

CONTENTS

CHAPTER 1 Position, scalars and vectors

How to locate the position of a point in a plane

Scalars and vectors

Concept of scalars

Concept of vectors

Vector notation and representation

Magnitude of vectors

Negative and equal vectors

Addition of vectors

Addition of coplanar forces

Parallelogram law of vector addition

Velocity vector

Resolving vectors into components

Resultant of two or more vectors by resolution of forces

CHAPTER 2 Linear and projectiles motion, speed, velocity, acceleration and projectile motion

Linear motion

Using equations of linear motion

Motion under gravity

Vertical and horizontal motion of objects under gravity

Projectiles

Projectile motion

Vertical projection

Maximum height

Maximum height for vertical projection

Time of flight

Horizontal projection

Projectiles in x - y plane

Deriving the formula for projectiles in the x - y plane

Time of flight

The maximum height

The horizontal motion of projectiles

The maximum range

CHAPTER 3 Equilibrium of forces

Equilibrium

Dynamic and static equilibrium

Equilibrium of three coplanar forces

How to determine the equilibrant

Steps to sketch the triangle of forces

Moment of a force

Moment of an unbalanced force

Moments and directions

Moment and equilibrium

Conditions of equilibrium for parallel coplanar forces

Couple and torque

Balancing a couple

Centre of gravity and stability

Centre of gravity (G)

Centre of gravity of objects with uniform shape

Centre of gravity of non-uniform shape

Determination of centre of gravity of a lamina

Stability

Stable equilibrium

Unstable equilibrium

Neutral equilibrium

Application of stability

Floating and Sinking

Upthrust

Archimedes's principle

Finding relative density of substances

Principle of floatation

Making objects float on liquid

CHAPTER 4 Pressure

Concept of pressure

Pressure in liquids

The laws of liquid pressure

Pressure due to liquid column

Atmospheric (air) pressure

Evidence of atmospheric or air pressure

Column of liquid supported by atmospheric (air) pressure

Application of fluid pressure

The drinking straw

The syringe

The lift pump

The force pump

The bicycle pump

Hydraulic press

The hydraulic car brake

To find the density of a liquid

CHAPTER 5 Simple harmonic motion

Terms used in describing simple harmonic motion

Link between simple harmonic motion and uniform circular motion

Angular and linear motion compared

Angular velocity

Angular acceleration

Linear and angular motion compared

Displacement, velocity and acceleration of a simple harmonic motion

The velocity equation

Restoring force, period and energy of simple harmonic motion

Force in simple harmonic motion

Vibration of weight in a spiral spring

Vibration of simple pendulum

Energy transformation in simple harmonic motion

Free, damped and forced vibrations

Damped vibration

Forced vibration

Examples of forced vibration

Resonance

Examples of resonance

CHAPTER 6 Newton's laws of motion and linear momentum

Newton's first law of motion

Link between force and motion

Inertia

Newton's first law and inertia

Consequences of inertia

Momentum

Impulse

Newton's second law of motion

Impulse and momentum change

Force, mass and acceleration

Effect of force on acceleration

Effect of mass on acceleration

Newton's third law of motion

Outcomes of Newton's laws of motion

Conservation of linear momentum

Collision and momentum conservation

Mathematical proof of conservation of linear momentum

Elastic and inelastic collision

Inelastic collision

Explosion

Application of momentum

CHAPTER 7 Machines

Definition and general description of a machine

Effect of friction on mechanical advantage

Efficiency and friction

Relationship between M.A. and V.R. and efficiency of a machine

Simple machines

The lever

Classes of levers
Pulleys
Single fixed and single movable pulleys
Block and tackle system
Two pulley systems
Three pulley systems
Four or more pulley systems
Wheel and axle
Gears
The inclined plane
The screw
The screw jack
The wedge

CHAPTER 8 Temperature

Measurement of temperature
Fixed points and temperature scales
The Celsius scale of temperature
How to find the lower fixed point
How to find the upper fixed point
Absolute zero and Kelvin temperature scale
Link between Celsius and Kelvin temperature scales
Thermometers
Construction of liquid-in-glass thermometer
Properties of a good thermometric liquid
Advantages of mercury over alcohol as a thermometric liquid
Advantages of alcohol over mercury as a thermometric liquid
Why water is a bad thermometric liquid
Types of liquid-in-glass thermometer
The laboratory thermometer
The clinical thermometer
Sixâ€™s maximum and minimum thermometers
Other types of thermometers

CHAPTER 9 Measurement of heat energy

Specific heat capacity and heat capacity

Heat energy and factors affecting it

Specific heat capacity

Heat capacity

Heat exchange

Measurement of specific heat capacity of solid by method of mixture

Measurement of the specific heat capacity of liquid by method of mixture

Electrical method of measuring specific heat capacity of a liquid

Electrical method of measuring specific heat capacity of a solid

Conversion of potential energy to heat energy

Significance of specific heat capacity

Latent heat

Specific latent heat of fusion

Latent heat of fusion

Determination of specific latent heat of fusion of ice

Melting and freezing points of a substance

Factors affecting melting point of a substance

Effect of pressure on the melting point of ice

Latent heat of vaporisation

Specific latent heat of vaporisation

Determination of specific latent heat of steam

Evaporation

Cooling effect of evaporation

Working of refrigerators

Vapour pressure

Measurement of unsaturated and saturated vapour pressures

The effect of temperature on saturation vapour pressure

Boiling and saturation vapour pressure

Determination of boiling point of small quantity of liquid

Differences between boiling and evaporation

Applications of vapour pressure

Humidity

Relative humidity

Hygrometer

Dew and dew point

Mist, fog and clouds

CHAPTER 10 Expansion of gases

Evidence of gas expansion

Measurement of gas pressure and Boyle's law

Measurement of pressure

The liquid manometer

The aneroid barometer

Boyle's law

Graphs of Boyle's law

Verification of Boyle's law

Charles's and pressure laws

Charles's law

Verification of Charles's law

The intercept on the temperature axis

The cubic expansivity of a gas at constant pressure

Pressure law

Verification of pressure law

Graphs of pressure against temperature

General gas law and kinetic theory

The general gas law

Kinetic theory of gases

Explaining gas laws using kinetic theory of gases

Boyle's law

Charles's law

Pressure law

Limitations of gas laws

CHAPTER 11 Waves

Waves, production and propagation

What is a wave?

Mechanical waves

Production of mechanical waves

Wave front

Electromagnetic waves

Transverse waves

Longitudinal waves

Describing waves

Relationship between velocity, frequency and wavelength

Mathematical representation of wave motion

Phase

Out of phase

General progressive wave equation

Wave properties

Reflection of waves

Reflection of water waves

Reflection of sound waves

Reflection of heat radiation

Refraction of waves

Refractive index

Refraction of light waves

CHAPTER 12 Sources, propagation and reflection of light

Sources and propagation of light

Luminous and non-luminous objects

Interaction of light with matter

Light rays and beams

Rectilinear propagation of light

The pinhole camera

Effect of large pinhole on the image produced

Linear magnification

Shadows

Eclipses

Eclipse of the sun

Eclipse of the moon (Lunar eclipse)

Reflection of light

Reflection and diffuse reflections

The laws of reflection

Verification of laws of reflection

How an image is formed by plane mirror

How to locate the position of image in a plane mirror

Lateral inversion

Characteristics of images formed by plane mirrors

Rotation of plane mirror

Image formed by inclined mirrors

Images formed by two parallel mirrors

Uses of plane mirrors

Curved mirrors

What is a curved mirror?

Terms and definitions applied to spherical mirrors

Actions of concave and convex mirrors on parallel light rays

Convex mirror

Construction of ray diagrams

Hints for drawing good ray diagrams

Location and characteristics of images formed by curved mirrors

Defects of spherical mirrors

Parabolic mirrors

Mirror formula

Magnification

Sign convention

Methods of measuring focal length of a concave mirror

CHAPTER 13 Refraction of light

Refraction through rectangular and triangular prism

What is refraction?

The laws of refraction

Refractive index

The cause of refraction

Refraction through rectangular glass prism

Verification of Snell's law of refraction

Refraction through triangular glass prism

How to find the refractive index of a triangular glass prism

Effects caused by refraction

Real and apparent depth method of finding the refractive index

Total internal reflection

Conditions for total internal reflection

Critical angle and refractive index

Applications of total internal reflection

Advantages of using prism over mirror in optical instrument

How mirrors produce multiple images

Uses of optical fibres

Uses of total internal reflection

CHAPTER 14 Lenses and optical instruments

Convex and concave lenses

Convex lenses

Concave lenses

Action of lenses on parallel light

Terms and definitions used in describing lenses

Construction of ray diagrams

Location and characteristics of image formed by convex lenses

Location and characteristics of image formed by concave lenses

Lens formula and sign convention

Magnification

Sign convention

Methods of finding the focal length of convex lenses

Optical instruments

The eye

The working of the eye

Accommodation

Persistence of vision

Binocular vision

Near and far points

Defects of the eye

Short sightedness (myopia)

Correction of short sightedness

Long sightedness (hypermetropia)

Correction of long sightedness

The camera

Exposure control

Rangefinder cameras

Digital cameras

Movie cameras

The single lens camera

Differences and similarities between camera and eye

Film or slide projector
Microscopes
Simple microscope or magnifying glass
Compound microscope
Telescopes
The working of telescopes
Normal adjustment of a telescope
Angular Magnification
Galilean telescope
Prism binocular
Uses of binoculars

CHAPTER 15 Dispersion, colours and electromagnetic spectrum

Dispersion and spectrum of white light
Production of impure spectrum
Production of pure spectrum
The cause of dispersion
Combining the spectrum to form white light
Coloured disc
Colours
Colour additions
Absorption or subtraction of colours
Reflection and colours of objects

CHAPTER 16 Sound waves

Sound and musical notes
Sources of sound
Propagation of sound
Velocity of sound
Factors affecting the velocity of sound in air
How sound travels through air
Properties of sound waves
Reflection and echoes
How an echo is heard

Reverberation

Disadvantages of echoes and reverberations

Uses of echoes

Noises and musical notes

Characteristics of musical notes

Overtone (harmonic) and waveform

Vibration of strings and air columns in pipes

Forced vibration and resonance

Resonance in sound

Standing or stationary waves

Vibration in strings

The sonometer

Vibrating air columns in pipes

Closed pipes

Open pipes

Resonance tube experiment to determine the speed of sound in air