6. REFRACTION OF LIGHT OF CURVED SURFACES

1 Mark Questions

1. Write the names of the lenses shown in figure. (As–1)

a)  **b)** 

Ans. a) Plano – convex lens
b) Biconvex lens

2. A convex lens is made up of three different materials as shown in the figure. How many images does it form ? (As–2)

Ans. 1) Given convex lens is made up to three different materials have different refractive indices.
2) So the given lens has three different focal lengths. Hence it forms three images.

3. How does alight ray behave when it is passing through the focus of a lens ? (As–1)

Ans. When a light ray passing through the focus will take a path parallel to principal axis after refraction.

4. Suppose you are inside the water in a swimming pool near an edge. A friend is standing on the edge. Do you find your friend taller or shorter than his usual height ? Why ? (As–7)

Ans. When I saw my friend through water, he seems to be taller than his actual height.

This is due to light rays bend away from the normal as they enters rarer medium (air) from denser medium (water)

2 Mark Questions

II.5. Write the lens formula and explain the terms in it ? (As–1)

Ans. Lens formula :

$$\frac{1}{f}=\frac{1}{v}-\frac{1}{u} \quad \text{..... (1)}$$

Where f = the focal length of the lens
u = object distance
v = image distance

6. Write the lens maker's formula and explain the terms in it ? (As–1)

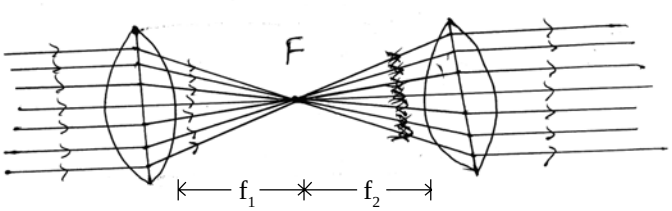
Ans. Lens marker's formula :

$$\frac{1}{f}=(n-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right) \quad \text{..... (1)}$$

Where f = focal length of the lens
n = absolute refractive index of the lens
R_1 = Radius of curvature of first surface
R_1 = Radius of curvature of second surface

7. Two converging lenses are to be placed in the path of parallel rays so that the rays remain parallel after passing through both lenses. How should the lenses be arranged ? Explain with a neat ray diagram. (As–1)

Ans. i) A parallel beam of light rays will converge on focal point of the lens after refraction.
ii) Light rays passes through the focal point will parallel to principal axis after refraction.
iii) So the two lenses are arranged on a common principal axis such that their focal points coincide with each other, then the rays remain parallel after passing through both lenses.



8. Write the names of different types of lenses. Draw their diagrams ? (As–1)

Ans. Different types of lenses :

1) Biconvex lens –

2) Biconcave lens –

3) Plano – Convex lens –

4) Plano – Concave lens –

5) Concavo – Convex lens –

$$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{20} - \frac{1}{60}$$

9. The focal length of a converging lens is 20 cm. An object is 60 cm from the lens. Where will the image beformed and what kind of image is it ? (As–1)

Ans. f = 20 cm; u = 60 cm; image distance (v) = ?

Lens formula : $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{v} = \frac{3-1}{60} = \frac{2}{60} = \frac{1}{30}$$

$\therefore$ v = 30 cm; Here a real diminished and inverted image is formed.

10. What is the focal length of double concave lens kept in air which two spherical surfaces of radii R_1 = 30 cm and R_2 = 60 cm. Take refractive index of lens as n = 1.5 ? (As–1)

Ans. n = 1.5; R_1 = 1.5 ? R_2 = 60 cm ($\because$ double concave lens)

$$\Rightarrow f = \frac{-20}{0.5} = \frac{-200}{5}$$

$\therefore$ f = –40 cm

Here minus sign indicates that the lens is divergent.

11. A double convex lens has two surfaces of equal radii 'R' and refractive index n = 1.5. Find the focal length 'f'. (As–1)

Ans. $R_1 = R_2 = R$

For a double convex lens, R_1 = R, R_2 = –R,

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$\therefore$ f = R

$\therefore$ The focal length of a double convex lens is 'R'.

12. Find the refractive index of the glass which is a symmetrical convergent lens if its focal length is equal to the radius of curvature of its surface ? (As–7)

Ans. Given lens is symmetrical convergent lens

R_1 = R; R_2 = –R

Focal length of the lens f = R

Lens maker's formula $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\Rightarrow a = 2(n-1) \Rightarrow n-1 = \quad \Rightarrow n = 1 + \quad = 1.5$

$\therefore n = 1.5$

13. Find the radii of curvature of a convexo – concave convergent lens made of glass with refractive index n = 1.5 having focal length of 24 cm. One of the radii of curvature is double the other ? (As–7)

Ans. $n = 1.5$; $f = 24$ cm; $R_2 = 2R_1$

Lens maker's formula :

=

= =

$R_1 =$

$\therefore R_1 = 6$ cm

$R_2 = 2R_1 = 2 \times 6 = 12$ cm

14. Let us assume a system that consists of two lenses with focal length f_1 and f_2 respectively. How do you find the focal length of the system experimentally, when (As–3)

i) two lenses are touching each other

ii) they are separated by a distance d' with common principal axis.

Ans. i) Two lenses are touching each other : The focal, lengths of two lenses having f_1 and f_2 respectively if they touch each other then the focal length of the system is

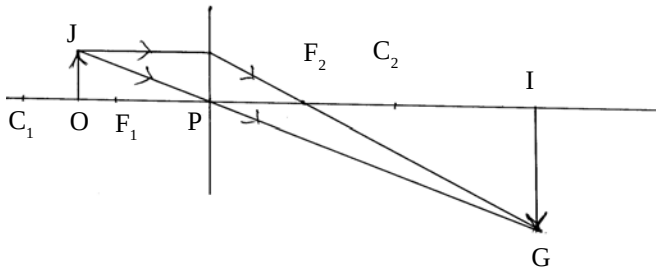
$$F = \frac{f_1 f_2}{f_1 + f_2} \quad \text{..... (1)}$$

ii) If the lenses are separated by a distance 'd' with common principal axis.
Then the focal length of the system

..... (2)

15. Draw a ray diagram for an object placed between F_1C_1 of convex lens. Explain the nature and position of image ? (As–5)

Ans. Object is placed between F_1C_1 of convex lens :



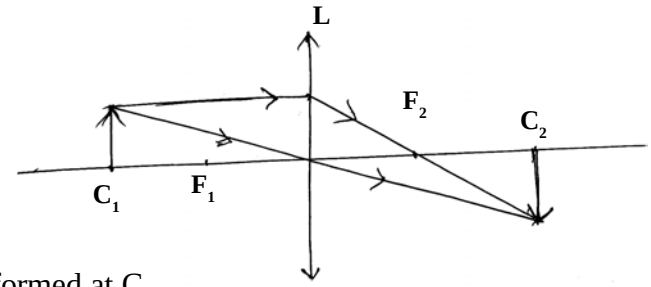
(Note : OJ = object; IG = Image**)**

Charactenstics :

1) Image is formed beyond C_2.
2) Real image is formed.
3) Inttered image.
4) Image is magnified

16. Draw a ray diagram for the image formed at C_2. Explain the nature of image and position of the object ? (As–5)

Ans.



If the image formed at C_2.

1) The object should be placed at C_1.
2) The image is real.
3) The image is inverted.
4) The image is same size as that of object.

4 Mark Questions

III.17. How do you find the focal length of a lens experimentally ? (As–1)

Ans. Aim : To determine the focal length of a convex lens.

Apparatus : Convex lens, meter scale, V-stand, screen, candle.

procedure :

1) Take a v-stand and place it on a long (nearly 2 m) table at the middle.
2) Place the convex lens on a 'V' stand.
3) Now place the candle at a distance of 60 cm from the lens, such that the flame of the candle lies along the principal axis of the lens.
4) Place the screen on the other side of the lens and adjust to get a clear image on it.
5) Now measure the image distance (V) between the lens and the screen.

6) Now repeat the experiment for various object distances like 50 cm, 40 cm, 30 cm etc.
7) Measure the image distances in allcases and note them in table.
8) Calculate the focal length in each case by using the formula, $f = \frac{uv}{u + v}$ and noteit in the table.
9) We find that the focal length remains constant in each case.

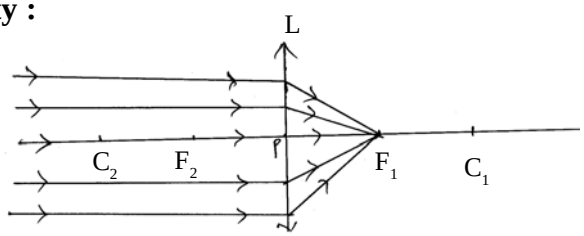
Table :

S.No.	Object distance (u)	Image distance (v)	Focal length f = uv/u + v
1.	60 cm		
2.	50 cm		
3.	40 cm		
4.	30 cm		

18. Draw ray diagrams (for a convex lens) for the following positions and explain the nature and position of image. (As–5)

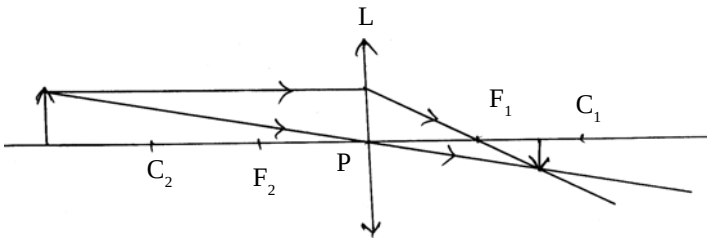
i) Object is placed at infinity.
ii) Object is placed beyond C_2.
iii) Object is placed at C_2.
iv) Object is placed between F_2 and C_2.
v) Object is placed at F_2.
vi) Object is placed between P and F_2.

Ans. i) Object at infinity :



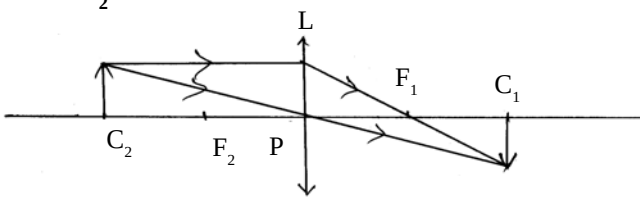
Characteristics :
1) Image is formed at the focal point.
2) The image is real, inverted and point size.

ii) Object is placed beyond C_2:



Characteristics :
1) The image is formed between F_1 and C_1.
2) The image is real, inverted and diminished.

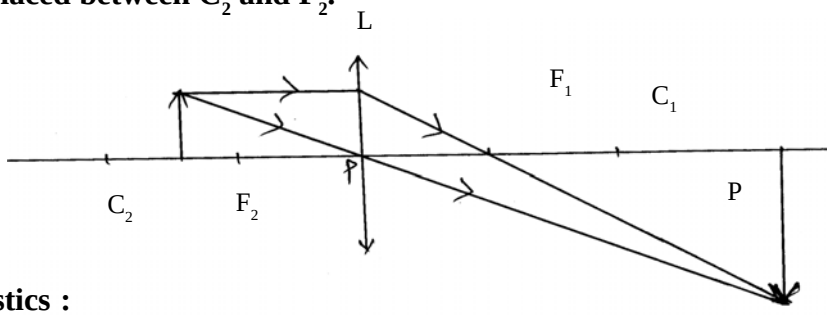
iii) Object is placed at C_2 :



Characteristics :

1) The image is formed at C_1.
2) The image is real, inverted and same size as that of object.

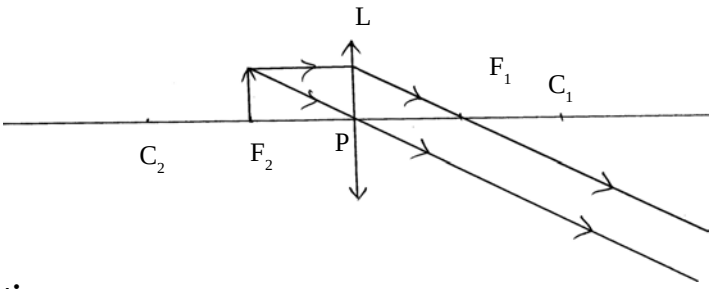
iv) Object is placed between C_2 and F_2.



Characteristics :

1) The image is formed beyond C_1.
2) The image is real, inverted and magnified.

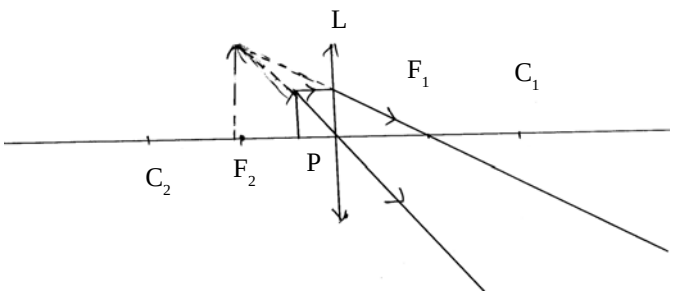
v) Object is placed at F_2 :



Characteristics :

1) The image is formed at infinity.
2) We cannot discuss the nature of image.

vi) Object is placed between F_2 and P :



Characteristics :

1) The image is formed on the same side of the object.
2) The image is virtual, erect and magnified.

BITS

I. Multiple Choice questions :

1. Wich one of the following materials cannot be used ot make a lens ( )

   A) Water B) Glass C) Plastic D) Clay

2. Which of the following is true ? ( )

   A) The distance of virtual image is always greater than the object distance for convex lens

   B) The distance of virtual image is not greater than the object distance for convex lens

   C) Convex lens always forms a real image D) Convex lens alwyas forms a virtual image

3. Focal length of the plano - convex lens is ..... when its radius of curvature of the surface is R and n is the refractive index of the lens ( )

   A) f = R B) f = C) f = D) f =

4. The value of the focal length of the lens is equal to the value of the image distance when the rays are ..... ( )

   A) passing through the optic centre B) Parallel to the principal axis

   C) Passing through the focus D) In all the cases

5. Which of the following is the lens maker's formula ? ( )

   A) $\frac{1}{f}=(n-1)\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$ B) $\frac{1}{f}=(n+1)\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

   C) $\frac{1}{f}=(n-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ D) $\frac{1}{f}=(n+1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

6. The distance between focus and 'Optic centre' is ..... ( )

   A) Focal length B) Radius of curvature C) Principal axis D) None

II. Fill in the blanks.

7. The rays from the distance object, falling on the convex lens pass through .....
8. The rays passing through the ..... of the lens is not deviated.
9. Lens formula is given by .....
10. Lens makers formula is given by .....
11. The focal length of the plano-convex lens is '2R' where R is the radius of curvature of the surface. Then the refractive index of the material of the lens is .....

12. The lens which can form real and virtual images is .....
13. The lens which always form virtual imagesis .....
14. Converging lens is .....
15. For drawing ray diagrams, we represent canvex lens with a symbol .....

III. Matching.

16. Object is beyond C_2	( )	A.	Image is formed beyond C_1
17. Object is at C_2	( )	B.	Image is formed between F_1 and C_1
18. Object is between C_2 and F_2	( )	C.	Image is formed at infinity
19. Object is at F_2	( )	D.	Image is formedis formed at F_1
20. Object is between F_2 and P	( )	E.	Image is formed on same side of object
		F.	Image is formed at C_1

Answer

I. 1) D 2) A 3) C 4) B 5) C 6) A

II. 7) FOCAL point (focus) 8) Optic centre 9) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

10) 11) 1.5 12) Convex lens

13) Concave lens 14) convex lens 15) $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

III. 16) B 17) F 18) A 19) C 20) E

❖ ❖ ❖ ❖❖

7. HUMAN EYE AND COLOURFUL WORLD

1 Mark Questions

1. What is least distance of distinet vision ? What is its value for a human being ?

Ans. The minimum distance at which an object is to be placed so that it can be viewed distinetly and confortably is known as least distance of distinct vision.

The value of least distance of distinet vision is 25 cm. (This value change from person to person and with age of person)

2. What is angle of vision ? What is its value for healthy human being ?

Ans. The maximum angle at which we are able to see the whole object is called angle of vision.

3. What is accommodation of eye lens ?

Ans. The ability of eye lens to change its focal length is called accommodation of lens.

4. How many types of eye defects ? What are they ?

Ans. There are mainly three common defects of vision.
They are i) Myopia ii) Hypermetropia iii) Presbyopia

5. What is Presbyopia ?

Ans. Presbyopia is a vision defect when the ability of accommodation of the eye usually decreases with agening.

6. What is the difference between for point and near point

Ans. The point of maximum distance at which the eye lens can form an image on the retina is called 'far point'. The point of minimum distance at which the eye lens can form an image on the retina is called near point.

7. What is Dispersion of light. Give an example.

Ans. The splitting of white light into its constituent colour (VIBGYOR) is known as dispersion.
Ex : The phenomenon 'Dispersion' is resparsible for producing rainbow.

8. What is scattering of light. Give an example.

Ans. The process of re-emission of absorbed light in all directions with different intensities by atoms or molecules is called scattering of light.

9. What is 'Minimum deviation angle' ?

Ans. The angle between incident ray and emergent ray is known as angle of deviation. When the angle of incidence is equal to angle of emergence the angle of deviation attains least value. This is known as 'angle of minimum deviation'.

10. What is the role of rods and cones in human eye ?

Ans. Rods – identify the colour
Cones – Identify the intensity of light

11. What are the maximum and minimum focal lengths of eye lens ?

Ans. Maximum focal length of eye lens = 2.5 cm
Minimum focal length of eye lens = 2.27 cm

12. To corrent Myopia and Hypermetropia. Mention the focal lengths of bi-concave and bi-convex lens ?

Ans. i) To correct the Myopia

The focal length of bi-concave lens is f = – D

Here D = Distance to far point from eye

ii) To correct the Hypermetropia

The foal length of bi–convex lens is f =

Here d = Distance to near point from eye.

13. Define power of lens ? What are its units ?

Ans. The reciprocal of focal length is called power of lens.

Let f be the focal length of lens,

Power of lens P = $\frac{1}{f\,(\text{in m})}$

(or) P =

The unit of power of lens is 'Dioptre' (D)

14. Write a formula to find the refractive index of the material of the prism. And explain the terms.

Ans. Refractive index of the material of a prism $\frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$

n =

Here A = Angle of prism

D = Angle of minimum deviation

2 Mark Questions

II.1. Explain briefly the reason for the blue of the sky.

Ans. 1) Sky appears blue due to a phenomenon known as scattering of light.

2) Our atmosphere contains different types of molecules and atoms. The reason for blue sky is due to the molecules N_2 and O_2.

3) The sizes of these molecules are comparable to the wave length of blue light. These molecules act as scattering centres for scattering of blue light.

4) That is why sky appears in blue colour.

2. How do you appreciate the role of molecules in the atmosphere for the blue colour of the sky ?

Ans. 1) The sky appear blue due to atmospheric refraction and scattering of light through molecules.

2) Molecules behaves as scattering entres.
3) The reason to blue sky is due to the molecules N_2 and O_2.
4) The sizes of these molecules are comparable to the wavelength of blue light.
5) In the absence of molecules there will be no scattering of sunlight and the sky will appear dark.
6) We should appreciate the molecules which are scattering centres.

3. Why does the sky sometimes appear write when you view in certain direction on hot days ?

Ans. 1) Our atmosphere contain atoms and molecules of different sizes.
2) According to their sizes, they are able to scatter different wavelengths of light.
3) For example, the size of the water molecule is greater than the size of the N_2 or O_2.
4) It acts as a scattering centre for other frequencies which are lower than the frequency of blue light.
5) On a hot day, due to rise in the temperature, water vapour enters into atmosphere which leads to abundant presence of water molecules in the atmosphere.
6) These water molecules scatter the colours of other frequencies other than blue. All such colours of other frequencies reach your eye and the sky appears white.

4. Why the reasons for appearance the red colour of sun during sunrise and at sunset ? And does not appear red during noon hours ?

Ans. 1) The atmosphere contains free molecules and atoms with different sizes. These molecules and atoms scatter light of different wavelengths which are comparable to their size.
2) Molecules having a size that is comparable to the wavelength of red light are less in the atmosphere.
3) Hence scattering of red light is less when compared to the other colours of light.
4) The light from the sun needs to travel more distance in atmosphere during sunrise and sunset to reach our eye.
5) In morning and evening times, during sunrise and sunset except red light all colours scatter more and vanish before they reach us.
6) Since scattering of red light is very small, it reaches 4s. As a result sun appears red in colour during sunrise and sun set.
7) During noon hours, the distance to be travelled by the sun rays in the atmosphere is less than that compared to morning and evening hours.
8) There fore all colours reach our eye without much scattering. Hence the sun appears white during noon hours.

5. How do you appreciate the working of cilliary muscles in the eye ?

Ans. 1) The ciliary muscles to which eye lens is attached helps the eye lens to hange its focal length by changing the radii of curvature of the eye lens.
2) When the eye is focussed on a distant object, the ciliary muscles are released so that focal length has its maximum value and when the eye is focussed on a closer object, the ciliary muscles are strained so that focal length of eye lens decreases.

3) Thus ciliary muscles adjust the focal length. This accommodation is a wonderful phenomenon through which we are able to see the distant and near objects.
4) If this ciliary muscles are not present, we cannot see the objects beyond a certain distance. If we imagine this we cannot guess our normal life.
Hence the role of ciliary musceles is highly appreciable.

6. Glass is known to be a transparent material. But ground glass is opaque and white in colour. Why ?

Ans. 1) Glass is generally a transparent material because it transmits most of the light incident on it.
2) when glass is ground it's surface becomes rough due to microscopic unevenness.
3) When light is incident on such a rough surface it is reflected in many directions.
4) This type of reflections is known as diffuse reflection. Due to this ground glass is opaque and white in colour.

7. If a white sheet of paper is stained with oil the paper turns transparent. Why ?

Ans. The refractive index of oil and refractive index of paper is same then light passes from oil to paper with out scattering hence the paper become transperent.

8. Geetha can read a book but she does not able to read the letters on backboard clearly.

i) What defect has Geetha ?

ii) Which type of lens she has to use to correct her eye defect ?

Ans. i) Geetha has eye defect 'Myopia'.

$$f = \frac{100}{P} \text{ (in cm)} = -20 \text{ cm}$$

ii) She has to use 'Biconcave lens" to correct her eye defect.

9. Ramu can see the name boards of buses cearly from long distance. But he can not read paper clearly.

i) What type of eye defect has Ramu ?

ii) What kind of lens does Ramu use to correct his eye defect ?

Ans. i) Ramu has eye defect – 'Hyper metropia'
ii) 'Hypermetropia' can be corrected by using 'biconvex lens'.

10. Doctor advised to use 2D lens. What is its focal length ?

Ans. Given power of lens P = 2D

We know that power lens P =

Where f = focal length of the lens

∴ Focal length f =

=

11. A prism with an angle A = 60^0 produces an angle of minimum deviation of 30^0. Find the refractive index of material of the prism.

Ans. Given angle of prism A = 60^0

Angle of minimum deviation D = 30^0

$\therefore$ Refractive index of the material of the prism

$$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$n = \frac{\sin\left(\frac{60^\circ + 30^\circ}{2}\right)}{\sin\left(\frac{60^\circ}{2}\right)}$$

$$= \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = \frac{2}{\sqrt{2}} = \sqrt{2} = 1.414$$

12. Explain an activity for the formation of artificial rain bow.

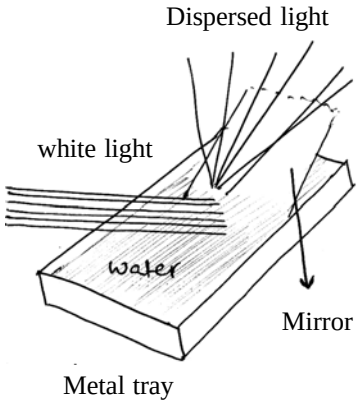
Ans. 1) Take a metal tray and fill it with water.

2) Place a mirror in the water such that it makes an angle to the water surface.

3) Now focus white light on the mirror through the water.

4) Try to obtain colours on a white cardboard sheet kept above the water surface.

5) We can observe the seven colours of VIBGYOR on the card board sheet.

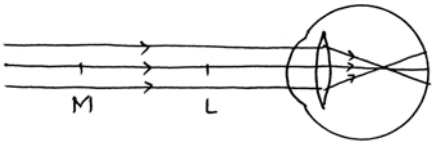


4 Mark Questions

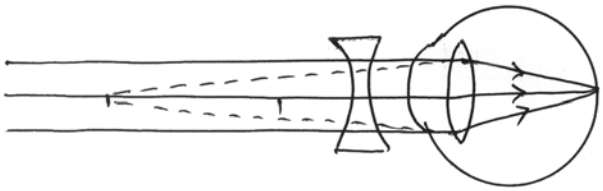
III.1. What is the eye defect Myopia ? How do you correct the Myopia ?

Ans. 1) Some people cannot see object at long distances but can see nearby objects clearly. This type of defect in vision is called myopia (near sightedness)

2) For the people of myopia, maximum focal length is less than 2.5 cm so that the rays coming nfrom distant object after refraction through the eye lens form an image before the retina as shown in the figure.



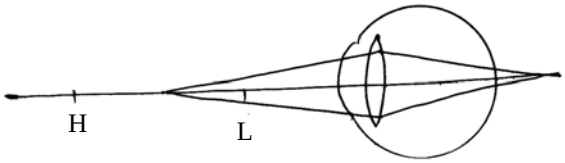
3) The point of maximum distance at which the eye lens can form an image on the retina is called far point (M).
4) The eye lens can form clear image on the retina when an object is placed between far point (M) and point of least distance of distinct vision (L).
5) If we are able to bring the image of the object kept beyond far point, between far point and the point of least distance of distinct vision using a lens.
6) This image acts as an object for the eye lens. This can be possible only when a bi-concave lens is used.



7) To correct one's myopia, we need to select a lens which forms an image at the far point for an object at infinity.
8) We need to select bi-concave lens to achieve this.

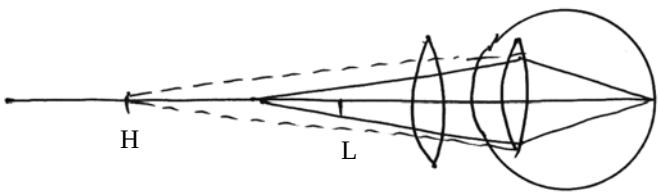
2. What is the eye defect hypermetropia ? Explain the correction of the eye defect Hypermetropia.

Ans. 1) Hypermetropia is also known as far sightedness. A person with hypermetropia can see distant objects clearly but cannot see objects at near distances, because the minimum focal length of eye for the person of hypermetropia is greater than 2.27 cm.
2) In such cases the rays coming from a near by object, after refraction at eye lens, forms an image beyond the retina as shown in figure.



3) The point of minimum distance at which the eye lens can form an image on the retina is called near point.
4) The people with defect of hypermetropia cannot see objects placed between near point (H) and point of least distance of distinct vision (L).
5) Eye lens can form a clear image on the retina when any object is placed beyond near point.
6) To correct the defect of hypermetropia, we need to use a lens which forms an image of an object beyond near point (H), when the object is between near point (H) and least distance of distrinct vision (L).

This is possible only when a double convex lens is used.



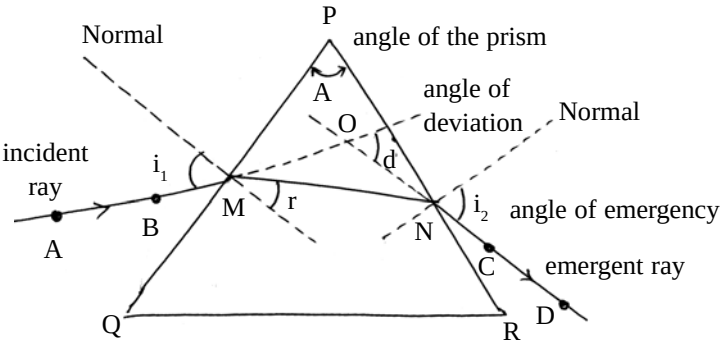
3. How do you find experimentally the refractive index of material of a prism ?

Ans. Aim : To find the refractive index of a prism.

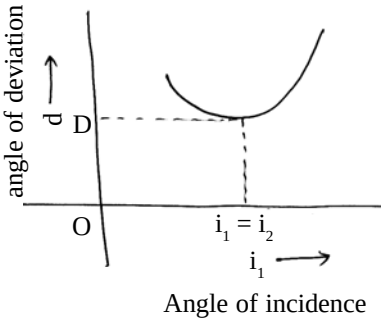
Material required : Prism, Piece of white chart, pencil, pens, scale and protractor.

Procedure :

1) Take a prism and place it on the white chart and draw line around triangular base and measure the angle of prism (A) between the sides PQ, PR.



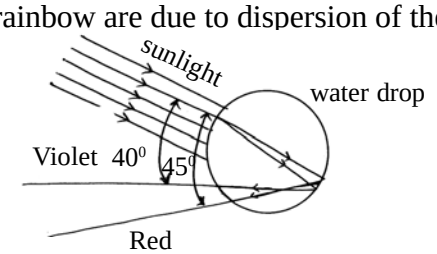
2) Draw a normal to PQ at M and draw a line with 30^0 to the normal. This is incident ray $\overline{AB}$. Fix two ball pins on this ray at A and B.
3) Place the prism in its exact position and Fix another two pins at C and D such that all four pins appear to lie along the same line by seeing the images of pins through the prism from the other side PR.
4) Draw line joining C and D and extend it to meet PR at N this is emerging ray. Draw normal at PR at N and measure the angle between normal at N and emergent ray .
5) If we extent the incident ray AB and emergent ray CD, they meet at O. Measure angle between these two ray and note as angle of deviation.
6) Similarly repeat the process for different angles of incidence and measure corresponding angle of deviation.
7) We draw a graph by taking angles of incident on X-axis and angles of deviation (d) on y-axis, we will get a curve as shown in the figure. Find angle of minimum deviation (D).
8) Now we can calculate the refractive index of the material of the prism by using the formula.



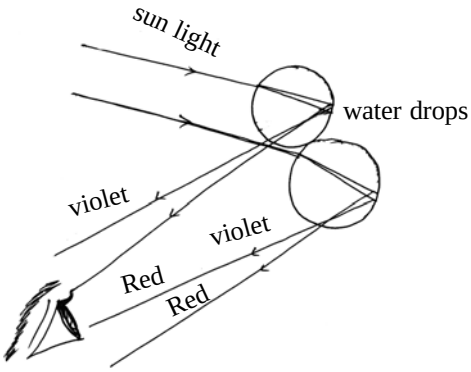
$$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$.

4. Explain the formation of rainbow.

Ans. 1) The beautiful colours of the rainbow are due to dispersion of the sunlight by millions of tiny water droplets.



2) The rays of sunlight enter the drop near its top surface. At this first refraction, the white light is dispersed into its spectrum of colours, violet being deviated the most and red the least.
3) Reaching the opposite side of the drop, each colour is reflected back into the drop because of total internal reflection. Arriving at the surface of the drop, each colour is again refracted into air.
4) At the second refraction the angle between red and violet rays further increases when compared to the angle between those at first refraction.
5) The angle between the incomins and outgoing rays can be anything between 0^0 and about 42^0. We observe rain bow when the angle between incoming and outgoing rays is near the maximum angle of 42^0.
6) Although each drop disperses a full spectrum of colour an observer is in a position to see only a single colour from any one drop depending upon its position.
7) The colour red will be seen when the angle between a beam of sunlight and light sent back by a drop is 42^0. The colour violet is seen when the angle between a sun beam and light sent back by a drop is 40^0.
8) If we look at an angle between 40^0 and 42^0 we can observe the remaining colours of VIBGYOR.



5. Find focal length of a lens suggested to a person with hypermetropia is 100 cm. Then find
i) the distance of near point
ii) power of the lens

Ans. Given focal length of bi convex lens f = 100 cm

i) Let d be the distance of near point. Then

Focal length of lens f =

$$100 = \frac{25\,d}{d - 25}$$

$$100\,(d - 25) = 25\,d$$

$$d - 25 = \frac{d}{4}\ ;\ d - \quad = 25$$

$$= 25$$

$$f = \quad = 33.33 \text{ cm}$$

$\therefore$ Distance of near point d = 33.33 cm

ii) We know that power of lens P =

p = (f = 100 cm)

p = 1D

6. A light ray fals on one of the focas of prism at an angle 40^0. So that it suffer angle of minimum deviation of 30^0. Find the angle of prism and angle of refraction at the given surface.

Ans. Given that angle of incidence $i_1 = 40^0$

Angle of minimum deviation $D = 30^0$

i) at angle of minimum deviation $i_1 - i_2$ (Here i_2 is angle of emergency)

so $A + D = 2i$,

$\therefore A = 2i_1 - D$

$= 2(40^0) - 30^0 = 50^0$

ii) at angle of minimum deviation

Angle of refraction r =

= $= 25^0$

7. A person is unable to see the objects nearer than 50 cm. He wants to read a book placed at distance of 25 cm.

i) Name the defect of the vision he is suffering from

ii) How can it be corrected

iii) What is the power of such lens ?

Ans. i) Since the person is not able to see the objects nearer than 50 cm.

ii) This defect of vision 'hypermetropia' can be corrected by using 'bi–convex lens'.

iii) Given that distance of near point d = 50 cm

If f be the focal length of the bi convex lens we have

f =

$f = \frac{25 \times 50}{50 - 25}$ = = 50 cm

Now power of lens p =

$\therefore$ p = = 2 D

$\therefore$ By using convex lens of power 2D, we can correct given defect of vision.

8. A person cannot see objects beyond a distance of 2 m. Then find

i) What type of eye defect he has ?

ii) What kind of lens he has to use to overcome his eye defect ?

iii) What is focal length of the lens ?

iv) What is power of the lens he has to use ?

Ans. i) Since the person is not able to see the objects beyond 2m, he is suffering from 'Myopia' or short sightedness.

ii) Thiss defect of vision – myopia can be corrected by using 'bi–concave lens'.

iii) Given that distance of far point D = 2m

We know that focal length of lens using to correct myopia is f = –D

Where D is distance of far point.

∴ Focal length of f = – 2m = – 200 cm

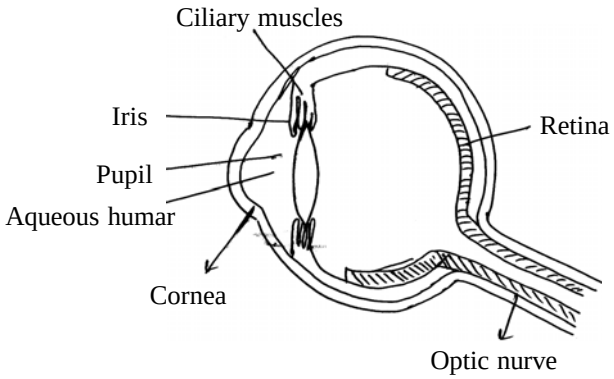
iv) Now power of lens p =

$$= \qquad = -0.5 \text{ dioptre}$$

Here – indicates that it is concanve lens.

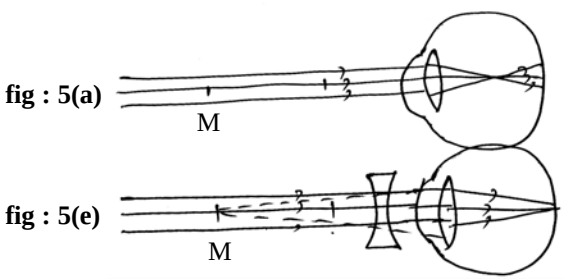
5 Mark Questions

1. Draw the figure showing eye parts. **(T.B. Page 138)**



2. Draw the figures showing how the eye defects occured and how will they corrected.

Myopia : (T.B. Page 141)



Hypermetropia : (T.B. Page 142)

fig : 6(a)

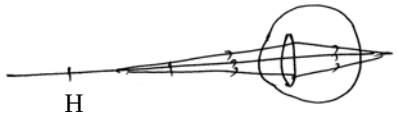
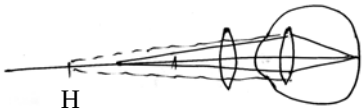


fig : 6(e)



BITS

I. Multiple Choice questions :

1. The size of an object as perceived by an eye depends primarily on ( )

   A) actual size of the object B) distance of the object form the eye

   C) aperture of the pupil D) size of the image formed on the retina

2. When objects at different distances are seen by the eye which of the following remain constant ?

   A) focal length of eye - lens B) object distance from eye lens ( )

   C) the radii of curvature of eye - lens D) image distance from eye lens

3. During refraction ..... will not change. ( )

   A) wave length B) frequency C) speed of light D) all the above

   $\frac{100}{f(cm)}$

4. Far point of a person is 5 m. In order that he has normal vision what kind of spectcles should he use ( )

   A) concave lense with focal length 5 cm B) concave lense with focal length 10 cm

   C) convex lense with focal length 5 cm D) convex lense with focal length 2.5 cm

5. The process of re-emission of absorbed light in all directions with different intensities by the atom or molecule is called ( )

   A) scattering of light B) dispersion of light C) reflection of light D) refraction of light

6. Power of lens = ( )

   A) $\frac{1}{f(cm5)}$ B) C) D)

7. The vision defect when the ability of accommodation of the eye usually decreases with agening

   A) Hypermetropia B) Myopia C) Presbyopia D) Blindness ( )

8. Some time a person may suffer from both myopia and hypermetropia with agening. Then he need to use ( )

   A) bi-concave lens B) bi-convex lens C) bi-focal lens D) cooling lens

9. The splilting of white light into seven colours is due to ( )

A) dispersion B) scattering C) reflection D) refraction

10. The reason for the blue colour of the sky is ( )

A) Reflection B) Refraction C) Dispersion D) Scattering

11. The maximum and minimum focal lengths of eye lens are ( )

A) 24 cm / 22.7 cm B) 2.5 cm / 2.27 cm C) 25 mm/22.7 mm D) B and C

12. Which part of retena identify the colour ( )

A) rods B) cones C) A and B D) none of the above

13. The angle of minimum deviation for an equalateral triangle prism is found to be 30^0. Its refractive index is ( )

A) B) C) D)

14. An equilateral triangle prism is arranged in minimum deviation position for an angle of incidence of 45^0. The angle of minimum deviation is ( )

A) 45^0 B) 60^0 C) 30^0 D) 0^0

15. The colour which has least wavelength in visible spectrum VIBGYOR ( )

A) Violet B) Red C) Green D) Blue

16. Refractive index of material of prism ( )

A) B) C) D)

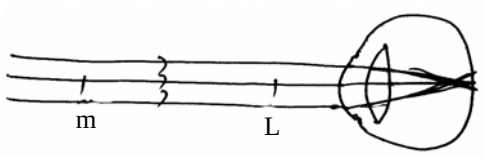
17. If power of lens of 2D then focal length of that lens ( )

A) 100 cm B) 50 cm C) 200 cm D) 25 cm

18. If power of lens is + 0.5 D then that lens is ( )

A) Concave lens of focal length 50 cm B) Convex lens of focal length 50 cm

C) Convex lens of focal length 200 cm D) Concave lens of focal lengeth 200 cm

19. 

The adjacent figure shows which eye defect ? And how it will correct ? ( )

A) Hypermetropia, bi-concave lens B) Myopia, bi-convex lens

C) Hypermetropia, bi-convex lens D) Myopia, bi-concave lens

20. Eye lens adjust its focal length according to distance of object. Which helps for this ? ( )

A) Carnia B) Retina C) Ciliary muscles D) Rods and Cones

II. Fill in the blanks.

1. The value of least distance of distinct vision is about .....
2. Myopia can be corrected by using ..... lens.
3. In minimum deviation position of prism, the angle of incidence is equal to angle of .....
4. The maximum focal length of the eye lens is about .....
5. The distance between the eye lens and retina is about .....
6. The eye lens can change its focal length due to working of ..... muscles.
7. Angle of vision in healthy human is .....
8. The splitting of white light into different colours (VIBGYOR) is called .....
9. If a person can see only near object clearly. Then he is suffering with eye defect .....
10. The ability of eye lens to change its focal length is called .....
11. The shape of rainbow when observed during travel in an aeroplane is .....
12. The reason for formation of rainbow is .....
13. During refraction of light the character of light which does not change is .....
14. The reciprocal of focal length is called .....
15. The angle between incident ray and emergent ray is .....

Answer

I.

1) B	2) B	3) B	4) A	5) A	6) C	7) C
8) C	9) A	10) D	11) D	12) A	13) B	14) A
15) A	16) B	17) B	18) D	19) D	20) C	

II.

1) 25 cm	2) bi-concave lens	3) angle of emergent	4) 2.5 cm
5) 2.5 cm	6) ciliary muscles	7) 60^0	8) dispersion
9) Myopia	10) Accommodation of lens		11) circular
12) dispersion	13) frequency	14) power of lens	15) Angle of Deviation

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8. ATOMIC STRUCTURE

1 Mark Questions

1. What is a spectrum ? How many types of spectrums are there ?

Ans. A group of wave lengths is called spectrum. Spectra are of 2 types. A) Emmisson spectrum B) Absorption spectrum.

2. Which type of spectrum is rain bow ?

Ans. Continuous spectrum

3. What is electron configuration ?

Ans. The arrangement of electrons in shells, sub-shells and orbitals of an atom is called electron configuration.

4. The electron configuration of Helium is $1s^2$. Write the information conveyed by it ?

Ans. He = $1s^2$

'1' denotes principal quantum number

'S' denotes angular momentum quantum number

'2' denotes the number of electrons present in that orbital

5. Raju represented the configuration of Helium atom as $\boxed{\uparrow\uparrow}$ $1s^2$. Which rule is violated in this ?

Ans. Pauli's exclusion principle is violated here. Electrons with paired spoins are donotated by $\boxed{\uparrow\downarrow}$. Opposite spins.

6. Write the values of magnetic quantum number for the sub shell d.

Ans. The angular momentum quantum number (l) for sub shell d is '2'.

So magnetic quantum number m = $2l + 1$

i.e., $2 \times 2 + 1 = 5$.

The values are $-1 - 10 + 1 + 2$

7. What is the maximum value of 'l' for n = 4 ?

Ans. n = 4

so l = n – 1 = 4 – 1 = 3 i.e., 'f' orbital

8. Haw many spin orientations are possible for an electron in an orbital ?

Ans. Two spin orientations are possible for an electron in an orbital i.e., clockwise and anti clock wise. If both are positive values than the spins are parellel otherwise anti parellel.

9. State Pauli's exclusion principle ?

Ans. Pauli's exclusion principle states that no two electrons of the same atom have four quantum numbers same.

10. State Aufbau principle ?

Ans. Aufbau principle states that the lowest energy orbitals are filled first.

11. State Hund's rule ?

Ans. Hund's rule states that the orbitals of equal energy are occupied with one electron each before pairing start's.

12. Write the electronic configuration of calcium atomic number 20 ?

Ans. Ca Atomic number (z) = 20

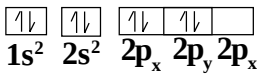
= $1s^2\ 2s^2 2p^6 3s^2 3p^6 4s^2$

13. Among Red and blue colours which is having high energy – Give reason ?

Ans. Blue colour is having high energy. This is because the wavelength of blue colour is less than red colour. The colour with lower wave length has higher frequency.

14. Following orbital diagram shows the electron configuration of oxygen atom. Which rule does not support this ? **(As–1)**

O = 8



Ans. Hund 's rule because degenerate orbitals are filled first then pairing starts.

15. An electron in an atom has the following set of four quantum numbers to which orbital it belong to and name that element ?

n	l	m	s
2	0	0	$-\frac{1}{2}$

$\frac{1}{2}$

Ans. It belong to $2s^2$.

Name of the element is Beryllium.

16. Write the four quantum numbers for $1s^1$ electron ?

Ans.

n	l	m	s
1	0	0	+

17. Why ar Bohr's orbits called stationary orbits ?

Ans. As long as the electron is revolving in an orbit it's energy is same. Hence these orbits are called stationary orbits.

18. Write Planck's equation and write what each letter represents in that equantion.

Ans. $E = h\lambda$

Here E = Energy of radiation

h = Planck's constant

λ = frequency of the radiation absovbed / emitted

19. When do we get Atomic line spectra ?

Ans. Atomic line spectra arise because of absorption or emmission of certain frequencies of light energy.

2 Mark Questions

II.1. Write the differences between Orbit and Orbital ?

Ans.

Orbit	Orbital
1. The path of the electrons which revolves around the the nucleus is called orbit.	1. The space around the nucleus where the probability of finding the electron is maximum is called orbital
2. Orbits are circular and non-directional.	2. Orbitals have definite shape. Except 's' orbital other orbitals are directional.

2. The wave length of a radio wave is 1 m. Find its frequency ?

Ans. Wave length of a wave = 1 m

Speed of light = 3×10^8 m/sec.

Frequency = ?

$C = \lambda$

$3 \times 10^8 = \quad \times 1$

$= \qquad = 3 \times 10^8$ Hez.

3. Krishna said that, "The velocity of an electron and its exact position can not be determined at a time". Do you agree with this statement explain.

Ans. Yes, I agree with the statement of Krishna. Because electrons are very small. To know its position light of very short wave length is required. This short wave length light interacts with the electron and disturbs the motion of the electron. Hence it is not possible to determine its position and velocity accurately.

4. Write the four quantum numbers for the differenting electron of potassium atomic number 19 ?

Ans. K = 19 = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$.

The last electron enters into 4s orbital. So the four quantum numbers are as follows

n	l	m	s
4	0	0	$+\frac{1}{2}$

5. The Electronic configuration of an element 'X' is given as belon, observe it and Answer the Questions ?

X = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$

A) Name the element 'X'

B) Which is the outer most shell ?

Ans. A) Name of the element 'X' is Scandium.

B) Outer most shell is '4'.

6. Write the electronic configuration of copper atomic number 29. Which rule is deviated ? Then why is it so ?

Ans. Cu = 29 = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

Aufbau principle is deviated here.

Lower energy 4s is not complete filled.

But this is because half filled and completely filled orbitals are stable.

7. What is ground state and excited staten? Does the electron remains in the excited state forever ?

Ans. Lowest energy stte of the electron is known as ground state. By gaining energy it moves to a high energy level called excited state. The electron does not remain in the excited state for ever. By loosing energy the electron come back to its ground state.

4 Mark Questions

III.1. Write the values of Angular momentum Quantum number, Magnetic quantum number, number of electrons present in the orbitals of principal quantum number '2'.

Ans.

Principal quantum number	**Angular momentum qunatum number (l)**	**Magnetic qunatum number 2l + 1**	**Orbital notation**	**Number of electrons present in the orbitals**
2	0	0	2s	2
	1	–10 + 1	2p	6

2. What is (n + l) rule ? On its basis explain the order of filling of 3d, 4s and 4p orbitals.

Ans. 1) Electrons enter into the orbitals in the increasing order of (n + l) values.

2) If two orbitals have same (n + l) value, the electrons enter into the orbital which has lower 'n' value.

3)

Orbitals	(n + 1) value
3d	3 + 2= 5
4s	4 + 0 = 4
4p	4 + 1 = 5

4) So, the electrons first enter into 4s then 3d and then 4p.

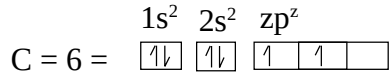
3. By considering carbon as an example explain Hunds rule ?

Ans. 1) Hunds rule states that electron pairing takes place only after filling all the available degenerate orbitals with one electron each.

2) **Ex :** Carbon. Its atomic number is '6'. So it is having six electrons.

3) The first 4 electrons goes into 1s and 2s orbitals.

4) The next two electrons enter into 2p orbitals with both electrons having same spin.



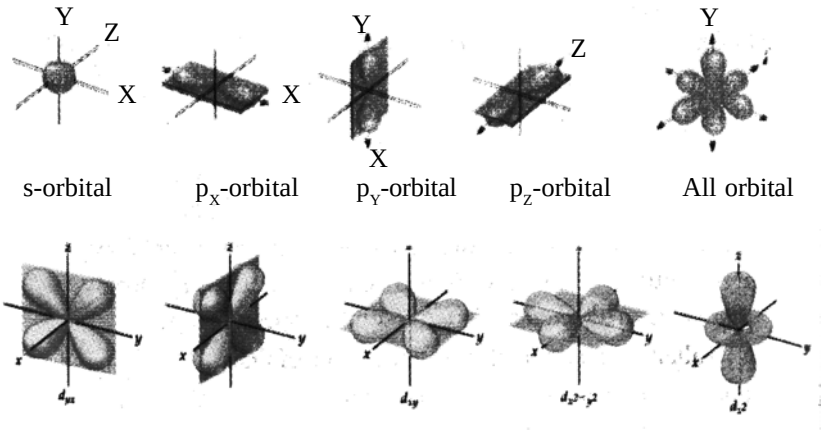
4. **In an atom the number of electrons in M shell is equal to the electrons present in the L shell. Consideing K shell as the first shell.**
   Answer the following questions.
   A) Which is the outer most shell.
   B) How many electrons are there in its outer most shell ?
   C) What is the atomic number of that element ?
   D) Write the electronic configuration of that element ?

Ans. Number of electrons in K shell = 2
Number of electrons in L shell = 8
Number of electrons in M shell = 8
A) Outer most shell is M.
B) 8 electrons are there in its outer most shell.
C) The atomic number of that element is 18.
D) The electronic configuration is $1s^2 2s^2 2p^6 3s^2 3p^6$

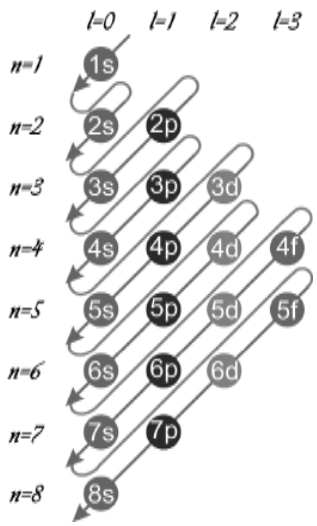
5 Mark Questions

1. **Draw the diagrams of the orbitals having. Spherical, Dumbell, double dumbell.**

Ans.



2. **Draw the chart showing the filling order of atomic orbitals (Moeller chart).**



BITS

I. Multiple Choice questions :

1. Planck's constant ( )
   A) 6.626×10^{-32} JS B) 6.626×10^{-34} JS C) 6.626×10^{-27} JS D) 6.626×10^{39} JS
2. Hydrogen spectrum is ( )
   A) Line spectrum B) Band spectrum C) Green spectrum D) Violet spectrum
3. Quantum mechanical model of an atom was proposed by ( )
   A) Neil Bohr B) Sommer feld C) Ludwig planck D) Erwin schordinger
4. Size and energy of the main shell was given by ( )
   A) n B) l C) m D) s
5. The 'l' value of 'f' orbil is ( )
   A) 1 B) 2 C) 3 D) 4
6. Magnetic quantum number (m_l) values can be known from ( )
   A) n B) n – 1 C) $2l + 1$ D)
7. Maximum number of electrons that can be accomorated in 'd' sub shell is ( )
   A) 7 B) 5 C) 10 D) 14
8. In the equation $c = \lambda$ the letter that represents frequency is ( )
   A) C B) $\frac{1}{\lambda}$ C) $\frac{1}{\lambda^2}$ D) h
9. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ is the electronic configuration of ( )
   A) Potassium B) Phosphorus C) Sulphur D) Argon
10. 'P' orbital starts from ..... orbit. ( )
    A) 1 B) 2 C) 3 D) 4

II. Matching.

1. Scandium	( )	A.	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$
2. Aluminium	( )	B.	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$
3. Copper	( )	C.	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$
4. Neon	( )	D.	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$
5. Chromium	( )	E.	$1s^2\ 2s^2\ 2p^6$
		F.	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2$

Answer

I. 1) B 2) A 3) D 4) A 5) C 6) C 7) C
8) B 9) C 10) B

II. 1) B 2) D 3) A 4) E 5) C

❖ ❖ ❖ ❖❖

9. CLASSIFICATION OF ELEMENTS - PERIODIC TABLE

1 Mark Questions

1. Which group of elements are called chalcogens.

Ans. The elements in a group 16 (VIA) which form ores with elements are called chacogens.

2. Which group elements has electronic configuration of ns^2 or ns^2np^6.

Ans. VIII A group elements have the configuration of ns^2 or ns^2np^6.

3. How does the metallic character changes in periods and groups.

Ans. 1) The metallic character increases as we move along a group.
2) The metallic character decreases as we move along a period (from left to right).

4. How does the valency changes in periods from left to right.

Ans. In periods the valence has increased from 1 to 4 and after decreased from 3 to 1. In group valence has not changed.

5. The Element X Belongs to 4^{th} period and 5^{th} group. Write the no of valence electrons, Valency and state whether it is metal or non-metal.

Ans.

X element belongs to 4^{th} period and 5^{th} group	**:**	Arsenic
Valence	**:**	03
Metallic character	**:**	metalloid

2 Mark Questions

II.1. Write the limitations of law of triads.

Ans. Limitations :

i) All the then known elements could not be arranged in the form of triads.
ii) The law failed for very low mass or for very high mass elements. In case of F, Cl, Br, the atomic mass of Cl is not an arithmetic mean of atomic masses of F and Br.
iii) As the techniques improved for measuring atomic masses accurately, the law was unable to remain strictly valid.

2. Why the elements are classified.

Ans. They approximately more than 115 elements. We cannot easily understand chemical and physical properties of it. So there is a necessicity to classify the elements.

3. What is Dobereiner triad ? Give Two examples to it.

Ans. Dobereiner discovered that "The relative atomic mass of the middle element in each triad was close to the average of the relative atomic masses of the other two elements". This statement is called the Dobereiner's law of Triads.

Li : 07	Ca : 40	Cl : 35.5
Na : 23	Sr : 87.5	Br : 80
K : 39	Ba : 137	I : 127

4. Why lanthanides and actinides are placed separately at the bottom of the periodic table.

Ans. The properties of these elements does not coincide with other elements because the valance electron enters in to 4f and 5f orbitals respectively. So they are placed separately at the bottom of the periodic table.

5. Define modern periodic law ? How many periods and groups are present.

Ans. Modern Periodic Law : "The physical and chemical properties of elements are the periodic function of the electronic configurations of their atoms". The modern periodic table has eighteen vertical columns known as groups and seven horizontal rows known as periods.

6. The Atomic Numbers of elements A, B, C, D and E are 7, 10, 12, 41, 88 respectively.

a) Which have same chemical properties.

b) Which are inert in nature.

c) Which belongs to 3rd period.

d) Which belongs to non metallic group.

Ans. A) C & E B) B C) C D) A

7. The atomic number of element is 16.

a) What is its valency

b) belongs to which group

c) Name of the element

d) Metal or non-metal

Ans. a) 2 b) VI A Group c) Sulphur d) Non metal

8. X, Y and Z elements has electronic configuration as mentioned below.

X = 2, Y = 2, Z = 2, 8, 2

a) Which belongs to Group II

b) Which belongs to II period

c) Which is inert in nature

Ans. a) The element "Y" belongs to II Group

b) The Valence of the element Z : 2 so it belongs to II period

c) The X element has completely filled outer most orbital. So it belongs to Inert Group.

9. Identify the element that has the lower Ionization energy in each pair of the following

i) Mg or Na ii) Li or O iii) Br or F iv) K or Br

Ans. Ionization energy decreases as we go down in a group and generally increases from left to right in a period.

a) Mg Or Na : Mg. Na are belongs to same period. Na has lower I.E Value

b) Li or O : Li has lower I.E Value.

c) Br or F : Br and F are belongs to same group. Br has less I.E Value.

d) K or Br : K and Br are belong to same period. K has less I.E Value.

10. The electronic Configuration of the A, B, C, D elements are

A) $1s^2 2s^2$

B) $1s^2 2s^2 2p^6 3s^2$

C) $1s^2 2s^2 2p^2 3s^2 3p^6$

D) $1s^2 2s^2 2p^6$

1. Which belongs to same period

2. Which belongs to same group

3. Which are inert

4. C element belongs to which Group and Period

Ans. 1) B and C are belongs to same period.

2) A and B are belongs to same group.

3) D belongs to inert gas.

4) C element belongs to 3 period and V A group.

4 Mark Questions

III. 1. Write the newlands law of octaves and drawbacks of this rule ?

Ans. Newlands law of octaves states that when elements are arranged in the ascending order of their atomic masses they fall into a pattern in which their properties repeat at regular intervals. Every eighth element starting from a given elements resembles in its properties to that of the starting element.

a) Certain elements, totally dissimilar in their properties, were fitted into the same group.

b) The law was not valid for elements that had atomic masses higher than Calcium.

c) Newland's periodic table was restricted to only 56 elements.

2. a) Why the elements are classificed :

b) What is the properity has to taken for classifying the elements by mendeleeff.

c) In mendeleefs periodic table some gaps are not filled by the elements ? Why.

Ans. a) They approximately more than 115 elements. We cannot easily understand chemical and physical properties of it. So there is a necessicity to classify the elements.

b) Mendeleeff's states that the physical and chemical properties of the elements are a periodic function of their atomic weights".

c) Based on the arrangement of the elements in the table he predicted that some elements were missing and left blank spaces at the appropriate places in the table. Mendeleff believed that some new elements wouldbe discovered definitely.

3. What are the main properties of mendeleef periodic table ? What are the limitations.

Ans. **The Periodic Law :** Based on Mendeleeff's observations regarding the properties of elements in the periodic table, a law known as the periodic lw of the properties of elements was proposed.

"The law states that the physical and chemical properties of the elements are a periodic function of their atomic weights".

Salient features and achievements of the Mendeleeff's periodic table :

1) Groups and sub-groups : There are eight vertical columns in Mendeleff's periodic table called as groups. They are represented by Roman numerals I to VIII. Elements present in a given vertical column (group) have similar properties. Each group is divided into two sub-group 'A' and 'B'. The elements within any sub-group resemble each other to great extent. For example, sub-group IA elements called 'alkali metals' (Li, Na, K, Rh, Cs, Fr) resemble each other very much.

2) Periods : Thehorizontal rows in Mendeleeff's periodic table are called periods. There are sevenperiods in the table, which are denoted by Arabic numerals 1 to 7. A period comprises the entire range of elements after which properties repeat themselves.

3) Predicting the properties of missing elements : Based on the arrangement of the elements in the table he predicted that some elements wre missing and left blank spaces at the appropriate places in the table. Mendeleef believed that some new elements would be discovered definitely. He predicted the properties of these new additional elements in advance purely depending onhis table. His predicted properties wre almost the same as the observed Properties of those elements after their discovery. He named those elements tentatively by adding the prefix 'eka' (eka is a Sanskrit numeral means one) to the name of the element immediately above each empty space. The predicted the properties of elements namely eka-aluminium, ekaboron, eka-aluminium and eka-silicon were close to the observed properties of Scandium, Gallium and Germanium respectively whichwere discovered later.

Limitations of Mendeleeff's periodic table :

1. Anomalous pair of elements : Certain elements of highest atomic mass precide those with lower atomic mass. For example, tellurium (atomic mass 127.6) precedes iodine (atomic mass 126.9)

2. Dissimilar elements placed togehter : Elements with dissimilar properties were placed in same group as sub-group A and sub-group B. For example, alkali metal like Li, Na, K etc., of IA group have little resemblance with coinage metals like Cu, Ag, Au of IB group.

3. Some similar elements separated : Some similar elements like 'copper and mercury' and 'silicon and thalium' etc are placed in different groups of the periodic table.

4. Write the name of elements of imagine by mendeleef ? Write their names given by mendeleef ?

Ans. Predicting the properties of missing elements : Based on the arrangement of the elements in the table he predicted that some elements were missing and left blank spaces at the appropriate places in the table. He named those elements tentatively by adding the prefix 'eka' (eka is a Sanskrit numeral means one) to the name of the element immediately above each empty space. The predicted the properties of elements namely eka-aluminium, eka-boron, eka-aluminium and eka-silicon were close to the observed properties of Scandium, Gallium and Germanium respectively which wre discovered later.

5. Define the modern periodic law ? Discuss the contructionof the long form of periodic table.

Ans. Modern Periodic table : Based on the modern periodic law the physical and chemical properties of atoms of the elements depend not on the number of protons but on the number of electrons and their arrangements (electronic configurations) in atoms. Therefore, the modern periodic law may be stated as "The physical and chemical properties of elements are the periodic function of the electronic configurations of their atoms".

1. The modernperiodic table has eighteen vertical columns known as groups and seven horizontal rows known as periods and also arranged the elements in a period according to Atomic number.
2. The elements with similar outer shell (valence shell) electronic configurations in their atoms are inthe same column called group.
3. Depending upon to which sub-shell the diferentiating electron. i.e., the last coming electron enters in the atom of the given element, the elements are classified as 's' 'p', 'd' and 'f' block elements.

a) The elements with valence shell electronic configuration from ns^2np^2 to ns^2np^2 are called p-block elements.

b) The s-block and p-block elements together known as Representative elements. The elements with valence electronic configuration ns^2np^6.

c) nd to ns^2np^6 nd^{10} are called d-block elements. In d-block elements as we move from left to right in periodic table, we observe a transition of elements from metals, to non-metals. Hence we call d-block elements as "Transition elements".

d) The elements in which f-orbitals are being filled in their atoms called f-block elements. These elements are also called "inner transition elements".

Periods : The horizontal rows in the periodic table are called periods. They are seven periods in form of periodic table. These periods are represented by Arabic numerals 1 through 7.

1. They are only two elements in first period e.g., hydrogen (H) and helium (He).
2. They are only Eight elements in Second and Third periods.
3. The fourth and 5^{th} period contains 18 elements.
4. The 6^{th} period contains 32 elements.
5. The seventh period is incomplete period.

'4f' elements are called Lanthanoids or Lanthanides. Elements from $_{58}Ce$ to $_{71}Lu$ possess almost the same properties as $_{57}La$. So they are called lanthanoids. The 5f elements are called Actinoids also known as Actinides they are from $_{90}Th$ to $_{103}Lr$.

The f-block elements known as lanthanoids and actinoids are shown separately at the bottom of the periodic table.

6. Explain how the elements are classified into S, P, D and Fblock elements in the periodic table and give the advantage of t his kind of classification.

Ans. Depending upon the which sub-shell the differentiating electron i.e., the last coming electron enters in the atom of the given element, the elements are classified as 's' 'p', 'd' and 'f' block elements.

S Block Elements : The elements with valence shell electronic configuration ns^1 np^6 are called **P-block elements :** The s-block and p-block elements together known as Representative elements.

D Block Elements : The elements with valence electronic configuration $ns^2np^6nd^1$ to $ns^2np^6nd^{10}$ are called d-block elements. In d-block elements as we move fromleft to right in periodic table, we observe a transition of elements from metals, to non-metals. Hence we call d-block elements as "Transition elements".

F Block Elements : The elements in which f-orbitals arebeing filled in their atoms called f-block elements. These elements are also called "inner transition elements".

Advantages :

1) The systematic grouping of elements into groups made the study simple.
2) Each period begins with the electron entering a new shell and ends with the complete filling of S and P sub shells of that shell.

7. Elements in a group generally posses similar properties but elements along a period have different properties. How do you explain this statement.

Ans. 1) Physical and chemical properties of elements are related to their electronic configuration, particularly the outer shell configuration.

2) Therefore all the elements in a group should have similar chemical properties.
3) Similarly, across the table from left to right in any period, elements get an increase in the atomic number by one unit between any two successive elements.
4) Therefore, the electronic configuration of valence shell of any two elements in a period is not same. Due to this reason, elements along a period possess diferent hemical properties.

8. Identify the element that has the alrger atomic radius in each pair of the following.
i) Mg or Ca ii) Li or Cs iii) N or P iv) B or Al

Ans. Atomic radii of elements decrease across a period from left to right and increase in groups from top to bottom.

i) Mg or Ca : The atomic radius of Ca is greater than Mg because both element are belongs to same group but the atomic number of Calcium is more than Mg. Therefore to accommodate more number of electrons, more shells are required.

ii) Li or Cs : The atomic radius of Ca is greater than Li because both element are belongs to same group but the atomic number of Cs is more than Li. Therefore to accommodate more number of electrons, more shells are required.

iii) N or P : The atomic radius of P is greater than N because both element are belongs to same group but the atomic number of P is more than N. Therefore to accommodate more number of electrons, more shells are required.

ii) B or Al : The atomic radius of Al is greater than B because both element are belongs to same group but the atomic number of Al is more than B. Therefore to accommodate more number of electrons, more shells are required.

9. What is ionization energy ? What are the factors influence it.

Ans. Ionization Energy : The energy required to remove electron from the outer most orbit or shell of a neutral gaseous atom is called ionization energy. The following factors are influenced on Ionization energy.

a) Nuclear Charge
b) Secreening Effect
c) Penetrating power of the orbitals
d) Stable configuration
e) Atomic Size

10. Define atomic radius ? How does the property has change in Groups and periods.

Ans. The half of the distance between two nuclei outer most orbital is called atomic radius.

Atomic radii increase from top to bottom in a group (column) of the periodic table. As we go down in a group, the atomic number of the element increases.

Atomic radii of elements decrease across a period from left to right. As we go to right, electrons enter into the same main shell. Hence, the nuclear attraction on the outer shell increases. As a result the size of the atom decrease.

11. How do the following properties change in Groups and periods
a) Ionisation Energy b) Electronic affinity c) metallic and nonmetallic nature

Ans. a) Ionisation Energy :

Period : When we move from left to right it does follow a regular trend but generally increases due to increase in atomic number.

Group : In groups from top to bottom, the ionization energy decrease due to increase in atomic size.

b) Electronic affinity :

Period : Electron affinity values increases from left to right in a period.

Group : Electron affinity values decrease from top to bottom in a group.

c) metallic and nonmetallic nature :

Period : Metallic nature decrease from left to right in a period and increase nonmetallic nature.

Group : Metallic nature increase from top to bottom in a group.

12. How do you appreciate the role of electronic configuration of the atoms of elements in periodic classification ?

Ans. 1) Modern periodic table is based on electronic configuration. So elements are arranged in ascending order of their atomic number.

2) The chemical properties of elements depends on valence electrons the elements in same group has same number of valence electrons. So the elements belongs to same group have similar properties.

3) So the construction of modern periodic table mainly depends on electronic configuration.

4) Certain elements of highest atomic mass precede those with lower atomic mass. This type of Anomalous pair of elements are also rectified in Modern periodic table.

5) Hence electronic configuration play a major role in the preparation of Modern periodic table. So it is appreciated.

BITS

I. Fill in the blanks.

1. The scienctist who classified elements first is .....
2. Li, Na, K are examples for .....
3. According Mendeleeff physical and chemical properties of elements are periodic functions of .....
4. Ek-Born proposed by mendelee H after named as .....
5. Modern periodic table was prepared based on the elements .....
6. In mendaleeff's periodic table ..... group are prensent.
7. Modern periodic table was prepared by .....
8. The in complete period in modern period table is ..... period.
9. In the modern periodic table ..... groups are present.
10. In the modern periodic table ..... periods are present.
11. The electronic configuration of as element is $1s^2 2s^2 2p^6 3s^2$ the it belongs ..... period.
12. The electronic configuration of as element is $1s^2 2s^2 2p^4$ then it belongs to ..... block.
13. The valency of noblegases is .....
14. The same group elements has same .....
15. In a group from top to bottom metlic nature .....
16. It atomic size of 'A' is less than 'B' than ionisation energy of is ..... than B.
17. Transition elements are called ..... block elements.
18. f-block elements are known as ..... elements.

19. Among Na, Na^+ ..... has least atomic radiis
20. The elements from atomic number 58 to 71 are called as .....
21. The elements from atomic number 90 to 103 are called as .....
22. If 'A' belongs to 3rd period 'B' belongs 4th periods then ..... has more atomic radius.
23. Most electronegative element is .....
24. Least electronegative element is .....
25. Due to increase in screening effect value ..... decreases.
26. The electronic configuration of Cr is .....
27. The electronic configuration of Cu is .....
28. If an element beongs to 3rd period then its valency is .....
29. Electromegetivty scale was invented by .....
30. The noble gas which does's has octet configuration in outer most shall is .....

II. Matching.

a) 1.	Alkali earth metals	( )	A.	IA groups
2.	Helogens	( )	B.	Gallions
3.	Noblegases	( )	C.	IIA groups
4.	Alkali meatals	( )	D.	VIIA groups
5.	Ek-Aluminium	( )	E.	O' group
b) 1.	Cl, Br, I	( )	A.	pM
2.	Atomic radius	( )	B.	KJ mol^{-1}
3.	Ionisction energy	( )	C.	Dobereiser
4.	S, P block element	( )	D.	configuration
5.	ns^2, np^6	( )	E.	representative elements

Answer

I. 1) Doberiner 2) Dobreiner triod 3) Atomir weight 4) Seandium
5) electronic configuration 6) 8 7) H–J Moseley
8) 7th period 9) 18 10) 7 11) 3
12) p 13) 0 14) valency eletronic configuration
15) increase 16) more 17) 'd' block 18) inner transtion
19) Na^+ 20) Lanthanides 21) Actinides 22) 'B' element
23) Fluorine (F) 24) Cesium (Cs) 25) Ionisation energy 26) [Ar] $4s^1$ $3d^5$
27) [Ar] $4s^1 3d^{10}$ 28) 3 29) pauling 30) Helium (He)

II. a) 1) C 2) D 3) E 4) A 5) B

b) 1) C 2) A 3) B 4) E 5) D

❖ ❖ ❖ ❖❖

10. CHEMICAL BONDING

1 Mark Questions

1. Give examples of elements which are stable in their atomic state ?

Ans. Helium, Neon, Argon, Krypton, Xenon, Radon are stable in their Atomic state.

2. Why the Noble gases are least reactive ?

Ans. Except Helium other Noble gases have eight electrons in their outer most shell. i.e., why Noble gases are least reactive.

3. What is octet rule ?

Ans. Presence of eight electrons in the outermost orbit is called octet rule.

4. Why is the chemical formula of water is H_2O why not HO_2 ?

Ans. The valency of hydrogen is one (1) Valency of oxygen is two (2) So two hydrogen atoms shares 'Their electron with one oxygen atom. i.e., why the chemical formula of water is H_2O.

5. Name the bond formed between Alkalimetals and Halogens ?

Ans. Inoic bond is formed between Alkalimetals and Halogens.

6. What type of bond is formed in 17^{th} group / VII A group elements ?

Ans. Covalent bond

7. What is coordination number ? Write the coordination number of sodium chloride ?

Ans. The number of ions of opposite charge that surround a given ion of given charge is known as co-ordination number.

Co-ordination number of solid sodium chloride is 6.

8. Write the conditions that are favourable for the formation of cations ?

Ans. The atoms of elements with low conisation energy, low electron affinity high atomic size and low electro negativity form cations.

9. Write the conditions that are favourable for the formation of anions ?

Ans. The atoms of elements with high ionisation potential, high electron affinity, small atomic size and high electro negitivity form anion.

10. Give example for ionic compounds ?

Ans. Sodium chloride (NaCl), Magnesium chloride ($MgCl_2$), Aluminium chloride ($AlCl_3$).

11. Give examples for covalent compounds ?

Ans. Oxygen molecule (O_2), Nitrogen molecule (N_2), Methane molecule (CH_4), Ammonia molecule (NH_3), water molecule (H_2O).

12. Explain the difference between the valence electrons and the covalency of an element ?

Ans. **Valence electrons :** The electrons present in the outer most orbit of an atom are called valence electrons.

Covalency : The total number of covalent bonds that an atom of an element forms is called its covalency.

13. Bond length of F_2 is 1.44 A°. What does it mean ?

Ans. The equilibrium distance between the nuclei of two fluorine atoms is 1.44 A^0.

14. The Bond dissociation energy of H – F molecule (Hydrogen fluorid) molecule is 570 KJ mol^{-1}. What does it mean ?

Ans. 570 KJ mol^{-1} energy is needed to break the covalent bond of hydrogen fluoride molecule.

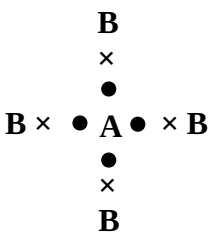
2 Mark Questions

II.1. What is VSEPRT (theory) ? Who proposed it ?

Ans. 1) To explain the bond angles inthe molecules through covalent bonds the valence-shell-electron pair repulsion theory was proposed.

2) This theory was proposed by sidgwick and powell and improved by Gillespie and Nyhlan.

2. A chemical compound has the following Lewis notation :



A) Write the valence electrons of A.

B) Write the valence electrons of B.

C) How many covalent bonds are there in the molecule.

D) Suggest a name for the elements A and B.

Ans. A) 4 B) 1 C) 4 D) CH_4

3. The electronic configuration of X, Y are given belon.

$X = 1s^2 2s^2 2p^6 3s^2 3p^1$

$Y = 1s^2\ 2s^2 2p^4$

Answer the following questions.

1) What is the valency of X ?

2) Which will form Anion ?

3) Which will form cation ?

4) What is the valency of X ?

Ans. 1) Valecny of X = 3

2) 'Y' will form Anion

3) 'X' will form Cation

4) Valency of Y = 2

4. Why do only valence electrons involve in bond formation why not electrons of inner shells ?

Ans. The nucleus and the electrons in the inner shell remain unaffected as they arenot exposed directly when atoms come close together. But the electrons in the outer most shell of an atom get affected. Thus the valence electrons are responsible for the formation of bond between atoms.

5. What are Lewis symbols ? What is the significance of Lewis symbols ?

Ans. The symbol of the element, surrounded by the valence electrons of its atom, represented in the form of dots around it is known as Lewis symbols or electron dot symbols.

Significance :

1) The number of dots present around the symbol gives the number of electrons present in the outer most shell. i.e., number of valence electrons.
2) The common valency of the element is equal to the number of dots around the symbol.

6. What are the Draw backs of electronic theory of valence ?

Ans. 1) When covalent bond is formed between any two atoms, irrespective of the nature of the atoms, the bond lengths and bond energies are expected to be the same. But practically it was observed that bond lengths and bond energies are not same when the atoms that form the bond are different.
2) If fails to explain the shapes of the molecules.

7. Why VESPER THEORY is proposed ? What is the draw back of this theory ?

Ans. To explain the bond angles in the molecules with 3 or morethan 3 atom with all atoms attached to a central atom through covalent bonds. VESPER Theory was proposed.

Drawback : VESPER theory does not explain the strongths of the bonds.

4 Mark Questions

III.1. An element X has electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2$
An element Y has electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
What type of bond is formed between then ? Explain ?

Ans. 1) The electronic configuration of X = $1s^2\ 2s^2\ 2p^6\ 3s^2$
2) It contains 2 electrons in its outer most orbit. $X \xrightarrow{-ze^-} X^{2+}$
3) It looses its 2 electrons to attain the stable structure of Ne.

4) The electronic configuration of Y = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
5) It has 7 electrons in its outer most orbit. To attain the stable structure it requires are electron.
6) $Y \xrightarrow{+e^-} Y^-$
7) The two electrons of X is transformed to 2y atoms.
8) The bond formed is Ionic bond
$X^{2+} + 2y^- \longrightarrow XY_2$

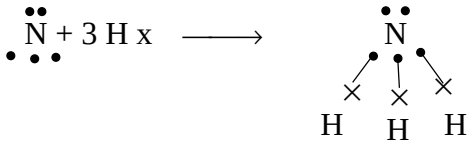
2. Two chemical reactions are described below.
1) Nitrogen and hydrogen react to form ammonia.
2) Carbon and hydrogen react to form a molecule of methane.
For each reaction give
a) The valency of each of the atoms involves in this reaction.
b) The Lewis structure of the product that is formed.

Ans. A) The valency of each of the atoms involved in this reaction.
N = 7 = $1s^2\ 2s^2\ 2p^3$ Valency = 3
H = 1 = $1s^1$ Valency = 1
C = 6 = $1s^2\ 2s^2\ 2p^3$ Valency = 4

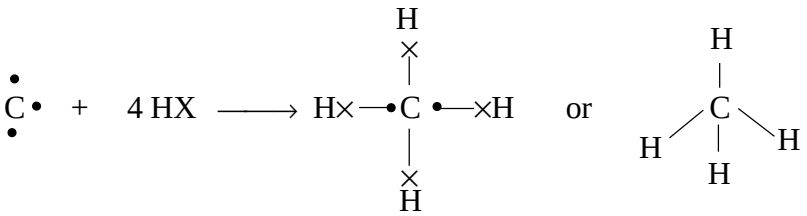
Note : 1) Valency of VA group and above is 8 – group number.

2) Group number becomes valency up to IV A.

B) $N + 3H \longrightarrow NH_3$ (Ammonia)



$C + 4\,H \longrightarrow CH_4$ (Methane)



3. Usha said the bond angle of water $109^0 28^1$. But priya told the bond angle of water is decreased to $104^0 31^1$. How priya told this – Explain ?

Ans. 1) Priya told the bond angle of water is $104^0 31^1$ on the basis of Hybridisation.

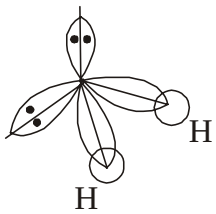
2) Hybridisation is a phenomenon of inter mixing of atomic orbitals of almost equal energies of an atom and their redistribution into an equal number of identical orbitals.

3) Oxygen = 8 = $1s^2 2s^2 2p^4$. The valence orbital of oxygen atom has one 2s orbital and three 2p orbitals ($2p_x$, $2p_y$, $2p_z$) inter mix and redistribute into for identical sp^3 orbitals.

4) Among the six outer most electrons two sp^3 orbitals get pairs and the sp^3 orbitals get one electron each.

5) The two sp^3 orbitals of oxygen atom overlap with 's' orbitals of two hydrogen atoms giving σ sp^3 – s bonds.

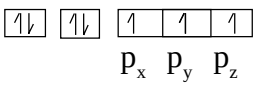
6) Due to the lone pair - lone pair repulsions and lone pair bond pair repulsions the bond angle of water decreases from $109^0\ 28^1$ to $104^0 31^1$.



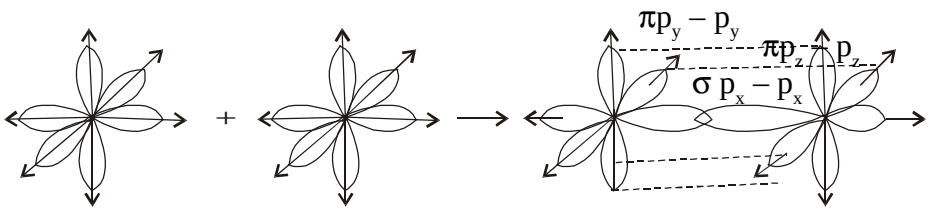
4. Explain the formation of Nitrogen molecule on the basis of valence bond theory ?

Ans. 1) A covalent bond between two atoms is formed when the two atoms approach each other closely and one atom overlaps its valence orbital containing unpaired electron with the valence orbital of the other atom that contains un paired electron of opposite spin. The paired electrons in the over lapping orbitals are attracted to the nuclei of both the atoms.

2) **Ex :** Nitrogen = Z = 7 = $1s^2\ \ 2^2\ \ 2p^3$



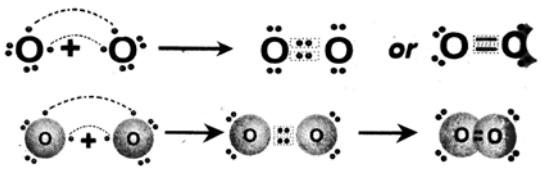
3) p_x orbital of one Nitrogen atom overlaps with the p_x orbital of the other Nitrogen atom giving $\sigma\ p_x - p_x$ bond along the inter nuclear axis.
4) p_y and p_z orbitals of one 'N' atom overlap the p_y and p_z orbital of other 'N' atom laterally, perpendicular to inter nuclear axis giving $\pi p_y - p_y$ and $\pi p_z - p_z$ bonds.
5) Thus N_2 molecule has a triple bond between two Nitrogen atoms.



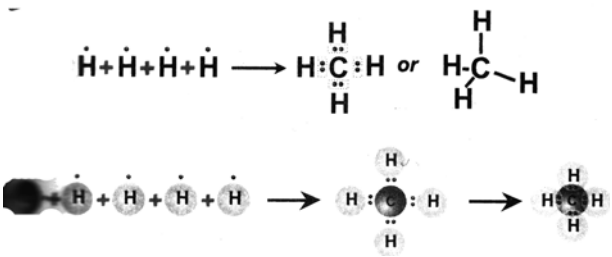
5 Mark Questions

1. Draw the Lewis structure of following.
A) Oxygen molecule B) Methane molecule C) Ammonia molecule D) Water mole

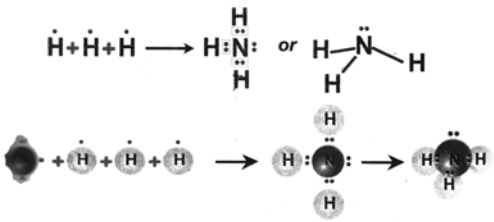
A) Oxygen molecule



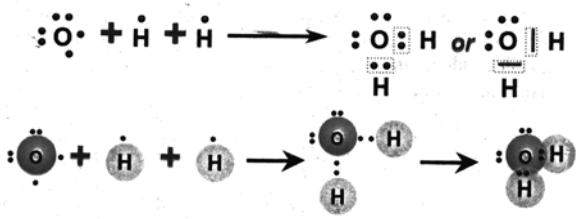
B) Methane molecule



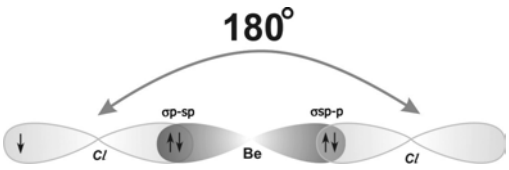
C) Ammonia molecule

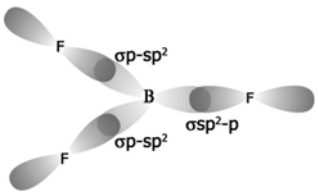


D) Water mole



2. Hybridisation structure of
A) Beryllium chloride **B) Boran trifluoride**





BITS

I. Multiple Choice questions :

1. Which one of the following is an ionic compound ( )
A) HCl B) CO_2 C) H_2O D) CaO
2. In N_2 molecule the atoms are bonded by ( )
A) 1 σ 3 π B) 1 σ 2 π C) 3 σ 2 π D) 2 σ 1 π

3. Covalent compounds are soluble in ( )
   A) polar solvants B) Non–polar solvents
   C) Concentrated ions D) All solvents
4. The bond angle in NH_3 molecule is ( )
   A) $109^0 28^1$ B) 90^0 C) $107^0 48^1$ D) 105^0
5. Polar covalent bond is present in ( )
   A) HCl B) NaCl C) MgO D) Na_2O
6. Valency of Noble gases is ( )
   A) 0 B) 1 C) 3 D) 5
7. The number of unpaired electrons in oxygen atom is ( )
   A) 0 B) 1 C) 2 D) 3
8. The number of valency electrons in carbon atom is ( )
   A) 0 B) 2 C) 4 D) 6
9. Among the following electron deficinet molecule is ( )
   A) NaCl B) MgO C) CH_4 D) $BeCl_2$
10. Ionic bond is formed between atoms of elements with electro negitivity difference equal to or greator than ( )
    A) 0.1 B) 1.0 C) 1.9 D) 9.1

II. Fill in the blanks.

11. Transfer of electrons between atoms of two dissimilar elements leads to the formation of ..... bond.
12. Elements with more electro negative character forms .....
13. The equilibrium distance between the nuclei of tw atoms which form a covalent bond is called .....
14. The bond angle in $BeCl_2$ is .....
15. Ionic compounds have ..... melting point.
16. In shared electron pair is called .....
17. ..... proposed the Ionic bond.
18. Covalent bond was proposed by .....
19. VSEPRT was proposed by .....
20. Valence bond theory was proposed by .....

III. Matching.

Group – A		Group – B
1. $BeCl_2$	( )	A. Pyramid
2. H_2O	( )	B. linear
3. CH_4	( )	C. face centred cubic structure
4. NH_3	( )	D. V shape
5. NaCl	( )	E. Tetrahedral
		F. Trigonal bipyramid

Answer

I. 1) D 2) B 3) B 4) C 5) A 6) A 7) C
8) C 9) D 10) C

II. 11) Ionic 12) Anions 13) Bond length 14) 180^0 15) High
16) Lone pair 17) Kossel 18) G.N. Lewis 19) Sidgwick and Powell 20) Linus pauling

III. 1) B 2) D 3) E 4) A 5) C

❖ ❖ ❖ ❖❖