FEDERAL BOARD | FBISE

9th Class Physics Notes Federal Board (FBISE) Full Book Notes

Complete chapter-wise study notes with original practice questions and an MCQ answer key

These notes follow the chapters of the National Book Foundation (NBF) Physics book for Class 9, Federal Board (FBISE), in the order given below.

Prepared for students of the Federal Board of Intermediate and Secondary Education, Islamabad.
For the current model paper and official announcements, visit fbise.edu.pk.

About These Notes

These notes cover the full Class 9 Physics course of the Federal Board (FBISE), following the National Book Foundation (NBF) book. Each chapter gives the key concepts, important definitions, the formulas you must know, and the key terms to revise. After the notes, every chapter has original practice questions: 10 multiple choice questions, 5 short questions and 2 long questions. An answer key for all multiple choice questions is given at the end of the book.

How to Use This Book

- Read one chapter's notes first and learn the definitions and formulas by heart.
- Attempt the MCQs without looking at the key, then check your answers and re-read the parts you got wrong.
- Write the short and long questions in your own words; practise the numerical examples with the formulas given.
- Revise the key terms of every chapter before the examination.

Chapters in This Book

1. **Chapter 1:** Physical Quantities and Measurement
2. **Chapter 2:** Kinematics
3. **Chapter 3:** Dynamics - I
4. **Chapter 4:** Dynamics - II
5. **Chapter 5:** Pressure and Deformation in Solids
6. **Chapter 6:** Work and Energy
7. **Chapter 7:** Density and Temperature
8. **Chapter 8:** Magnetism
9. **Chapter 9:** Nature of Science and Physics

A Note on the Examination Paper

The FBISE Class 9 Physics paper is SLO-based, in line with the Student Learning Outcomes of the course. The paper pattern, including any marks distribution and time allowed, is set by the Board and may change, so no marks figures or paper-pattern figures are printed in these notes. Students should check the current model paper on the official FBISE website, fbise.edu.pk, before the examination.

All practice questions in this book are original and written for these notes. They are not copied from any past paper or guide. Figures such as the value of g (about 10 m/s^2 near the Earth's surface) and the density of water (1000 kg/m^3) are standard textbook values used in the NBF book.

Chapter 1: Physical Quantities and Measurement

Physics begins with measurement. Every physical quantity is measured by comparing it with a standard unit. This chapter introduces physical quantities, SI units, prefixes, measuring instruments and the errors that can occur while measuring.

Key Concepts

- Physics is the study of matter, energy and their interaction. A physical quantity is a quantity that can be measured, for example length, mass, time and temperature.
- Base quantities are the seven quantities of the SI system: length, mass, time, electric current, temperature, amount of substance and luminous intensity. All other quantities are derived quantities, obtained from base quantities.
- The SI unit of length is the metre (m), of mass the kilogram (kg), of time the second (s), of temperature the kelvin (K) and of electric current the ampere (A).
- Prefixes such as kilo (10^3), milli (10^-3), micro (10^-6) and nano (10^-9) are used to express very large or very small quantities in a compact way.
- A measuring instrument has a least count, the smallest value it can measure. The least count of a metre rule is 1 mm and of a stopwatch is usually 0.1 s or 0.01 s.
- Vernier callipers measure small lengths accurately to 0.1 mm (0.01 cm). A screw gauge (micrometer) measures very small lengths to 0.01 mm.
- Zero error occurs when the zero of an instrument does not coincide with the zero of the scale. It must be subtracted from or added to the observed reading as appropriate.
- Random error varies from one reading to another and is reduced by taking the average of several readings. Systematic error is constant and is caused by a faulty instrument or method.
- Significant figures show how precisely a quantity is known. The result of a calculation should not have more significant figures than the least precise measurement used.
- Volume of a regular solid is found from its dimensions; volume of an irregular solid is found by the displacement method using a measuring cylinder.

Important Definitions

Term	Definition
Physical quantity	A quantity that can be measured, such as length, mass, time or temperature.
Base quantity	A quantity that is defined independently, such as length, mass and time.
Derived quantity	A quantity obtained by combining base quantities, such as speed, area and density.
Unit	The standard amount of a physical quantity with which the quantity is compared.
Least count	The smallest value that a measuring instrument can measure.
Zero error	The error shown by an instrument when it should read zero, caused by a misaligned zero mark.
Significant figures	The digits in a measurement that are known reliably plus one uncertain digit.
Precision	How close repeated measurements of the same quantity are to each other.

Accuracy	How close a measurement is to the true value of the quantity.
Vernier constant	The difference between one main scale division and one vernier scale division, equal to 0.1 mm for a common vernier calliper.

Important Formulas

> Least count of vernier callipers = 1 main scale division - 1 vernier scale division = 0.01 cm
>
> Least count of screw gauge = pitch / number of divisions on the circular scale = 0.01 mm
>
> Corrected reading = observed reading - zero error
>
> Volume of a cuboid = length x width x height
>
> Volume of a cylinder = pi x (radius)^2 x height
>
> Average value = sum of all readings / number of readings
>
> 1 km = 1000 m; 1 cm = 10 mm; 1 mm = 1000 micrometres

Key Terms to Remember

physical quantity, **base quantity**, **derived quantity**, **SI unit**, **prefix**, **least count**, **zero error**, **vernier callipers**, **screw gauge**, **significant figures**, **precision**, **accuracy**, **random error**, **systematic error**

Chapter 1: Physical Quantities and Measurement — Practice Questions

Multiple Choice Questions

1. Which of the following is a base quantity?

(a) Speed (b) Force (c) Mass (d) Area

2. The SI unit of electric current is:

(a) Volt (b) Ampere (c) Ohm (d) Watt

3. Which of the following is a derived quantity?

(a) Length (b) Time (c) Density (d) Mass

4. One micrometre is equal to:

(a) 10^-3 m (b) 10^-6 m (c) 10^-9 m (d) 10^-2 m

5. The least count of a metre rule is:

(a) 1 cm (b) 0.1 cm (c) 1 mm (d) 0.01 mm

6. A screw gauge is used to measure:

(a) Long distances (b) Very small lengths (c) Mass of a body (d) Time intervals

7. Which instrument is most suitable for measuring the diameter of a wire?

(a) Metre rule (b) Measuring tape (c) Screw gauge (d) Stopwatch

8. If the zero of a vernier calliper is below the main scale zero, the zero error is:

(a) Positive (b) Negative (c) Zero (d) Cannot be found

9. The number of significant figures in 0.00450 is:

(a) 2 (b) 3 (c) 4 (d) 5

10. Taking the average of several readings mainly reduces:

(a) Systematic error (b) Zero error (c) Random error (d) Least count

Short Questions

1. Define a physical quantity and give two examples of base and two of derived quantities.
2. State the seven base quantities of the SI system with their units and symbols.
3. Define least count and state the least count of a metre rule and a screw gauge.
4. What is zero error? How is a reading corrected for zero error?
5. Distinguish between precision and accuracy with an example.

Long Questions

1. Describe the construction and working of vernier callipers. Explain how the diameter of a small cylinder is measured with them, including the correction for zero error.
2. Explain random error and systematic error. Describe the methods used to reduce each type of error in a measurement, and explain the rules of significant figures with examples.

Chapter 2: Kinematics

Kinematics is the study of motion without considering the forces that cause it. This chapter explains rest and motion, types of motion, speed, velocity, acceleration and the equations of motion, including the motion of freely falling bodies.

Key Concepts

- Rest and motion are relative: a body at rest in one frame of reference may be in motion in another. A body is in motion when its position changes with time relative to a reference point.
- Motion may be translatory (all parts move together, for example a car moving on a road), rotatory (a body turns about a fixed axis, for example a spinning wheel) or vibratory (a body moves to and fro about a mean position, for example a pendulum).
- Distance is the total length of the path travelled and is a scalar. Displacement is the shortest distance from the initial to the final position in a stated direction and is a vector.
- Speed is distance covered per unit time, a scalar quantity. Velocity is displacement per unit time, a vector quantity, and has both magnitude and direction.
- Average speed is total distance divided by total time. Instantaneous speed is the speed at a particular instant, shown by the speedometer of a vehicle.
- Acceleration is the rate of change of velocity. If velocity increases, acceleration is positive; if it decreases, it is retardation (negative acceleration). Uniform acceleration means velocity changes by equal amounts in equal intervals of time.
- The slope of a distance-time graph gives speed; the slope of a velocity-time graph gives acceleration, and the area under a velocity-time graph gives displacement.
- The three equations of motion for uniformly accelerated motion are: v = u + at; S = ut + (1/2)at^2; and 2aS = v^2 - u^2, where u is initial velocity, v final velocity, a acceleration, t time and S distance.
- A freely falling body moves with the acceleration due to gravity, g, which is about 10 m/s^2 near the surface of the Earth. In free fall the initial velocity is zero and the equations of motion apply with a = g.
- In the absence of air resistance all bodies fall with the same acceleration regardless of their mass; air resistance is what makes a feather fall more slowly than a stone in air.

Important Definitions

Term	Definition
Rest	The state of a body when its position does not change with time relative to a reference point.
Motion	The change in position of a body with time relative to a reference point.
Distance	The total length of the path travelled by a body; a scalar quantity.
Displacement	The shortest distance between the initial and final positions of a body in a specified direction; a vector quantity.
Speed	Distance covered per unit time; a scalar quantity.
Velocity	Displacement per unit time; a vector quantity with magnitude and direction.
Acceleration	The rate of change of velocity with time.
Retardation	Negative acceleration; the rate at which velocity decreases.

Uniform velocity	Velocity that remains constant in magnitude and direction.
Free fall	Motion of a body under the force of gravity alone, with no air resistance.

Important Formulas

> Speed = distance / time
>
> Velocity = displacement / time
>
> Acceleration a = (v - u) / t
>
> v = u + at
>
> S = ut + (1/2) a t^2
>
> 2aS = v^2 - u^2
>
> For free fall: v = gt; h = (1/2) g t^2; v^2 = 2gh (taking g = 10 m/s^2)
>
> Average speed = total distance / total time

Key Terms to Remember

rest, **motion**, **translatory motion**, **rotatory motion**, **vibratory motion**, **distance**, **displacement**, **speed**, **velocity**, **acceleration**, **retardation**, **uniform acceleration**, **free fall**, **acceleration due to gravity**

Chapter 2: Kinematics — Practice Questions

Multiple Choice Questions

1. Which of the following is a vector quantity?

(a) Speed (b) Distance (c) Velocity (d) Time

2. The SI unit of acceleration is:

(a) m/s (b) m/s^2 (c) m^2/s (d) s/m

3. A body moving with uniform velocity has:

(a) Zero acceleration (b) Constant acceleration (c) Increasing acceleration (d) Negative acceleration

4. The slope of a velocity-time graph gives:

(a) Distance (b) Displacement (c) Speed (d) Acceleration

5. The area under a velocity-time graph gives:

(a) Acceleration (b) Speed (c) Displacement (d) Force

6. If a car covers 60 km in 2 hours, its average speed is:

(a) 20 km/h (b) 30 km/h (c) 60 km/h (d) 120 km/h

7. A body starting from rest attains a velocity of 20 m/s in 4 s. Its acceleration is:

(a) 4 m/s^2 (b) 5 m/s^2 (c) 10 m/s^2 (d) 80 m/s^2

8. Which equation gives the distance covered by a body moving with uniform acceleration?

(a) v = u + at (b) S = ut + (1/2)at^2 (c) 2aS = v^2 - u^2 (d) a = (v - u)/t

9. In free fall near the Earth, the acceleration of a body is about:

(a) 1 m/s^2 (b) 5 m/s^2 (c) 10 m/s^2 (d) 20 m/s^2

10. Retardation means:

(a) Increase in velocity (b) Decrease in velocity (c) Constant velocity (d) Zero velocity

Short Questions

1. Distinguish between distance and displacement with one example each.
2. Define speed and velocity. Why is velocity a vector while speed is a scalar?
3. Define acceleration and retardation. State their SI units.
4. What information is obtained from the slope and the area of a velocity-time graph?
5. Define free fall and state the value of the acceleration due to gravity near the Earth.

Long Questions

1. Derive the three equations of uniformly accelerated motion (v = u + at, S = ut + (1/2)at^2, 2aS = v^2 - u^2) using a velocity-time graph, and solve: a car starting from rest accelerates uniformly at 2 m/s^2 for 10 s; find its final velocity and the distance covered.
2. Explain the motion of a freely falling body. Describe an experiment to show that, in the absence of air resistance, bodies of different masses fall with the same acceleration, and explain why a feather falls slowly in air.

Chapter 3: Dynamics - I

Dynamics is the study of motion and the forces that cause it. This chapter explains force, Newton's laws of motion, momentum, friction and the law of conservation of momentum.

Key Concepts

- A force is a push or a pull that changes or tends to change the state of rest or motion of a body, or changes its shape. Force is a vector quantity and its SI unit is the newton (N).
- Newton's first law (law of inertia): a body remains at rest or in uniform motion in a straight line unless acted upon by an unbalanced external force.
- Inertia is the property of a body that resists a change in its state of rest or motion. Mass is the measure of inertia: the greater the mass, the greater the inertia.
- Newton's second law: the acceleration produced in a body is directly proportional to the applied force and inversely proportional to its mass, and takes place in the direction of the force. It is written as F = ma.
- Newton's third law: to every action there is an equal and opposite reaction. Action and reaction act on different bodies, so they never cancel each other.
- Momentum is the product of mass and velocity (p = mv). It is a vector quantity and its SI unit is kg m/s (or N s). A heavy fast-moving body has more momentum than a light slow one.
- The change in momentum of a body equals the impulse, which is force multiplied by the time for which it acts: impulse = F x t = change in momentum. This explains why airbags and cricket gloves reduce the force of an impact by increasing the time of contact.
- The law of conservation of momentum states that in the absence of an external force, the total momentum of a system remains constant. It explains the recoil of a gun and the motion of a rocket.
- Friction is the force that opposes relative motion between two surfaces in contact. It acts opposite to the direction of motion. Static friction acts before motion starts; sliding (kinetic) friction acts during motion; rolling friction is the smallest.
- Friction is useful in walking, braking and writing, but it causes wear and wastes energy as heat. It is reduced by lubrication, polishing surfaces, streamlining and using ball bearings.

Important Definitions

Term	Definition
Force	A push or pull that changes or tends to change the state of rest or motion or the shape of a body.
Inertia	The property of a body that resists any change in its state of rest or uniform motion.
Mass	The quantity of matter in a body; a measure of its inertia.
Newton	The SI unit of force; one newton accelerates a mass of 1 kg at 1 m/s^2.
Momentum	The product of the mass and velocity of a body (p = mv).
Impulse	The product of force and the time for which it acts; equal to the change in momentum.
Friction	The force that opposes the relative motion between two surfaces in contact.
Weight	The force with which the Earth attracts a body towards its centre (W = mg).

Free-body diagram	A diagram showing all the forces acting on a body.
Balanced forces	Forces that are equal in magnitude and opposite in direction, producing no acceleration.

Important Formulas

> F = ma (Newton's second law)
>
> W = mg (weight of a body)
>
> p = mv (momentum)
>
> Impulse = F x t = change in momentum = m(v - u)
>
> Friction force F = mu x R, where mu is the coefficient of friction and R the normal reaction
>
> 1 N = 1 kg m/s^2

Key Terms to Remember

force, **inertia**, **mass**, **newton**, **momentum**, **impulse**, **friction**, **static friction**, **sliding friction**, **rolling friction**, **normal reaction**, **conservation of momentum**, **action**, **reaction**, **weight**

Chapter 3: Dynamics - I — Practice Questions

Multiple Choice Questions

1. The SI unit of force is:

(a) Joule (b) Watt (c) Newton (d) Pascal

2. Which of the following is the best measure of inertia?

(a) Weight (b) Mass (c) Volume (d) Density

3. Newton's first law is also called the law of:

(a) Action and reaction (b) Inertia (c) Gravitation (d) Conservation of energy

4. A force of 10 N acts on a mass of 2 kg. The acceleration produced is:

(a) 2 m/s^2 (b) 5 m/s^2 (c) 10 m/s^2 (d) 20 m/s^2

5. Momentum is the product of:

(a) Mass and acceleration (b) Mass and velocity (c) Force and time (d) Weight and velocity

6. The SI unit of momentum is:

(a) kg m/s (b) kg m/s^2 (c) N m (d) J

7. The recoil of a gun is explained by the law of conservation of:

(a) Energy (b) Mass (c) Momentum (d) Charge

8. Friction always acts:

(a) In the direction of motion (b) Opposite to the direction of motion (c) Perpendicular to motion (d) Along the normal

9. Which type of friction is the smallest?

(a) Static friction (b) Sliding friction (c) Rolling friction (d) Limiting friction

10. A cricket player pulls his hands back while catching the ball to:

(a) Increase momentum (b) Increase the time of impact and reduce force (c) Decrease the time of impact (d) Increase the force

Short Questions

1. State Newton's three laws of motion in your own words.
2. Define momentum and impulse. State their SI units.
3. What is inertia? Why is it harder to stop a loaded truck than an empty one?
4. State the law of conservation of momentum and give one daily-life example.
5. Define friction. Name its three types and state which is the largest and which is the smallest.

Long Questions

1. State and explain Newton's second law of motion. Derive the relation F = ma, and solve: a force of 20 N acts on a body of mass 4 kg initially at rest; find the acceleration and the velocity after 5 s.
2. State the law of conservation of momentum and prove it for two bodies colliding with each other. Explain with the help of this law why a gun recoils when a bullet is fired, and why a rocket moves forward in space.

Chapter 4: Dynamics - II

This chapter extends the study of forces to circular motion, gravitation and the turning effect of forces. It covers centripetal force, Newton's law of gravitation, the motion of satellites and the conditions for equilibrium.

Key Concepts

- A body moving in a circle at constant speed still has acceleration, because its direction of velocity changes continuously. This is centripetal acceleration, directed towards the centre of the circle.
- Centripetal force is the force that keeps a body moving in a circular path; it acts towards the centre. It is provided by tension in a string, friction between tyres and road, or gravity in the case of the Moon.
- The Moon moves around the Earth and artificial satellites move in orbits because the gravitational force provides the necessary centripetal force.
- Newton's law of gravitation states that every body attracts every other body with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres: F = G m1 m2 / r^2.
- G is the universal gravitational constant. Its value is the same everywhere in the universe. The force of gravity on the Earth is called weight, W = mg.
- The acceleration due to gravity, g, depends on the mass and radius of the planet and on height above the surface. It decreases as we go up from the Earth's surface and is slightly less at the equator than at the poles.
- An artificial satellite is put into orbit at a height where its orbital speed is high enough that it keeps falling towards the Earth but never reaches it. Geostationary satellites stay fixed above one point on the equator and are used for communication and weather observation.
- Torque is the turning effect of a force. It equals force multiplied by the perpendicular distance from the pivot (moment arm). A large torque is produced by a large force or a long moment arm, which is why a long spanner opens a tight nut more easily.
- A couple is formed by two equal and opposite forces acting along different lines; it produces rotation without translation, as when turning a steering wheel.
- A body is in equilibrium when the resultant force and the resultant torque acting on it are both zero. In stable equilibrium a displaced body returns to its original position; in unstable equilibrium it moves further away; in neutral equilibrium it stays in its new position.

Important Definitions

Term	Definition
Centripetal acceleration	The acceleration of a body moving in a circle, directed towards the centre of the circle.
Centripetal force	The force that keeps a body moving in a circular path, acting towards the centre.
Gravitation	The force of attraction between any two masses in the universe.
Universal gravitational constant (G)	The constant in Newton's law of gravitation, whose value is the same everywhere in the universe.
Artificial satellite	A man-made object placed in orbit around the Earth or another planet.

Geostationary satellite	A satellite that orbits above the equator with the same period as the Earth's rotation, so it stays above one fixed point.
Torque	The turning effect of a force about a pivot, equal to force multiplied by the moment arm.
Moment arm	The perpendicular distance from the line of action of a force to the pivot.
Equilibrium	The state of a body when the resultant force and the resultant torque on it are both zero.
Centre of gravity	The point of a body at which its whole weight can be taken to act.

Important Formulas

> Centripetal acceleration a = v^2 / r
>
> Centripetal force F = m v^2 / r
>
> Newton's law of gravitation: F = G m1 m2 / r^2
>
> Weight W = mg; g = G M / R^2 for a planet of mass M and radius R
>
> Orbital speed of a satellite v = square root of (G M / r)
>
> Torque = force x moment arm
>
> For equilibrium: sum of forces = 0 and sum of torques = 0

Key Terms to Remember

centripetal acceleration, **centripetal force**, **gravitation**, **gravitational constant**, **weight**, **artificial satellite**, **geostationary satellite**, **torque**, **moment arm**, **couple**, **equilibrium**, **stable equilibrium**, **unstable equilibrium**, **centre of gravity**

Chapter 4: Dynamics - II — Practice Questions

Multiple Choice Questions

1. Centripetal acceleration is always directed:

(a) Along the tangent (b) Away from the centre (c) Towards the centre (d) In the direction of motion

2. The centripetal force needed to keep a body in a circular path is provided by:

(a) Friction or tension or gravity (b) Weight only (c) Momentum (d) Inertia

3. According to Newton's law of gravitation, the force between two masses is inversely proportional to:

(a) The distance (b) The square of the distance (c) The sum of the masses (d) The difference of the masses

4. The value of the gravitational constant G is:

(a) Different on each planet (b) The same everywhere (c) Zero in space (d) Greater at the poles

5. The weight of a body is greatest:

(a) At the equator (b) At the poles (c) At the centre of the Earth (d) On the Moon

6. A geostationary satellite stays above:

(a) The North Pole (b) One fixed point on the equator (c) The South Pole (d) Any point on Earth

7. Torque is maximum when the force is applied:

(a) At the pivot (b) Perpendicular to the lever arm (c) Parallel to the lever arm (d) At the centre of gravity

8. A couple consists of:

(a) Two equal forces in the same direction (b) Two equal and opposite forces along different lines (c) Two unequal forces (d) One force and one reaction

9. A body is in equilibrium when:

(a) Only the resultant force is zero (b) Only the resultant torque is zero (c) Both resultant force and resultant torque are zero (d) It is moving at high speed

10. A cone standing on its base is in:

(a) Unstable equilibrium (b) Neutral equilibrium (c) Stable equilibrium (d) No equilibrium

Short Questions

1. Define centripetal force and centripetal acceleration. State the direction of each.
2. State Newton's law of gravitation and write its mathematical form.
3. Why does the acceleration due to gravity decrease with height above the Earth?
4. What is a geostationary satellite? Give two of its uses.
5. Define torque and moment arm. Why is a long spanner better for opening a tight nut?

Long Questions

1. Derive the expression for centripetal force ($F = m v^2 / r$) for a body moving in a circle. Explain how the Moon stays in orbit around the Earth and how an artificial satellite is kept in orbit.
2. State Newton's law of gravitation. Derive the relation $g = G M / R^2$ and explain why the value of g varies from place to place on the Earth and decreases with altitude.

Chapter 5: Pressure and Deformation in Solids

Pressure is force acting per unit area. This chapter explains pressure in solids and fluids, Pascal's law, atmospheric pressure, the barometer, and how solids deform under stress, including Hooke's law.

Key Concepts

- Pressure is defined as force per unit area: P = F / A. Its SI unit is the pascal (Pa), equal to one newton per square metre. A small area produces a large pressure for the same force, which is why a sharp knife cuts and a nail pierces easily.
- A solid transmits a force over its area of contact; the pressure it exerts on a surface depends on its weight and on the area in contact with the surface. A person standing on one foot exerts more pressure on the ground than when standing on both feet.
- Pressure in a liquid at a depth h is given by P = rho g h, where rho is the density of the liquid. It is the same in all directions at the same depth and increases with depth; this is why dams are built thicker at the bottom.
- Pascal's law states that pressure applied to an enclosed liquid is transmitted equally to all parts of the liquid. Hydraulic machines such as the hydraulic press and hydraulic brakes work on this principle: a small force on a small piston produces a large force on a large piston.
- Atmospheric pressure is the pressure exerted by the air around us, about 101,300 Pa (1 atmosphere) at sea level. It decreases with height above sea level.
- A mercury barometer measures atmospheric pressure by the height of a mercury column it supports; a height of about 76 cm of mercury corresponds to standard atmospheric pressure. An aneroid barometer uses a partially evacuated metal box and is portable.
- When a force is applied to a solid it may deform. Stress is the internal force per unit area; strain is the fractional change in length (change in length divided by original length). Stress has the unit of pressure; strain has no unit.
- Hooke's law states that within the elastic limit, the extension of a spring or wire is directly proportional to the applied force: F = k x, where k is the spring constant. The elastic limit is the maximum stress a material can bear and still return to its original shape.
- Beyond the elastic limit a material undergoes permanent deformation, and if the force is increased further it reaches its breaking point. Ductile materials stretch a lot before breaking; brittle materials break with little stretching.
- Young's modulus is the ratio of stress to strain within the elastic limit: E = stress / strain. It measures the stiffness of a material; steel has a much higher Young's modulus than rubber.

Important Definitions

Term	Definition
Pressure	Force acting per unit area (P = F / A); SI unit pascal (Pa).
Pascal	The SI unit of pressure; one pascal equals one newton per square metre.
Pascal's law	Pressure applied to an enclosed liquid is transmitted equally to all parts of the liquid.
Atmospheric pressure	The pressure exerted by the weight of the air above a point on the Earth.
Barometer	An instrument used to measure atmospheric pressure.

Stress	The internal force per unit area set up in a body when a deforming force is applied.
Strain	The fractional change in length of a body under stress; it has no unit.
Elastic limit	The maximum stress a material can withstand and still return to its original shape when the force is removed.
Hooke's law	Within the elastic limit, the extension of a body is directly proportional to the applied force.
Young's modulus	The ratio of stress to strain within the elastic limit; a measure of a material's stiffness.

Important Formulas

> Pressure P = F / A
>
> Pressure in a liquid P = rho g h
>
> Hydraulic press: F2 / F1 = A2 / A1
>
> Stress = force / area = F / A
>
> Strain = change in length / original length = x / L
>
> Hooke's law: F = k x
>
> Young's modulus E = stress / strain = (F / A) / (x / L)
>
> 1 atm = 101,300 Pa = 76 cm of mercury

Key Terms to Remember

pressure, **pascal**, **atmospheric pressure**, **barometer**, **Pascal's law**, **hydraulic press**, **stress**, **strain**, **elastic limit**, **Hooke's law**, **Young's modulus**, **ductile**, **brittle**, **density**

Chapter 5: Pressure and Deformation in Solids — Practice Questions

Multiple Choice Questions

1. The SI unit of pressure is:

(a) Newton (b) Joule (c) Pascal (d) Watt

2. Pressure is defined as:

(a) Force x area (b) Force / area (c) Area / force (d) Force + area

3. A sharp knife cuts easily because it has:

(a) A large area (b) A small area and so exerts large pressure (c) A large force (d) A heavy mass

4. Pressure in a liquid at a given depth depends on:

(a) The shape of the container (b) The density of the liquid and the depth (c) The volume of the liquid (d) The area of the surface

5. Pascal's law is the working principle of the:

(a) Barometer (b) Hydraulic press (c) Thermometer (d) Spring balance

6. Standard atmospheric pressure at sea level is about:

(a) 76 cm of mercury (b) 10 cm of mercury (c) 100 cm of mercury (d) 50 cm of mercury

7. Which instrument is used to measure atmospheric pressure?

(a) Manometer (b) Barometer (c) Hydrometer (d) Ammeter

8. Stress is measured in the same unit as:

(a) Force (b) Pressure (c) Energy (d) Length

9. According to Hooke's law, within the elastic limit, extension is directly proportional to:

(a) Area (b) Applied force (c) Original length (d) Density

10. Young's modulus is the ratio of:

(a) Stress to strain (b) Strain to stress (c) Force to length (d) Extension to force

Short Questions

1. Define pressure and state its SI unit. Why does a camel's broad feet exert less pressure on sand?
2. State Pascal's law and name two machines that work on it.
3. Write the formula for pressure in a liquid and explain why a dam is thicker at the bottom.
4. Define stress and strain. State the unit of each.
5. State Hooke's law and define the elastic limit.

Long Questions

1. Define pressure in a liquid and derive the formula P = rho g h. Explain, with the help of a diagram, the construction and working of a mercury barometer and how it measures atmospheric pressure.
2. State and explain Hooke's law. Describe an experiment to verify Hooke's law using a spring, and explain stress, strain and Young's modulus, including what happens beyond the elastic limit.

Chapter 6: Work and Energy

Work is done when a force moves a body through a distance. Energy is the ability to do work. This chapter covers work, kinetic and potential energy, the law of conservation of energy, power, efficiency and the common forms and sources of energy.

Key Concepts

- Work is done when a force moves a body in the direction of the force: work = force x distance moved in the direction of the force. Its SI unit is the joule (J). No work is done if there is no displacement, or if the displacement is perpendicular to the force.
- Energy is the capacity to do work. Its SI unit is also the joule. Energy exists in many forms: kinetic, potential, heat, light, sound, electrical, chemical and nuclear energy.
- Kinetic energy is the energy of a moving body: K.E. = (1/2) m v^2. It depends on the mass and on the square of the velocity, so doubling the speed increases the kinetic energy four times.
- Potential energy is stored energy due to position or state. Gravitational potential energy is P.E. = mgh, where h is the height above a reference level. A stretched spring or a compressed spring also stores elastic potential energy.
- The law of conservation of energy states that energy can neither be created nor destroyed; it can only change from one form to another. The total energy of an isolated system remains constant.
- When a body falls freely, its potential energy decreases and its kinetic energy increases by the same amount, so the total mechanical energy stays constant if air resistance is neglected.
- Power is the rate of doing work: power = work / time. Its SI unit is the watt (W); one watt is one joule per second. A more powerful machine does the same work in less time. The kilowatt-hour is the commercial unit of electrical energy.
- Efficiency is the ratio of useful output energy (or work) to the input energy, expressed as a percentage. No machine is 100 percent efficient, because some energy is always wasted as heat due to friction.
- Renewable sources of energy, such as solar, wind, hydroelectric and biomass, are replenished by nature. Non-renewable sources, such as coal, oil and natural gas, are limited and will run out.
- Solar cells convert light energy into electrical energy; a hydroelectric dam converts the potential energy of stored water into electrical energy through a turbine; wind turbines convert the kinetic energy of moving air into electricity.

Important Definitions

Term	Definition
Work	The product of force and the distance moved in the direction of the force (W = F x d).
Joule	The SI unit of work and energy; one joule is the work done when a force of 1 N moves a body 1 m.
Energy	The capacity of a body to do work.
Kinetic energy	The energy possessed by a body due to its motion: K.E. = (1/2) m v^2.
Potential energy	The energy possessed by a body due to its position or state: P.E. = mgh.
Power	The rate of doing work (P = W / t); SI unit watt (W).

Watt	The SI unit of power; one watt equals one joule per second.
Efficiency	The ratio of useful output energy to input energy, usually expressed as a percentage.
Renewable energy	Energy from sources that are naturally replenished, such as sunlight, wind and flowing water.
Law of conservation of energy	Energy can neither be created nor destroyed; it can only be transformed from one form to another.

Important Formulas

> Work W = F x d (force in the direction of displacement)
>
> Kinetic energy K.E. = (1/2) m v^2
>
> Gravitational potential energy P.E. = mgh
>
> Power P = W / t = F x v
>
> Efficiency = (useful output / input) x 100%
>
> 1 kWh = 3.6 x 10^6 J
>
> Total mechanical energy = K.E. + P.E. (constant for a freely falling body without air resistance)

Key Terms to Remember

work, **joule**, **energy**, **kinetic energy**, **potential energy**, **power**, **watt**, **efficiency**, **conservation of energy**, **renewable energy**, **non-renewable energy**, **kilowatt-hour**, **solar energy**, **hydroelectric energy**

Chapter 6: Work and Energy — Practice Questions

Multiple Choice Questions

1. The SI unit of work is:

(a) Watt (b) Newton (c) Joule (d) Pascal

2. Work is zero when the displacement is:

(a) In the direction of force (b) Opposite to the force (c) Perpendicular to the force (d) Very small

3. Kinetic energy of a body depends on its:

(a) Mass and velocity (b) Mass and height (c) Weight only (d) Volume

4. If the velocity of a body is doubled, its kinetic energy becomes:

(a) Two times (b) Three times (c) Four times (d) Half

5. The potential energy of a body of mass 2 kg at a height of 5 m (g = 10 m/s^2) is:

(a) 10 J (b) 25 J (c) 50 J (d) 100 J

6. Power is defined as:

(a) Work x time (b) Work / time (c) Force x distance (d) Energy x time

7. The SI unit of power is:

(a) Joule (b) Watt (c) Newton (d) Volt

8. One kilowatt-hour is equal to:

(a) 3600 J (b) 3.6 x 10^6 J (c) 1000 J (d) 3.6 x 10^3 J

9. Which of the following is a renewable source of energy?

(a) Coal (b) Petrol (c) Solar energy (d) Natural gas

10. The efficiency of a machine is always:

(a) 100% (b) More than 100% (c) Less than 100% (d) Zero

Short Questions

1. Define work and state the condition under which work done is zero.
2. Define kinetic energy and write its formula. How does it change if the mass is doubled?
3. Define potential energy and write the formula for gravitational potential energy.
4. State the law of conservation of energy and give one example of energy transformation.
5. Define power and efficiency. State their SI units and formulas.

Long Questions

1. Define kinetic energy and derive the formula K.E. = (1/2) m v^2 for a body of mass m moving with velocity v. Solve: find the kinetic energy of a 1000 kg car moving at 20 m/s.
2. State and explain the law of conservation of energy. Show that the total mechanical energy of a freely falling body remains constant, and discuss renewable and non-renewable sources of energy with examples.

Chapter 7: Density and Temperature

Density tells us how much mass is packed into a given volume. Temperature tells us how hot or cold a body is. This chapter covers density, thermal expansion, temperature scales, specific heat capacity and the transfer of heat.

Key Concepts

- Density is mass per unit volume: density = mass / volume. Its SI unit is kg/m^3. Water has a density of 1000 kg/m^3; substances denser than water sink in it, and less dense substances float.
- Relative density (specific gravity) is the ratio of the density of a substance to the density of water at 4 degrees Celsius. It has no unit. The relative density of a substance can be found with a density bottle or a hydrometer.
- Most substances expand on heating and contract on cooling. Solids expand least, liquids more, and gases most. Thermal expansion must be allowed for in bridges, railway tracks and pipelines, where gaps and expansion joints are provided.
- A bimetallic strip is made of two metals with different rates of expansion joined together; on heating it bends towards the metal that expands less. It is used in thermostats and fire alarms.
- Temperature is the measure of the hotness or coldness of a body; it determines the direction of heat flow. Heat is the energy transferred from a hotter body to a colder one because of a temperature difference.
- The Celsius scale fixes the ice point at 0 degrees C and the steam point at 100 degrees C. The Fahrenheit scale fixes them at 32 degrees F and 212 degrees F. The Kelvin scale starts at absolute zero (-273.15 degrees C); its unit is the kelvin.
- Conversion between scales: K = C + 273, and C/100 = (F - 32)/180. Body temperature is about 37 degrees C, which is 98.6 degrees F.
- Specific heat capacity is the amount of heat needed to raise the temperature of 1 kg of a substance by 1 K. Its SI unit is J/(kg K). Water has a high specific heat capacity (4200 J/(kg K)), which is why it is used in cooling systems and why coastal areas have mild climates.
- The heat gained or lost by a body is Q = m c (change in temperature), where m is mass, c is specific heat capacity and the temperature change is final minus initial temperature.
- Heat is transferred by conduction (through a solid, molecule to molecule, without the movement of the material), convection (by the movement of the fluid itself, as in heating water) and radiation (by electromagnetic waves, which need no medium, as heat from the Sun reaches the Earth).

Important Definitions

Term	Definition
Density	Mass per unit volume of a substance; SI unit kg/m^3.
Relative density	The ratio of the density of a substance to the density of water at 4 degrees C; it has no unit.
Thermal expansion	The increase in size of a substance when its temperature rises.
Temperature	The measure of the hotness or coldness of a body.
Heat	Energy transferred from a hotter body to a colder body because of a temperature difference.
Absolute zero	The lowest possible temperature, 0 K or -273.15 degrees C, at which the motion of particles is minimum.

Specific heat capacity	The heat needed to raise the temperature of 1 kg of a substance by 1 K.
Conduction	Transfer of heat through a solid by the vibration of particles, without movement of the material.
Convection	Transfer of heat by the actual movement of a fluid.
Radiation	Transfer of heat by electromagnetic waves, which needs no medium.

Important Formulas

> Density = mass / volume
>
> Relative density = density of substance / density of water
>
> K = C + 273
>
> C / 100 = (F - 32) / 180
>
> Heat Q = m c (T2 - T1)
>
> Linear expansion: change in length = original length x coefficient of linear expansion x temperature change
>
> Density of water = 1000 kg/m^3
>
> Specific heat capacity of water = 4200 J/(kg K)

Key Terms to Remember

density, **relative density**, **thermal expansion**, **bimetallic strip**, **temperature**, **heat**, **Celsius scale**, **Fahrenheit scale**, **Kelvin scale**, **absolute zero**, **specific heat capacity**, **conduction**, **convection**, **radiation**

Chapter 7: Density and Temperature — Practice Questions

Multiple Choice Questions

1. The SI unit of density is:

(a) kg/m (b) kg/m^2 (c) kg/m^3 (d) g/cm

2. The density of water is:

(a) 100 kg/m^3 (b) 1000 kg/m^3 (c) 10,000 kg/m^3 (d) 1 kg/m^3

3. A substance with a density less than water will:

(a) Sink in water (b) Float on water (c) Dissolve in water (d) Stay suspended

4. Relative density has:

(a) Unit kg/m^3 (b) Unit g/cm^3 (c) No unit (d) Unit N/m^2

5. Which expands the most on heating?

(a) Iron (b) Water (c) Air (d) Glass

6. A bimetallic strip bends on heating because the two metals have:

(a) Different densities (b) Different rates of expansion (c) Different masses (d) Different colours

7. Absolute zero is equal to:

(a) 0 degrees C (b) -100 degrees C (c) -273.15 degrees C (d) 273.15 degrees C

8. Body temperature of a healthy person is about:

(a) 37 degrees C (b) 27 degrees C (c) 47 degrees C (d) 32 degrees C

9. The specific heat capacity of water is:

(a) 420 J/(kg K) (b) 4200 J/(kg K) (c) 42,000 J/(kg K) (d) 4.2 J/(kg K)

10. Heat from the Sun reaches the Earth by:

(a) Conduction (b) Convection (c) Radiation (d) Evaporation

Short Questions

1. Define density and relative density. State the SI unit of density and the value of the density of water.
2. Why are gaps left between railway tracks and in bridges? Explain with reference to thermal expansion.
3. Distinguish between heat and temperature.
4. Convert 25 degrees C into kelvin and into Fahrenheit.
5. Define specific heat capacity. Why is water used as a coolant in car radiators?

Long Questions

1. Define density and relative density. Describe an experiment to find the density of an irregular solid using a measuring cylinder and a balance, and explain why some objects float and others sink in water.
2. Explain conduction, convection and radiation with one daily-life example of each. Describe how a thermos flask reduces heat loss by all three methods.

Chapter 8: Magnetism

Magnets attract iron, nickel and cobalt and have been used as compasses for centuries. This chapter covers magnetic and non-magnetic materials, magnetic fields, the Earth's magnetism, and the link between electricity and magnetism.

Key Concepts

- A magnet attracts magnetic materials such as iron, nickel and cobalt. Materials that are attracted by a magnet are called magnetic materials; materials such as wood, plastic and copper are non-magnetic.
- Every magnet has two poles, a north pole and a south pole. Like poles repel each other and unlike poles attract each other. A magnet always has both poles; a single pole cannot exist alone.
- The region around a magnet in which its magnetic effect can be felt is called the magnetic field. Magnetic field lines show the direction and strength of the field; they leave the north pole and enter the south pole outside the magnet, and they never cross each other.
- A freely suspended magnet comes to rest pointing north-south. This is because the Earth itself behaves like a huge magnet, with its magnetic south pole near the geographic north pole. A compass uses this property to find direction.
- The Earth's magnetic field protects us from charged particles coming from the Sun, and it is also the reason a compass needle points north.
- A temporary magnet, such as soft iron, loses its magnetism when the magnetising force is removed. A permanent magnet, such as steel, keeps its magnetism. Soft iron is used in electromagnets; steel is used for permanent magnets.
- When a bar magnet is cut into pieces, each piece becomes a complete magnet with its own north and south poles. The poles cannot be separated.
- An electric current produces a magnetic field around the conductor. This was discovered by Oersted. A coil of wire carrying a current behaves like a magnet; its poles can be found by the right-hand rule.
- An electromagnet is a temporary magnet made by passing a current through a coil wound on a soft iron core. Its strength can be changed by changing the current or the number of turns, and it can be switched off. Electromagnets are used in electric bells, cranes and relays.
- Magnetic materials are classified by their behaviour in a magnetic field. Ferromagnetic materials (iron, nickel, cobalt) are strongly attracted; paramagnetic materials are weakly attracted; diamagnetic materials are weakly repelled.

Important Definitions

Term	Definition
Magnet	A body that attracts iron, nickel and cobalt and can point north-south when freely suspended.
Magnetic material	A material that is attracted by a magnet, such as iron, nickel and cobalt.
Magnetic pole	One of the two ends of a magnet where the magnetic force is strongest.
Magnetic field	The region around a magnet in which its magnetic effect can be felt.
Magnetic field lines	Imaginary lines that show the direction and strength of a magnetic field.

Compass	A small magnet used to find direction, because it aligns with the Earth's magnetic field.
Temporary magnet	A magnet that keeps its magnetism only while the magnetising force is present, such as soft iron.
Permanent magnet	A magnet that keeps its magnetism after the magnetising force is removed, such as steel.
Electromagnet	A temporary magnet formed by passing an electric current through a coil wound on a soft iron core.
Right-hand rule	A rule for finding the direction of the magnetic field around a current-carrying conductor or the poles of a coil.

Important Formulas

> Magnetic field lines leave the north pole and enter the south pole outside the magnet.
>
> Like poles repel; unlike poles attract.
>
> Strength of an electromagnet increases with current and with the number of turns of the coil.
>
> Earth's magnetic field: the geographic north is near the Earth's magnetic south pole.

Key Terms to Remember

magnet, **magnetic material**, **north pole**, **south pole**, **magnetic field**, **magnetic field lines**, **compass**, **Earth's magnetism**, **temporary magnet**, **permanent magnet**, **electromagnet**, **Oersted**, **ferromagnetic**, **paramagnetic**, **diamagnetic**

Chapter 8: Magnetism — Practice Questions

Multiple Choice Questions

1. Which of the following is a magnetic material?

(a) Copper (b) Wood (c) Iron (d) Plastic

2. Like magnetic poles:

(a) Attract each other (b) Repel each other (c) Have no effect (d) Cancel each other

3. A freely suspended magnet points in the:

(a) East-west direction (b) North-south direction (c) Up-down direction (d) Random direction

4. Magnetic field lines outside a magnet travel from:

(a) South pole to north pole (b) North pole to south pole (c) Centre to the poles (d) One magnet to another

5. Magnetic field lines never:

(a) Form closed loops (b) Cross each other (c) Leave the north pole (d) Enter the south pole

6. The core of an electromagnet is made of:

(a) Steel (b) Soft iron (c) Copper (d) Aluminium

7. An electromagnet is a:

(a) Permanent magnet (b) Temporary magnet (c) Natural magnet (d) Non-magnetic material

8. The magnetic effect of an electric current was discovered by:

(a) Faraday (b) Oersted (c) Newton (d) Ampere

9. Which material is best for making a permanent magnet?

(a) Soft iron (b) Steel (c) Copper (d) Nickel

10. The Earth's magnetic south pole lies near the geographic:

(a) South pole (b) North pole (c) Equator (d) Prime meridian

Short Questions

1. Define a magnet and a magnetic material. Give three examples of each.
2. State the law of magnetic poles.
3. What is a magnetic field? Describe the pattern of magnetic field lines around a bar magnet.
4. Distinguish between a temporary magnet and a permanent magnet, giving one use of each.
5. Define an electromagnet and state two factors that increase its strength.

Long Questions

1. Describe the properties of a magnet. Draw and explain the magnetic field pattern around a bar magnet, and explain why a freely suspended magnet points north-south and how a compass works.
2. Describe the construction and working of an electromagnet. Explain how its strength can be changed, compare it with a permanent magnet, and list four uses of electromagnets in daily life.

Chapter 9: Nature of Science and Physics

Science is a systematic way of understanding the natural world. This chapter explains what science is, how physics is studied, the scientific method, the main branches of physics, and the role of physics in technology and society.

Key Concepts

- Science is the organised knowledge of the natural world, gained through observation, experimentation and reasoning. Physics is the branch of science that studies matter, energy and the interaction between them.
- The scientific method has clear steps: observe a phenomenon, ask a question, form a hypothesis (a testable idea), test it by experiment, collect and analyse data, and draw a conclusion. If the hypothesis is supported, it may become a theory; a theory that is tested again and again can become a law.
- A hypothesis is a tentative explanation that can be tested. A theory is a well-tested explanation of a group of observations. A law is a statement that describes a pattern found in nature, usually in mathematical form.
- Physics is divided into branches such as mechanics (motion and forces), heat and thermodynamics, light and optics, sound, electricity and magnetism, and modern physics (atomic, nuclear and particle physics).
- Technology is the application of scientific knowledge to make useful devices. Physics has given us electricity, electronics, computers, lasers, medical imaging, satellites and many other technologies that shape daily life.
- Measurement and mathematics are the language of physics. A physical law is only accepted when experiments confirm it; a single experiment that contradicts a theory can lead scientists to revise or replace it.
- Scientists work with honesty, care and open-mindedness. Results must be shared so that others can repeat the experiment and check them. Repeating an experiment is an important test of a scientific claim.
- Physics helps solve real problems: generating electricity, improving transport and communication, diagnosing and treating disease, protecting the environment and exploring space.
- Some famous physicists whose work shaped the subject include Galileo (motion and astronomy), Newton (laws of motion and gravitation), Einstein (relativity), Faraday (electricity and magnetism) and Marie Curie (radioactivity).
- Science and society influence each other: scientific discoveries change how people live, while the needs of society set the questions scientists try to answer. Science must be used responsibly, with care for people and the environment.

Important Definitions

Term	Definition
Science	Organised knowledge of the natural world gained through observation, experiment and reasoning.
Physics	The branch of science that studies matter, energy and the interaction between them.
Hypothesis	A testable idea or tentative explanation of an observation.
Theory	A well-tested explanation of a group of related observations.

Law	A statement describing a pattern in nature, usually expressed mathematically.
Observation	Careful watching and recording of a natural phenomenon.
Experiment	A controlled test carried out to check a hypothesis.
Technology	The application of scientific knowledge to make useful tools and devices.
Mechanics	The branch of physics dealing with motion and forces.
Modern physics	The branch of physics dealing with atoms, nuclei and particles, including relativity and quantum ideas.

Important Formulas

> Scientific method: observation -> question -> hypothesis -> experiment -> data analysis -> conclusion
>
> Branches of physics: mechanics, heat, light, sound, electricity and magnetism, modern physics

Key Terms to Remember

science, **physics**, **scientific method**, **hypothesis**, **theory**, **law**, **observation**, **experiment**, **technology**, **mechanics**, **thermodynamics**, **optics**, **modern physics**, **ethics in science**

Chapter 9: Nature of Science and Physics — Practice Questions

Multiple Choice Questions

1. Physics is the study of:

(a) Living things only (b) Matter, energy and their interaction (c) Chemical reactions only (d) The Earth only

2. The first step of the scientific method is:

(a) Forming a hypothesis (b) Observation (c) Drawing a conclusion (d) Doing an experiment

3. A testable idea that explains an observation is called a:

(a) Law (b) Theory (c) Hypothesis (d) Fact

4. A well-tested explanation of a group of observations is called a:

(a) Hypothesis (b) Theory (c) Guess (d) Model

5. Which branch of physics deals with motion and forces?

(a) Optics (b) Mechanics (c) Thermodynamics (d) Acoustics

6. The branch of physics that deals with light is called:

(a) Mechanics (b) Acoustics (c) Optics (d) Thermodynamics

7. Technology is:

(a) Pure knowledge (b) The application of scientific knowledge to make useful devices (c) A branch of chemistry (d) A type of experiment

8. Which scientist gave the laws of motion and gravitation?

(a) Galileo (b) Einstein (c) Newton (d) Faraday

9. Marie Curie is famous for her work on:

(a) Electricity (b) Radioactivity (c) Relativity (d) Motion

10. A scientific conclusion is accepted when it is:

(a) Stated by a famous person (b) Confirmed by experiments and repeatable by others (c) Written in a book (d) Old and traditional

Short Questions

1. Define science and physics in your own words.
2. List the steps of the scientific method in order.
3. Distinguish between a hypothesis, a theory and a law.
4. Name five branches of physics and state what each studies.
5. Give two examples of how physics has improved daily life through technology.

Long Questions

1. Explain the scientific method step by step with a suitable example. Distinguish clearly between a hypothesis, a theory and a law, and explain why a single experiment can lead scientists to revise a theory.
2. Describe the main branches of physics and give one example from each. Discuss the role of physics in technology and society, with examples of benefits and the need to use science responsibly.

MCQ Answer Key

Check your answers below. Each chapter has 10 MCQs, numbered 1 to 10.

Chapter	1	2	3	4	5	6	7	8	9	10
Ch. 1	C	B	C	B	C	B	C	B	B	C
Ch. 2	C	B	A	D	C	B	B	B	C	B
Ch. 3	C	B	B	B	B	A	C	B	C	B
Ch. 4	C	A	B	B	B	B	B	B	C	C
Ch. 5	C	B	B	B	B	A	B	B	B	A
Ch. 6	C	C	A	C	D	B	B	B	C	C
Ch. 7	C	B	B	C	C	B	C	A	B	C
Ch. 8	C	B	B	B	B	B	B	B	B	B
Ch. 9	B	B	C	B	B	C	B	C	B	B

Score guide: count your correct answers out of 90. Re-read the notes for every chapter in which you scored less than 7 out of 10.

End of notes. Good luck with your studies — revise regularly, practise the numericals, and check fbise.edu.pk for the current model paper.