

**Meghalaya Board  
Class X  
Science and Technology  
Sample Paper 1 – Solution**

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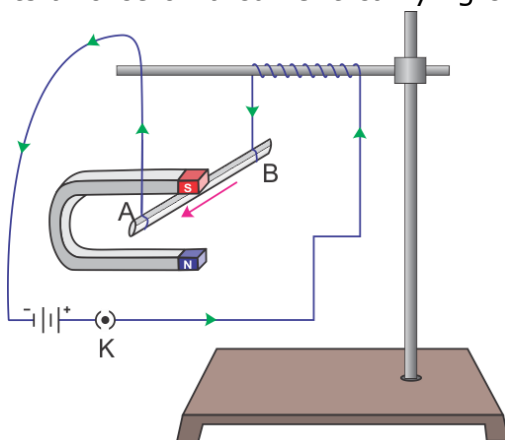
**SECTION A**

**PHYSICS**

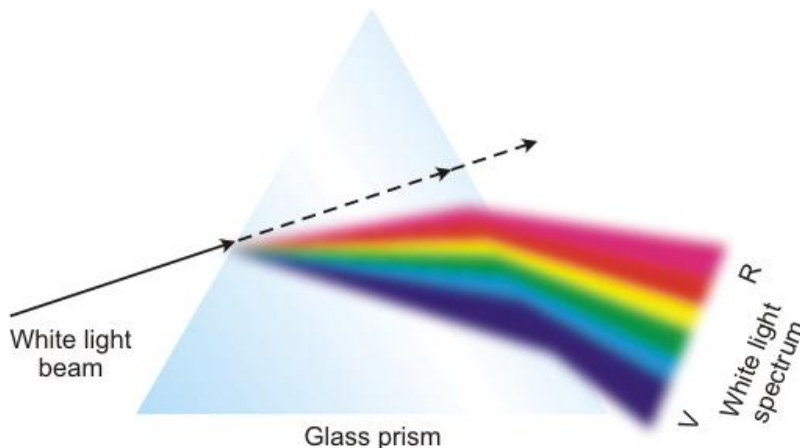
1. Focal point is the principal focus of the mirror where a parallel beam of light meets (or appear to meet) after reflection from the mirror.
2. At high attitudes, there is no atmosphere. Hence, there is no scattering of light and the sky appears dark.
3. In a series connection of resistors same current passes through all the resistors. Hence current will be same. Ratio of current will be 1 : 1
4. This phenomenon is called electromagnetic induction.
5.
  - (i) Power consumed is  
 $P = VI$   
 $\therefore P = 220 \times 3.4 = 748 \text{ W}$
  - (ii) Resistance of the heater is  
 $V = IR$   
 $\therefore R = \frac{V}{I} = \frac{220}{3.4} = 64.7 \Omega$
6. The blowing wind strikes across the blades of the windmill. The wind exerts a force on these blades and rotates it. This in turn rotates the turbine of the generator to generate electricity.
7. Yes, refraction takes place in the different layers of atmosphere as the light travels from one layer to another. This happens due to the variable optical densities of the layers. The cooler air layer has higher optical density than the hot air.
8. A pool of water appears to be less deep than it actually is because light rays from an object in water are bent away from the normal as they pass from the water into the air. This makes the pool appear shallower than it really is.

- 9.** 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.



- 10.** Splitting of white light into its constituent colours is called dispersion of white light. When passed through a glass prism, white light disperses into seven colours—violet, indigo, blue, green, yellow, orange and red. Violet light bends the most, while red light bends the least. This can be seen in the diagram below.



**11.** Object distance,  $u = -60$  cm

Image distance,  $v = 120$  cm

From lens formula,

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

$$\therefore \frac{1}{f} = \frac{1}{120} - \frac{1}{-60} = \frac{1}{120} + \frac{1}{60}$$

$$\therefore \frac{1}{f} = \frac{3}{120} = \frac{1}{40}$$

$$\therefore f = 40 \text{ cm}$$

Height of the object,  $h = 5$  cm

From magnification formula,

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

$$\therefore h' = \frac{v}{u} h = \frac{120}{-60} \times 5 = -10 \text{ cm}$$

**Or**

Focal length of a convex mirror,  $f = 200$  cm

Distance of scooter from the mirror,  $u = -400$  cm

From the mirror formula,

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

$$\therefore \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{200} - \frac{1}{-400} = \frac{1}{200} + \frac{1}{400}$$

$$\therefore \frac{1}{v} = \frac{3}{400}$$

$$\therefore v = 133.33 \text{ cm}$$

Hence, the image is located 133.33 cm from the mirror. As the image distance is positive, it is a virtual image.

Magnification produced by the mirror is

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

$$\therefore m = \frac{-133.33}{-400} = +0.33$$

- 12.** Power of a lens gives the degree of convergence or divergence of light rays achieved by the lens. It is the reciprocal of its focal length. It is represented by the letter P. The power P of a lens of focal length f is

$$P = \frac{1}{f(\text{in metres})}$$

Its SI unit is called diopetre, represented as D. One diopetre is the power of a lens with a focal length of 1 metre.

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.

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

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

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.

**Or**

- (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,  $P = 4 \text{ kW} = 4000 \text{ W}$

Potential difference of the power supply,  $V = 220 \text{ V}$

- (i) Power is

$$P = VI$$

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

- (ii) Resistance and power are related as

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

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

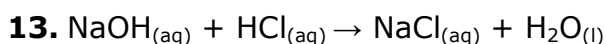
- (iii) Energy consumed by the heater is

$$E = Pt$$

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

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

**SECTION B  
CHEMISTRY**



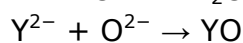
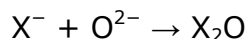
**14.** Because aluminium has greater affinity for oxygen than for carbon, therefore carbon cannot reduce alumina ( $\text{Al}_2\text{O}_3$ ) to aluminium.

**15.** The IUPAC name of this compound is propan-2-ol or 2-propanol.

**16.** Horizontal rows in the periodic table are called periods. Elements in the same period have the same number of orbitals and electrons are added to the same valence shell.

Vertical columns in the periodic table are called groups. An extra shell is added as we go down the group. However, the elements have the same number of electrons in their respective valence shells, i.e. their valency is the same, and hence, they show similar chemical properties.

(a) To attain the octet, X needs to lose one electron, so its valency is one, whereas Y needs to lose two electrons, so its valency is 2.



(b) Valency of X is 1, so the molecular formula of chloride is  $\text{XCl}$ . The molecular formula of the chloride of Y is  $\text{YCl}_2$ .

**17.** The reaction which takes place when baking soda is heated for cooking is:



Baking soda from any acid

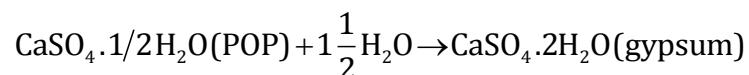
The carbon dioxide produced in this reaction cause bread or cake to rise and make them soft and spongy.

**18.** The constituents of Solder - Lead (Pb), Tin (Sn). It contains 50% lead and 50% tin. Being a low melting solid, it is used for soldering electrical wires together.

**19.**

(a) Plaster of Paris has the chemical formula  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$  which is produced by heating gypsum with the chemical formula  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  at 373 K.

The reaction is



Use of plaster of Paris: In surgical bandages for supporting fractured bones in the right position

- (b) The pH of a solution is the negative of the logarithm (exponent) to the base 10 of the hydrogen ion concentration (expressed as moles per litre).  

$$\text{pH} = -\log_{10}[\text{H}^+]$$

**20.**

- (a) When ethanol reacts with chromic anhydride, only partial oxidation occurs and ethanol is formed. On the other hand, when ethanol is heated with alkaline  $\text{KMnO}_4$ , it produces ethanoic acid due to complete oxidation.
- (b) When propanone reacts with hydrogen cyanide, a molecule of  $\text{H-CN}$  is added across the carbon-oxygen double bond of propanone. Hence, 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.

**21.** Steps to discourage the use of alcohol:

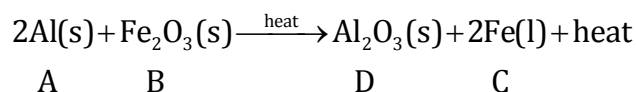
- By not getting attracted towards this habit and to stop my friends also to keep control on themselves to condemn alcoholism.
- By making poster, banners and writing articles on this issue.
- By sensitizing the people about the harmful effects of liquor consumption.

**Or**

- $\text{CH}_4$ ,  $\text{C}_2\text{H}_6$ , and  $\text{C}_3\text{H}_8$  are alkanes as they have each carbon bonded to four other atoms through single covalent bonds and follow general formula  $\text{C}_n\text{H}_{2n+2}$ .
- $\text{C}_2\text{H}_4$ ,  $\text{C}_3\text{H}_6$  are alkenes since they contain a single carbon-carbon double bond and follow general formula  $\text{C}_n\text{H}_{2n}$ .
- $\text{C}_3\text{H}_4$ ,  $\text{C}_2\text{H}_2$  and  $\text{C}_4\text{H}_6$  are alkynes as they contain a single carbon-carbon triple bond and follow the general formula  $\text{C}_n\text{H}_{2n-2}$ .

**22.**

- (a) 'A' is aluminium, 'B' is iron (III) oxide



- (b) The reaction is highly exothermic. It is a displacement reaction and redox reaction.

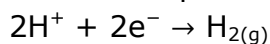
23.

(a) Metals have free electrons which helps them in the conduction of electricity, whereas non-metals have no free electrons which make them a poor conductor of electricity.

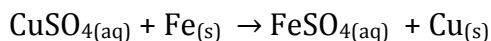
Moreover, when electricity is passed through a metallic wire, these free electrons move in a particular direction to conduct the flow of charges which helps in the conduction of electricity.

However, there are exceptions. Graphite being a non-metal is a good conductor of electricity and is also used as electrodes.

(b) A non-metal cannot supply electrons to convert  $H^+$  to  $H_{2(g)}$ , whereas metals can provide electrons.



(c) When an iron nail is placed in a copper sulphate solution, the blue colour of  $CuSO_4$  fades away slowly and a reddish brown copper metal is formed.



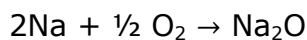
However, if a strip of copper metal is placed in iron(II) sulphate, no reaction occurs because copper is less reactive than iron and therefore cannot displace iron from iron(II) sulphate.

(d) Sodium is a highly reducing metal ( $Na \rightarrow Na^+ + e^-$ ,  $E^\circ = +2.71$ ); thus, it will give away its electrons to atoms of elements less reducing than itself (which is most substances).

The practical upshot of this is that it will react with moisture in the air:



and with oxygen:



Sodium is kept in liquids which are not so easily reduced (long-chain hydrocarbons like kerosene, where the carbon is already in a very low formal oxidation state) which also expels moisture.

**Sample Paper 1 – Solution**

- (e) The two metals sodium and magnesium are more reactive than carbon. They are above carbon in the reactivity series and thus have a high affinity to oxygen than carbon and thus cannot be reduced by it.

**Or**

The creation of Mendeleev's periodic table was based upon certain physical and chemical properties:

Physical properties: The atomic masses of the elements were taken into account and the elements were arranged in order of increasing atomic masses. This influenced some of their physical properties like melting points, boiling points, density etc.

Chemical properties: The distribution of the elements into different groups was linked with formation of hydrides by combining with hydrogen and formation of oxides by combining with oxygen. This is linked with the valency of the elements.

The two main observations which posed challenge to Mendeleev's periodic table are as follows:

- (i) Position of isotopes: Since the isotopes of an element differ in their atomic masses, they must be assigned separate positions in the periodic table.
- (ii) Anomalous positions of some elements: In the Mendeleev's periodic table, certain elements with higher atomic masses precede or placed before the elements with lower atomic masses. For example: the elements Argon (At. mass = 39.9) is placed before the element Potassium (At. Mass = 39.1).

**SECTION C**  
**BIOLOGY**

- 24.** Asexual reproduction: Single parent is involved.

Sexual reproduction: Two parents are involved.

- 25.** Biomagnification

- 26.** When we keep plant cell in the hypotonic solution it absorbs water from the surroundings and becomes more turgid.

- 27.** In humans, sense organs act as receptors and possess sensory (receptor) neurons.



- 28.** The respiratory organs of fish are gills. Gills are capable of absorbing dissolved oxygen from water. However, they cannot use the atmospheric oxygen for respiration. Hence, fish die when taken out of water.
- 29.** The hormone adrenaline is secreted by the adrenal gland. This hormone is secreted in excess (large amounts) when there is any situation of stress and danger so that the body gets prepared to face such a situation.
- 30.** On the basis of presence of feathers in both birds and reptiles, both are said to be closely related. Initially feathers performed the function of protection from cold as in case of reptiles but later on in birds they adapted to help them in flight.
- 31.** It is because of the complexity in structure and function which ensures the union of sperm and ovum and development of embryo inside the body of the female.
- 32.** The biological process of removing harmful metabolic wastes from the body is called excretion. Unicellular organisms remove their wastes through simple diffusion.
- 33.**
- (a) The respiratory organs of fish are gills. Gills are capable of absorbing dissolved oxygen from water. However, they cannot use the atmospheric oxygen for respiration. Hence, fish die when taken out of water.
  - (b) Alveoli are covered with blood capillaries so that the exchange of gases can take place between the membranes of the alveoli and surrounding capillaries.
  - (c) The function of the cartilaginous rings of the trachea is to stabilise the trachea and keep it rigid while allowing the trachea to expand and lengthen when the person breathes.
- 34.** Aquatic organisms obtain oxygen dissolved in water. As compared to air, the availability of oxygen in water is low. Hence, aquatic organisms have to breathe faster as compared to terrestrial organisms.
- 35.**
- (a) In  $F_1$ , the progeny would be Gg, so all would be green stemmed.
  - (b) If  $F_1$  plants self-pollinate,
- |         |       |   |       |
|---------|-------|---|-------|
| Parents | Gg    | × | Gg    |
| Gametes | G   g |   | G   g |

Sample Paper 1 – Solution

	G	g
G	GG (Green)	Gg (Green)
g	Gg (Green)	gg (Purple)

Ratio of GG:Gg:gg = 1:2:1

Or

36.

(a)

- (i) Underground water does not evaporate.
  - (ii) Underground water percolates, which enriches the water table and reaches groundwater resources.
  - (iii) Water stored underground is protected from contamination by human and animal wastes and does not promote breeding of pests.
- (b) Since forests are useful to animals as well as humans, it is the responsibility of every individual to conserve forests, and not just the the legislation. Some examples where locals have taken the initiative are as follows –
- (i) Chipko Movement - It prevented the workers from felling the trees. Chipko movement quickly spread across communities and media and forced the government to rethink their priorities in the use of forest produce. This type of participation by people led to efficient forest management.
  - (ii) Another example of people's participation in the management and conservation of forests was seen in the Sal forests of West Bengal. A.K Banerjee, a forest officer, got the villagers involved in protecting 1.272 hectares of badly degraded forests. Due to this active participation of locals, the Sal forests underwent a remarkable recovery.