CBSE
Class X Science
Sample Paper 1 – Solution

Section A

1. Electrolysis of water to form oxygen and hydrogen is an endothermic reaction because electrical energy is absorbed during this reaction.

2. All isotopes of an element have the same number of protons, and hence, they have the same atomic number. Hence, they can be placed at the same position in the periodic table.

3.

  (a) Electrical appliances are connected in parallel combination at home.
  (b) Frequency of AC supply in India is 50 Hz.
  (c) Overloading is the condition in which too many appliances are connected in a single socket thus drawing an extremely high current.
  (d) The live wire is at a high potential, i.e. 220 V, while the neutral wire is at zero potential. Thus, the potential difference between the live wire and the neutral wire is 220 – 0 = 220 V.

4.

  (a) The given picture shows air pollution.
  (b) Air pollution causes respiratory problems such as asthma and lung disorders such as bronchitis.
  (c) Air pollution can be reduced by the use of efficient engines, unleaded petrol and CNG in automobiles and installation of electrostatic precipitators in tall chimneys.
  (d) Chlorofluorocarbons (CFCs) cause the depletion of the ozone layer and create 'ozone holes'.

5. (iii) Iris

    The size of the pupil of the eye is adjusted by the iris.

OR

(iv) Blue colour is scattered most.
Red colour of the Sun at the time of sunrise and sunset is because blue colour is scattered most.

6. ii) 1

Linear magnification produced by a plane mirror is 1.

7. i) Voltmeter

   A device used to measure the potential difference is a voltmeter.

8. (d) Cerebellum

   The cerebellum controls balance and coordination. A person with a damaged cerebellum has trouble strumming a guitar.

   OR

   (c) Photonasty

   Photonasty is the process in which plants sleep during the night as there is no sunlight.

9. (c) Weight

   For any species, a characteristic that changes gradually over a range of values shows continuous variation. Human weight is an example of continuous variation. It ranges from that of the fattest person in the world to that of the thinnest person. Any weight is possible between these values.

10. (iv) The given elements belong to the 17th group of the Modern Periodic Table. All these elements have 7 electrons in their outermost shell.

11. (ii) Newlands' Octaves of elements were similar to the octaves found in music. In his Octaves, every eighth element had properties similar to properties of the first element.

12. (i) The atomic number as per the electronic configuration is 10. This is the atomic number of Neon. Thus, 'Z' is Ne.

    OR

    (iii) The Law of Octaves was applicable only up to calcium, as after calcium, every eighth element does not possess properties similar to that of the first.

13. (i) Both assertion and reason are true, and reason is the correct explanation of the assertion.
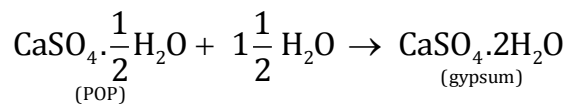
14. (i) Both assertion and reason are true, and reason is the correct explanation of the assertion.

Section B

15.

(a) Plaster of Paris has the chemical formula $CaSO_4.1/2H_2O$. It is produced by heating gypsum (with the chemical formula $CaSO_4.2H_2O$) at 373 K.

The reaction is

$$\underset{(POP)}{CaSO_4.\frac{1}{2}H_2O} + 1\frac{1}{2}H_2O \rightarrow \underset{(gypsum)}{CaSO_4.2H_2O}$$

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).

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

OR

(a) The cold drink turns blue litmus red because of its acidic nature. It will have no action on red litmus.

(b) A < C < B

B will have maximum acid strength because pH is inversely proportional to the concentration of hydrogen ions in a solution.

16.

(a) The glottis is covered by a small cartilaginous flap of skin called the epiglottis which prevents the entry of food particles into the wind pipe while swallowing.

(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.

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, 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. 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.
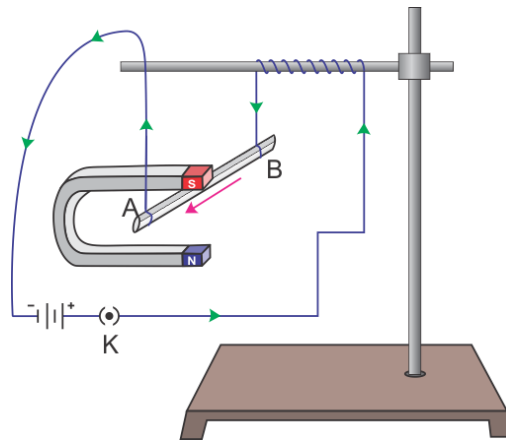
19. Splitting of white light into its constituent colours is called dispersion of white light. When passed through a glass prism, white light disperses into seven colours— violet, indigo, blue, green, yellow, orange and red.

Violet light bends the most, while red light bends the least. This can be seen in the diagram below.
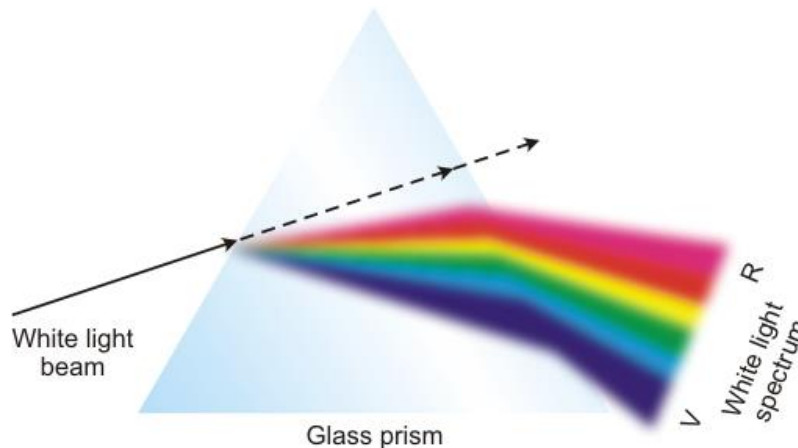
20. Object distance, u = −60 cm

Image distance, v = 120 cm

From the 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 the magnification formula,

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

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

<div align="center">OR</div>

Focal length of a convex mirror, f = 200 cm

Distance of a scooter from the mirror, u = −400 cm

From the mirror formula,

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

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

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

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

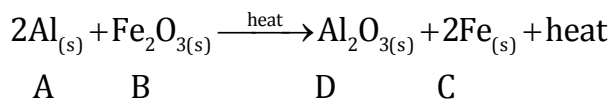Hence, the image is located 133.33 cm from the mirror. As the image distance is positive, it is a virtual image.

Magnification produced by the mirror is

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

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

21.

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

$$2Al_{(s)} + Fe_2O_{3(s)} \xrightarrow{\text{heat}} Al_2O_{3(s)} + 2Fe_{(s)} + \text{heat}$$
<div>   A   B   D   C</div>

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

22. 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.

OR

The plant will not remain healthy for a long time because
- It would not get oxygen for respiration.
- It would not get carbon dioxide to carry out photosynthesis.
- The upward movement of water and minerals would be hampered due to lack of transpiration.

23.

(a) In the F_1 generation, 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

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

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

24. It is possible to limit family size by the use of the following contraceptive methods:
- <u>Barrier method:</u> Using a mechanical barrier which prevents the sperm from reaching the egg
- <u>Chemical method:</u> Using certain chemicals which change the hormonal balance of the body and prevents pregnancy
  - <u>Surgical method:</u> Blocking through surgery of the male and female tracts (which transport gametes) to prevent pregnancy

Section C

25.

(a)

(i) Part in which digestion of starch starts: Mouth

(ii) Part in which bile is stored: Gall bladder

(iii) Part in which nutrients are absorbed: Small intestine

(b) Role of hydrochloric acid in the stomach: It kills bacteria in the stomach and provides an acidic medium for the action of pepsin.

(c)
(i) Gastric sphincter: It controls the release of food from the stomach to the small intestine.
(ii) Anal sphincter: It controls the release of undigested waste from the rectum through the anus.
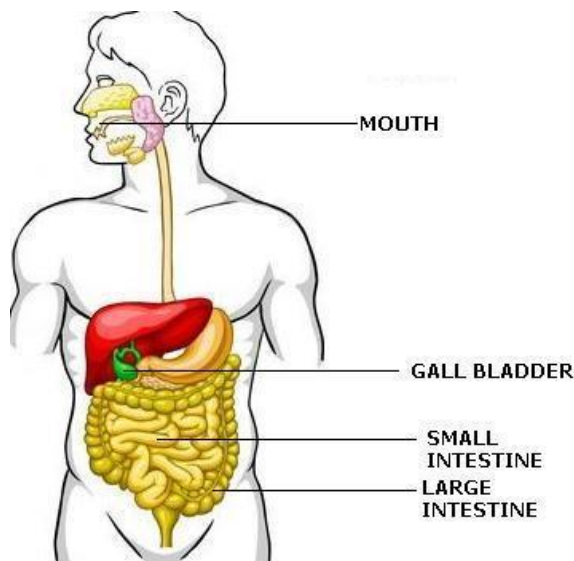
OR

(a) Gaseous exchange in alveoli
(b) Air rich in oxygen is present in the bronchiole.
(c) The pulmonary artery contains deoxygenated blood.
(d) The pulmonary vein contains oxygenated blood.
(e) Stomata

26. 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 dioptre, represented as D. One dioptre 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.

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

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

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) Define:
  i. The centre of curvature of a spherical mirror is the centre of the hollow sphere of glass of which the mirror is a part.
  ii. The centre of the spherical surface (reflecting) of the mirror is called its pole.

(b) Mirror formula: $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$

   Magnification, $m = -\dfrac{v}{u}$

   where f is the focal length of the mirror
   v is the image distance
   u is the object distance

(c) Given:
   v = −45 cm (real and inverted image)
   f = −20 cm (concave mirror)

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

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

   $$\dfrac{1}{u} = \dfrac{1}{-20} - \dfrac{1}{-45} = \dfrac{-9+4}{180} = \dfrac{-5}{180}$$

   $$u = -36 \text{ cm}$$

The object should be placed at a distance of 36 cm in front of the concave mirror.

27.

(a) Metals have free electrons which help 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 an electrode.

(b) A non-metal cannot supply electrons to convert H^+ to H_2, whereas metals can provide electrons.

$2H^+ + 2e^- \rightarrow H_{2(g)}$
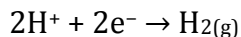
(c) When an iron nail is placed in a copper sulphate solution, the blue colour of $CuSO_4$ fades away slowly and a reddish brown copper metal is formed.

$$CuSO_{4(aq)} + Fe_{(s)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$$
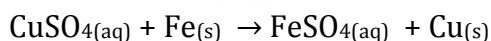
However, if a strip of copper metal is placed in iron (II) sulphate, no reaction occurs because copper is less reactive than iron and therefore cannot displace iron from iron (II) sulphate.

(d) Sodium is a highly reducing metal ($Na \rightarrow Na^+ + e^-$, $E° = +2.71$); 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:
$Na + H_2O \rightarrow NaOH + \frac{1}{2} H_2$

and with oxygen:
$2Na + \frac{1}{2} O_2 \rightarrow Na_2O$
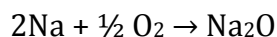
Sodium is kept in liquids which are not so easily reduced (long-chain hydrocarbons like kerosene, where the carbon is already in a very low formal oxidation state) which also expels moisture.

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

OR

(a)
   (i)   Ionic compounds have very strong inter-ionic attractive forces, whereas covalent compounds have comparatively weaker attractive forces between their 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 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
 (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

$E = Pt$

$\therefore E = 4 \ kW \times 2h$

$\therefore E = 8 \ kWh$

29.

(a)

(i) Underground water does not evaporate.

(ii) Underground water percolates, 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 government or legislation. Some examples where locals have taken the initiative are as follows:

(i) Chipko Movement: It prevented the workers from felling trees. The Chipko Movement quickly spread across communities, and the 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) Sal forests of West Bengal: A.K. Banerjee, a forest officer, got the villagers involved in protecting 1.272 hectares of badly degraded forests. The Sal forests underwent a remarkable recovery because of the active participation of locals.

30.

(a) A is propanol.

(b) B is propene.

(c) Reaction which occurs when A is converted to B: Dehydration reaction

(d) C is propane.

(e) Reaction which occurs when B is converted to C: Addition reaction