

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

1.

(A)

- (i) Pink – Other colours belong to the spectrum, while pink colour is not present in the spectrum.
- (ii) True.
- (iii) Compounds of the homologous series have the same **functional** group.
- (iv) Sulphide ores : Froth flotation method : Cassiterite ore : **Magnetic separation**
- (v) EDUSAT : Education :: IRNSS : Navigation

(B)

- (i) Option (c)
The SI unit of the universal gravitational constant is $\text{N.m}^2/\text{kg}^2$.
- (ii) Option (d)
Tinning is carried out to avoid the formation of a greenish layer on a brass vessel due to corrosion.
- (iii) Option (d)
Electromagnetic induction means the generation of current in a conductor due to relative motion between a conductor and a magnet.
- (iv) Option (b)
When an object is placed between the optical centre and the focus (F_1) in front of a convex lens, the image formed is virtual, erect and magnified.
- (v) Option (b)
The halogen which is liquid at room temperature is bromine.

2.

- (i) Metals combine with oxygen on heating in air and metal oxides are formed.
Metal + Oxygen \rightarrow Metal oxide
$$2\text{Na}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{Na}_2\text{O}_{(s)}$$

Sodiumoxide

$$2\text{Mg}_{(s)} + \text{O}_{2(g)} \longrightarrow 2\text{MgO}_{(s)}$$

Magnesium
oxide

(ii) The phenomenon in which ice converts to water due to applied pressure and then reconverts to ice on the removal of pressure is called regelation.

When ice melts, heat is absorbed but the temperature remains the same. When the water refreezes, heat is evolved and still the temperature remains the same. This heat which is absorbed or evolved is called latent heat.

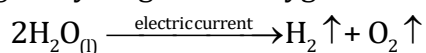
(iii) A lens is a transparent material bound by two surfaces, out of which at least one surface is spherical.

Hypermetropia is corrected using a convex lens.

(iv) Decomposition reactions:

The chemical reactions in which two or more products are formed from a single reactant are called decomposition reactions.

When an electric current is passed through acidified water, it decomposes to give hydrogen and oxygen.



(v) The electronic configuration of the element is 2, 8, 2.

1. Valency of the element is 2. So, it belongs to Group 2.

2. The number of shells present is 3. So, the element belongs to Period 3.

(vi)

Common name	Structural formula	IUPAC name
Ethylene	$\text{CH}_2=\text{CH}_2$	<u>Ethene</u>
Acetic acid	<u>CH_3-COOH</u>	Ethanoic acid

(vii) **Medium Earth Orbit (MEO) Satellite:**

(a) A satellite orbiting at a height between 2000 km and 35780 km above the Earth's surface is called a medium earth orbit satellite.

(b) The orbital path of such a satellite is normally elliptical and passes through the North and South Polar Regions.

(c) These satellites are used in navigation.

3.

(i)

(a) As the law of gravitation given by Newton is applicable throughout the universe and to all particles, Newton's gravitational law is also called the universal law of gravitation.

$$(b) F = \frac{Gm_1m_2}{r^2}$$

where G is the gravitational constant

m_1 and m_2 are masses of two objects

F is the gravitational force

If we consider

$m_1 = m_2 = \text{unit mass}$ and $r = \text{unit distance}$, then $G = F$

This means G represents the magnitude of gravitational force of attraction between two unit masses separated by a unit distance.

(c) The CGS unit of the gravitational constant G is $\text{dyne.cm}^2/\text{g}^2$.

(ii) Amount of heat required, $Q = mc(T_2 - T_1) + mL$

Mass of water = $m = 20 \text{ g}$

Specific heat of water = $c = 1 \text{ cal/g } ^\circ\text{C}$

$T_2 - T_1 = 100^\circ\text{C} - 40^\circ\text{C} = 60^\circ\text{C}$

Latent heat of vaporisation of water = $L = 540 \text{ cal/g}$

Thus,

$Q = 20 \times 1 \times (60) + 20 \times 540 = 12000 \text{ cal} = 12 \text{ kcal}$

Thus, the amount of heat required to convert 20 g of water at 40°C to steam at 100°C is 12000 calories.

(iii)

(a) The process of focusing the eye on the objects at different distances is called accommodation. The accommodation is brought by changing the curvature of the eye lens making it thinner or thicker.

(b) The iris controls the size of the pupil and thus regulates the amount of light entering the eye.

The ciliary muscles adjust the focal length of the lens so that a sharp image is formed on the retina.

(iv)

Short circuiting	Overloading
If a bare live wire and bare neutral wire come in contact with each other, then the resistance of the circuit becomes very small, and hence, very huge current flows through the circuit. This is called short circuiting.	A flow of a large amount of current in a circuit beyond its permissible value is called overloading.
A large amount of heat is produced and the components involved become very high and the circuit catches fire.	It occurs when many electrical appliances are connected to the same supply of power.
Short circuiting can be prevented by using a fuse (circuit breakers) in the circuit.	Overloading can be avoided by not connecting many appliances of high power rating to the same supply.

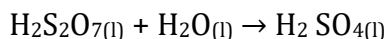
(v)

Mendeleev's periodic table	Modern periodic table
The elements were arranged in the increasing order of their atomic weights.	The elements are arranged in the increasing order of their atomic numbers.
There were 8 groups.	There are 18 groups.
Isotopes were not given any separate position.	Isotopes are assigned the same position as they have the same atomic number.
Some elements with similar properties were found in different groups, while elements with different properties were found in the same group.	Elements with similar chemical properties belong to the same group.

(vi)

Step I

Write the given chemical equation.



Step II

Count the number of atoms of the various elements present on the two sides of the equation.

Element	No. of atoms in reactants	No. of atoms in products
H	4	2
S	2	1
O	8	4

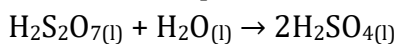
Step III

Equalise the number of atoms on the reactant and product sides by using the coefficient 2 on the product side.

Element	No. of atoms in reactants	No. of atoms in products
H	4	2×2
S	2	1×2
O	8	4×2

Now, the number of all the atoms on the reactant side is equal to all the atoms on the product side.

Rewrite the equation as



It is a balanced equation.

(vii) It is the magnetic separation method.

This method requires an electromagnetic machine.

The two main parts of this machine are iron rollers and the conveyor belt moving continuously around them.

One of the rollers is non-magnetic, while the other is electromagnetic.
The powdered ore is poured on the conveyor belt near the non-magnetic roller.
Two collector vessels are placed below the magnetic roller.
The particles of the non-magnetic part in the ore are not attracted towards the magnetic roller.
They are carried further along the belt and fall in the collector vessel away from the magnetic roller.
The particles of the magnetic ingredients of the ore stick to the magnetic roller and fall in the collector vessel near the magnetic roller.
By using this method, magnetic and non-magnetic ingredients in the ore can be separated depending on their magnetic nature.

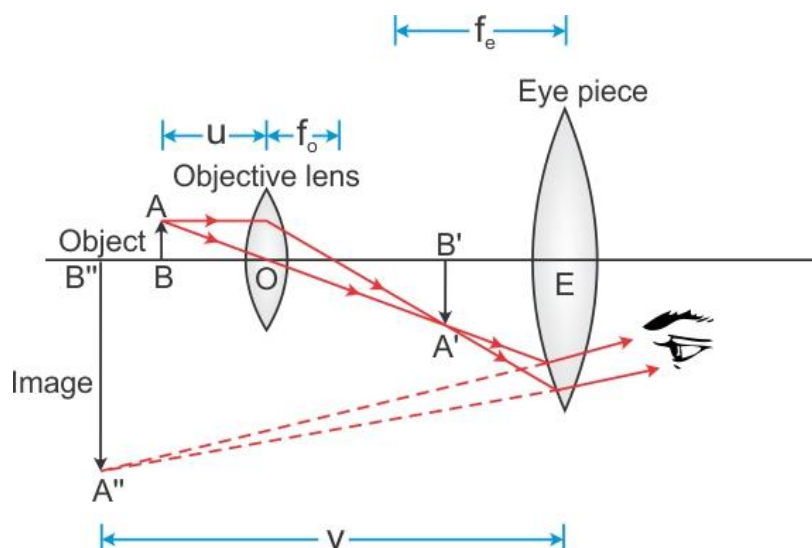
4.

(i)

- Carbon dioxide is evolved in the form of effervescence.
- The bubbles are seen in a small test tube due to the formation of CO_2 in the reaction between acetic acid and sodium carbonate.
- Lime water turns milky.

$$\begin{array}{ccccccc} \text{Ca(OH)}_2 & + & \text{CO}_2 & \longrightarrow & \text{CaCO}_3 \downarrow & + & \text{H}_2\text{O} \\ \text{lime water} & & & & \text{milky white} & & \\ & & & & \text{ppt} & & \end{array}$$
- When excess of gas is passed through lime water, calcium hydrogen carbonate is formed and solution becomes colourless.

(ii)



- In the compound microscope, the object has to be placed in front of the objective lens slightly beyond the focus of the objective lens.
- The final image formed by the compound microscope is inverted, virtual relative to the object and highly magnified.
- A compound microscope is used to observe blood cells, microorganisms etc.