A

CMPREHENSIVE BOOK

OF

PHYSICS PRACTICALS

VIVA VOCE

FOR CLASS

1. VERNIER CALLIPER

Q.1: What is vernier calipers?

Ans. It is simple instrument by which length of an object can be measured accurately up to one-tenth of a millimeter or one-hundredth of a centimeter.

Q.2: What is the use of Vernier Scale?

Ans. To increase the accuracy of the main scale.

Q.3: What is least count (L.C.)?

Ans. The minimum measurement that can be taken by an instrument.

Q.4: What is the least count of?
(a) meter scale (b) Stop Watch (c) Vernier Calliper

Ans. The least count of:
(a) meter scale = 0.1 cm or 1 mm.
(b) stop watch = 0.01 sec or 1/100 sec. or according to stop watch.
(c) vernier scale = 0.01 cm or 0.1 mm

Q.5: What are units of vernier scale?

Ans. Vernier has not units of its own.

Q.6: What is the difference in the measurement of one smaller division on the main scale (M.S.) and that of vernier scale (V.S.)

Ans. (1 smallest Div. on M.S.) – (1 smallest Div. on V.S) = 0.1 – 0.09 = 0.01 cm
= Least count.

Q.7: How the L.C. of a vernier is determined?

Ans. By using the relation:

$$\text{L.C.} = \frac{\text{Smallest division on Main scale}}{\text{Total number of divisions on vernier scale}}$$

Q.8: Will the accuracy of a vernier will increase or decrease if 20 divisions are made in the same length?

Ans. The accuracy will increase since the L.C. will decrease i.e.

$$\text{Accuracy} \ \alpha \ \frac{1}{\text{Least count}}$$

Q.9: Which one is smaller M.S. div. or V.S. div.?

Ans. V.S. division.

Q.10: 1 division on V.S. = _____ cm.

Ans. 0.09 cm.

10 div. on V.S. = 0.9 cm
1 div. on V.S. = 0.9/10 cm = 0.09 cm

Q.11: What are the functions of
(a) Sliding strip (b) Upper jaws

Ans. (a) For measuring depth. (b) For measuring the inner diameter.

Q.12: What is meant by zero error (Z.E.)?

Ans. The error which arises when zeros of M.S. and V.S. do not coincide upon joining the two jaws.

Q.13: When Z.E. is positive?

Ans. The Z.E. is positive when the zero of V.S. is to the right of the zero of M.S.

Q.14: How we find the corrected reading?

Ans. Corrected reading = Meaning reading – ($\pm$ Z.E.)

Q.15: Do you know any use of vernier scale?

Ans. It is used in spectrometer, barometer, traveling microscope, etc.

Q.16: What are significant figures?

Ans. Numbers 0, 1, 2, 3, ……. are called significant figures when they occur. The zero is not a significant figure if it is at the extreme left or extreme right of a number, e.g.
1.02 has three significant figures, but 1.20 has two significant figures.

Q.17: What is meant by degree of accuracy?

Ans. It is the measurement estimated by the number of significant figures in the result.

Q.18: Why is the vernier calipers so called?

Ans. A French mathematician named Pierre Vernier invented it and it is named after him.

Q.19: How does temperature affect the length of a cylinder?

Ans. The length of a cylinder increases with the increase of temperature and decreases with the decrease of temperature.

Q.20: What is the unit of volume?

Ans. In MKS system, the unit of volume is m^3. In CGS system, the unit of volume is cm^3. In FPS system, the unit of volume is ft^3.

2. SCREW GAUGE

Q.1: What is a screw?

Ans. Screw is a simple machine related to inclined plane.

Q.2: What is meant by "gauge"?

Ans. The gauge means device or instrument.

Q.3: Name two main parts of a screw-gauge?

Ans. (a) A nut (b) A bolt or screw

Q.4: What is meant by pitch of a screw?

Ans. Pitch is the distance between two nearest (consecutive or successive) threads along the axis of screw.

Q.5: How is the pitch found?

Ans. By dividing the distance covered by the screw in a known number of rotations by the total number of relations.

Q.6: What is the least count (L.C.) of the screw gauge?

Ans. L.C. of screw gauge = 0.001 cm.

Q.7: How the L.C. of a screw gauge is found?

Ans. By using the relation:

$$\text{L.C.} = \frac{\text{Pitch of the screw}}{\text{No. of circular scale divisions}}$$

Q.8: What is meant by zero error of a screw-gauge?

Ans. The error which arises when the zero of circular scale does not coincide with the zero of the main scale upon joining the two studs.

Q.9: When the zero-error is positive?

Ans. If the zero of the circular scale lies above the reference line, provided that the fixed and movable studs are in contact.

Q.10: What is the degree of accuracy of the screw gauge?

Ans. Degree of accuracy = L.C. or
Reading power = 0.001 cm

Q.11: What is mechanical advantage of a screw gauge?

Ans. Like a screw jack mechanical advantage of a screw gauge is 2π r/h; where 'r' is the radius of cylinder of the screw and 'h' is the pitch.

Q.12: What is meant by range of the screw gauge?

Ans. The maximum length of the main scale.

Q.13: What is formula for area of cross section of wire?

Ans. Area of circle = $2 \pi r$

Q.14: What is back lash error?

Ans. Within a nut there is a little space for the play of screw. Due to continuous use this space increases. Thus when the screw is turned in one direction the stud moves as usual. However, when the screw is rotated in the opposite direction, the stud does not move for a while. This error is called Back lash error. In short
"Back lash error is the error introduced on reversing the direction of rotation".

Q.15: How back lash error is avoided?

Ans. By turning the screw in one direction only.

Q.16: What are "precision instrument"?

Ans. The instrument that can measure up to a fraction of a mm, e.g., vernier caliper, screw gauge and spherometer.

Q.17: What is Pi (π)?

Ans. Ratio between the circumference of a circle to its diameter.

$$\pi = \frac{\text{Length of Circumference}}{\text{diameter}}$$

Q.18: Does the diameter of the screw depend on temperature?

Ans. Yes it does. Diameter increases with the increase of temperature and decreases with the decrease of temperature.

3. SPHEROMETER

Q.1: Why the instrument is given the name "spherometer"?

Ans. Because it is used to determine the radius of curvature of a spherical surface.

Q.2: What is the pitch of a spherometer?

Ans. The distance covered by the circular disc in one complete rotation along the main scale. Mostly pitch of spherometer = 1 mm = 0.1 cm.

Q.3: How do you find the least count of spherometer?

Ans. L.C. of spherometer $= \dfrac{\text{Pitch of screw}}{\text{No. of divisions an circular scale}}$

$= \dfrac{0.1 \text{ cm}}{100}$

$= 0.001$ cm.

Q.4: What is meant by 'radius of curvature' of a surface?

Ans. The radius of that sphere from which the surface is cut.

Q.5: What is the radius of curvature of phone surface?

Ans. Infinite.

Q.6: What is the formula for the radius of curvature?

Ans. $$R = \frac{a^2}{6h} + \frac{h}{2}$$

Where,

a = mean distance between the legs of the spherometer, and
h = height or depth of a surface

Q.7: Is there any zero error in a spherometer?

Ans. Spherometer may have a zero error.

Z.E. in spherometer = reading on the plane glass sheet

Q.8: When the zero error (Z.E.) is positive and when negative?

Ans. **Positive:** If the edge of the circular disc is at zero of main scale and the zero of the circular scale is ahead of the edge of main scale. If it is behind the edge of main scale, the Z.E. is **negative.**

Q.9: Can you measure the radius of curvature of wrist-watch glass by using a spherometer?

Ans. No, because the wrist-watch glass is small and all the legs of the spherometer cannot rest on it.

Q.10: What will be the effect of:
(a) changing the pitch or
(b) changing the number of circular divisions upon accuracy or least count.

Ans. (a) If we decrease the pitch the L.C. will decrease and hence the accuracy increases.

(b) If we increase the No. of circular divisions, the accuracy increases since the L.C. decreases.

Q.11: What are the other uses of spherometer?

Ans. (a) In finding a small increase in length during finding the coefficient of linear expansion.

(b) In finding the small change in length due to the change in the weight suspended during the determination of young's modules.

Q.12: Why main scale is marked on both sides of zero?

Ans. To measure both height and depth.

Q.13: Is paper insertion method for testing the touching position of the screw is correct?

Ans. No, because the thickness of ordinary paper (0.01 cm) is greater than the L.C.

Q.14: Define focal length?

Ans. The distance between the pole and the principal focus of spherical mirror is called the focal length. The focal length of spherical mirror is half of its radius of curvature.

4. SURFACE TENSION:

Q.1: Define surface tension?

Ans. "The tangential cohesive force acting along the unit length of the surface of a liquid"

$$\boxed{T = F / L}$$

Where F = total force along a line
L = length of the line

In this experiment:

F = m g
= weight of the pan + weight in the pan.
L = 2 (length of the slide) + 2 (breadth of the slide).

Sometime we neglect the breadth since it is very small.

Q.2: What are units of surface tension in C.G.S. and S.I. (M.K.S.) system?

Ans. Dynes / cm (C.G.S.)
Newton / meter (M.K.S.)

Q.3: What are cohesion and adhesion force?

Ans. Cohesion force is the attractive force between like molecules, whereas, the adhesion is the attractive force between unlike molecules, e.g. attraction between glass slide and the liquid.

Q.4: What are the factors affecting the surface tension?

Ans. (a) Nature of liquid (b) Nature of the surface in contact (c) Temperature

Q.5: What is the effect of temperature on the surface tension?

Ans. Surface tension decreases with the rise of temperature.

Q.6: Define critical temperature.

Ans. The temperature at which the surface tension is zero.

Q.7: Why the free surface of water is concave but that of mercury is convex?

Ans. The free surface of water is concave because:

Cohesion force between water molecules $<$ adhesion force between water and gas molecules

Because the free surface of mercury is convex because Cohesion force $>$ adhesion force

Q.8: What is the shape of free surface at critical temperature?

Ans. Ay critical temperature the surface tension because zero hence the free surface is flat.

Q.9: Why the surface of the slide should not be oily?

Ans. The surface tension will decrease.

Q.10: Define angle of contact.

Ans. Angle of contact, for a pair of solid and liquid, id define as
"the angle between tangent to the liquid surface drawn at the point of contact and the solid surface inside the liquid."

Q.11: Give some practical applications of surface tension.

Ans. (a) A drop of falling liquid is always in spherical shape.

(b) We use oily substances to set out hairs.

(c) We use soaps and detergent for cleaning clothes.

(d) A thin layer of water over the umbrella protects us against light rain.

(e) Capillary action e.g. rising of oil in the wick of a lamp.

(f) Flying insects can walk on water surface without getting their feel wet.

5. YOUNG'S MODULUS:

Q.1: Define elasticity.

Ans. Property of materials to regain their original length, volume or shape after the deforming force has been removed.

Q.2: State Hooke's Law.

Ans. "If the deforming force is not greater than elastic limit, the strain is directly proportional to the stress."

$$\text{Stress} \ \alpha \ \text{Strain}$$

or $$\boxed{\frac{\text{Stress}}{\text{Strain}} = E}$$

Here constant 'E' is called "MODULUS OF ELASTICIT".

Q.3: Define YOUNG'S MODULUS(Y).

Ans. The ratio of longitudinal stress to the linear strain

$$\boxed{\frac{\text{Longitudinal Stress}}{\text{Linear Strain}} = Y}$$

Q.4: What is elastic limited?

Ans. The maximum value of stress beyond which stress is not proportional to strain. (Beyond elastic limit strain is rapid).

Q.5: Define STRESS.

Ans. The restoring force per unit area set up inside the body which is under the influence of deforming force.

Stress (inside the body) = deforming force (externally applied)

Q.6: Define Strain.

Ans. The ratio of change in length (L), volume (V) or shape to the original length (L) volume (V) or shape.

$\frac{l}{L}$ = longitudinal strain

$$\boxed{\frac{v}{V} = \text{cubical strain}}$$

Q.7: What are the units of:
(a) Stress (b) Strain (c) Young's modulus

Ans. (a) Newton / meter^2 or dynes / cm^2
(b) No units since if the ratio between the similar quantities
(c) N / m^2 or dynes / cm^2

Q.8: What is the function of second wire?

Ans. To eliminate the error due to change in temperature.

Q.9: Which one is more elastic, foam or iron?

Ans. Iron, because iron can regain its original shape or length more easily than foam.

Q.10: Gases and liquids have elasticity or not?

Ans. Yes, they have.

6. ADDITION OF VECTORS:

Q.1: What are scalar and vector quantities?

Ans. (a) **Scalar** is a physical quantity which is completely represented only by magnitude with a suitable unit, having no direction, e.g. time, mass, speed, density, work, energy, etc.

(b) **Vector** is a physical quantity has both 'magnitude and a specified direction' e.g. displacement, velocity, acceleration, force, weight, torque, momentum, magnetic field intensity, electric field intensity.

Q.2: Define resolution of vectors?

Ans. The splitting up of a single vector into two or more vectors is called resolution of vector.

Q.3: What do you mean by components of a vector?

Ans. Two or more such vectors which are at right angle to each other are called rectangular components.

Q.4: What are rectangular component?

Ans. The components of a vector which are at right angle to each other are called rectangular components.

Q.5: Define the following:

(a) unit vector (b) null vector
(c) position vector (d) negative vector

Ans. (a) **Unit vector** is that vector whose magnitude is unity '1', and it simply indicates the direction.

(b) **Null vector** is that vector whose magnitude is zero and it may have any arbitrary direction or no direction. It is also called zero vector.

(c) **Position vector** is that vector which specifies the position of a point with respect to origin of reference axes.

(d) The **negative** of a vector is that vector which is equal in magnitude but opposite in direction of that vector.

Q.6: State head to tail rule of addition of vectors?

Ans. It states that 'When the representative lines of all the given are drawn, arrange them in such a way that head of first vector line joins with the tail of second vector, then head of second vector joins with the tail of third vector and so on. The line joining the tail of first vector with head of last vector will represent the resultant vector in magnitude and direction'.

Q.7: State parallelogram law of vector addition?

Ans. It states that 'If two vectors are completely represented by two adjacent sides of a parallelogram, then the diagonal of the parallelogram from the tails of two vectors gives their resultant vector'.

Q.8: What is a scalar product?

Ans. When the product of two vectors is a scalar quantity it is called scalar product or dot product, e.g. work is a dot product of force and displacement.

Q.9: What is a vector product?

Ans. When the product of two vectors is a vector quantity it is called vector product or cross product, e.g. torque is a vector product of force and force arm.

Q.10: How a vector is multiply by a number?

Ans. When a vector is multiplied by a positive number its magnitude changes but direction remains the same. But when a vector is multiplied by a negative number not only its magnitude changes but its direction is also reversed.

Q.11: What is the unit of force?

Ans. The force is measured in Newton (MKS system) or in dyne (CGS system) or in pound (BE system).

Q.12: Define Pythagoras' theorem.

Ans. It states that for a right angled triangle

$$\boxed{(\text{hypotenuse})^2 = (\text{base})^2 + (\text{perpendicular})^2}$$

7. VALUE OF 'g' AT KARACHI:

Q.1: Define the term free fall.

Ans. It is the fall of body from certain height toward the earth under the action of gravity.

Q.2: Why is the free fall method so called?

Ans. It is called free fall method because to find out the value of g we use the relation = $g\ 32\ h/T^2$, which holds only for a body falling freely from rest under the action of gravity and in this method metallic bob fulfills this requirement.

Q.3: What kind of motion is executed by the bar?

Ans. The motion of bar is simple harmonic motion.

Q.4: Why do we take one-fourth of the time period of the bar as time of free fall?

Ans. It is because the metallic bob travels the vertical distance in the time the bar completes one-fourth of its oscillation.

Q.5: Define time period of a bar.

Ans. The time taken by the bar to execute one complete oscillation is called the time period of the bar.

Q.6: How does the mass of bob affect the value of g in the experiment?

Ans. As the value of g is independent of the mass of a falling body, so the value of g will not change if we change the mass of bob.

8. LAWS OF PENDULUM:

Q.1: Define simple pendulum.

Ans. An ideal simple pendulum is defined as 'single isolated particle suspended by a weightless, flexible and inextensible string with a friction-less support'.

Q.2: Why the word 'SIMPLE' is used before the pendulum?

Ans. Because the pendulums used in the wall clocks are 'COMPOUND PENDULUMS', in which a metallic rod is used in place of the thread.

Q.3: Define 'g'?

Ans. Acceleration due to gravity.

Q.4: What is the difference between 'g' and 'G'?

Ans. The value of G (gravitational constant) remains constant throughout the universe, whereas the value of 'g' decreases with the increase in the height.

Q.5: What is the value of 'g' at the C.G. of the earth?

Ans. Zero.

Q.6: How the value of 'g' changes as we move from the surface towards the C.G. of the earth?

Ans. As a rule it should decrease gradually but due to variable density of the earth, it increases up to a small depth and then decreases.

Q.7: Where the 'g' is greater, at equator or poles?

Ans. At the poles (where the earth is slightly compressed).

Q.8: Where 'g' will be smaller, at Karachi or at Muree?

Ans. At Muree (7000 ft. above sea level).

Q.9: What is the value of 'g' at sea level?

Ans. $g = 9.781\ m/s^2$ at equator.

$g = 9.832\ m/s^2$ at poles.

Q.10: Why the amplitude of the pendulum is kept small (2cm or about 5 cm)?

Ans. If the amplitude is large the motion of the simple pendulum will not be simple harmonic. If θ will not be small $\sin\theta \neq \theta$ and $T \neq 2\sqrt{L/g}$.

Q.11: Define simple harmonic motion (S.H.M).

Ans. The motion of the vibrating body is S.H.M. when

(a) The magnitude of its acceleration is directly proportional to the displacement x from the mean position.

(b) The direction of acceleration is always towards the mean position (that is opposite to x) mathematically:

$$\boxed{a \ \alpha \ -x}$$

Q.12: Define vibratory system?

Ans. Back and forth or to and from motion between two fixed positions.

Q.13: Define the following terms:
(a) amplitude (x_o) (b) oscillation or vibration
(c) frequency (f) (d) time period (T)

Ans. (a) Amplitude: the maximum displacement from the mean (equilibrium) position.
(b) Oscillation: the motion from one extreme position to the other and then back to the original one.
(c) Frequency: number of vibrations per second.
(d) time period: time taken for one vibration.

Q.14: What is the relation between frequency and time period?

Ans. $\boxed{f = \frac{1}{T}}$ or $\boxed{T = \frac{1}{f}}$

Q.15: What are the units of frequency?

Ans. Vibrations / sec, cycles / sec (c.p.s.) or Hertz.

Q.16: What is the frequency of a second pendulum?

Ans. 0.5 Hz or $\frac{1}{2}$ Hz, because

$f = \frac{1}{T} = \frac{1}{2}$ (T = 2 s for a second's pendulum)

Q.17: Prove that $g = 4\pi^2 \frac{L}{T^2}$

Ans. For a simple pendulum time period is given by:

$$T = 2\pi \sqrt{L/g}$$

$$T^2 = 4\pi^2 L/g$$

i.e. $\boxed{g = 4\pi^2 L/T^2}$

Where L = length of the simple pendulum.

Q.18: Let the time period of a simple pendulum is 4s at the place where g = 900 cm/s^2. What will be the time period at the place where g = 100 cm/s^2.

Ans. 12 s.
EXPLANATION: $g = 4\pi^2 L/T^2 \Rightarrow T^2 \alpha \frac{1}{G}$ when L remain constant
Therefore, when g decreases by 9 times, the 'T' increases by 3 times.

Q.19: Time period will increase or decrease if we use a heavier bob.

Ans. There will be no change in the time period.

EXPLANATION: The relation $\boxed{T = 2\sqrt{L/g}}$ shows that there is no effect of mass on the time period.

Q.20: Can you replace the thread by a metallic wire?

Ans. No, because the wire is not flexible.

EXPLANATION: By definition of simple pendulum, the string must be perfectly flexible. The thread is flexible but a metallic wire is not. That is why the wire can be used in place of thread.

Q.21: What is restoring force?

Ans. The force which tends to bring a vibrating body towards the mean position.

Q.22: What is restoring force (net force) acting on the bob?

Ans. If the air friction is neglected, restoring force on the bob = mg Sin θ.

Q.23: What is net force on the bob, at equilibrium (mean) position?

Ans. Zero, since at mean position the weight of the bob is perfectly balanced by the tension (T) in the string.

Q.24: Define equilibrium.

Ans. A body is said to be in equilibrium when its linear and angular accelerations are zero or when F = 0 &

EXPLANATION: when a body is
(a) at rest or
(b) moving with uniform linear velocity its linear acceleration is zero.
(c) not rotating at all or
(d) rotating at a constant rate it is in equilibrium.

Q.25: Can you replace the thread by a rubber band?

Ans. No, because it is not inextensible. By definition the string must be inextensible.

Q.26: Can we use a cricket ball in place of the bob?

Ans. No, by definition of simple pendulum the bob must be as small as possible.

Q.27: Why the pendulum stops after some time?

Ans. Its energy is lost as heat.

Q.28: How P.E. and K.E. of the pendulum interchange into each other during vibrations?

Ans. (a) In the form of P.E. at extreme positions.
(b) In the form of K.E. at mean position and
(c) In the form of P.E. and K.E. between mean and extreme positions.

Q.29: From where the length of the pendulum is measured?

Ans. From the centre of gravity of the bob to the point of suspension.

9. A.C. SUPPLY:

Q.1: What is meant by electric current?

Ans. The flow of electrons.

Q.2: What are A.C. and D.C. currents?

Ans. Alternating current (A.C.) changes its direction with a definite frequency. The direct current (D.C.) flows in one direction only.

Q.3: What is meant by frequency?

Ans. Number of vibrations per sec.

Q.4: What is the frequency of A.C. in Karachi or Pakistan?

Ans. 50 cycles/s.

Q.5: What types of waves are produced in the thread?

Ans. Transverse stationary waves.

Q.6: What kind of vibrations are produced in the thread?

Ans. Forced vibrations.

Q.7: If the tension (T or Mg) is increased by four times what will be the effect on the length of one loop?

Ans. The relating $f = \frac{1}{2l}\sqrt{Mg/m}$ shows that length of the loop (l) will increase by two times.

Q.8: What will happen if supply D.C. current?

Ans. The rod will not vibrate because the soft iron piece will be magnetized in one direction only.

Q.9: What is the frequency of D.C.?

Ans. Zero.

Q.10: Why the rod is vibrating?

Ans. The magnetic field produced by soft iron strip reverses its direction 50 times in each second.

Q.11: What is the function of bulb?

Ans. It shows that current is flowing in the circuit.

Q.12: If the iron rod is replaced by copper rod, will the rod vibrate?

Ans. No, copper is not attracted by a magnet.

Q.13: What is the relation between frequency of iron strip and frequency of waves in string in Melde's apparatus?

Ans. The frequency of iron strip is equal to the frequency of waves in string.

Q.14: What is solenoid?

Ans. A solenoid is a coil of wire wound uniformly on cylinder having a length that is large compared with its radius. A uniform magnetic field is produced inside the coil, parallel to its axis, when the steady direct current is passed through it.

Q.15: What do you mean by stationary or standing waves?

Ans. When two exactly similar waves (same amplitude, frequency and time period) traveling in opposite directions with equal velocity superpose on one another in a confined medium (say pipe), the resultant wave obtained is called stationary or standing wave.

Q.17: What type of waves are formed in the string?

Ans. Transverse stationary waves are formed in the string.

12. RESONANCE TUBE:

Q.1: What type of waves are produced in the air column?

Ans. Longitudinal or compressional stationary waves.

Q.2: An open end is a node or antinode?

Ans. An antinode.

Q.3: Is there a node or antinode at the close end of water level?

Ans. A node.

Q.4: Where resonance is produced?

Ans. In the air column.

Q.5: Can you call it an organ pipe?

Ans. Yes, a closed organ pipe.

Q.6: What is an organ pipe?

Ans. The organ pipes are wind pipes in which the air column resonates.

Q.7: What is sound?

Ans. Physically the compressional waves produced in a material medium. Psychologically the sensation or hearing produced in the brain.

Q.8: What is the relation between the velocity of sound and the temperature?

Ans. $V \alpha \sqrt{T}$

For 1^oC rise of temperature the velocity of sound increases by 0.6 m/s.

Q.9: What is meant by end-correction?

Ans. The distance between the open of the tube and the antinode at the position of tunning fork.

Q.10: How can you find the end correction (E)?

Ans. By using the relation

$$E = 0.3\ d$$

Where d is the internal diameter of the tube.

Q.11: What is the fundamental frequency (υ)?

Ans. The minimum frequency that can produce resonance.

Q.12: What are harmonies or overtones?

Ans. The multiples of fundamental frequency (υ_1) that can produce resonance. In a closed organ pipe or resonance tube the overtones are

$3\ \upsilon_1, 5\ \upsilon_1, 7\ \upsilon_1, 9\ \upsilon_1, \ldots\ldots\ldots\ldots$

or

odd integral multiple of fundamental frequency.

Q.13: Define time period.

Ans. It is the time required to complete one vibration or oscillation. It is reciprocal of frequency and measured in seconds.

Q.14: What is resonance?

Ans. Resonance is a phenomenon in which there is a marked increase in the amplitude of a vibrating, body by the influence of a second vibrating body having the same time period as the first.

Q.15: What is an echo?

Ans. Echo is the effect produced when sound wave is reflected on striking a solid obstacle like wall or rock.

13. FOCAL LENGTH OF CONVEX LENS BY TWO PIN METHOD:

Q.1: What is a lens?

Ans. A lens is a portion of a transparent medium bounded by two spherical surfaces or by one spherical surface and a plane surface.

Q.2: How many principal foci are there for a lens?

Ans. Two, one on either side of the lens.

Q.3: What is the reference point for measuring p, q and f for a lens?

Ans. The optical centre of the lens.

Q.4: What kind of images are formed by convex lens?

Ans.

Position of Object	Position of Image	Relative size of image	Nature of image
1. at infinity	at focus	point	real; inverted
2. beyond C	between F & C	smaller	real; inverted
3. at C	at 'C'	equal	real; inverted
4. between C &F	beyond 'C'	larger	real; inverted
5. at F	at infinity	magnified	real; inverted
6. between F & O	behind the object	magnified	Virtual; erect

Q.5: What is the magnifying power (M) of a magnifying glass?

Ans. $M = (1 + \frac{d}{f})$, where d = 25 cm = least distance of distinct vision.

Q.6: If the power of a convex lens is 0.1 diopter; what will be its focal length?

Ans. $P = 1/f$, so that, $f = 1/p = 1/0.1 = 10m$

Q.7: Which defect is present in lenses but not in mirrors?

Ans. Chromatic aberration.

Q.8: What are uses of lenses?

Ans. Combination of lenses are used in microscopes, telescopes, projectors, binoculars, cameras, etc.

Q.9: What is lens maker's formula?

Ans. $1/f = (n - 1)(1/R_1 - 1/R_2)$

Where,

f = focal length of the lens.
n = refractive index of the glass used for making the lens.
R_1 = Radius of curvature of one surface.
R_2 = Radius of curvature of the other surface.

14. FOCAL LENGTH OF CONCAVE LENS BY CONCAVE MIRROR:

Q.1: What is a concave lens?

Ans. The lens which is thinner at the centre and thicker at the edges is known as concave lens.

Q.2: What is the difference between a convex lens and a concave lens?

Ans. (a) Sides of a convex lens are bulging whereas the surface of the concave lens are deep towards the optical centre.
(b) Real images of surrounding objects can be obtained by a convex lens on the screen like a wall. This cannot be done by a concave lens.

Q.3: Can you find the focal length of a concave lens without using an auxiliary apparatus?

Ans. No, an auxiliary apparatus like plane mirror, a convex lens or a concave mirror must be used to find the focal length of a concave lens because:
(a) the image formed by the concave mirror is on the same side as the object and
(b) the image formed by a concave lens is always virtual.

Q.4: What is the maximum distance of the image formed by a concave lens?

Ans. Focal length of the lens.

Q.5: What is the distance of the image formed by the concave lens from the concave mirror when the parallax is removed?

Ans. The distance is equal to the radius of curvature of the concave mirror.

Q.6: Can you get final image of the object if the distance of the concave lens and the concave mirror is greater than the radius of curvature of the mirror?

Ans. No, because the rays passing through the lens can never fall normally on the mirror and the final image cannot be formed at the object. Thus parallax can never be removed.

Q.7: How many images are formed in this experiment?

Ans. (a) virtual image of the object formed by the concave lens.
(b) the real image of the first image (virtual object) formed by concave mirror.
(c) the final image of the second image formed by the concave lens.

Q.8: Which lens is used for the correction of short-sightedness (myopia)?

Ans. Concave lens.

Q.9: How long-sightedness (hypermetropia) is correct?

Ans. By using a convex lens.

Q.10: What are other uses of concave lenses?

Ans. (a) As on eye-piece in the Gallilean telescope.
(b) In making achromatic combinations.

15. REFRACTIVE INDEX OF LIQUID:

Q.1: What is refractive index of a transparent medium?

Ans. The ratio of the velocity of light in vacuum to the velocity of light in the given medium.

$$n = \frac{C}{V}$$

or $$\boxed{n = \frac{\text{Sin } i}{\text{Sin } \upsilon}}$$

Where c = velocity of light in the vacuum
v = velocity of light in the given medium.

Q.2: What are the factors affecting the refractive index?

Ans. (a) Wave length of the light used.
(b) Nature or the medium.

Q.3: What is meant by monochromatic light?

Ans. Light consisting of only one colour or wave-length.

Q.4: Can you see all the wave-lengths?

Ans. No, wave lengths from 4000 A^o (violet) to 6000 A^o (Red) are visible only.

Q.5: Can the refractive index of a medium be less than or equal to 1?

Ans. No, since in the relation:

$$n = \frac{C}{V} \text{ and we always have}$$

$$V < C$$

$$n > 1$$

Q.6: What is the refractive index of?
(a) glass (b) water (c) air (d) vacuum

Ans. (a) 1.5 (b) 1.33
(c) 1.003 (d) (V = C in vacuum)

Q.7: What is the principle of this experiment?

Ans. The focal length (f) of combination of thin lenses is given by:

$$\boxed{\frac{1}{f} = \frac{1}{f_l} + \frac{1}{f_g}}$$

Where, f_l and f_g are the focal lengths, the liquid lens, and the glass lens respectively.

Q.8: What type of lens is formed by water?

Ans. Plano-concave lens.

Q.9: What type of combined lens is formed?

Ans. Plano-concave lens.

Q.10: Which one is greater, the focal length of the combination or the focal length of the convex lens?

Ans. The focal length of the combination.

Q.11: What is function of plane mirror?

Ans. To reflect the rays refracted by the lens of liquid. When the pin is at the centre of curvature of the combination, the reflected rays form the image at the position of the pin.

Q.12: What are the laws of reflection?

Ans. (a) The angle of incidence is always equal to the angle of reflection.

(b) The angle of incidence, angle of refraction and the normal to the point of incidence, all lie in one plane.

Q.13: What are laws of refraction?

Ans. (a) The ratio Sin i / Sin r is always constant give a given medium and is called refracted index, μ or n (Snell's Law).

(b) The incident ray, the refracted ray and normal to the point of incidence, all lie in the same plane.

Q.14: Which substance has greatest value of refractive index?

Ans. Diamond (2.42)

Q.15: What defect may be produced in the image when very small quantity of water and hence the image produced will be distorted.

Ans. The water surface will not be flat due to the small quantity of water and hence the image produced will be distorted.

16. REFRACTIVE INDEX OF THE MATERIAL OF A PRISM:

Q.1: What is a prism?

Ans. A piece of transparent medium bounded by three rectangular and two triangular surfaces.

Q.2: Define deviation.

Ans. Total bending of a ray of light while crossing on optical medium.

Q.3: Define angle of deviation (D).

Ans. The angle between the incident ray and the emergent ray.

Q.4: What is the relation between the angle of incidence and the angle of deviation?

Ans. When the angle of incidence starts increasing from a smaller value, at first the angle of deviation decreases up to a certain limit (angle of minimum deviation) and then it increases.

Q.5: How does the angle of deviation vary with the wave length?

Ans. Shorter the wavelength, greater will be the angle of deviation.

Q.6: What is the relation between wavelength and energy?

Ans. Inverse proportion i.e. shorter the wavelength, greater is the energy of a colour.

Q.7: What is angle of prism in this experiment?

Ans. 60^{o}.

Q.8: How angle of prism is related with the angle of deviation?

Ans. larger the angle of prism, larger is the angle of deviation.

Q.9: Give some examples of total internal reflection.

Ans. (a) Mirage (b) Glittering of precious stones (c) Shiny appearance of the water surface of swimming pools as seen from inside the water.

Q.10: When light enters into the prism is there any change in the frequency of wave length?

Ans. The wavelength decreases but the frequency does not change.

Q.11: What is the relation between the speed of light (C) frequency (υ) and wave length (λ)?

Ans. $\boxed{C = \upsilon \times \lambda}$

Q.12: What is unit of refractive index?

Ans. No units, because it is the ratio between two similar quantities.

Q.13: Which of the colours have maximum and minimum angle of deviations?

Ans. The deviation is greater in the violet colour and smallest is red.

Q.14: Why the danger signals are red?

Ans. Since the deviation in the red colour is minimum, therefore, they can be seen from the maximum distance.

Q.15: Define dispersion of light.

Ans. Separation of colours present in polychromatic light by a prism.

Q.16: Give any example of dispersion.

Ans. Rainbow in the sky due to droplets of water.

Q.17: What are totally reflecting prisms?

Ans. The prisms in which the angle of prism are 90^o, 45^o and 45^o.

Q.18: What kind of glass is used for making prism?

Ans. Crown glass or optical glass.

Q.19: Why is PO cut equal to OM in this experiment?

Ans. Because the image is formed at the same distance behind as the object is in front of the reflecting face of the prism.

Q.20: What is meant by critical angle?

Ans. When refraction takes place from a denser to a rare medium, that angle of incidence for which the angle of refraction is 90^o, is called the critical angle.

Q.21: What is totally reflecting prism?

Ans. It is a glass prism having angles of 45^o, 45^o, 90^o. It deviates the path of light through 90^o or 180^o without any loss in intensity.

Q.22: Why do the precious stones like diamond glitter?

Ans. These precious stones have large refractive indices and small critical angles which make the incoming light totally reflected a number of times without much loss in intensity and hence make their faces look bright.

17. REFRACTIVE INDEX OF MATERIAL OF GLASS SLAB:

Q.1: What do you mean by refractive index?

Ans. Refractive index of a medium determines the extent to which one medium is optically denser than the other medium for a particular of a light used.

Q.2: What is absolute refractive index?

Ans. When light passes from vacuum into another medium than the ratio of the since of angle of incidence to the sine of angle of refraction is called absolute refractive index.

Q.3: On what factors refractive index depends?

Ans. It depends:
(a) Nature of medium (b) Wave length of incident light.

Q.4: What is the unit and the use of refractive index?

Ans. Being a ratio refractive index has no units and it is used to test the purity of a material because every pure material has a definite refractive index.

Q.5: Why does an object appear near through glass or water?

Ans. It is due to refraction of light.

Q.6: If an object is placed under the glass slab what type of its image is formed?

Ans. Virtual image is formed in the glass slab.

Q.7: What is meant by critical angle?

Ans. When refraction tales place from a denser to rare medium, the angle of incidence for which the corresponding angle of refraction is 90^o is called critical angle.

Q.8: On what factors critical angle depends?

Ans. It depends upon the nature of material and the nature of the medium in which the material is placed. It also changes with the colour of light, greater for red light and smaller for violet light.

Q.9: Define total internal reflection?

Ans. When light strikes the surface of an optically rare medium to an angle of incidence greater than the critical angle, light instead of emerging into the rare medium is reflected back into the denser medium. This phenomenon is called total internal reflection.

Q.10: Under what conditions total internal reflection occur?

Ans. (a) The light must pass from a denser to rare medium.
(b) Angle of incidence in the denser medium must be greater than the critical angle for that medium.

19. SET UP OF A COMPOUND MICROSCOPE:

Q.1: What is the difference in the construction of a telescope and microscope?

Ans. In the telescope the objective of larger focal length is used whereas in microscope image of very small objects.

Q.2: What is meant by magnifying glass?

Ans. A simple microscope is also called a magnifying glass because it produces magnified image of very small objects.

Q.3: Where the image is formed in compound microscope?

Ans. The image is compound microscope is formed at the least distance of distinct vision, which is 25 cm for a healthy eye.

Q.4: What is the formula to calculate the magnifying power of compound microscope?

Ans. The magnifying power of a compound microscope is given by:

$$M = \frac{L}{f_o}\left(1 + \frac{d}{f_o}\right)$$

Where,

f_o = focal length of objective
f_o = focal length of eye-piece
L = Length of microscope

Q.5: What is magnifying power?

Ans. Magnifying power as simply magnification produced by any lens is the ratio of distance of image to distance of object from the lens.

i.e. $$\text{Magnification} = \frac{\text{distance of image from the lens}}{\text{distance of object from the lens}}$$

Q.6: What is an objective and an eye-piece?

Ans. An objective is a lens which is placed near the object, and eye-piece is a lens which is close to the eye.

Q.7: What is a compound microscope and what are it uses?

Ans. It is an optical instrument consists of two convex lenses. It is used for viewing magnified image of very small objects.

Q.8: What are the condition of large magnification in a compound microscope?

Ans. Following are the conditions of large magnification in a compound microscope:

(a) Focal length of objective and that of eye-piece should be small.
(b) Length of microscope should be large.

Q.9: What is a simple microscope?

Ans. It consists of a convex lens and when an object is placed with in its focal length, a virtual and magnified image is formed.

Q.10: What is the difference in using of a telescope and a microscope?

Ans. Telescope is used to see distant object clearly whereas the microscope is used to see small objects in magnified form.