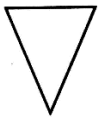
Time : 2 Hrs. **Marks : 40**

Q.1 (A) Choose the correct alternative from the given options:

1. c) Ni
2. a) critical
3. b) 110 W
4. c) 
5. b) inertia

Q.1 (B) Answer the following.

1. Alkaline earth metals.
2.

Group A		Group B	
i)	Water at 0 °C	a.	Maximum volume
ii)	Water at 4 °C	b.	Minimum volume

3. LIGO-Laser Interferometric Gravitational Wave Observatory
4. Direction showing satellite
5. False

Q.2 (A) Give scientific reasons: (Any two)

1. i) This happens due to oxidation reaction.
   ii) Over a period of a time, a thin layer of aluminium oxide (Al_2O_3) is formed on the surface of aluminium utensils.
   Hence, the luster of the surface of the aluminium utensils in the house is lost after a few days.
2. i) Electrical energy = Electrical power × time
   ii) Devices consuming high electrical power are used largely for practical applications.
   iii) This leads to heavy expenditure of electrical energy. To measure such value of energy unit joule is significantly small.
   iv) Hence, unit kWh is used in practice. Unit 1 kWh represents power of 1 k W used for 1 hour and equals 3.6×10^6J
3. i) Though steam and boiling water have same temperature, the heat contained in steam is more than that in boiling water.
   ii) Steam is formed when boiling water absorbs specific latent heat of vaporization i.e., 540 cal/g.
   iii) As a result, when steam comes in contact with the skin of a person, it gives off additional 540 calories per gram causing severe (more serious) burns.
   Hence, burns caused from steam are more serious than those caused from boiling water at same temperature.

Q.2 (B) Answer the following. (Any 3)

1. (a) The reaction is called polymerization.
   A macromolecule formed by regular repetition of a small unit is called polymer. The small unit that repeats regularly to form a polymer is called monomer. The reaction by which monomer molecules are converted into a polymer is called polymerization.
   For example, many number of ethylene monomers combine together to form a polymer called polyethylene.
   (b) The product obtained is polyethylene. It is used to make carry bags, sports wears, etc.

2. Complete the following chart.

	Ionic compounds		Covalent compounds (carbon compounds)
1)	They have high melting points and boiling points.	1)	They have low melting points and boiling points.
2)	They conduct electricity in the molten and dissolved state.	2)	Generally they do not conduct electricity.
3)	They have strong inter molecular forces.	3)	They have weak intermolecular force.
4)	They have ionic bonds in them	4)	They have covalent bonds.
5)	The chemical bonds in them produce ions.	5)	The chemical bonds in them do not produce ions.

3.

	Specific latent heat of fusion	Specific latent heat of vaporization
i)	The amount of heat energy absorbed at constant temperature by unit mass of a solid to convert into liquid phase is called the specific latent heat of fusion.	The amount of heat energy absorbed at constant temperature by unit mass of a liquid to convert into gaseous phase is called the specific latent heat of vaporization.
ii)	Specific latent heat of fusion has lower value than specific latent heat of vaporization.	Specific latent heat of vaporization has greater value than specific latent of fusion.
	Example: Specific latent heat of fusion of ice = 80 cal/g	Example: Specific latent heat of vaporization of water = 540 cal/g

4. **Given:** P_1 = 2 D, P_2 = 2.5 D, P_3 = 1.7 D
To find: focal length (f)
Formulae: i) P = $P_1 + P_2 + P_3$ ii) f = $\frac{1}{P}$
Calculation: From formula (i), Power of the combination,
P = 2 + 2.5 + 1.7 = 6.2 D
From formula (ii),
f = $\frac{1}{6.2}$
∴ f = 0.16 m
Ans: The focal length of the combination is 0.16 m.

5. i) The incident ray and the refracted ray are on the opposite side of the normal at the point of incidence, and all three lie in same plane.
ii) a. For a given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant
b. The second law is also called as Snell's law.
c. If 'i' is the angle of incidence and 'r' is angle of refraction, then $\frac{\sin i}{\sin r}$ = constant

Q.3 Answer the following questions. (Any 5)

1. a) Ethanoic acid reacts with ethanol in presence of an acid catalyst and ester, ethyl ethanoate and water are formed.

$$\underset{\text{ethanoic acid}}{CH_3—COOH} + \underset{\text{(ethanol)}}{CH_3—CH_2OH} \longrightarrow \underset{\text{(ethyl ethanoate)}}{CH_3—COO—CH_2—CH_3} + \underset{\text{water}}{H_2O}$$

b) This reaction is known as esterification.
c) If ethanol is heated directly, it will catch fire. Therefore, to prevent ethanol from catching fire, it is heated using a water bath.

2. The value of the acceleration due to gravity, g, changes from place to place on the earth. It also varies with the altitude and depth below the earth's surface. The factors affecting the value of g are the shape of the earth, altitude and depth below the earth's surface.
(1) The earth is not perfectly spherical It is somewhat flat at the poles and bulging at the equator. At the surface of the earth, the value of g is maximum (9.832 m/s^2) at the poles as the polar radius is minimum, while it is minimum (9.78m/s^2) at the equator as the equatorial radius is maximum.
(2) As the height (h) above the earth's surface increases, the value of g decreases. It varies as

$\frac{1}{(R+h)^2}$, where R is radius of the earth.

(3) In the interior of the earth, on the average, the value of g is less than that at the earth's surface. As the depth below the earth's surface increases, the value of g decreases and finally it becomes zero at the centre of the earth.

3. i) Galvanometer is a sensitive device which works on the same principle of an electric motor.
ii) A coil is positioned between the pole pieces of a magnet in such a way that the pointer on the galvanometer dial is connected to it.
iii) When a small current (for example 1 mA) flows through the coil, the coil will rotate. The rotation will be proportional to the current.
iv) The pointer in the galvanometer deflects on both the sides of the zero mark depending on the direction of the current.
v) Galvanometer is generally used to make electrical measurements.

4. 1) Copper is more reactive than silver. Hence, displacement reaction occurs.
2) When copper coin is dipped in silver nitrate solution, more reactive metal copper displaces less reactive metal silver from silver nitrate solution.
3) Due to which a shining white deposit of silver metal is formed on copper coin.
$2\ AgNO_3(aq) + Cu(s) \rightarrow Cu(NO_3)_2\ (aq) + 2\ Ag(s)$

5. On the basis of electronic configuration, elements in the modern periodic table are classified into **four** blocks. Groups 1 and 2 elements are included in **s-block** and all these elements are metals (except hydrogen). Groups 13 to 18 elements are included in **p-block.** This block contains metals, nonmetals and metalloids. Groups 3 to 12 elements are included in **d-block** and all these elements are **metals.** Elements shown at the bottom of the periodic table i.e., lanthanides and actinides constitute **f-block** and all these elements are metals.

6. ***Given:*** New mass of earth (M')
= 4M
= $4 \times 6 \times 10^{24}$ kg, height of the satellite (h)
= 35780 km
= 35.78×10^6 m

To find: Time period (T)

Formulae: i) $v_c = \sqrt{\frac{GM}{(R+h)}}$

ii) $T = \frac{2\pi(R+h)}{v_e}$

Calculation: Substituting formula (i) in formula (ii),

$T = 2\pi \sqrt{\frac{(R+h)^3}{GM'}}$

$= 2\pi \sqrt{\frac{[(6.4+35.78)\times10^6]^3}{6.67\times10^{-11}\times4\times6\times10^{24}}}$ ($\because$ R = 6.4×10^6 m)

= 43020 s

$\therefore$ $T = \frac{43020}{3600}$ h = 11.95 $\approx$ 12 h

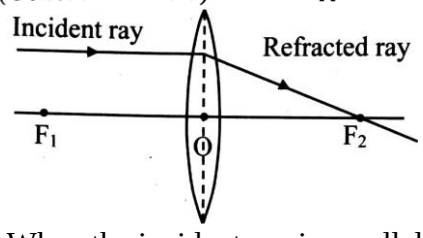
Ans: The satellite would take approximately 12 hours to complete one revolution around the earth.

7. When copper reacts with concentrated nitric acid, reddish coloured poisonous nitrogen dioxide gas, copper nitrate and water are formed.

$Cu(s) + 4HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l)$

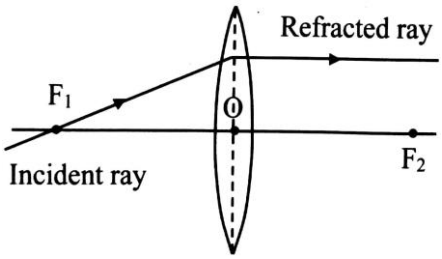
(Conc. Nitric acid) Cupper Nitrate Nitrogen dioxide

8. i)



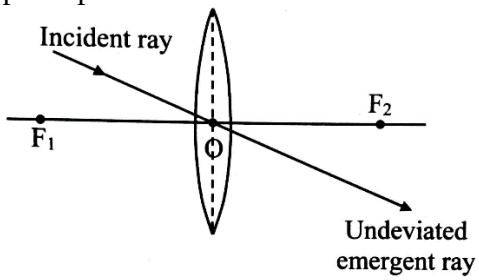
When the incident ray is parallel to the principal axis, the refracted ray passes through the principal focus.

ii)



When the incident ray passes through the principal focus, the refracted ray is parallel to the principal axis.

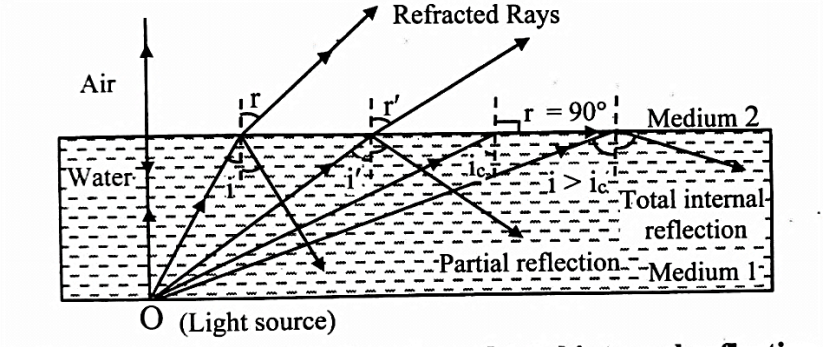
iii)



When the incident ray passes through the optical centre of the lens, it passes without changing its direction.

Q.4 Answer the following questions. (Any 1)

1. a) The average atomic mass of element X and Z
$= \frac{Atomic\ mass\ of\ X + atomic\ mass\ of\ Z}{2} = \frac{7+39}{2} = \frac{46}{2} = 23$
b) The average atomic mass of X and Z is equal to the atomic mass of element Y.
c) Dobereiner's law of classification is illustrated by this example.
d) Element X – Lithium (Li), Element Y – Sodium (Na), Element Z – Potassium (K)
e) Be, Mg, Ca is another triad which illustrates Dobereiner's law.
2. i) When a ray of light enters a rarer medium from a denser medium, it gets partially reflected i.e., part of the light gets reflected and comes back into the denser medium obeying the laws of reflection. This is called partial reflection.
ii) The rest of the light gets refracted and goes into the rarer medium. As light is going from denser to rarer medium, it bends away from the normal i.e., the angle of incidence (i) is smaller than the angle of refraction (r).
iii) According to Snell's law, the refractive index of the material is constant. Hence, on increasing the angle of incidence the angle of refraction r increases.
iv) For a particular value of i for which, the value of r becomes equal to 90°, is called the critical angle. For i = critical angle = i_c, r = 90°
$_2n_1 = \frac{\sin i_c}{\sin 90°} = \sin i_c$ …….($\because \sin 90° = 1$)
v) For angles of incidence larger than the critical angle, the angle of refraction is larger than 90°, such rays return to the denser medium as shown in the figure. Thus, all the incident light gets reflected back into the denser medium. This is called total internal reflection.



Partial reflection, Critical angle and total internal reflection