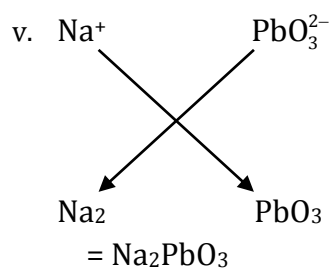
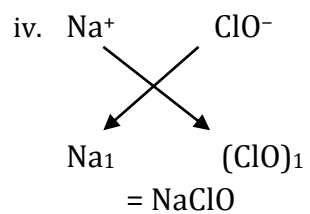
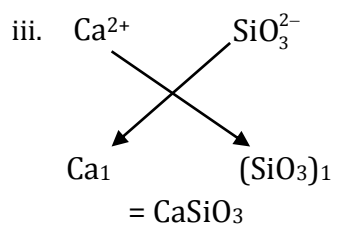
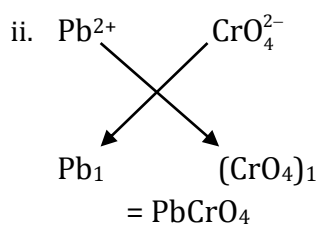
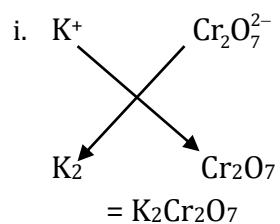


ICSE Board
Class IX Chemistry
Paper – 6 Solution

SECTION I

Answer 1

(a)



(b)

- i. They are good conductors of electricity in the fused or aqueous state because electrostatic forces of attraction between ions in the solid state are very strong, and these forces weaken in the fused state or in the solution state. Hence, ions become mobile.
- ii. In electrovalent compounds, there exists a strong force of attraction between the oppositely charged ions, and a large amount of energy is required to break the strong bonding force between ions. So, they have high boiling and melting points.
In covalent compounds, weak forces of attraction exist between the binding molecules, thus less energy is required to break the force of binding. So, they have low boiling and melting points.
- iii. As water is a polar compound, it decreases the electrostatic forces of attraction, resulting in free ions in aqueous solution. Hence, electrovalent compounds dissolve. Covalent compounds do not dissolve in water but dissolve in organic solvents. Organic solvents are non-polar; hence, these dissolve in non-polar covalent compounds.
- iv. Electrovalent compounds are usually hard crystals yet brittle because they have strong electrostatic forces of attraction between their ions which cannot be separated easily.
- v. Polar covalent compounds conduct electricity because they form ions in their solutions.

(c)

Electronic configuration = 2, 8, 7

- i. VIIA
- ii. Third period
- iii. Seven
- iv. Valency of T = -1
- v. Non-metal

(d)

Balance the following equations:

- i. $8\text{NH}_3 + 3\text{Cl}_2 \rightarrow 6\text{NH}_4\text{Cl} + \text{N}_2$
- ii. $3\text{CaOCl}_2 + 2\text{NH}_3 \rightarrow 3\text{CaCl}_2 + \text{N}_2 + 3\text{H}_2\text{O}$
- iii. $2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$
- iv. $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- v. $\text{C} + 4\text{HNO}_3 \rightarrow \text{CO}_2 + 4\text{NO}_2 + 2\text{H}_2\text{O}$

(e)

- i. Physical properties depend on atomic mass, and isotopes have different mass number, i.e. they have different number of neutrons. So, isotopes have different physical properties.
- ii. Argon does not react as it has the outermost orbit complete, i.e. 8 electrons in the outermost shell.
- iii. Actual atomic mass is greater than the mass number because the mass number is a whole number approximation of atomic mass unit. In fact, neutrons are slightly heavier than protons, and an atom has over 200 sub-atomic particles.
- iv. $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$ are isotopes of chlorine element which differ in the number of neutrons, whereas chemical properties are determined by the electronic configuration of an atom. Isotopes of an element are chemically alike.

(f)

	Formula	Valency
i.	$\text{S}_2\text{O}_3^{2-}$	-2
ii.	I^-	-1
iii.	CrO_4^{2-}	-2
iv.	MnO_4^{2-}	-2
v.	ClO^-	-1

(g)

- i. $-100^\circ\text{C} = -100 + 273 = 173\text{K}$
- ii. $273^\circ\text{C} = 273 + 273 = 546\text{ K}$
- iii. $20^\circ\text{C} = 20 + 273 = 293\text{ K}$
- iv. $5^\circ\text{C} = 5 + 273 = 278\text{ K}$
- v. $10^\circ\text{C} = 10 + 273 = 283\text{ K}$

(h)

- i. Low
- ii. Less
- iii. Chlorofluorocarbon
- iv. Ultraviolet
- v. 2

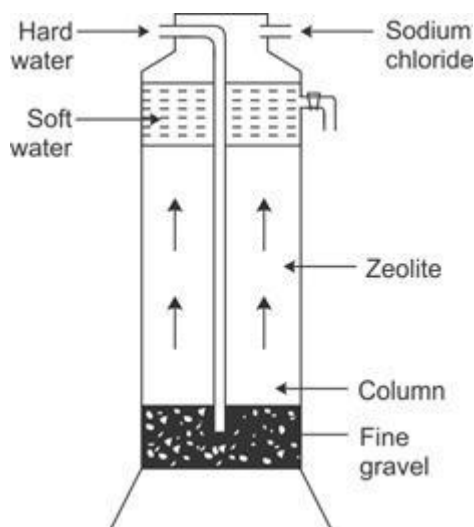
SECTION II

Answer 2

(a)

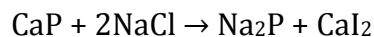
- i. When a solid changes into a liquid, it absorbs heat equal to the latent heat of fusion. When a liquid changes into a solid, it loses heat equal to the latent heat of solidification.
- ii. When a liquid changes into a gas, it absorbs heat equal to the latent heat of vaporisation. When a gas condenses into a liquid, it loses heat equal to the latent heat of condensation.

(b) Permutit is an artificial zeolite. Chemically, it is hydrated sodium aluminium orthosilicate with the formula $\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_8 \cdot x\text{H}_2\text{O}$. For the sake of convenience, let us give it the formula Na_2P .



A tall cylinder is loosely filled with lumps of permutit. When hard water containing calcium and magnesium ions percolates through these lumps, ions exchange. Sodium permutit is slowly changed into calcium and magnesium permutit, and the water becomes soft with the removal of calcium and magnesium ions.

When no longer active, permutit is regenerated by running a concentrated solution of brine over it and removing calcium chloride formed by repeated washing.



(c) K and Na can displace hydrogen from acids by reacting violently.

Pb displaces hydrogen from only hot concentrated acids.

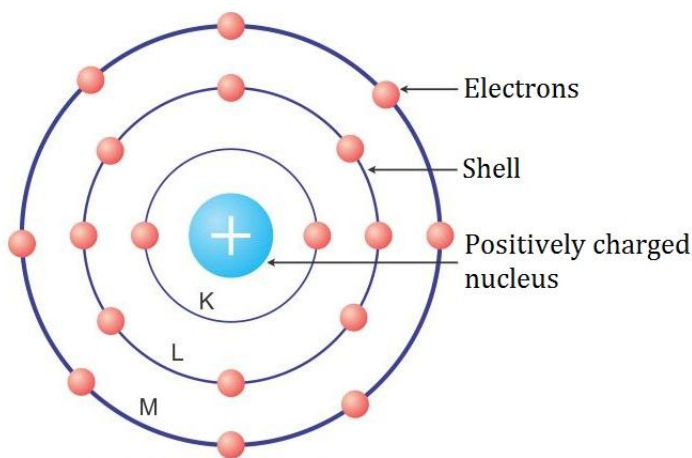
Ag and Pt do not displace hydrogen from acids at all.

Fe displaces hydrogen gently from acids.

Al displaces hydrogen from acids vigorously.

Answer 3

(a) Bohr's model of an atom



Bohr's Model of an Atom

- i. K-shell = 2
- ii. L-shell = 8
- iii. M-shell = 18
- iv. N-shell = 32

(b) If an element exhibits two different positive valencies, then

- i. for the lower valency, use the suffix -OUS at the end of the name of the metal
- ii. for the higher valency, use the suffix -IC at the end of the name of the metal.

Example:

Element	Lower valency	Higher valency
Ferrum (Iron)	Ferrous (Fe^{2+})	Ferric (Fe^{3+})

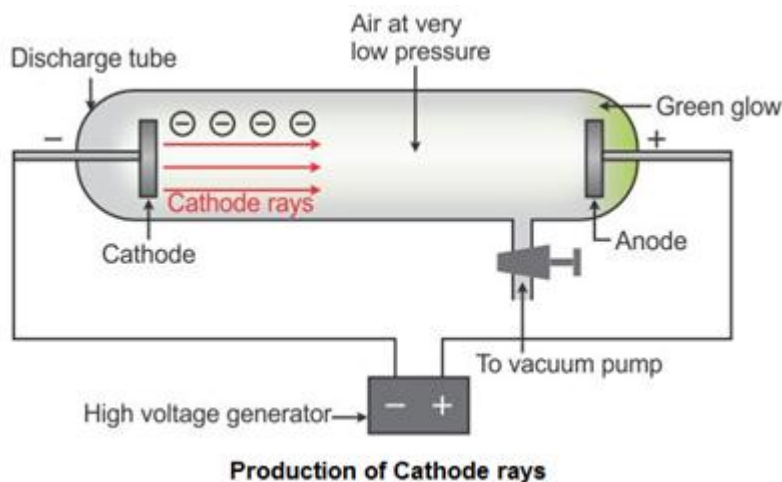
(c)

Deliquescent substances	Hygroscopic substances
1. Water-soluble salts absorb moisture from the atmosphere and dissolve in it to form a saturated solution. The substance is called a deliquescent substance and the phenomenon is called deliquescence.	1. When a substance can absorb moisture from the air without changing its state (solid/liquid), the substance is called hygroscopic and the phenomenon is known as hygroscopy.
2. They are solid crystalline in nature.	2. They may be crystalline solid or liquids.
3. They absorb moisture from the atmosphere and dissolve in it to form a saturated solution.	3. They absorb moisture from the atmosphere and dissolve in it but do not form a saturated solution.
4. Examples: Caustic soda (NaOH), caustic potash (KOH), magnesium chloride (MgCl_2), zinc chloride (ZnCl_2), ferric chloride (FeCl_3)	4. Examples: Copper oxide (CuO), calcium oxide (CaO), copper sulphate (CuSO_4), concentrated sulphuric acid (H_2SO_4)

Answer 4

(a) Discovery of cathode rays

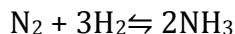
- J. J. Thomson created very low pressure inside the discharge tube and applied a high voltage. He observed a greenish glow near the anode of the glass tube.
- The rays which are emitted from the cathode hit the anode and cause the greenish glow. The streams of rays emitted from the cathode are called **cathode rays**.



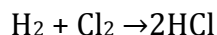
- J. J. Thomson placed a light paddle wheel in the path of the cathode rays. The paddle wheel started to rotate. He concluded that the cathode rays are a stream of particles.
- He applied an electric field parallel to the path of the rays. The cathode rays deflected towards the anode. He concluded that the cathode rays are negatively charged.

(b)

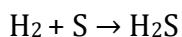
- i. Three volumes of hydrogen and one volume of nitrogen react at temperature 450–500°C and pressure 200–900 atm in the presence of finely divided iron catalyst with molybdenum as promoter to give ammonia.



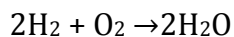
- ii. Equal volumes of hydrogen and chlorine react slowly in diffused sunlight to form hydrogen chloride.



- iii. Hydrogen gas on passing through molten sulphur reacts to give hydrogen sulphides.



- iv. Hydrogen burns in the presence of electric spark with a 'pop' sound in oxygen and with a blue flame forming water.



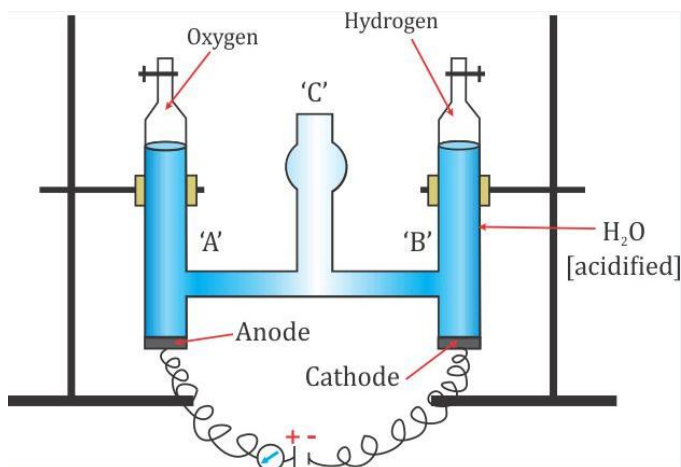
Answer 5

(a)

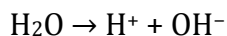
- i. In the periodic table, the vertical lines are called groups and the horizontal lines are called periods.
- ii. Lithium
Sodium
Potassium
Rubidium
Caesium
Francium
- iii. First element: Fluorine; Last element: Astatine
- iv. First element: Lithium; Last element: Neon
- v. The first period is the shortest period having only 2 elements.
The second period is a short period consisting of 8 elements.
The third period is a short period consisting of 8 elements.

(b) Hydrogen is commercially obtained by the electrolysis of water.

Water is a poor conductor of electricity. Thus, a less volatile acid such as sulphuric acid is added to water to make it a good conductor of electricity. This is called acidulated water.

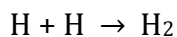
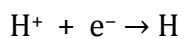


Water dissociates on passing an electric current through acidulated water.



H^+ being positively charged moves towards the cathode (negatively charged electrode).

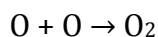
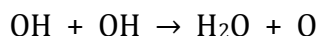
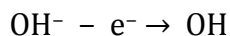
At cathode,



Thus, hydrogen gas is evolved at the cathode.

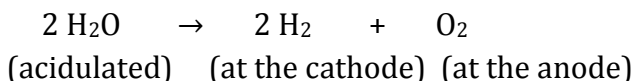
OH^- , being negatively charged, moves towards the anode (positively charged electrode).

At anode,



Oxygen is evolved at the anode.

Hence, water dissociates to give hydrogen and oxygen by passing an electric current through acidulated water.



Answer 6

(a) Merits of Mendeleev's periodic table:

- He generalised the study of the elements, then known as the study of mere groups.
- Mendeleev's periodic table had some blank spaces. These vacant spaces were left for including elements which were not discovered at that time.
- Mendeleev could also predict the properties of these unknown elements on the basis of the properties of the elements lying adjacent to these vacant spaces.
- He predicted the presence of three elements. They were named Eka-boron, Eka-aluminium and Eka-silicon. The properties of these three elements were similar to the actual elements discovered later.
Eka-boron was similar to Scandium, Eka-aluminium was similar to Gallium and Eka-silicon was similar to Germanium.
When noble gases were discovered later, they could be accommodated in the periodic table in the form of a separate group without disturbing the positions of the other elements.
- He was able to correct the values of the atomic masses of elements such as gold and platinum; he placed these elements going strictly by the similarities in their properties.

(b)

- i. An atom is electrically neutral because the number of positively charged particles, i.e. protons, is equal to the number of negatively charged particles, i.e. electrons.
- ii. The mass of an atom is contributed by the mass of the protons and neutrons present inside the nucleus of an atom, and the electrons present outside the nucleus are of negligible mass. Therefore, the mass of an atom is concentrated inside the nucleus of an atom.
- iii. The size of the nucleus is very small as compared to the size of an atom; therefore, the atom as a whole is an empty space.
- iv. Hydrogen was previously used in meteorological balloons because of its lowest density and high lifting power.
- v. Hydrogen is now no longer used in meteorological balloons as it is highly inflammable in nature, i.e. it catches fire easily.

Answer 7

(a) $P_1 = 700 - 15 = 685 \text{ mmHg}$ $P_2 = 760 \text{ mmHg}$

$V_1 = 100 \text{ cm}^3$ $V_2 = ?$

$T_1 = 27 + 273 = 300 \text{ K}$ $T_2 = 273 \text{ K}$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{685 \times 100}{300} = \frac{760 \times V_2}{273}$$

$$V_2 = \frac{685 \times 100 \times 273}{300 \times 760} = \frac{187005}{2280}$$

$V_2 = 82.01 \text{ cm}^3$

(b) $P_1 = 750 \text{ mmHg}$ $P_2 = ?$

$V_1 = 1000 \text{ cm}^3$

The 40% of the initial volume

$$= \frac{40}{100} \times 1000$$

$= 400 \text{ cm}^3$

$V_2 = 1000 - 400 = 600 \text{ cm}^3$

$P_1 V_1 = P_2 V_2$

$750 \times 1000 = P_2 \times 600$

$P_2 = \frac{750 \times 1000}{600} = \mathbf{1250 \text{ mmHg}}$

(c) Law of conservation of mass:

It states that mass can neither be created nor destroyed in a chemical reaction.

During any change, physical or chemical, matter is neither created nor destroyed.

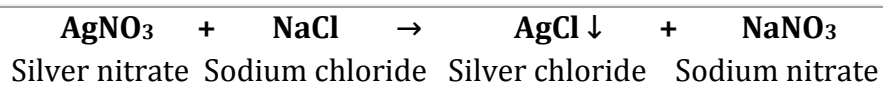
However, it may change from one form to another.

Experimental verification of the law of conservation of mass:

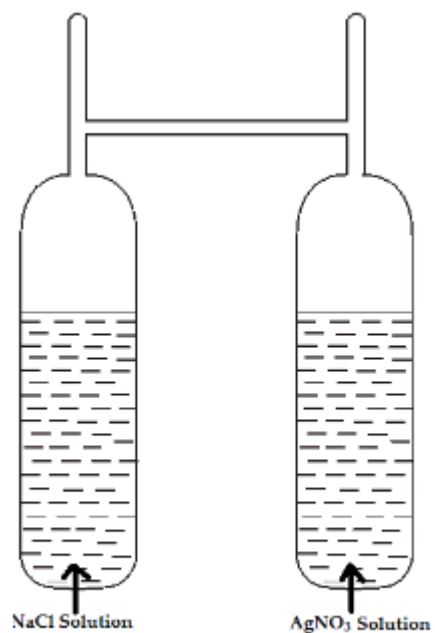
Requirements: H-shaped tube called Landolt's tube, sodium chloride solution, silver nitrate solution etc.

Procedure: A specially designed H-shaped tube is taken. Sodium chloride solution is taken in one limb of the tube and silver nitrate solution in the other limb as shown in the figure. Both the limbs are sealed and weighed. Now, the tubes are inverted so that

the solutions can mix up together and react chemically. The reaction takes place and a white precipitate of silver chloride is obtained.



The tube is weighed again. The mass of the tube is exactly the same as the mass obtained before inverting the tube. Thus, this experiment clearly verifies the law of conservation of mass.



Landolt's tube