Maharashtra State Board
Class X Science and Technology Paper I
Board Paper – 2017 Solution

1.

(A)

(a)

(i) Sugar

Camphor, ammonium chloride, naphthalene balls are volatile, while sugar is a non-volatile substance.

(ii) Methyl orange

Turmeric, rose petals and beetroot are natural indicators, while methyl orange is a synthetic indicator.

(b)

Column I	Column II
(i) Myopia	(c) Converging power of the eye lens becomes high
(ii) Hypermetropia	(a) Converging power of the eye lens becomes low

(c)

To increase the effective resistance in a circuit, the resistors are connected in series.

(B)

(1) (d) decomposition

In decomposition reactions, one compound breaks down (or decomposes) to form two or more products. When calcium carbonate is heated, it forms calcium oxide and releases carbon dioxide.

(2) (d) greenish yellow

The colour of the universal indicator solution is greenish yellow.

(3) (b) 10 cm

The height of the image formed by a plane is always equal to the height of the object placed before it.

(4) (b) Decreases

According to Ohm's law, resistance of a conductor is inversely proportional to the current flowing through it.

(5) (c) CO_2

Carbon dioxide passed into limewater gives a milky solution.

$Ca(OH)_{2(aq)} + CO_{2(g)} \rightarrow CaCO_{3(s)} + H_2O_{(l)}$

2.

(1) Application of baking soda:

- Used as an antacid to remove acidity of the stomach
- Used in soda-acid fire extinguishers

(2) The path along which a unit North Pole moves in a magnetic field is called a magnetic line of force.

Properties of magnetic lines of force: (any two)

(i) Magnetic lines of force (or magnetic field lines) are closed continuous curves. They start from the North Pole and end at the South Pole.

(ii) The tangent at any point on a magnetic line of force gives the direction of the magnetic field at that point.

(iii) No two magnetic lines of force can intersect each other.

(iv) Magnetic lines of force are crowded where the magnetic field is strong, and they are far from each other where the field is weak.

(3)

Normal Elements	**Transition Elements**
Elements belonging to groups 1 and 2, and 13 to 17 are called normal elements.	Elements belonging to groups 3 to 12 are called transition elements.
In these elements, all the inner shells are completely filled except the outermost shells.	In these elements, the outermost shell and next to the outermost shell (penultimate shell) are incomplete.

(4)

Natural sources of water pollution	Man-made sources of water pollution
Dead animals	Domestic waste
Ashes released due to forest fires	Oil spills

(5)

Given : Converging lens, $f = 10$ cm and $u = -20$cm

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

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

$$\rightarrow \frac{1}{v} = \frac{1}{10} + \frac{1}{(-20)} = \frac{1}{10} - \frac{1}{20}$$

$$\rightarrow \frac{1}{v} = \frac{1}{20 \text{ cm}}$$

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

(6) When a ray of light is incident on extremely small particles, the particles deflect the light in different directions. This phenomenon is called scattering of light.

3.

(1) When the surface of a metal is attacked by air, moisture or any other substance around it, the metal is said to corrode and the phenomenon is known as corrosion.
Iron reacts with moist air to acquire a coating of brown flaky substance called rust.
Rust is hydrated iron (III) oxide ($Fe_2O_3.xH_2O$).

(2)

Instrument	Number of convex lenses	Use
Simple microscope	1	Used by watch repairers to view tiny watch parts
Compound microscope	2	Used for observing tiny cells and tissues in the body
Telescope	2	Used to view faraway objects in outer space

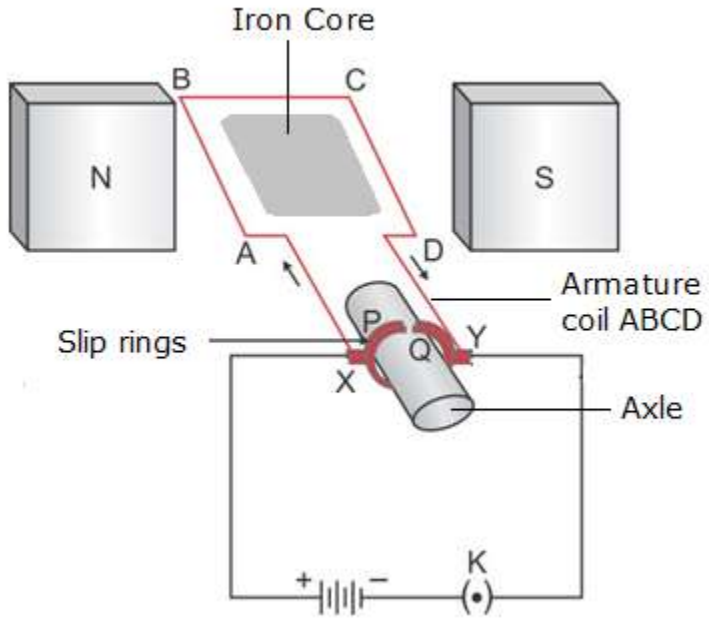
(3)

(a) In case we are exposed to exhaust fumes in traffic, we should immediately cover our nose with a handkerchief and move away from the polluted area. We could also request vehicle owners to take the pollution under control (PUC) test for their vehicles to avoid air pollution owing to exhaust fumes.

(b) When we are exposed to a series of bursting firecrackers with high decibel levels, we should immediately cover our ears. This will protect our ears from the internal damage caused by the intense sound. In case the firecrackers are burst in a silence zone, we will immediately report the situation to a nearby police station so that strict action can be taken. Lighting of such firecrackers causes air pollution and contributes to noise pollution.

(c) If we get turbid water during monsoon, we should first make the water potable by stirring it with alum. Alum allows the impurities to settle leaving pure water on the top. Alternatively, we can make the water potable by passing the water through candle filters or electric filters. This not only makes the water potable but also removes water-borne pathogens, thereby preventing water-borne diseases.

(4) <u>DC Motor:</u>



<u>Uses of DC Motor:</u>

(1) It is used in domestic appliances such as mixer, blender and washing machine.

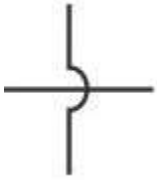
(2) It is used in electric fans, hair dryers and tape recorders.

(5) Demerits of Mendeleev's periodic table:

- Hydrogen resembles alkali metals and halogens. So, a correct position could not be assigned to hydrogen in the periodic table.
- The position of isotopes could not be explained. Isotopes are atoms of the same element with similar chemical properties but different atomic masses. If the elements are arranged according to atomic masses, the isotopes should be placed in different groups of the periodic table.
- At certain places, an element of higher atomic mass has been placed before an element of lower atomic mass.
  Example: Cobalt (Co = 58.93) is placed before nickel (Ni = 58.71).

(6)

(a) Wire crossing:



Use: To cross wires without any joints in the circuit.

(b) Rheostat:

Use: To change the current in the circuit.

(c) Ammeter:

Use: To measure the current in the circuit.

4.

(A) <u>Expression for heat produced in a conductor by using Joule's experiment:</u>

(i) Refraction occurs twice, once at Point N and the second time at Point M.
(ii) Air is rarer than glass. So, when light passes from the rarer medium to the denser medium, it bends towards the normal.
(iii) When light passes from the denser (glass) medium to the rarer (air) medium, it bends away from the normal.
(iv) Ray AB is called the incident ray, and ray CD is called the emergent ray.
(v) Refraction of light is the phenomenon of change in the direction of propagation of light when it passes obliquely from one transparent medium to another.

(B)

(a) The resistance of a conductor is directly proportional to its length l and inversely proportional to its area of cross-section A.

$R \propto l$ and $R \propto \frac{1}{A}$

$\therefore R \propto \frac{l}{A}$

$\therefore R = \rho \frac{l}{A}$

where ρ is the proportionality constant and is called the resistivity of the material of the conductor.

Rearranging the above equation,

$\rho = \frac{RA}{l}$

This is the expression for resistivity.

The SI unit of resistivity is ohm-metre (Ω.m).

(b) A current will be induced in Coil B. When there is a change in the current in Coil A, a magnetic field is associated with it. This induces a potential difference between the two coils which gives rise to a current in Coil B. This change can be noted by observing the deflection in the galvanometer.