

Physics [Part 17 to 24]

17. Magnetic Effect of Electric Current and Light

1. Give detail on Oersted?

Name : Oersted

Born : 14th August 1777

Birth place : Langeland Denmark

Died : 9th March 1851

Best known for : The study of electromagnetism

2. What is magnetic field?

The region surrounding the magnet, in which the force of the magnet can be experienced, is called magnetic field.

3. What is magnetic line of force?

The lines along which the iron filings align themselves represent magnetic lines of force.

4. What do the magnetic field have?

Magnetic field is a quantity that has both magnitude and direction. The direction of the magnetic field is taken to be the direction in which a north pole of the compass needle moves inside it.

5. Which indicates magnetic field magnitude?

If the current is increased, the deflection also increases. It indicates that the magnitude of the magnetic field produced at a given point increases as the current through the wire increases.

6. Which produces magnetic field?

An electric current flowing through a conductor produces a magnetic field. The field so produced exerts a force on a magnet placed in the vicinity of a conductor.

7. What is Flemings left hand rule?

When the direction of the current and that of the magnetic field are perpendicular to each other, the force is perpendicular to both of them. Stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular. If the forefinger points in the direction of magnetic field and the middle finger points in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.

8. What is electric motor?

An electric motor is a rotating device that converts electrical energy into mechanical energy.

9. What is commutator?

A device that reverses the direction of flow of current through a circuit is called a commutator. In electric motors the split ring acts as a commutator.

10. What electromagnetic induction?

The emf produced in this way is called an induced emf and the phenomenon is known as electromagnetic induction.

11. What is induced current?

The induced emf will cause a current to flow through the conductor. Such a current is known as induced current.

12. What makes conductor moves?

When a current-carrying conductor is placed in a magnetic field, it experiences a force. This force causes the conductor to move.

13. What is Fleming`s right hand rule?

Stretch the thumb, forefinger and middle finger of right hand so that they are mutually perpendicular to each other. If the forefinger indicates the direction of the magnetic field and the thumb shows the direction of motion of conductor, then the middle finger will show the direction of induced current.

14. What is electric generator?

In an electric generator, mechanical energy is used to rotate a conductor in a magnetic field to produce electricity.

15. What is AC?

Alternating Current

16. What is DC?

Direct Current

17. What is advantage of AC over DC?

An important advantage of AC over DC is that electric power can be transmitted over long distances without much loss of energy

18. What is light?

An object reflects light that falls on it. This reflected light when received by our eyes, enables us to see things.

19. What is reflection of light?

A highly polished surface, such as a mirror, reflects most of the light falling on it.

20. What are laws of light?

(i) The angle of incidence is equal to the angle of reflection($i = r$)

(ii) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane

21. What is concave mirror?

A spherical mirror whose reflecting surface is curved inwards is called a concave mirror.

22. What is convex mirror?

A spherical mirror whose reflecting surface is curved outwards is called a convex mirror.

23. What is pole?

The centre of the reflecting surface of a spherical mirror is a point called the pole. It is represented by the letter P.

24. What is centre of curvature?

The reflecting surface of a spherical mirror forms a part of a sphere. This sphere has a centre. This point is called the centre of curvature of the spherical mirror. It is represented by the letter C.

25. What is radius of curvature?

The radius of the sphere of which the reflecting surface of a spherical mirror forms a part, is called the radius of curvature.

26. What is principal of axis?

The imaginary straight line passing through the pole and the centre of curvature of a spherical mirror is called the principal axis.

27. What is principal focus?

The reflected rays appear to come from a point on the principal axis. This point is called the principal focus of the convex mirror. The principal focus is represented by the letter F.

28. What is focal length?

The distance between the pole and the principal focus of a spherical mirror is called the focal length. It is represented by the letter f .

29. What is aperture?

The effective diameter of the reflecting surface of spherical mirror is called its aperture.

30. What are the uses of convex mirrors?

Convex mirrors are commonly used as rear-view mirrors in vehicles. These mirrors are fitted on the sides of the vehicle, enabling the driver to see traffic behind him/ her to facilitate safe driving. Convex mirrors are preferred because they always give an erect image. Also they have a wider field of view as they are curved outwards.

While dealing with the reflection of light by spherical mirrors, we shall follow a set of sign conventions called the New Cartesian Sign Convention. In this convention, the pole (P) of the mirror is taken as the origin. The principal axis of the mirror is taken as the X axis ($X'X$) of the coordinate system. The conventions are as follows.

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- (i) The object is always placed to the left of the mirror.
- (ii) All distances parallel to the principal axis are measured from the pole of the mirror.
- (iii) All the distances measured to the right of the origin (along $+X$ axis) are taken as positive while those measured to the left of the origin (along $-X$ axis) are taken as negative
- (iv) Distances measured perpendicular to and above the principal axis (along $+Y$ axis) are taken as positive.
- (v) Distances measured perpendicular to and below the principal axis (along $-Y$ axis) are taken as negative.

31. What is mirror formula?

In a spherical mirror, the distance of the object from its pole is called the object distance (u). The distance of the image from the pole of the mirror is called the image distance (v). You already know that the distance of the principal focus from the pole is called the focal length (f). There is a relationship between these three quantities given by the mirror formula which is expressed as $1/v + 1/u = 1/f$. This formula is valid in all situations.

32. What is refraction of light?

The observations of light indicate that light does not travel in the same direction in all media. It appears that when travelling obliquely from one medium to another, the direction of propagation of light in the second medium changes. This phenomenon is known as refraction of light.

33. What are the laws of refraction?

Refraction of light is due to change in the speed of light as it enters from one transparent medium to another. Experiments show that the refraction of light occurs according to certain laws. The following are the laws of refraction of light.

- (i) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
- (ii) The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction.

34. What is lens?

A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens.

35. What is power of lens?

The power of a lens is defined as the reciprocal of its focal length.

36. What is diopetre?

The SI unit of power of a lens is 'diopetre'. It is denoted by the letter D.

37. What is retina?

The human eye is like a camera. Its lens system forms an image on a light-sensitive screen called the retina.

38. What are the defects of vision?

There are mainly three common refractive defects of vision. These are:

- (i) Myopia (near - sightedness)
- (ii) Hypermetropia (far-sightedness)
- (iii) Presbyopia

39. What is Myopia?

Myopia is also known as nearsightedness.

40. What is hypermetropia?

Hypermetropia is also known as farsightedness

41. What is presbyopia?

The power of accommodation of the eye usually decreases with ageing. For most people, the near point gradually recedes away. They find it difficult to see nearby objects comfortably and distinctly without corrective eye - glasses. This defect is called Presbyopia.

18. Light

1. What were the words of Nicholas Copernicus?

The polish scientist Nicholas Copernicus suggested that “The earth is not stationary. It spins on its own axis and revolves around the Sun”.

2. When was International year of astronomy declared?

The year 2009 was declared the “International Year of Astronomy”.

3. What are sources of light?

The objects that emit light are called as sources of light.

4. What are the types of light?

Sources of light are of two types : natural and artificial.

5. What are luminous bodies?

During the day, we are able to see with the help of sunlight and during the night, we can see with the help of light from the electric bulb, torch light, candle etc. Bodies that emit light on their own are called luminous bodies.

6. What are non-luminous bodies?

Objects like table, chair etc. do not emit light on their own. Objects like these that do not emit light on their own are called non-luminous bodies.

7. How do we see objects?

We see an object we need the following

- a. source of light
- b. object to be seen
- c. observer.

8. What is rectilinear propagation of light?

When the cylinder was bent the same candlelight/object could not be seen. This is because light travels in a straight line. This property is called rectilinear propagation of light .

9. What is the observation of pinhole camera?

The light that comes from the object passes through the pinhole and forms an inverted image on the tracing paper. When the distance between the pinhole and the tracing paper is increased, the size of the image also increases. When the distance is decreased, the size of the image decreases. If the size of the pinhole is increased, the clarity of the image decreases and the image becomes blurred.

10. What are translucent objects?

The objects which allow the light to pass through them partially are called translucent objects.

11. Give some examples of translucent objects?

Air with dust particles, mist, ground glass, a sheet of paper smeared with oil are some more examples of translucent objects.

12. What is transparent objects?

The objects which allow light to pass through them are called transparent objects.

13. What are opaque objects?

The objects which do not allow light to pass through them are called opaque objects.

14. What are the properties of shadow?

- Shadow is always formed on the opposite side of the light source.
- It only shows the shape or outline of the object and not the details.
- A shadow cast by an intense beam of light is dark.
- A shadow is always black regardless of the colour of the object and the light source.

- The size of a shadow varies depending on the distance between the object and the source of light, and the distance between the object and the screen.
- (As the distance between the object and the source of light increases the size of the shadow decreases and as the distance between the object and the screen increases the size of the shadow increases)
- Source of light, an opaque object and the shadow will always lie in a straight line.

15. What is reflection?

When a tennis ball is thrown against a wall, it bounces back. Similarly when a beam of light falls on a smooth shining surface, it bounces back into the same medium (solid, liquid or gas). This phenomenon is called reflection.

16. How are eclipse formed?

Shadow is cast since light travels in straight line. Solar and lunar eclipses occur because of this property of light. When the sun, the earth and the moon come in a straight line eclipses are formed.

17. What is lunar eclipse?

When the earth comes between the sun and the moon, lunar eclipse occurs . This happens on a full moon day.

- The Sun - source of light
- The Earth - opaque object
- The Moon-screen

When the shadow of earth falls on the moon, the moon is hidden. This is called lunar eclipse.

18. What is solar eclipse?

When the moon comes between the sun and the earth, solar eclipse occurs. This happens on a new moon day.

- The Sun - source of light
- The Moon - opaque object
- The Earth-screen

When the shadow of the moon falls on the earth, the sun is hidden. This is called solar eclipse.

19. Heat and Light

1. What is heat?

The energy which can be transferred from a hotter body to a colder body and which produces a sensation of hotness or coldness is called heat.

2. What are the sources of heat?

Sun, combustion, friction, electric current,.

3. Do sun gives heat?

The sun gives out heat besides light.

4. What is combustion?

Burning of coal, kerosene etc., produces heat. These are called fossil fuels since they are made from the remains of plants and animals that died millions of years ago and were buried deep inside the earth.

5. What is nuclear fusion?

The sun gives us 3.8×10^{26} joule of heat energy per second. This energy is produced by nuclear fusion.

6. What is friction?

The weather becomes very cold in winter. If we rub our hands together, they become warm. The faster we rub, the hotter they become. Rubbing two things together produces heat due to friction.

The ancient man used friction to produce a spark. Sometimes he rubbed two flint stones to make a fire.

7. What is electric current?

When electric current flows through a conductor heat energy is produced. The water heater, iron box, electric kettle etc. work on this principle.

8. What is thermometer?

The sensation of hotness or coldness is relative, we use thermometers to measure the temperature.

9. What are the two different scales to measure for temperature?

Thermometers have two different scales to measure temperature.

a) Centigrade or Celsius scale.

b) Fahrenheit scale.

10. What is Kelvin Scale?

The SI unit of temperature is kelvin(K)

- Kelvin scale is also known as absolute scale of temperature
- On this scale $0\text{ K} = -273^{\circ}\text{C}$ 0 K (kelvin) is also known as absolute zero

11. Why thermometer use mercury?

- It is opaque and shiny.
- Does not stick to glass.
- It is a good conductor of heat.
- It shows large expansion for small temperature changes.
- It expands uniformly.
- In some thermometers ALCOHOL is used.

12. What is laboratory thermometer?

The laboratory thermometer consists of a thick walled glass tube enclosing a fine uniform bore capillary tube. There is a cylindrical bulb at one end. The bulb and a part of the stem are filled with mercury.

13. What clinical thermometer?

Clinical thermometers are available with Fahrenheit markings. They are also available with both Celsius and Fahrenheit markings.

14. What is light?

Light is a form of energy that gives us the sense of vision. The absence of light causes darkness. To see objects, our eye should receive light from them.

15. What is reflection?

When light falls on a transparent material like clear glass it passes through it. However, when it falls on opaque objects like table, chair, etc. some of it bounces back. This bouncing back of light from a surface is called reflection.

16. What is mirror?

A mirror is used by us every day for looking at our own image while combing our hair or washing our face. A mirror is a shiny surface which reflects almost all the light falling on it.

17. What is curved mirrors?

The mirror with the bulged reflecting surface is called a convex mirror and the mirror with a hollow reflecting surface is called a concave mirror. These are known as curved mirrors.

18. What is spherical mirror?

Any curved surface is a part of a sphere. Hence convex and concave mirrors are referred to as spherical mirrors.

19. What is real mirror?

The image formed on the paper or screen is called a real image.

20. What is VIBGYOR?

The colours are Violet, Indigo, Blue, Green, Yellow, Orange and Red represented as VIBGYOR.

21. What is depression?

The splitting up of white light into its seven constituent colours is called dispersion.

22. What is spectrum?

This band of colours is called a spectrum.

20. Light and Sound

1. What is reflection?

The bouncing of light from the surface of a body is known as reflection.

2. What is ray?

The path taken by the light is known as a ray and is represented by a straight line with an arrow mark. The arrow mark denotes the direction of the light.

3. What is parallel beam?

Two or more rays form a beam. When the rays are parallel it is called as parallel beam.

4. What is Convergent beam?

If the rays meet at a point (converge), they form a convergent beam.

5. What is divergent beam?

If the rays move away from a point it is called as divergent beam.

6. What is reflected ray?

The light ray that comes out from the reflecting surface after reflection is called a reflected ray.

7. What is normal?

The perpendicular line drawn to the surface at the point of incidence is called a normal.

8. What is angle of incidence?

The angle between the incident ray and the normal at the point of incidence is called the angle of incidence (i).

9. What is angle of reflection?

The angle between the reflected ray and the normal drawn from the point of incidence is called the angle of reflection (r).

10. What is incident ray?

A light ray which strikes the surface is called an incident ray.

11. What is law of reflection?

1. The incident ray, the reflected ray and the normal to the surface at the point of incidence lie in the same plane.

2. The angle of incidence is equal to the angle of reflection

12. What is regular reflection?

Reflection from a polished surface is called Regular reflection.

13. What is irregular reflection?

Reflection from a rough (unpolished) surface is called irregular or diffused reflection.

14. What is multiple images?

We are aware that a plane mirror forms only a single image of an object. But two or more mirrors are arranged to form number of images of an object. These are called Multiple Images.

15. How does periscope work?

The working of a periscope is based on the principle of successive reflections from two plane mirrors. It consists of two plane mirrors facing each other fixed at 45° to the frame work of a tube.

16. What is refraction?

The bending of ray of light when it passes from one medium to another is called refraction.

17. What is denser medium?

The direction of deviation depends on the densities of the two media. The medium of greater density is known as denser medium. Ex : Glass

18. What is lower medium?

The medium of lower density is known as rarer medium. Ex: Air

19. Describe about human eye?

- The human eye has a convex lens.
- The convex lens of an eye forms an image of the object on a screen called the retina.
- The retina is covered by a large number of nerve fibres(optic fibres) which sensitive to light.
- They carry the image by means of optic nerves to the brain.

20. What is power of accommodation of eye?

The human eye focusses the image for different objects at different distances by changing the focal length of the lens. This is done by the ciliary muscles, which stretch and relax to change the focal length of the lens. This action of the eye is called the power of accommodation of the eye.

21. Why is sound important?

Sound plays an important role in our lives. It helps us to communicate with one another. It is difficult to communicate without talking. Every one and everything around us produce sounds.

22. What is sound?

Sound needs a medium for propagation. Sound can travel through solid, liquid and gases. It can not travel through vacuum.

23. How do we hear sounds?

A vibrating body causes air molecules to vibrate. These vibrations reach our ear and are collected by the pinna and then funnelled into the ear tube. The vibrations strike the eardrum and start vibrating. The ear drum sends the vibrations to the inner ear. From there the signal goes to the brain. That is how we hear sounds.

24. What is prongs and stem?

A tuning fork is made of steel. The two upper ends of the tuning fork are called the 'prongs', while the lower end is called the 'stem'.

25. What is frequency?

The number of oscillations per second is called the frequency. Frequency is expressed by hertz – Hz.

26. What is time period?

The time taken by the vibrating body to complete one vibration or oscillation is called the time period. The unit of period is second(s).

27. What is amplitude?

The maximum displacement of a vibrating body from its mean position is called amplitude. The unit of amplitude is metre (m)

28. What is audible sound?

The human ear can hear the range of audible frequencies between 20 Hz and 20000 Hz. They are called audible sounds.

29. What is inaudible sound?

Sounds of frequencies lesser than 20 Hz and greater than 20000 Hz can not be heard by the human ear. They are called inaudible sounds.

30. What is noise?

Any unpleasant sound is called noise.

31. What is noise pollution?

Unwanted sound from any source that causes discomfort of any kind is called noise pollution.

32. What are the harmful effects of noise pollution?

- Exposure to sudden high noise level can damage to the eardrum.
- High levels of noise can also lead to nervous tension and increase in blood pressure.
- Noise also disturbs sleep, increases stress and causes headache

33. What are the steps to control noise pollution?

1. The use of loudspeaker in functions should be stopped.
2. Cars and other vehicles should not produce loud sounds.
3. T.V and Musical systems should be listened at low volumes.

34. What is optical fiber?

An optical fibre is a device based on the principle of total internal reflection. Optical fibres are thin, flexible and transparent strands of glass which can carry light along them very easily. A bundle of such thin fibres forms a light pipe.

35. What are the uses of optical fiber?

1. Optical fibres are used to transmit communication signals.
2. In medicine, optical fibres are used in endoscope and laparoscopes.

21. Sound

1. What are the significance of sound?

- Sound makes it possible for us to communicate with one another through speech.
- It enables us to share our thoughts and ideas with others.
- Musical sound gives us pleasure.
- Sounds from radio and television give us information and entertainment.
- Horn sounds (honking of vehicles) alert us and keep us safe on the road.

2. What is vibration?

Vibrations are “repeated small to and fro motion of objects”.

3. How is sound waves created?

Sound waves are created by vibrating bodies and sound is a sensation ‘heard’ by the listener.

4. How do sound waves travel?

Sound waves can travel through liquids, solids as well as gases. The substance (solid, liquid or gas) through which the sound waves travel is called a medium. Sound waves need a material medium to propagate; they cannot travel through vacuum.

5. Who proved sound waves cannot travel through vacuum?

Robert Boyle, the scientist, proved that sound waves cannot pass through vacuum or empty space.

6. What is waves?

A wave is a series of disturbances that move through a medium. The particles of the medium do not move from the source to the destination, but the disturbance alone is carried from the source to the destination.

7. What are the characteristics of wave?

Waves that require a material medium to propagate, such as sound waves, are referred to as mechanical waves. Mechanical waves are of two kinds - longitudinal waves and transverse waves. Some waves such as electromagnetic waves do not require a medium to propagate and can travel through vacuum.

8. What are the types of wave?

- Electromagnetic Waves Mechanical Waves (Transverse waves) (eg. Light waves, Infrared waves, Ultraviolet waves, etc.)
- Mechanical Waves which is further classified as Longitudinal waves eg: sound waves
Transverse waves eg: water waves

9. What is longitudinal waves?

“If the particles of a medium vibrate in a direction, parallel to or along the direction of the propagation of wave, it is called a longitudinal wave.”

10. What is compression and refraction?

Compression is the area with maximum pressure, rarefaction is the area with minimum pressure.

11. What is transfer waves?

“If the particles of the medium vibrate in a direction, perpendicular to the direction of propagation, the wave is called a transverse wave.”

12. Discuss about transverse waves?

- Particles of the medium vibrate in a direction which is perpendicular to the direction of propagation.

- Crests and troughs are formed
- Can travel through solids and surfaces of liquids.
- eg. Water waves

13. Discuss about longitudinal waves?

- Particles of the medium vibrate in a direction which is parallel to the direction of propagation.
- Compressions and rarefactions are formed.
- Can travel through solids, liquids and gases.
- eg. Sound waves

14. What is amplitude?

The maximum displacement of a particle from the mean position is called amplitude. Its unit is metre.

15. What is time taken?

Time taken by a particle of the medium to complete one vibration is called Time period. Its unit is second.

16. What is frequency?

The number of vibrations completed by a particle in one second is called frequency . Its unit is hertz.

$$n = 1/T$$

17. What is wave length?

Distance moved by a wave during the time a particle completes one vibration. Its unit is metre.

18. What is relationship between velocity of wave, wave length and frequency?

Distance travelled by a wave in one Time period, T, Distance λ Time

Velocity, $V = \text{Distance/Time} = \lambda/T$

But Frequency $n = 1/T$

Therefore $v = n\lambda$

19. How do sound travel?

Sound travels almost five times faster through water and twenty times faster through iron than it travels in air. Speed of light ($3 \times 10^8 \text{ m/s}$) is even faster than the speed of sound (340 m/s).

20. What is echo?

Sound waves can be reflected from large surfaces such as large walls of a building, sides of a hill or the walls of a cave. When reflected sound waves reach the ear, it can be heard distinctly after the original sound has stopped. This is called an Echo.

21. What is reverberation?

The repeated reflections that result in the persistence of sound, often referred to as 'rolling sound' is called reverberation.

22. Who gave first proof for radio waves?

Hertz, a German scientist, gave the first experimental proof of the existence of radio waves.

23. What is the audible range of sound for human and some animals?

- Human 20 - 20,000 Hertz
- Elephant 16 - 12,000 Hertz
- Dolphins 70 - 1,50,000 Hertz
- Cat 100 - 32,000 Hertz

24. What is SONAR?

The word “SONAR” is an acronym for “Sound, Navigation And Ranging”. A sonar consists of transmitter, detector, and display. The transmitter produces and transmits pulses of ultrasonic waves.

These waves travel through water and after striking some underwater object such as the seabed or a shoal of fish, get reflected and are received by the detector.

25. What is ultra sonic waves?

‘Ultrasonic waves’ can be used to visualize inner organs of the human body. Pulses of ultrasonic waves are passed through parts of the body, which get reflected by organs. When several pulses are sent and received, it is possible to build a picture of the object reflecting the wave pulses. This is called ultrasonography.

26. Who was first to make attempt on Doppler Effect?

Doppler was the first to explain this phenomenon and hence, it has been named after him as the Doppler Effect.

22. Heat and Gas Law

1. What is heat?

“Heat is a form of energy transfer between two systems or between a system and its surroundings due to temperature difference between them”. We represent heat transfer by the symbol Q .

2. What is specific heat capacity?

“Specific Heat Capacity (SHC) is the heat required to raise the temperature of unit mass of a substance through unit temperature”. The symbol for specific heat capacity is c .

3. How is specific heat capacity defined?

“The amount of heat energy required to raise the temperature of 1 kg of a substance through 1 K.” The SI unit of SHC is $\text{J kg}^{-1} \text{K}^{-1}$.

4. What is thermal capacity?

Thermal capacity is the “quantity of heat required to raise the temperature of an object through 1k”. Its unit is joule / kelvin (J/K or JK-1). Thermal Capacity of an object = $m \times c$

5. What is latent heat?

Early scientists were amazed at the fact that heat energy seemed to be absorbed by the substance without any change in temperature. They therefore, called it “Latent Heat”. The word “latent” means – present but not visible (hidden).

6. What is latent heat of vaporization?

The latent heat required to evaporate a liquid is referred to as the latent heat of vaporization.

7. What is latent heat of fusion?

The latent heat required to melt a substance is referred to as the latent heat of fusion.

8. What is specific latent fusion?

The Specific Latent Heat of Fusion of any substance is the quantity of heat energy required to melt one kilogram of a substance without change in temperature.

9. What is Boyle's law?

Boyle's Law states that “Temperature remaining constant, the pressure of a given mass of gas is inversely proportional to its volume”.

10. Who is Robert Boyle?

Robert Boyle is best known for his work in physics and chemistry. He formulated Boyle's law. He is regarded as the first modern chemist. He described the elements as primitive, simple and perfectly complete bodies. From 1661, the term ‘element’ has been reserved for material substances.

11. What is Charles law?

Charles' Law states that "Pressure remaining constant, the volume of a given mass of gas is directly proportional to the absolute temperature".

12. Who is Jacques Charles?

Jacques Charles was a French inventor, scientist, mathematician, balloonist and a Professor of Physics in Paris. He found the relation between the temperature and the volume. His experiment revealed that all gases expand and contract to the same extent when heated through the same temperature intervals. He constructed the first hydrogen balloon, which brought him fame and royal patronage. He also invented the hydrometer.

13. What is Kelvin Scale?

The zero of the Kelvin scale corresponds to -273°C and is written as 0K (without the degree symbol). One division on the Kelvin scale has the same magnitude of temperature as one division of the Celsius or Centigrade scale. Thus 0°C corresponds to +273K.

Kelvin scale(K) = Celsius scale (0°C) + 273

Celsius scale (0°C) = Kelvin scale (K) – 273

14. Who is Lord Kelvin?

Lord Kelvin was a physicist and an engineer. He is widely known for his significant contribution to thermodynamics. He devised the Kelvin scale of temperature. The unit of temperature was named after him to honour his outstanding contribution and achievements.

15. Who received Nobel Prize in Physics 2015?

The Nobel Prize in Physics, 2015 was awarded jointly to Takaaki Kajita and Arthur B. McDonald " for the discovery of neutrino oscillations, which shows that neutrinos have mass".

23. Atomic Structure

1. What is atom?

Atoms are the building blocks of all matter. Atoms are extremely small in size and are expressed in terms of 10^{-10} m (1 \AA)

2. What is atom in Greek language?

In Greek language, atom means 'incapability of being cut'.

3. What are the laws of chemical combination?

- Law of Conservation of Mass
- Law of Definite Proportion
- Law of Reciprocal Proportion
- Law of Multiple Proportion and
- Gay Lussac's Law of Combining Volume

4. What is law of definite proportion?

The Law of Definite Proportions can be stated as. "A pure chemical compound prepared by any method consists of the same elements combined together in a fixed proportion by mass".

5. What is law of conservation of mass?

The Law of Conservation of Mass can be stated thus: "Mass can neither be created nor destroyed during a physical or a chemical change".

6. What was Dalton's atomic theory based on?

- Matter is made up of small, indivisible particles called atoms.
- Atoms can neither be created nor destroyed.
- Atoms of the same element are identical in all respects.
- Atoms of different elements are different in all respects.

- Atoms of different elements may combine with each other in a fixed simple whole number ratio to form “compound atoms” (or molecules).
- The atom is the smallest particle of matter that takes part in a chemical reaction.

7. What is atomic electricity?

The first direct experimental evidence to prove the electrical nature of matter came from Michael Faraday. He demonstrated through his experiments that electricity is composed of particles called ‘atoms of electricity’.

8. Who proposed concept on electron?

It was George Johnstone Stoney, an Irish Physicist, who first proposed the term ‘electron’ for ‘atom of electricity’ in 1891. His contribution to research in this area laid the foundations for the eventual discovery of particles by J.J. Thomson in 1897.

9. Who found visible rays travelling between two electrodes?

In 1878, Sir William Crookes, while conducting an experiment using a discharge tube, found certain visible rays travelling between two metal electrodes. These rays are known as Crooke’s Rays or Cathode Rays.

10. What is CRT?

The discharge tube used in the experiment is now referred to as Crookes tube or more popularly as Cathode Ray Tube (CRT).

11. What is negative electrode?

The electrode which is connected to the negative terminal of the battery is called the cathode (negative electrode).

12. What is positive electrode?

The electrode connected to the positive terminal is called the anode (positive electrode).

13. What is florescent material?

When invisible radiation falls on materials like zinc sulphide, they emit a visible light (or glow). This is called fluorescent material.

14. What are the properties of Cathode rays?

- Cathode rays travel in straight lines parallel to each other
- Cathode rays are made up of small particles that have mass and kinetic energy.
- Cathode rays are negatively charged particles
- The direction of deflection indicates that the cathode rays consist of negatively charged particles. These negatively charged particles are called electrons.
- The nature of the cathode rays does not depend on the nature of the gas filled inside the tube or the cathode used.

15. What was the concept of Goldstein?

The presence of positively charged particles in the atom has been precisely predicted by Goldstein based on the conception that the atom being electrically neutral in nature, should necessarily possess positively charged particles to balance the negatively charged electrons.

16. What is protons?

When hydrogen gas was taken in a discharge tube, the positively charged particles obtained from the hydrogen gas were called PROTONS.

17. What are the properties of Anode Rays?

1. Anode rays travel in straight lines.
2. Since they rotate the light paddle wheel placed in their path, they consist of material particles.
3. Anode rays are deflected by electric and magnetic fields. Since they are deflected towards the negatively charged plate, they consist of positively charged particles.
4. The properties of anode rays depend upon the nature of gas taken in the discharge tube.

5. The mass of the particle is the same as the atomic mass of the gas inside the discharge tube.

18. What is compared to Thomson atomic model?

Thomson's Atomic Model can be compared to a watermelon or a ripened guava. The red edible portion of the watermelon represents the positive sphere. The black seeds look like the electrons embedded in an atom. Thomson's scientific model of the atom is popularly known as the 'plum pudding' model.

19. What are the findings of Thomson on atom?

1. An atom consists of a positively charged sphere with electrons embedded in it.
2. The positive and negative charges are equal in magnitude; hence the atom as a whole is electrically neutral.

24. Atomic Structure

1. Who proposed the idea of atom as small particle?

John Dalton proposed the idea of the atom as the smallest possible particle of any substance.

2. Who explained neutrality of atom?

J.J.Thomson's atomic theory explained the electrical neutrality of atoms, it could not reveal the presence of nucleus in an atom, which was later proposed by Ernest Rutherford in 1909.

3. Who is father of nuclear physics?

Ernest Rutherford, a British physicist probed atoms with alpha particles. He was known as the "father of nuclear physics". He was awarded the Nobel prize for his contribution to the structure of atom in 1908.

4. What was Rutherford's Experiment?

A stream of alpha particles was made to pass through a thin gold foil of about 4×10^{-5} cm thickness. Most of the alpha particles did go through the foil in a straight line. Some alpha

particles were deflected through an average angle of 90° . Rarely the path of 1 in 20,000 alpha particles scored a direct hit on the nucleus and returned in an angle of 180° .

5. What is alpha particle?

Alpha particles are helium ions He^{2+} (2 protons, 2 neutrons and no electrons). The mass of an alpha particle is about 8000 times the mass of an electron. Velocity of alpha particles is about 2×10^7 m/s.

6. What was Rutherford's theory of Atom?

- Atom has a very small nucleus at the centre.
- There is a large empty space around the nucleus.
- Entire mass of an atom is due to the mass of nucleus.
- Electrons are distributed in the vacant space around the nucleus.
- The electrons are moving in circular paths around the nucleus.

7. Who is Niels Bohr?

Niels Bohr was born on October 7, 1885 in Copenhagen, Denmark. He was also an outstanding soccer player. He worked with Rutherford at the University of Manchester. Bohr's theory became the basis for modern physics known as Quantum Mechanics. Bohr received the Nobel Prize for physics in 1922.

8. Discuss about Bohr law?

- Niels Bohr modified Rutherford's atom model and put forth the following postulates.
- In atoms, electrons revolve around the nucleus in stationary circular paths.
- These paths are called orbits or shells or energy levels.
- As long as electrons revolve in the same orbit, it does not lose or gain energy.
- The circular orbits are numbered as 1, 2, 3, 4 or designated as K, L, M, N shells.
- These numbers are referred to as principal quantum numbers (n).
- As we move away from the nucleus, the energy of the orbit constantly increases.

- Maximum number of electrons that can be accommodated in an energy level (n) is given by $2n^2$.
- When an electron absorbs energy, it jumps from lower energy level to higher energy level.
- When an electron returns from higher energy level to lower energy level, it gives off energy.

9. What is orbit?

Orbit is defined as the path, by which electrons revolve around the nucleus.

10. What are neutrons?

In 1932, James Chadwick observed that when beryllium was exposed to alpha particles, particles with about the same mass as protons were emitted. These emitted particles carried no electrical charge. Hence, they were called as neutrons.

11. What is isotopes?

Atoms of the same element with different number of neutrons are called isotopes.

12. What are the fundamental particle of atom?

Protons: They are positively charged particles. They are present inside the nucleus.

Electrons: They are negatively charged particles. They revolve around the nucleus in circular orbits.

Neutrons: They are neutral particles. They are present inside the nucleus.

13. What are the sub atomic particles?

Besides Electrons, Protons and Neutrons, there are many sub-atomic particles such as:

- \bar{p} Mesons
- \bar{p} Positrons

- $\bar{\nu}$ Neutrinos
- \bar{q} Quarks
- $\bar{\pi}$ Pions
- \bar{g} Gluons

13. What is nucleons?

The elementary particles such as protons and neutrons are collectively referred to as nucleons.

14. What is atomic number?

The Atomic number of an atom can be defined as the number of protons present in the nucleus of the atom or the number of electrons present outside the nucleus of the atom. Thus the atomic number of hydrogen would be one and that of helium would be two. The symbol of Atomic Number is Z.

15. What is mass number?

The mass number (A) is defined as the sum of the number of protons and neutrons present in the nucleus of an atom of an element.

16. What are isotopes?

Isotopes are atoms of an element that differ in mass numbers, but have the same atomic number.

17. What are the characteristics of isotopes?

- Isotopes of an element differ in mass numbers only.
- Difference in mass number is due to the difference in number of neutrons.
- Isotopes of an element have the same chemical properties.
- However, variation in physical properties is noted in isotopes.
- Elements having isotopes exhibit fractional atomic mass.

18. What are the uses of isotopes?

- Many isotopes find use in medical field.

- Iron-59 isotope is used in the treatment of anaemia.
- Iodine-131 isotope is used in the treatment of goitre.
- Cobalt-60 isotope is used in the treatment of cancer.
- Phosphorous-32 isotope is used in eye treatment.
- Carbon-11 isotope is used in brain scan.

19. What are K,L,M,N?

It is known that atoms consist of a positively charged nucleus with protons and neutrons in it. Negatively charged electrons constantly revolve around the nucleus in a set of orbits. The electron orbits are numbered as 1, 2, 3, etc. Starting from the orbit closest to the nucleus. These orbits are also called K, L, M, N shells, as mentioned in the atom model proposed by

Niels Bohr.

20. What are cell number and maximum number of electrons?

First shell (K) $2(12) = 2$

Second shell (L) $2(22) = 8$

Third shell (M) $2(32) = 18$

Fourth shell (N) $2(42) = 32$

21. What is valence electrons?

The number of electrons in the outer energy level (orbit) of an atom are the ones that can take part in chemical bonding. These electrons are referred to as the valence electrons.

22. Give the electronic name of elements given below?

- Hydrogen H
- Helium He
- Lithium Li
- Beryllium Be

- Boron B
- Carbon C
- Nitrogen N
- Oxygen O
- Fluorine F
- Neon Ne
- Sodium Na
- Magnesium Mg
- Argon Ar