1. (i) Write the correct alternative.

   i.   **(c)** it bends towards the normal
        Explanation:
        it bends towards the normal

   ii. **(d)** calcination
        Explanation:
        calcination

   iii. **(a)** atomic masses
        Explanation:
        atomic masses

   iv. **(a)** Diamond
        Explanation:
        Diamond

   v.   **(a)** Reactants
        Explanation:
        Reactants

   (ii) Answer the following questions.

   i.   **(b)** False
        Explanation:
        False

   ii. **(a)** True
        Explanation:
        True

   iii. **(a)** True
        Explanation:
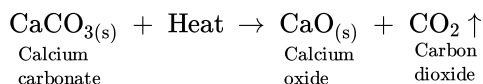   True

   iv. Convex lens

        Torch uses concave lens while camera uses convex lens.
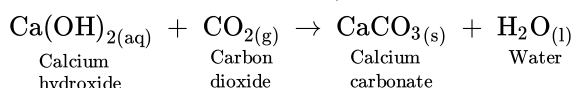
   v. $\dfrac{Gm_1\, m_2}{9\, d^2}$

2. (i) Give scientific reasons. (Any 2)

   i.   i. When limestone is heated, calcium oxide and carbon dioxide gas are formed.

        $$\underset{\substack{\text{Calcium}\\\text{carbonate}}}{CaCO_{3(s)}} + Heat \rightarrow \underset{\substack{\text{Calcium}\\\text{oxide}}}{CaO_{(s)}} + \underset{\substack{\text{Carbon}\\\text{dioxide}}}{CO_2 \uparrow}$$

        ii. When carbon dioxide gas is passed through freshly prepared lime water, the solution turns milky due to the formation of calcium carbonate, which is insoluble in water.

        $$\underset{\substack{\text{Calcium}\\\text{hydroxide}}}{Ca(OH)_{2(aq)}} + \underset{\substack{\text{Carbon}\\\text{dioxide}}}{CO_{2(g)}} \rightarrow \underset{\substack{\text{Calcium}\\\text{carbonate}}}{CaCO_{3(s)}} + \underset{\text{Water}}{H_2O_{(l)}}$$

   ii. Atomic radius is the distance between the nucleus of the atom and its outermost shell.

        i. As we move down in a group, a new shell is added.

        ii. Therefore, the distance between the outermost electron and the nucleus increases. As a result of this, the atomic size increases in spite of the increased nuclear charge.

        Hence, atomic radius goes on increasing down a group.

   iii. i. Electric bulb works on the principle of heating effect electric of current.

        ii. The solenoid type coil of bulb has high resistivity. Hence, it can be heated by passing current through it.

iii. The melting point of tungsten is very high. So, when the tungsten filament is heated at very high temperature, it does not melt.

iv. The intensity of light emitted by filament depends on the temperature. Hence, when current is passed through the bulb, the filament gets heated to high temperature (up to $3400^\circ C$) and starts glowing.

Hence, tungsten metal is used to make a solenoid type coil in an electric bulb.

(ii) Answer the following questions. (Any 3)

i. i. Propan-z-ol

ii. 2-Chloropentane

ii. i. **Newton's universal law of gravitation:** Gravitational force between two bodies in the universe is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

ii. Gravitational force between the two bodies is given by,

$F = \dfrac{Gm_1 m_2}{r^2}$

When distance between the objects is tripled, the force F' will be,

$F' = \dfrac{Gm_1 m_2}{(3r)^2} = \dfrac{Gm_1 m_2}{9r^2} = \dfrac{1}{9}\,F$

$\therefore$ Force becomes $\dfrac{1}{9}$ times the initial force.

iii. Consider, the mass m_2 is doubled. Then, the force F' will be,

$F' = \dfrac{Gm_1(2\,m_2)}{(r)^2} = 2\dfrac{Gm_1 m_2}{r^2} = 2\,F$

$\therefore$ Force becomes double the initial force.

iii. i. **Communication satellite:** These satellites use specific waves to establish communication between different locations in the world.

ii. **Earth observation satellite:** These satellites are used in the study of forests, deserts, oceans, polarice on earth's surface. These are also used in exploration and management of natural resources. They also collect information which guides us in case of natural calamities like floods and earthquakes.

iv. Ray diagram:
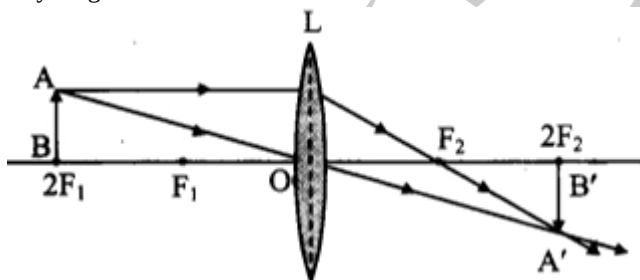
v. Given: Speed of light in medium $(v_2) = 1.5 \times 10^8\ m/s$,
velocity of light in vacuum $(v_1) = 3 \times 10^8\ m/s$
To find: Absolute refractive index (n)
Formula: $n = \dfrac{v_1}{v_2}$
Calculation: From formula,
$n = \dfrac{3 \times 10^8}{1.5 \times 10^8} = 2$
The absolute refractive index of the medium is 2.

3. Answer the following questions. (Any 5)

(i) i. Two metals that react with water: Potassium, sodium

ii. Two moderately reactive metals: Zinc, iron

iii. a. Most highly reactive metal: Potassium

b. The most less reactive metal: Gold

(ii) i. The reaction type: Decomposition reaction

ii. Reactant: Calcium carbonate

Products: Calcium oxide, carbon dioxide

iii. $\mathrm{CaCO_{3(s)}}$ + Heat $\rightarrow$ $\mathrm{CaO_{(s)}}$ + $\mathrm{CO_2}\uparrow$
Calcium carbonate　Calcium oxide　Carbon dioxide
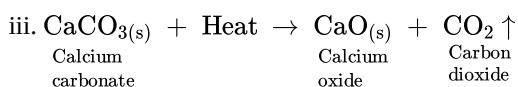
(iii) **Given:** Potential difference $(V) = 220\ V$,

Power of bulb 1 $(P_1) = 50\ W$,

Power of bulb 2 $(P_2) = 60\ W$,

To find: Total current (I)

Formulae: i. $P = VI$

ii. $I = I_1 + I_2$

Calculation: Since both the bulbs are connected in parallel, the potential difference will be same.

From formula (i),

$I_1 = \frac{P_1}{V} = \frac{50}{220}\ A, I_2 = \frac{P_2}{V} = \frac{60}{220}\ A$

From formula (ii),

Total current is given by,

$I = \frac{50}{220} + \frac{60}{220} = \frac{50+60}{220}$

$\therefore I = \frac{110}{220} = \frac{1}{2} = 0.5A$

The total current flowing in the main conductor is 0.5 A.

(iv) i. a. Ionic compounds are composed of cations and anions.

b. $NaCl$ is formed when sodium metal gives away one electron to form Na^+ ion while the nonmetal chlorine takes up one electron to form Cl^- ion.

c. These ions are held together by strong electrostatic forces of attraction (ionic bond). Therefore, NaCl is an ionic compound.

ii. Two properties of ionic compound:

a. Ionic compounds exist in solid state and are hard.

b. Ionic compounds have high melting and boiling points.

(v) i. The acceleration due to gravity (g) on earth's surface is given as, $g = \frac{GM}{R^2}$

ii. As we go inside the earth, our distance from the centre of the earth decreases and no longer remains equal to the radius of the earth (R).

iii. Along-with the distance, the part of the earth which contributes towards the gravitational force felt also decreases, decreasing the value of (M).
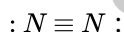
iv. Due to combined result of change in R and M, value of g decreases as we go inside the earth and becomes zero at the centre of the earth.

(vi) i. The atomic number of nitrogen is 7. The valence shell of nitrogen contains 5 electrons.

ii. Electron-dot structure of N_2:
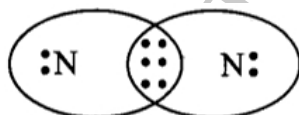
Line structure of N_2:

$: N \equiv N :$

(vii) i. Refraction of light

ii. Laws of refraction:

a. Incident ray and refracted ray at the point of incidence N are on the opposite sides of the normal to the surface of the slab at that point i.e. CD, and the three, incident ray, refracted ray and the normal, are in the same plane.

b. For a given pair of media, here air and glass, the ratio of $\sin i$ to $\sin r$ is a constant. Here, i is the angle of incidence and r is the angle of refraction.

(viii) Assume that the satellite completes one revolution in time T seconds. During this period the distance travelled by the satellite will be equal to circumference of the orbit. Assuming the radius of the orbit to be r, the distance travelled by the satellite will be $2\pi r$.

Here, velocity $(v_c) = \frac{\text{distance}}{\text{time}} = \frac{2\pi r}{T}$

$\therefore$ Time period $T = \frac{2\pi r}{v_c}$

As, $r = R + h$,

$\therefore T = \frac{2\pi(R+h)}{v_c} = \frac{2 \times 3.14 \times (6400 + 35780)}{3.08}$

$= 2 \times \frac{3.14}{3.08} \times 42180$

$$= \frac{84360 \times 3.14}{3.08}$$

$$= 86003.38 \ s$$

$$= 23.89 hrs$$

$$\approx 23 \text{ hrs } 54 \text{ min}$$

The satellite will complete one revolution around the earth in $23 \ hrs \ 54 \ min$.

4. Answer the following question. (Any 1)

(i)   i. **Physical nature:** Ionic compounds are solids and are hard due to strong inter-ionic forces of attraction. They are generally brittle and break into pieces when pressure is applied.

ii. **Melting and boiling points:** Ionic compounds have high melting and boiling points as considerable amount of energy is required to break the strong inter-ionic forces of attraction.

iii. **Solubility:** Ionic compounds are generally soluble in water because water molecules orient in a particular manner around the ions which are separated by dissociation process. This results in new force of attraction between the ion and surrounding water molecules replacing the original intermolecular attraction. Ionic compounds are insoluble in kerosene and petrol because new attractive force cannot be established in these solvents.

iv. **Electrical conductivity:** Ionic compounds conduct electricity in molten state or in its aqueous solution. Conduction of electricity in these states is due to movement of charged particles (i.e., ions) towards the oppositely charged electrodes. However, in solid state, ionic compounds do not conduct electricity as movement of the ions is not possible due to their rigid structure.

(ii)

Sr. No.	Common Name	Structural Formula	IUPAC Name
i.	Ethylene	$CH_2 = CH_2$	Ethene
ii.	Acetylene	$HC \equiv CH$	Ethyne
iii.	Acetic acid	$CH_3\text{-}COOH$	Ethanoic acid
iv.	Methyl alcohol	$CH_3\text{-}OH$	Methanol
v.	Acetone	$CH_3\text{-}OH\text{-}CH_3$	Propan-2-one