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# Physics

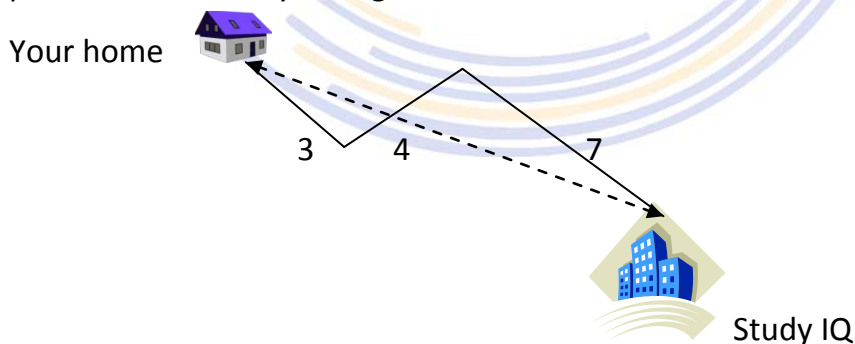
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- ❖ All the laws of physics are expressed in terms of physical quantities.
  - ✓ Scalar: Those have only magnitude eg. Distance ( measured in metre), time(sec), current (ampere), temperature (Kelvin), luminous intensity (candela), mass (kg), amount of substance (mole).
  - ✓ Vector quantities: Those which have direction and magnitude eg.

## 1. Displacement vs Distance

Distance is the actual length of path travelled by a moving body.

Displacement is the shortest distance the initial and final position of the body, along with the direction.



Distance travelled by you to reach study iq =  $3+4+7=14$  units but displacement is the length of the dotted line joining your home and institute directing towards south-east.

2. Velocity: defines Speed along with direction of motion of body.
3. Acceleration : rate of change of velocity with respect to time.

❖ **Newton's Laws of Motion:**

- I. A body at rest will remain at rest and a body in motion will continue to remain in motion until an external force is applied to it.

Concept of Inertia : A body resist change in its state of rest or of uniform motion.

- a. Inertia of Rest
- b. Inertia of Motion.
- c. Inertia of Direction.

II.  $F \text{ (measured in newton)} = m \times a$

Or

We can say, Force applied to a body is directly proportional to the rate of change of momentum (momentum = mass  $\times$  velocity) which is produced by body.

- III. Every action has an equal and opposite reaction. That means When two bodies act upon one another, their total momentum remains constant provided no external force is applied to it.

❖ **Concept of friction :**

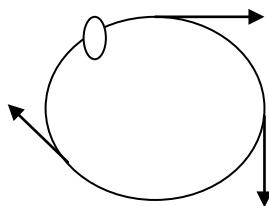
Some force acting on a stationary object which opposes its motion. This is Friction. Its of 3 types:

- a. Static friction : exerted by object at rest
- b. Sliding (also called Dynamic or Kinetic friction): exerted when object slides over a surface.
- c. Rolling: exerted when an object rolls over a surface.

Static > Sliding > Rolling

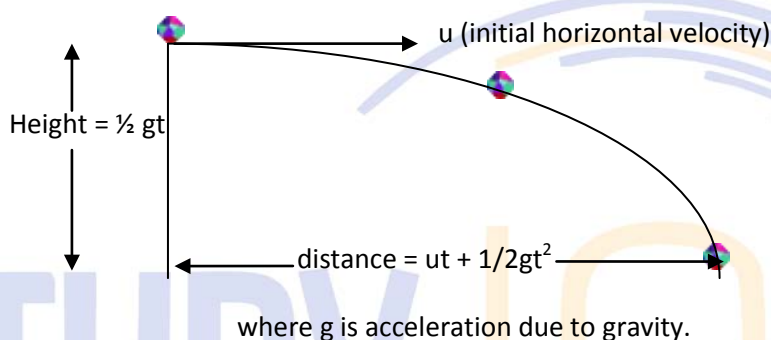
- ❖ **Circular motion:** When a body moves around a fixed point in a circular path with uniform speed.

Note that circular motion is accelerated even though the speed of body remains constant. (because the object in circular motion changes direction).



❖ **Projectile motion:** A falling object having a horizontal velocity is called a projectile, and it moves in a curved path called parabola. It Possesses :

- ✓ A horizontal motion with constant velocity.
- ✓ A vertical motion with constant acceleration.



Note that: it is the gravitational attraction of the sun which keeps the planets revolving around it in their orbit. And it is the gravitational attraction of earth which makes the moon (or artificial satellite) go around the earth repeatedly.

❖ Few Derived physical Quantities :

- ✓ Work (measured in joules , = Force in the direction of motion X distance)
- ✓ Power (Watts) = Work done / Time taken.
- ✓ Energy is the ability to do work. It is a scalar quantity. (kinetic & Potential)  
SI unit of energy ( 1 calorie = 4.18 joules).

❖ **Concept of Escape velocity:** If an object like a rocket is to escape into the space, then it must be given a high velocity which an object should have in order to overcome the earth's gravity and enter into space. This is called 'Escape Velocity'.

- ✓ The escape velocity for all the objects on earth is found to be 11.6 km/sec.
- ✓ Note that escape velocity is independent of the mass of the object. It depends upon the mass of earth and its radius.
- ✓ The escape velocity on moon is  $1/5^{\text{th}}$  of that of earth. (2.32 km/sec).

❖ **Heat , Temperature (measured in Celsius or Kelvin) and thermometer:**

$$K = C + 273$$
$$F = (9/5)C + 32$$

**Specific Heat:** is the amount of heat which is required to raise the temperature of a unit mass of a substance by 1 degree Celsius. It is measured in joules per kilogram per degree Celsius.

3 types of thermometer:

- Galileo's Gas thermometer : used air as gas.
- Laboratory : uses mercury. (Temperature range is  $-10^{\circ}\text{C}$  to  $110^{\circ}\text{C}$ )
- Clinical: uses mercury. (Temperature range is  $35^{\circ}\text{C}$  to  $42^{\circ}\text{C}$ ). Normal human body temperature  $37^{\circ}\text{C}$  ( $98.6^{\circ}\text{F}$ ).

3 types of Thermal expansion:

- Coefficient of Linear expansion ( $\alpha$ ): length of object changes on heating.
- Superficial expansion ( $\beta$ ): change in area of the object.
- Cubical expansion ( $\gamma$ ) : change in volume.

$$\gamma = 3 \alpha$$
$$\beta = 2 \alpha$$

❖ **Latent Heat:** It is the amount of heat absorbed by a unit mass of the substance to change its state without change of temperature.

- Fusion (solid to liquid change)
- Vapourisation (liquid to gas change)

❖ **Saturated Vapour Pressure:** is the pressure of vapour above the liquid surface when the vapour is in dynamic equilibrium with the liquid. The saturated vapour pressure of a liquid increases with temperature.

❖ **Boiling point:** where saturated vapour pressure = atmospheric pressure.  
Concluding that an increase in pressure on the surface of water raises its boiling point.

❖ **Periodic Motion:** Note that time period depends neither on the mass/nature of the bob nor on the amplitude (maximum displacement from origin) of pendulum.

$$T = 2\pi \sqrt{\text{length of pendulum}/g}$$

$$\text{Frequency} = 1/T$$

❖ **Wave motion :**

- Electromagnetic waves: does not require medium to travel eg. Light.

Vs

Mechanical : require medium eg. Sound.

- Transverse waves: particles vibrate at right angles to the direction in which wave is moving eg. Light

Vs

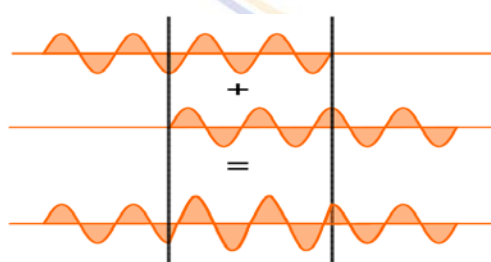
Longitudinal : particles vibrate parallel to the direction of wave eg. Sound.

Wavelength: distance between 2 nearest points in a wave which are in same phase of vibration or distance between 2 crests.

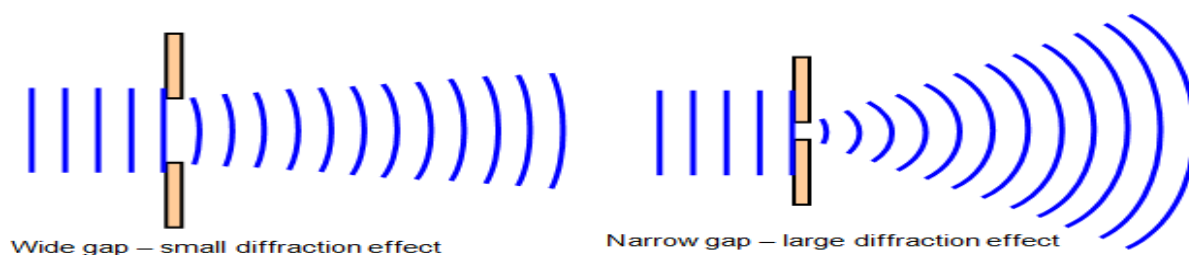
$$\text{Velocity of wave} = \text{frequency of wave} \times \text{wavelength}$$

Note that the speed of sound depends on nature of medium, temperature & humidity of air. Sound cannot be heard on the surface of the moon because there is no air on the moon to carry the sound waves.

**Interference** is the combination of two or more electromagnetic waveforms to form a resultant wave in which the displacement is either reinforced or cancelled.



**Diffraction** is the phenomenon where waves encounter an obstacle or a slit.



Light is faster than sound.

Hearing frequency of humans : 20Hz to 20,000 Hz. The sound waves having frequency higher than 20,000 are called Ultrasonic.

❖ **Structure of Atom: protons , neutrons and electrons.**

Atomic number = no. of protons.

Mass number = no. of protons + no. of neutrons.

Note that 92 is the highest atomic number of an atom available in nature. It belongs to Uranium.

❖ **Isotopes : same atomic number but different mass number.**

❖ **Radioactivity:** The spontaneous & uncontrollable disintegration of certain heavy atoms with emission of alpha/ beta and gamma rays.

Uranium – 238 (naturally radioactive, not easily found). Its isotope, Uranium- 235 is abundant in nature. So, it is used to make Plutonium-239 . The process of changing one element into another is done by 'transmutation'.

Nuclear Fission can be spontaneous , prompt or delayed.

Nuclear fusion is the source of sun's energy. Hydrogen atoms fuse to make helium atom. Composition of sun light :

- a. Ultra-Violet (shortest wavelength, produces fluorescence in certain substances, harmful to skin because of its ionizing effects)
- b. VIBGYOR – visible spectrum
- c. Infrared (longest wavelength, produces heat)

Note that : frequency is inversely proportional to wavelength.

❖ **Sources of Energy:**

- ✓ Solar Energy: Solar cells are made from semi-conductor – Silicon and germanium. In Solar furnaces, big concave reflectors are used to melt metals.
- ✓ Tidal Energy has been used in India at 3 places:
  - a. Gulf of Kutch (Gujarat)
  - b. Gulf of Cambay (Gujarat)
  - c. Sunderbans along the east coast in west Bengal.
- ✓ Biomass is converted into combustible gas constituting of methane, carbon dioxide, hydrogen and traces of hydrogen sulphide.

- ✓ The slow conversion of wood into coal by a biochemical process extending over a million of years is called 'carbonisation'.
- ✓ Petroleum is a mixture of mainly butane , others being propane & ethane. LPG is mixed with 'mercaptan' to enable detection of leaks.
- ✓ Natural Gas consists of 95% methane, 5% ethane, 2% propane, .06% butane. When natural gas is heated strongly in the absence of air, it decomposes. The hydrogen then obtained is used in the manufacture of ammonia & fertilizers. And the carbon is used as a filler in carbon industry.

Note: calorific value of LPG (50 kj/g) < Natural gas (55 kj/g)

- ❖ **Refraction** : When a ray of light is travelling from one medium to another, it changes direction.
  - a. Denser to lighter (away from normal)
  - b. Lighter to denser (towards the normal)

Law I : incident, refracted ray and normal lie in the same plane at point of incidence.

Law II or Snell's Law :  $n_1 \sin(\text{angle of incidence}) = n_2 \sin(\text{angle of refraction})$ .

Lateral displacement : the perpendicular shift of the incident ray from the emergent ray. It increases with increase in thickness of glass and/or in the angle of incidence.

- ❖ **Reflection** :

Law I : incident ray, reflected ray and normal all lie in the same plane.

Law II : angle of incidence= angle of reflection.

Lateral Inversion : the change of sides of an object and its mirror image.

Concave Mirrors used in torches, search light and vehicles, shaving mirrors.

| Position of Object       | Position of Image | Size of Image   | Nature of Image   |
|--------------------------|-------------------|-----------------|-------------------|
| <b>At infinity</b>       | At focus          | Point-sized     | Real & Inverted   |
| <b>Beyond C</b>          | Between F & C     | Diminished      | Real & Inverted   |
| <b>At C</b>              | At C              | Same            | Real & Inverted   |
| <b>Between C &amp; F</b> | Beyond C          | Enlarged        | Real & Inverted   |
| <b>At F</b>              | At infinity       | Highly enlarged | Real & Inverted   |
| <b>Between P &amp; F</b> | Behind the mirror | Enlarged        | Virtual and erect |

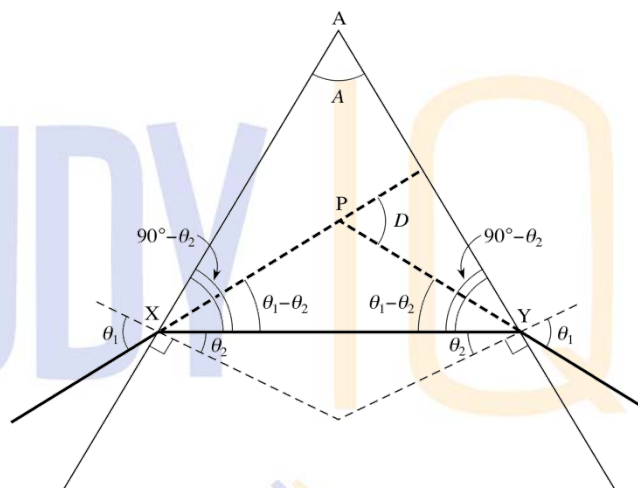
Convex Mirrors used as rear view mirrors in automobiles. Diminished images.

| Position of Object              | Position of Image                | Size of Image | Nature of Image |
|---------------------------------|----------------------------------|---------------|-----------------|
| <b>At infinity</b>              | At F, Behind mirror              | Small Point   | Virtual, erect  |
| <b>Between P &amp; infinity</b> | Between P & F, behind the mirror | Diminished    | Virtual, erect  |

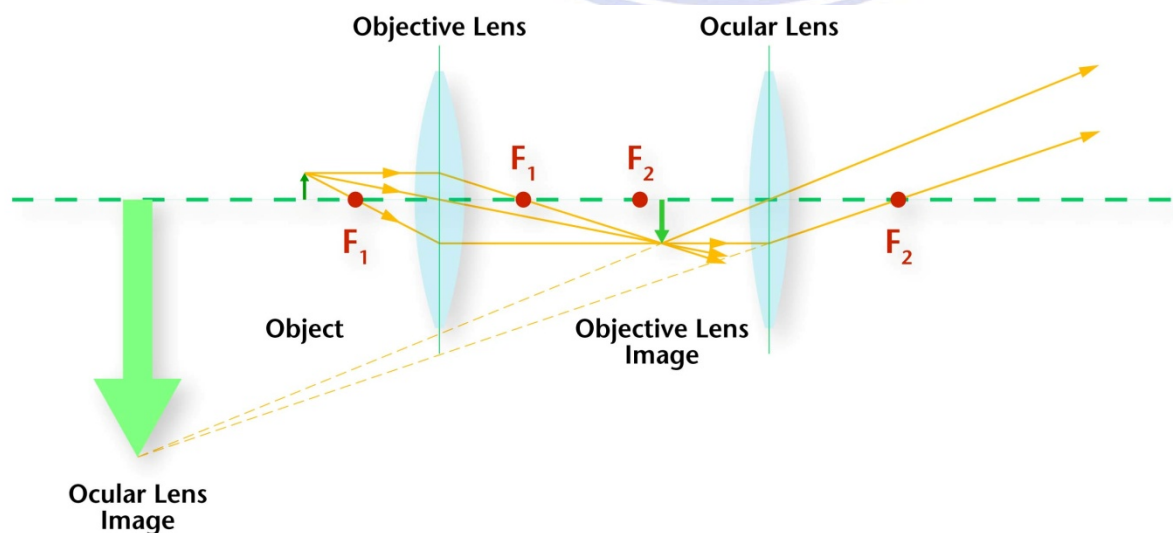
$$F=R/2$$

- ❖ **PRISM: Dispersion** : the phenomenon due to which light splits into seven colours when passed through an equilateral prism.

$$\text{Angle of (incidence + emergence)} = \text{angle of (prism + deviation)}$$



- ❖ **Compound Microscope** requires 2 convex lens with varying focal length for an enlarged view of object nearby. Objective lens is the one with lesser focal length.



- ❖ **Telescope** requires 2 convex lens. Objective is of larger focal length here in order to obtain image of an object far far away.

Power of a lens (in diopetre) =  $1/\text{Focal length (in meters)}$

Lens formula  $1/f = 1/v - 1/u$

- ❖ **A photographic camera** is based on the principle that if an object is placed beyond 2F of a convex lens, it always forms a real, diminished and inverted image between F and 2F on the other side of the lens. Eye functions similarly.
- ❖ **Magnetism** : Magnetite is the only natural magnet known (its an iron ore  $\text{Fe}_3\text{O}_4$ ). However, a mixture of ferric oxide and barium oxide called 'ferrite' is used in transistors and radio. Most powerful magnets are made from alloys of aluminium, nickel and cobalt (ALNICO).

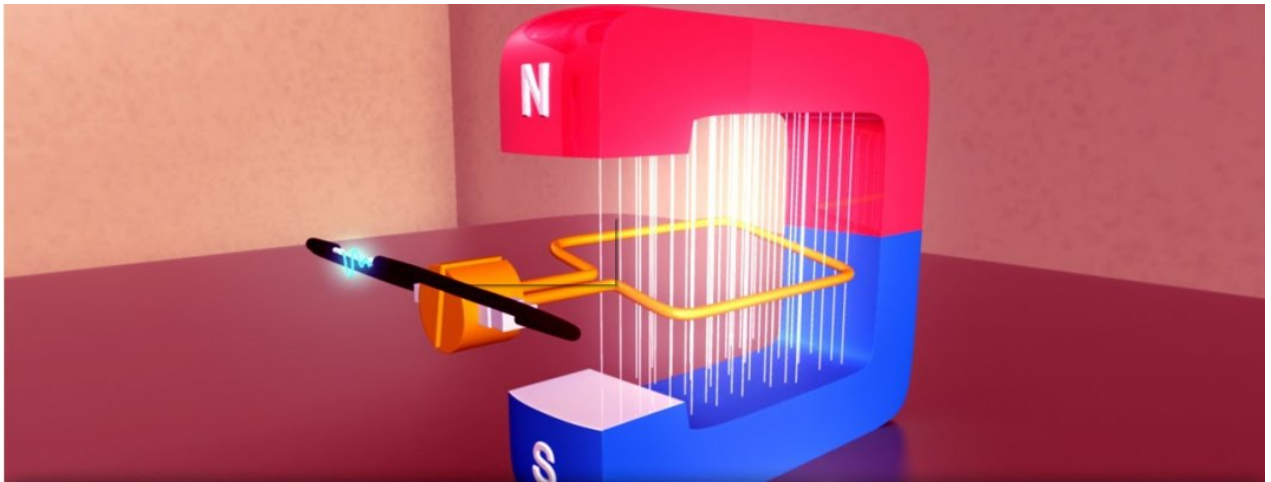
Note that the geographic north pole of the earth lies in the magnetic south pole of earth.

- ❖ **Electric Cell** is a device in which potential difference maintained between its two terminals by the conversion of chemical energy into electrical energy.
  1. Voltaic cell – wet cell, 2 metallic plates (one of copper, other one Zinc). Each plate is provided with a brass terminal. Electrolyte is  $\text{H}_2\text{SO}_4$ .
  2. Daniell Cell – can supply steady and continuous current till its chemicals are not exhausted. One copper rod, other one also copper rod but perforated with copper sulphate crystals. There exists a porous pot containing Zinc sulphate or dilute sulphuric acid.
  3. Dry Leclanche Cell – commonly used in transistors. It consists of zinc cylinders wrapped in a non-conducting material.

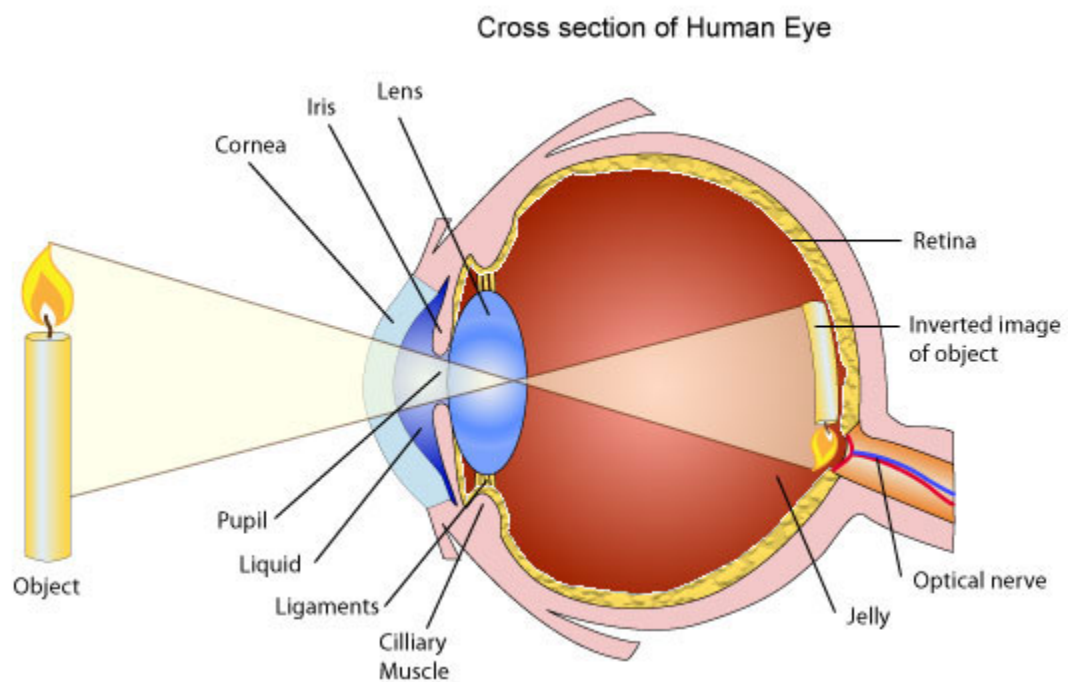
Note that Petrol, kerosene, diesel , asbestos, alcohol and benzene are non-conductors of electricity (also called insulators).

- ❖ **Electromagnetism** : A coil with a core of iron nail acts as a magnet only when electric current flows around iron nail. This phenomenon is used in electric bells, fans, TV for deflecting electron beam on picture tube.

- ❖ **Electromagnetic Induction or Faraday's experiment** : When a magnetic field is changed near a conductor, an induced AC current is produced. The magnitude of the current depends on
- a) Strength of magnet
  - b) Number of turns in coil.
  - c) Relative motion of magnet with respect to coil.



- ❖ **Accommodation of Eye** : The process by which ciliary muscles alter the focal length of the crystalline lens, so as to focus the nearer or the far off objects clearly on the retina. For object at infinity , focal length of eye is 1.7 cm.



- ✓ The pigment in the Iris decides the colour of the eye.
- ✓ Iris adjusts the size of pupil to determine the amount of light entering eye.
- ✓ Eye contains a crystalline lens (double convex).
- ✓ Ciliary muscles are responsible for change in focal length of the eye.
- ✓ The least distance of distinct vision is 25 cm. (maximum being infinity).

### Defects in eye :

- a. Hyperopia: far-sightedness, cannot see nearby objects clearly
- b. Myopia: near-sightedness.

| Instruments  | Use  |
|--------------|--|
| Altimeter    | Measures altitudes (used in aircrafts)                               |
| Ammeter      | electric current in a circuit  |
| Anemometer   | power & velocity of wind   |
| Audiometer   | Intensity of sound   |
| Barometer    | Atmospheric pressure   |
| Callipers    | Inner and outer diameters of cylinders                               |
| Calorimeter  | Quantity of heat   |
| Dilatometer  | Change in volume   |
| Dynamometer  | Electric power generated by engine                                   |
| Electrometer | Small Potential differences in electric currents                     |
| Endoscope    | Examines internal parts of body                                      |
| Galvanometer | Measures sharpness of electric current                               |
| Hydrometer   | Relative density of liquids  |
| Hygrometer   | Atmospheric humidity   |
| Hypsometer   | Determine boiling point of liquids                                   |
| Lactometer   | Relative density of milk, test purity                                |
| Micrometer   | To obtain $1/100^{\text{th}}$ of a millimetre                        |
| Microphone   | Converts sound waves to electrical vibration                         |
| Microscope   | Magnified view   |
| Periscope    | To view objects above sea level (used in submarines) uses reflection |
| Radar        | Detect direction & range of aeroplane, uses radiowaves               |
| Spectroscope | Record spectra   |
| Stereoscope  | To view 2D pictures  |
| Teleprinter  | Receive & send typed messages.                                       |
| Telescope    | To view Distant objects  |
| Thermostat   | Regulates temperature to a particular point                          |
| Voltmeter    | Measures electric potential between two points                       |

### ❖ Important Inventions and Inventor

- a) Aeroplane : Wright brothers.
- b) Cinematograph & electric Lamp : Thomas Alva Edison
- c) Theory of Evolution : Charles Darwin
- d) Fountain Pen: L.E. Waterman.
- e) Diesel engine : Rudolf Diesel
- f) Radio : G Marconi
- g) Radium : Marie & Pierre Curie
- h) Steam Engine: Thomas Newcome
- i) Jet Engine: Sir Frank Whittle.
- j) Razor: K G Gillette.
- k) Vulcanized Rubber: Charles Goodyear
- l) Telephone : Alexander Graham Bell
- m) TV : Johan Logie Bared
- n) Transistor : Bardeen , Shockley
- o) Typewriter : C Sholes

### ❖ Discoveries & Scientists

- a) Proton : Rutherford.
- b) Neutron : James Chadwick
- c) Atom : John Dalton
- d) Atomic Structure : Neil Bohr & Rutherford.
- e) Radioactivity : Henry Becquerel
- f) X-Rays : Roentgen
- g) Photoelectric Effect: Albert Einstein
- h) Periodic Table : Mendeleev
- i) Nuclear Reactor : Anrico Fermi
- j) Dynamite : Alfred Nobel

# TEST YOUR UNDERSTANDING

## PART I

**Question 1:** Light is a form of energy produced by a \_\_\_\_\_.

1. luminous object
2. transparent object
3. non-luminous object
4. opaque object

**Question 2:** An example for non-luminous object is \_\_\_\_\_.

1. a candle
2. the sun
3. an electric bulb
4. the moon

**Question 3:** The image formed by a plane mirror is always \_\_\_\_\_.

1. real and erect
2. virtual and erect
3. real and inverted
4. virtual and inverted

**Question 4:** The focus of a concave mirror is \_\_\_\_\_.

1. Real
2. Virtual
3. Undefined
4. at the pole

**Question 5:** A converging mirror is known as \_\_\_\_\_.

1. convex mirror
2. plane mirror
3. concave mirror
4. cylindrical mirror

**Question 6:** An image formed by a convex mirror is always \_\_\_\_\_.

1. virtual, erect and diminished
2. virtual, real and magnified
3. real, inverted and diminished

4. real, erect and magnified

**Question 7:** If the image formed by a concave mirror is virtual, erect and magnified, then the object is placed \_\_\_\_\_.

1. between the pole of the mirror and the focus
2. beyond the centre of curvature
3. at the centre of curvature
4. at the focus

**Question 8:** Dentists use a \_\_\_\_\_ to focus light on the tooth of a patient.

1. concave mirror
2. convex mirror
3. plane mirror
4. cylindrical mirror

**Question 9:** An object is placed 1.5 m from a plane mirror. How far is the image from the person?

1. 3 m
2. 1.5 m
3. 2 m
4. 1 m

**Question 10:** Name the type of image that can be obtained on a screen.

1. Virtual
2. Real
3. Diverging
4. Converging

**Question 11:** Butter paper is an example for \_\_\_\_\_ object.

1. a transparent
2. a translucent
3. an opaque
4. a luminous

**Question 12:** If an incident ray passes through the centre of curvature of a spherical mirror, the reflected ray will \_\_\_\_\_.

1. pass through the focus
2. pass through the centre of curvature

3. pass through the pole
4. retrace its path

**Question 13:** A positive magnification greater than unity indicate \_\_\_\_\_.

1. real image
2. virtual image
3. neither real nor virtual image
4. distorted image

**Question 14:** The focal length of a lens whose power is -1.5 D is \_\_\_\_\_.

1. -66.66 cm
2. + 1.5 m
3. + 66.66 cm
4. -1.5 m

**Question 15:** A virtual image is formed by \_\_\_\_\_.

1. a slide projector in a cinema hall
2. the ordinary camera
3. a simple microscope
4. Telescope

**Question 16:** An object is placed 25 cm from a convex lens whose focal length is 10 cm. The image distance is \_\_\_\_\_ cm.

1. 50 cm
2. 16.66 cm
3. 6.66 cm
4. 10 cm

**Question 17:** A ray of light travels from a medium of refractive index  $n_1$  to a medium of refractive index  $n_2$ . If angle of incidence is  $i$  and the angle of refraction is  $r$ .

Then  $\frac{\sin i}{\sin r}$  is equal to

1.  $n_1$
2.  $n_2$
3.  $n_{21}$
4.  $n_{12}$

**Question 18:** Two thin lenses of power +5 D and -2 D are placed in contact with each other. Focal length of the combination is

1. +3 m
2. -3 m
3. 0.33 m
4. -0.33 m

**Question 19:** A long-sighted person cannot see objects nearer to his eye than 50 cm. To enable him to read a book 25 cm away, he should use spectacle lenses whose power in dioptries is \_\_\_\_\_.

1. -6
2. -4
3. -2
4. + 4

**Question 20:** Hypermetropia is rectified by using

1. convex lens
2. concave lens
3. cylindrical lens
4. progressive lens

**Question 21:** When a wave travels through a medium \_\_\_\_\_.

1. particles are transferred from one place to another
2. energy is transferred in a periodic manner
3. energy is transferred at a constant speed
4. none of the above statements is applicable

**Question 22:** The minimum distance between the source and the reflector, so that an echo is heard is approximately equal to \_\_\_\_\_.

1. 10 m
2. 17 m
3. 34 m
4. 50 m

**Question 23:** Bats detect the obstacles in their path by receiving the reflected \_\_\_\_\_.

1. infrasonic waves
2. radio waves
3. electro-magnetic waves
4. ultrasonic waves

**Question 24:** The amplitude of a wave is \_\_\_\_\_.

1. the distance the wave moves in one second
2. the distance the wave moves in one time period of the wave
3. the maximum distance moved by the medium particles on either side of the mean position
4. the distance equal to one wave length

**Question 25:** The physical quantity, which oscillates in most waves, is

1. Mass
2. Energy
3. Amplitude
4. wavelength

**Question 26:** The speed of sound in medium depends upon

1. Amplitude
2. Frequency
3. wavelength
4. properties of the medium

**Question 27:** Which of the following will remain unchanged when a sound wave travels in air or in water?

1. Amplitude
2. Wavelength
3. Frequency
4. Speed

**Question 28:** A source of frequency of 500 Hz emits waves of wavelength 0.4 m, how long does the waves take to travel 600 m?

1. 3 s
2. 6 s
3. 9 s
4. 12 s

**Question 29:** Sound and light waves both

1. have similar wavelength
2. obey the laws of reflection
3. travel as longitudinal waves
4. travel through vacuum

**Question 30:** The method of detecting the presence, position and direction of motion of distant objects by reflecting a beam of sound waves is known as

1. RADAR
2. SONAR
3. MIR
4. CRO

**Question 31:** The technique used by bats to find their way or to locate food is \_\_\_\_\_.

1. SONAR
2. RADAR
3. Echolocation
4. Flapping

**Question 32:** An ultrasonic wave is sent from a ship towards the bottom of the sea. It is found that the time interval between the sending and receiving of the wave is 1.6 s. What is the depth of the sea, if the velocity of sound in the seawater is 1400 m/s?

1. 1120 m
2. 560 m
3. 1400 m
4. 112 m

**Question 33:** Unit of wavelength is \_\_\_\_\_.

1. Newton
2. Erg
3. Dyne
4. Angstrom

**Question 34:** The distance between a compression and the next rarefaction of a longitudinal wave is \_\_\_\_\_.

1.  $\frac{\lambda}{4}$
2.  $\frac{\lambda}{8}$
3.  $\frac{\lambda}{2}$
4. None of these

**Question 35:** The persistence of audible sound due to the successive reflections from the surrounding objects even after the source has stopped to produce that sound is called \_\_\_\_\_.

1. Reflection
2. Echo

3. Reverberation
4. Rarefaction

**Question 36:** A and B are two objects with masses 100 kg and 75 kg respectively, then \_\_\_\_\_.

1. both will have the same inertia
2. B will have more inertia
3. A will have more inertia
4. both will have less inertia

**Question 37:** The sparks produced during sharpening of a knife against a grinding wheel leaves the rim of the wheel tangentially. This is due to \_\_\_\_\_.

1. inertia of rest
2. inertia of motion
3. inertia of direction
4. force applied

**Question 38:** When a force of 1N acts on a mass of 1kg that is free to move, the object moves with

1. a speed of 1 m/s
2. a speed of 1 km/s
3. an acceleration  $10 \text{ m/s}^2$
4. an acceleration of  $1 \text{ m/s}^2$

**Question 39:** What is the force acting on an object of mass 10 kg moving with a uniform velocity of 10 m/s ?

1. 100 N
2. 10 N
3. 0
4. 1 N

**Question 40:** An athlete can take a longer jump if he comes running from a distance as compared to that when he jumps suddenly. Identify the type of inertia.

1. Inertia of rest
2. Inertia of motion
3. Inertia of direction
4. Inertia of position

**Question 41:** Impulse = \_\_\_\_\_.

1.  $ma$
2.  $Ft$
3.  $mv$
4.  $\frac{v-u}{t}$

**Question 42:** The resultant of action and reaction forces is \_\_\_\_\_.

1. greater than zero
2. less than zero
3. Zero
4. none of the above

**Question 43:** A coolie carries a load of 500 N to a distance of 100 m. The work done by him is

1. 5 N
2. 50,000 Nm
3. 0
4.  $1/5$  N

**Question 44:** The P.E. of a body at a certain height is 200 J. The kinetic energy possessed by it when it just touches the surface of the earth is

1.  $> \text{P.E.}$
2.  $< \text{P.E.}$
3.  $= \text{P.E.}$
4. cannot be known

**Question 45:** Two objects of masses  $1 \times 10^{-3}$  kg and  $4 \times 10^{-3}$  kg have equal momentum. What is the ratio of their kinetic energies?

1. 4:1
2. 2:1
3. 16:1
4.  $\sqrt{2} : 1$

**Question 46:** The type of energy possessed by a simple pendulum, when it is at the mean position is

1. kinetic energy
2. potential energy
3. potential energy + kinetic energy
4. sound energy

**Question 47:** An iron sphere of mass 30 kg has the same diameter as an aluminium sphere whose mass is 10.5 kg. The spheres are dropped simultaneously from a cliff. When they are 10 m from the ground, they have the same \_\_\_\_\_.

1. acceleration
2. momentum
3. potential energy
4. kinetic energy

**Question 48:** Which of the following statements does not represent ohm's law?

1. current / potential difference = constant
2. potential difference / current = constant
3. potential difference = current x resistance
4. current = resistance x potential difference

**Question 49:** Two resistances of 100 W and zero ohm are connected in parallel. The overall resistance will be

1. 100 W
2. 50 W
3. 25 W
4. zero ohm

**Question 50:** Three resistors 2 W , 3 W and 4 W are connected so that the equivalent resistance is 9 W . The resistors are connected \_\_\_\_\_.

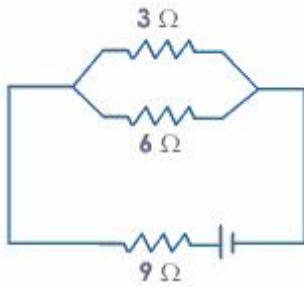
1. all in series
2. all in parallel
3. 2 W and 3 W in parallel and the combination in series with 4 W
4. 2 W and 3 W in series and the combination in parallel to 4 W

## ANSWER KEY TO PART I

|         |   |         |   |
|---------|---|---------|---|
| Ans 1). | 1 | Ans 26) | 4 |
| Ans 2)  | 4 | Ans 27) | 3 |
| Ans 3)  | 2 | Ans 28) | 1 |
| Ans 4)  | 2 | Ans 29) | 2 |
| Ans 5)  | 1 | Ans 30) | 2 |
| Ans 6)  | 1 | Ans 31) | 3 |
| Ans 7)  | 1 | Ans 32) | 1 |
| Ans 8)  | 1 | Ans 33) | 4 |
| Ans 9)  | 1 | Ans 34) | 3 |
| Ans 10) | 2 | Ans 35) | 3 |
| Ans 11) | 2 | Ans 36) | 3 |
| Ans 12) | 4 | Ans 37) | 3 |
| Ans 13) | 2 | Ans 38) | 4 |
| Ans 14) | 1 | Ans 39) | 3 |
| Ans 15) | 3 | Ans 40) | 2 |
| Ans 16) | 2 | Ans 41) | 2 |
| Ans 17) | 3 | Ans 42) | 1 |
| Ans 18) | 3 | Ans 43) | 3 |
| Ans 19) | 4 | Ans 44) | 1 |
| Ans 20) | 1 | Ans 45) | 1 |
| Ans 21) | 3 | Ans 46) | 1 |
| Ans 22) | 2 | Ans 47) | 1 |
| Ans 23) | 4 | Ans 48) | 4 |
| Ans 24) | 3 | Ans 49) | 1 |
| Ans 25) | 3 | Ans 50) | 1 |

## QUESTIONNAIRE PART II

**Question 51:** In the figure,



1.  $6\ \Omega$ ,  $3\ \Omega$  and  $9\ \Omega$  are in series
2.  $9\ \Omega$  and  $6\ \Omega$  are in parallel and the combination is in series with  $3\ \Omega$
3.  $3\ \Omega$ ,  $6\ \Omega$  and  $9\ \Omega$  are in parallel
4.  $3\ \Omega$ ,  $6\ \Omega$  are in parallel and  $9\ \Omega$  is in series

**Question 52:** When a current 'I' flows through a resistance 'R' for time 't' the electrical energy spent is given by \_\_\_\_\_.

1.  $IRt$
2.  $I^2 R t$
3.  $IR^2 t$
4.  $I^2 R / t$

**Question 53:** Which of the following is used in semi-conductors?

1. Aluminium
2. Copper
3. Silicon
4. None of these

**Question 54:** When a fuse is rated 8 A, it means \_\_\_\_\_.

1. it will not work if current is less than 8 A
2. it has a resistance of 8  $\Omega$
3. it will work only if current is 8 A
4. it will melt if current exceeds 8 A

**Question 55:** The work done in moving a unit positive charge across two points in an electric circuit is a measure of \_\_\_\_\_.

1. Current
2. potential difference
3. Resistance
4. Power

**Question 56:** The path of a free electron in a metal is \_\_\_\_\_.

1. Parabolic
2. Circular
3. a straight line
4. zig zag

**Question 57:** The blue colour of the clear sky is due to -

1. Diffraction of light
2. Dispersion of light
3. Reflection of light
4. Refraction of light

**Question 58:** When there is an electric current passing through a wire, the particles moving are \_\_\_\_\_.

1. Electrons
2. Protons
3. Atoms
4. Ions

**Question 59:** A positive charge released from rest \_\_\_\_\_.

1. moves towards the regions of lower potential
2. moves towards the regions of higher potential
3. moves towards the regions of equal potential
4. does not move

**Question 60:** The resistivity of a wire depends on \_\_\_\_\_.

1. Length
2. Material
3. area of cross- section
4. length, material and area of cross- section

**Question 61:** For which of the following substances, resistance decreases with temperature?

1. Copper
2. Platinum
3. Mercury
4. Carbon

**Question 62:** An electric current passes through a straight wire in the direction of south to north. Magnetic compasses are placed at points A and B as shown in the figure.



What is your observation?

1. The needle will not deflect
2. Only one of the needles will deflect
3. Both the needles will deflect in the same direction
4. The needles will deflect in the opposite directions

**Question 63:** The magnetic field lines due to a straight wire carrying a current are

1. Straight
2. Circular
3. Parabolic
4. Elliptical

**Question 64:** Magnetic field produced at the centre of a current carrying circular wire is

1. directly proportional to the square of the radius of the circular wire
2. directly proportional to the radius of the circular wire
3. inversely proportional to the square of the radius of the circular wire
4. inversely proportional to the radius of the circular wire

**Question 65:** The magnetic field lines inside a long, current carrying solenoid are nearly

1. Straight
2. Circular
3. Parabolic
4. Elliptical

**Question 66:** The direction of induced current is obtained by

1. Fleming's left-hand rule
2. Maxwell's right-hand thumb rule
3. Ampere's rule
4. Fleming's right-hand rule

**Question 67:** In an electric motor, the energy transformation is from

1. electrical to chemical
2. chemical to light
3. mechanical to electrical
4. electrical to mechanical

**Question 68:** A device used for measuring small currents due to changing magnetic field is known as

1. galvanometer
2. Ammeter
3. Voltmeter
4. Potentiometer

**Question 69:** For making a strong electromagnet, the material of the core should be

1. soft iron
2. Steel
3. Brass
4. Copper

**Question 70:** You have a coil and a bar magnet. You can produce an electric current by

1. moving the magnet but not the coil
2. moving the coil but not the magnet
3. moving either the magnet or the coil
4. using another DC source

**Question 71:** Which of the following describes the common domestic power supplied in India?

1. 220 V, 100 Hz
2. 220 V, 50 Hz
3. 110 V, 100 Hz
4. 100 V, 50 Hz

**Question 72:** When the main switch of the house is put off, it disconnects

1. live wire
2. neutral wire
3. earth wire
4. live and neutral wires

**Question 73:** What is the value of gravitational constant?

1.  $6.6734 \times 10^{-11} \text{ N m}^2/\text{kg}^2$
2.  $6.6734 \times 10^{-10} \text{ N m}^2/\text{kg}^2$
3.  $6.6734 \times 10^{-11} \text{ N m}/\text{kg}^2$
4.  $6.6734 \times 10^{-11} \text{ N m}^2/\text{kg}$

**Question 74:** If the distance between two bodies is doubled, the force of attraction  $F$  between them will be \_\_\_\_\_

1.  $1/4 F$

2.  $2 F$

3.  $\frac{1}{2} F$

4.  $F$

**Question 75:** The acceleration due to gravity is zero at \_\_\_\_\_.

1. the equator

2. Poles

3. sea level

4. the centre of the earth

**Question 76:** A feather and a coin released simultaneously from the same height do not reach the ground at the same time because of the \_\_\_\_\_.

1. resistance of the air

2. force of gravity

3. force of gravitation

4. difference in mass

**Question 77:** If acceleration due to gravity on earth is  $10 \text{ m/s}^2$  then, the acceleration due to gravity on moon is \_\_\_\_\_.

1.  $1.66 \text{ m/s}^2$

2.  $16.6 \text{ m/s}^2$

3.  $10 \text{ m/s}^2$

4.  $0.166 \text{ m/s}^2$

**Question 78:** If the mass of a ball is 5 kg on earth, then what would be its mass on Jupiter?

1. 5 kg

2. 5000 kg

3. 40000 kg

4. 50 kg

**Question 79:** The distance (s) in metres travelled by a particle is related to time (t) in seconds by the equation of motion  $-S = 10t + 4t^2$ . What is the initial velocity and acceleration of the body?

1. 10 m/s,  $8 \text{ m/s}^2$

2. 6 m/s,  $10 \text{ m/s}^2$

3. 4 m/s,  $4 \text{ m/s}^2$

4. 8 m/s,  $10 \text{ m/s}^2$

**Question 80: X-rays comprise of:**

1 Electrons only

2 Protons only

3 Neutrons only

4 Electromagnetic radiations

**Question 81:** Give the equation of motion connecting u, v, a and s where the symbols have their usual meaning

1.  $v = u + at$

2.  $S = ut + \frac{1}{2}at^2$

3.  $v^2 - u^2 = 2aS$

4.  $a = \frac{v - u}{t}$

**Question 82:** What do you infer, if S-t graphs of two cyclists meet at a point?

1. They collide

2. They pass each other

3. They are at rest

4. They are starting from rest

**Question 83:** Mixing of gases is called \_\_\_\_\_.

1. Diffusion
2. Effusion
3. Filtration
4. sedimentation

**Question 84:** The force between particles of matter is called as \_\_\_\_\_.

1. cohesive force
2. adhesive force
3. kinetic energy
4. thermal energy

**Question 85:** Particles of matter are \_\_\_\_\_.

1. Stationary
2. vibrating in one position
3. in continuous motion
4. rotating about an axis

**Question 86:** The temperature at which vapour changes into liquid is called \_\_\_\_\_.

1. freezing point
2. melting point
3. boiling point
4. liquefaction point

**Question 87:** Temperature is a measure of \_\_\_\_\_.

1. total kinetic energy of molecules
2. total potential energy of molecules
3. average potential energy of molecules
4. average kinetic energy of molecules

**Question 88:** For any substance the temperature remains same during the change of state due to \_\_\_\_\_.

1. loss of heat
2. latent heat
3. less supply of heat
4. lattice energy

**Question 89:** Superconductors are those materials

- 1 Which become non-conductors at transition point
- 2 Which loses all electrical resistance when cooled below a certain temperature
- 3 In which resistance rises to infinity below certain temperature
- 4 Which conducts electricity in extra widths

**Question 90:** When 1 litre of water freezes, the volume of ice formed will be

1. 0.9 litre
2. 1.0 litre
3. 1.11 litre
4. 1.5 litre

**Question 91:** 3730 watts = \_\_\_\_\_horse power

1. 5
2. 2
3. 746
4. 6

**Question 92:** A boy has five resistance of  $\frac{1}{5}$  ohm each. The maximum resistance that can be formed with them is

- 1 0.5 ohm
- 2 1 ohm
- 3  $\frac{1}{25}$  ohm
- 4  $\frac{1}{5}$  ohm

**Question 93:** Each of 3 capacitors of capacity C are connected together in series. This combination is added in parallel to a capacitor of capacity C. Resultant capacity will be

- 1 C
- 2 3C
- 3 4C
- 4  $\frac{4C}{3}$

**Question 94:** A falling drop of rain water acquires the spherical shape due to

- 1 Surface Tension
- 2 Gravitational force
- 3 Atmospheric pressure
- 4 Viscosity

**Question 95:** A periscope works by the principle of

- 1 Refraction
- 2 Total Internal reflection
- 3 Diffraction
- 4 Reflection and refraction

**Question 96:** A transformer mainly transforms -

- 1 Current
- 2 Voltage
- 3 Frequency
- 4 Power

**Question 97:** Which among the following is a solid at room temperature?

1. Nitrogen
2. Potassium permanganate
3. Bromine
4. Helium

**Question 98:** Which one of the following is not a radioactive element?

1. Uranium
2. Radium
3. Thorium
4. Cadmium

**Question 99:** A solid that sublimates on heating is \_\_\_\_\_.

1. sodium chloride
2. copper sulphate
3. lead sulphate
4. ammonium chloride

**Question 100:** An object is placed between the pole of concave mirror and the focus of the mirror, the image formed will be

- 1 Behind the mirror, virtual, erect and magnified
- 2 At infinity, real inverted and highly enlarged
- 3 Beyond centre of curvature, real inverted and enlarged
- 4 Beyond 2F, real inverted and enlarged

## ANSWER KEY TO PART II

Ans 51). 4

Ans 52) 2

Ans 53) 3

Ans 54) 4

Ans 55) 2

Ans 56) 4

Ans 57) 2

Ans 58) 1

Ans 59) 1

Ans 60) 4

Ans 61) 4

Ans 62) 4

Ans 63) 2

Ans 64) 4

Ans 65) 1

Ans 66) 4

Ans 67) 4

Ans 68) 1

Ans 69) 1

Ans 70) 3

Ans 71) 2

Ans 72) 4

Ans 73) 1

Ans 74) 1

Ans 75) 4

Ans 76). 1

Ans 77). 1

Ans 78). 1

Ans 79). 1

Ans 80). 4

Ans 81). 3

Ans 82) 2

Ans 83) 1

Ans 84) 1

Ans 85) 3

Ans 86) 4

Ans 87) 1

Ans 88) 2

Ans 89) 2

Ans 90) 1

Ans 91) 1

Ans 92) 2

Ans 93) 4

Ans 94) 1

Ans 95) 2

Ans 96) 2

Ans 97) 2

Ans 98) 4

Ans 99) 4

Ans 100) 1