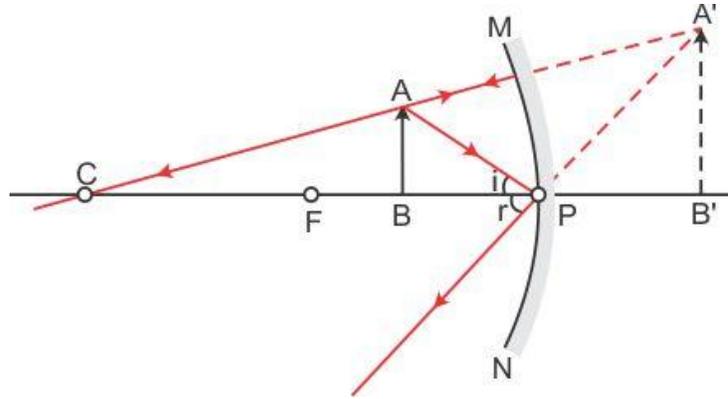
The mirror used in a solar furnace is a concave mirror. Image formed by the concave mirror when placed inside a solar furnace:



The mirror used as a rear-view mirror is a convex mirror. Image formed by the convex mirror:



A concave mirror can form a magnified and virtual image. A convex mirror cannot form an enlarged image. When the object is placed between the pole and the focus of the mirror, the image formed is virtual, enlarged and erect.



**SECTION B
CHEMISTRY**

- 13.** There are 7 horizontal rows in the modern periodic table. They are called periods.
- 14.** Ethanoic acid reacts with NaHCO_3 and forms brisk effervescence of CO_2 but ethanol does not react with NaHCO_3 .

$$\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$$
- 15.** The valency of potassium is 1 and oxygen is 2 in potassium oxide (K_2O).
- 16.** On heating, saturated hydrocarbons give a clean flame, whereas unsaturated hydrocarbons give a yellow flame with lots of black smoke.
- 17.** Sometimes, the pH of lake water becomes lower because of too much acid rain. The high acidity of lake water can kill the aquatic animals like fish since they can survive within a narrow range of pH change.
- 18.** While packaging of chips, they are flushed or surrounded with an inert gas such as nitrogen to prevent its contact with oxygen of air. This is done to avoid rancidity of fats and oils.
- 19.**
- (a) Zinc reacts with copper sulphate to give zinc sulphate and copper metal.

$$\text{CuSO}_{4(\text{aq})} + \text{Zn}_{(\text{s})} \rightarrow \text{ZnSO}_{4(\text{aq})} + \text{Cu}_{(\text{s})}$$
- (b) Magnesium reacts with HCl to give magnesium chloride and hydrogen gas.

$$\text{Mg}_{(\text{s})} + 2\text{HCl}_{(\text{aq})} \rightarrow \text{MgCl}_2 + \text{H}_{2(\text{g})}$$
- (c) Sodium reacts with water to give sodium hydroxide and hydrogen gas.

$$2\text{Na}_{(\text{s})} + 2\text{H}_2\text{O}_{(\text{l})} \rightarrow 2\text{NaOH}_{(\text{aq})} + \text{H}_{2(\text{g})}$$
- 20.** It is a metal.
 Example:

$$4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$$

$$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$$

$$\text{Na}_2\text{O} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O}$$

21.

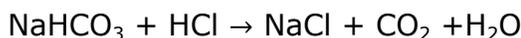
- (a) Test the three solutions with blue litmus paper; one solution will change blue litmus red. This solution is acidic.
- (b) Test the remaining two solutions with the red litmus paper [which changed in activity (a)]; one solution will change it again to blue. This solution is basic.
- (c) So, the third solution is distilled water.

Or

Washing soda: $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

Baking soda: NaHCO_3

Baking soda is an ingredient of antacids. It neutralizes HCl released in stomach and eases stomachache.



22. The distance between the centre of the nucleus and the outermost orbit of the atom is called the atomic radius of the atom of an element.

Variation along the period: - The atomic radius decreases as we move from left to right along the period. This is due to an increase in nuclear charge which tends to pull the electrons closer to the nucleus and reduces the size of the atom.

Variation along the group: - The atomic radius increases down the group. This is because new shells are being added as we go down the group. This increases the distance between the outermost electrons and the nucleus so the atomic size increases in spite of the increase in nuclear charge.

23. From the electronic configuration, it is clear that the compound is chlorine (Cl).

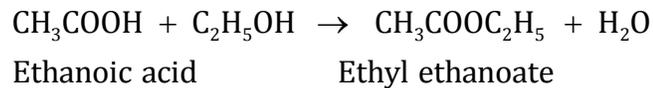
- (a) Atomic number: 17
- (b) Chlorine is a non-metal.
- (c) F, as it belongs to the same group as the element chlorine.
- (d) Compound is sodium chloride (NaCl) also known as common salt.
- (e) Compound is calcium bicarbonate $\text{Ca}(\text{HCO}_3)_2$ which causes temporary hardness of water.

Or

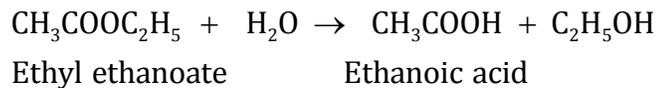
(a) Compound A with molecular formula $\text{C}_2\text{H}_4\text{O}_2$ is ethanoic acid, also called acetic acid. Its structural formula is CH_3COOH . A dilute solution of acetic acid called vinegar is used as a preservative of pickles.

(b) Compound A reacts with ethanol to form compound B which is an ester and has a pleasant smell. The reaction is called esterification reaction.

Sample Paper 2 – Solution



(c) Compound A can be obtained from ethyl ethanoate by reacting with water in the presence of dilute hydrochloric acid acting as a catalyst.



(d) Process is ester hydrolysis.

(e) Carbon dioxide is evolved with effervescence when compound A reacts with washing soda.

SECTION C
BIOLOGY

- 24.** Muscle tissues and nervous tissues provide control and coordination in multicellular animals.
- 25.** Ammonia, urea and uric acid
- 26.** Adrenaline controls the rate of respiration. Pons is the part of the brain which controls the rate of respiration.
- 27.** In lizards environment factor such as high incubation temperature helps in sex determination.
- 28.** No, geographical isolation will not be the major factor in the speciation of asexually reproducing organisms. This is because there is no exchange of genetic material with the other species in such organisms. They pass on the parent DNA to the offspring which leaves no chance of speciation.
- 29.** The process by which an ovum is released from the ovary is called ovulation. The ovaries are composed of ovarian follicles and each follicle has an ovum covered by follicle cells. From the age of puberty ovary starts releasing one ovum once a month.
- 30.** The stem of a plant always show negative geotropism i.e. it grows upwards against the pull of gravity. This movement of stem facilitates the leaves to get exposed so that they are able to attain maximum sunlight.
- 31.** In situation, where kidney failure cannot be treated by drugs or dialysis, the patient is advised for kidney transplantation. The donor for the kidney is preferably a close relative of the patient as it reduces the chances of rejection.
- 32.** In humans, the females have XX sex chromosome while the males have XY chromosome. When the X chromosome of female unites with X chromosome of male, a girl will be born and when X chromosome of females unites with Y chromosome of male, a boy will be born. Thus, the Y chromosome of male (father) determines the sex of child.
- 33.** Translocation is the movement of materials from leaves to other parts of the plant body.
During photosynthesis, carbohydrates from leaves are transported to non-photosynthetic parts of plants such as roots, stem and other organs. This process is performed by translocation. Therefore, translocation is essential in plants.

Sugars are synthesised in the leaves of plants. Plant hormones are not secreted by any gland. However, each plant cell can produce hormones.

- 34.** Self-pollination is the process of transferring the pollen from the anther to the stigma in the same flower. Cross pollination is the transfer of pollen grains from the anther of a flower to the stigma of another flower in a different plant of the same or different species.

Double fertilisation is the process in angiosperms (flowering plants) during reproduction, in which two sperm nuclei from each pollen tube fertilise two cells in an ovary. The pollen grain adheres to the stigma of the carpel (female reproductive structure) and grows a pollen tube which penetrates the ovum through a tiny pore called a micropyle. Two sperm cells are released into the ovary through this tube. One of the two sperm cells fertilises the egg cell (at the bottom of the ovule near the micropyle), forming a diploid ($2n$) zygote. The other sperm cell fuses with two haploid polar nuclei (contained in the central cell) in the centre of the embryo sac (or ovule). The resulting cell is the triploid ($3n$) primary endosperm nucleus. This triploid cell divides through mitosis and forms the endosperm, a nutrient-rich tissue, inside the seed.

- 35.** It was found that the earliest members of human species i.e. Homo sapiens were found in Africa. From there some members stayed in Africa while others migrated and spread out in various parts like Central Asia, Eurasia, South Asia, Australia etc. These species travelled both backwards and forwards from a common place where they initially originated and then evolved and settled as either a new separate group or sometimes re-mixed with the original group.

Or

Darwin proposed the theory of natural selection to understand the process of evolution. According to this theory, nature itself selects various traits or characteristics that will suit the members of a species. And thus the individuals who have those traits will be able to survive and reproduce to maintain the continuity of their species while others who are not able to survive perish over time.

36.

- (a) Separation of oxygenated and deoxygenated blood allows a highly efficient supply of oxygen to the body. This is especially important in birds and mammals which have high energy needs and constantly use energy to maintain their body.

(b) The lungs contain millions of alveoli which provide a surface for the exchange of gases. An extensive network of blood vessels is present in the wall of the alveoli. By lifting our ribs and flattening the diaphragm, the chest cavity becomes spacious. Air is sucked into the lungs and alveoli. The oxygen from the breath diffuses into the blood and carbon dioxide from the blood (brought from all over the body) diffuses out to the air.

Trachea has rings of cartilage around it. These rings of cartilage prevent the trachea from collapsing when we breathe out.

Or

The process by which a new species develops from the existing species is known as speciation.

Factors which lead to speciation:

- i. Geographical isolation
- ii. Genetic drift
- iii. Natural selection
- iv. Reduction in gene flow

Geographical isolation cannot be a major factor in speciation of a self-pollinating plant as it does not depend on another plant for reproduction.