9th Class Physics Notes
Balochistan Board
Full Book

Balochistan Textbook Board — BISE Quetta

Complete chapter-wise study notes

Study notes • Short questions with answers • Long questions with answers • MCQs with answer key

14 Chapters • 140 MCQs • 70 Short Questions • 28 Long Questions

For Class 9 (SSC-I) Science students of Balochistan

Original study notes written for students. This book follows the chapter list of the Balochistan Textbook Board Physics book for Class 9. Check the board's latest notification for any syllabus change before your examination.

Contents and Paper Pattern

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Paper Pattern — BISE Quetta (Class 9 Physics)

Total marks: 75 — Theory 60 + Practical 15.

Source: BBISE Scheme of Studies for SSC-I, notification No.BBISE/DD(R)/Misc:/164-QB/2026 dated 30 June 2026, as reproduced in a third-party scan. This figure is third-party reproduced and has not been read directly off an official BBISE document, so confirm it from the board before the examination.

Practical component (15 marks): practical-based assessment, including the use of the vernier caliper and the screw gauge and the determination of the density of a liquid (as shown in the BBISE model papers issued for examinations from 2026 onwards).

The internal split of the theory paper (MCQs, short questions and long questions) is not officially confirmed for Balochistan and is therefore not printed here. Prepare every chapter, because questions may come from any part of the book.

> **Important note on syllabus reduction:** BBISE Quetta issued a one-time proportionate reduction in the syllabus for the SSC Annual Examination 2026 (notification dated 25 September 2026), excluding Physics Chapters 13 (Magnetism) and 14 (Space Physics) for that examination only. These two chapters are still included in this full-book notes set, because the reduction was a one-time measure. Always check the board's latest notification for your own examination year.

How to use these notes

- Read the study notes of a chapter first, then cover the answers and try the short questions.
- Attempt all 10 MCQs of a chapter and check them against the answer key at the end of the chapter.
- Revise the formulas of each chapter before the examination.

Chapter 1: Introduction

Study Notes

- Physics is the branch of science that studies matter, energy and the relationship between them.
- The word physics comes from the Greek word 'physikos', meaning 'natural things'.
- Main branches of physics: mechanics (motion and forces), heat, light (optics), sound, electricity and magnetism, atomic physics and nuclear physics.
- Mechanics is further divided into kinematics (motion without causes), dynamics (motion and its causes) and statics (bodies at rest).
- A physicist studies nature by observation, measurement, experiment and reasoning.
- Science is organised knowledge gained through observation and experiment; technology is the practical use of scientific knowledge.
- Engineering applies scientific principles to design machines, buildings and systems.
- Muslim scientists made great contributions: Al-Haytham (optics), Al-Biruni (measurement of the Earth's radius), Ibn Sina (motion) and Al-Khwarizmi (mathematics).
- Physics is important in daily life: transport, electricity, medicine, communication and industry all depend on it.
- The scientific method has four steps: observation, hypothesis, experiment and conclusion; a tested theory that always holds true becomes a law.

Short Questions with Answers

Q1. Define physics.

Answer: Physics is the branch of science that deals with the study of matter, energy and their mutual relationship.

Q2. What is the difference between science and technology?

Answer: Science is organised knowledge about nature gained by observation and experiment; technology is the practical application of that knowledge to make useful things.

Q3. Name the main branches of physics.

Answer: Mechanics, heat, light, sound, electricity and magnetism, atomic physics and nuclear physics.

Q4. What is mechanics?

Answer: Mechanics is the branch of physics that studies the motion of bodies and the forces that cause motion.

Q5. Name two Muslim scientists and their fields.

Answer: Al-Haytham worked on optics and Al-Biruni measured the radius of the Earth.

Long Questions with Answers

Q1. Explain the scientific method and describe how a scientific law is formed.

The scientific method begins with careful observation of a natural event. The scientist then makes a hypothesis, a possible explanation of what was observed. Experiments are carried out to test the hypothesis. If the results agree with the hypothesis again and again, the hypothesis becomes a theory. When a theory is tested many times and is always found correct, it is called a law.

Q2. Describe the main branches of physics and give one daily-life use of each.

Mechanics studies motion and forces and is used in vehicles and machines. Heat studies temperature and heat transfer and is used in cooking and engines. Light studies reflection and refraction and is used in spectacles and cameras. Sound studies production and travel of sound and is used in loudspeakers. Electricity and magnetism are used in motors and generators.

Multiple Choice Questions

1. Physics is the study of
   (a) matter and energy (b) living things (c) chemicals only (d) the Earth only
2. The word physics comes from the Greek word
   (a) physikos (b) physica (c) physa (d) physos
3. Kinematics deals with motion
   (a) and its causes (b) without its causes (c) of fluids only (d) of planets only
4. The branch that studies light is
   (a) acoustics (b) optics (c) thermodynamics (d) mechanics
5. Al-Haytham is famous for his work on
   (a) motion (b) optics (c) electricity (d) heat
6. Technology is the
   (a) study of nature (b) practical use of science (c) study of stars (d) study of chemicals
7. A tested explanation that is always found correct is called a
   (a) hypothesis (b) theory (c) law (d) guess
8. Dynamics studies
   (a) bodies at rest (b) motion and its causes (c) light only (d) sound only
9. Al-Biruni measured the
   (a) mass of the Moon (b) radius of the Earth (c) speed of light (d) age of the Sun
10. The scientific method starts with
    (a) experiment (b) conclusion (c) observation (d) law

Answer Key (Chapter 1): 1-a, 2-a, 3-b, 4-b, 5-b, 6-b, 7-c, 8-b, 9-b, 10-c

Chapter 2: Physical Quantities

Study Notes

- A physical quantity is a quantity that can be measured, such as length, mass and time.
- Base quantities are seven: length, mass, time, electric current, temperature, amount of substance and luminous intensity.
- The SI unit of length is the metre (m), of mass the kilogram (kg) and of time the second (s).
- Derived quantities are formed from base quantities, for example speed (m/s), force (newton) and area (m2).
- Prefixes change the size of a unit: kilo (k) = 10^3, milli (m) = 10^-3, micro (u) = 10^-6, mega (M) = 10^6 and centi (c) = 10^-2.
- Scientific notation writes a number as a digit term times a power of ten, e.g. 300 000 = 3 x 10^5.
- Length is measured with a metre rule, a vernier caliper (least count 0.01 cm) and a screw gauge (least count 0.001 cm).
- Volume of a liquid is measured with a measuring cylinder; volume of an irregular solid is found by the displacement method.
- An error is the difference between the measured value and the true value; it can be reduced by taking repeated readings and finding the average.
- Precision means the closeness of repeated measurements to each other; accuracy means closeness to the true value.

Short Questions with Answers

Q1. What is a physical quantity?

Answer: A quantity that can be measured is called a physical quantity, for example length, mass and time.

Q2. Name the seven base quantities.

Answer: Length, mass, time, electric current, temperature, amount of substance and luminous intensity.

Q3. What is the SI unit of mass and time?

Answer: The SI unit of mass is the kilogram (kg) and of time is the second (s).

Q4. What is a derived quantity? Give one example.

Answer: A quantity derived from base quantities is a derived quantity, for example speed = length/time, measured in m/s.

Q5. What is the least count of a vernier caliper?

Answer: The least count of a vernier caliper is 0.01 cm, or 0.1 mm.

Long Questions with Answers

Q1. Explain base and derived quantities with examples, and state the SI units of the base quantities.

Base quantities are independent quantities that are not defined in terms of other quantities. There are seven: length (metre), mass (kilogram), time (second), electric current (ampere), temperature (kelvin), amount of substance (mole) and luminous intensity (candela). Derived quantities are obtained by combining base quantities.

Q2. Describe how a vernier caliper and a screw gauge are used, and explain precision and accuracy.

A vernier caliper measures small lengths: the main scale reading is added to the vernier scale reading multiplied by the least count (0.01 cm). A screw gauge measures very small thicknesses such as a wire: the pitch divided by the number of circular-scale divisions gives its least count (0.001 cm). Zero error must be checked and corrected before use.

Multiple Choice Questions

1. The SI unit of length is
   (a) kilometre (b) metre (c) centimetre (d) millimetre
2. Which is a base quantity?
   (a) speed (b) force (c) mass (d) area
3. The prefix milli means
   (a) 10^3 (b) 10^-2 (c) 10^-3 (d) 10^6
4. The SI unit of temperature is
   (a) degree Celsius (b) kelvin (c) Fahrenheit (d) joule
5. Speed is a
   (a) base quantity (b) derived quantity (c) non-physical quantity (d) constant
6. 1 kilometre is equal to
   (a) 100 m (b) 1000 m (c) 10 m (d) 10000 m
7. The least count of a screw gauge is
   (a) 0.1 cm (b) 0.01 cm (c) 0.001 cm (d) 1 cm
8. Volume of an irregular solid is found by the
   (a) ruler method (b) displacement method (c) balance method (d) graph method
9. The number of base quantities is
   (a) 5 (b) 6 (c) 7 (d) 9
10. 3 x 10^5 in ordinary form is
    (a) 30000 (b) 300000 (c) 3000000 (d) 3000

Answer Key (Chapter 2): 1-b, 2-c, 3-c, 4-b, 5-b, 6-b, 7-c, 8-b, 9-c, 10-b

Chapter 3: Kinematics

Study Notes

- Kinematics is the branch of mechanics that studies motion without considering its causes.
- A body is at rest if its position does not change with time, and in motion if its position changes with time.
- Motion is relative: a passenger in a moving bus is at rest relative to the bus but in motion relative to the road.
- Distance is the total path length travelled; it is a scalar. Displacement is the shortest distance from the start to the end point in a given direction; it is a vector.
- Speed is distance covered per unit time; velocity is displacement per unit time and has direction.
- Acceleration is the rate of change of velocity: a = (vf - vi) / t. Its SI unit is m/s2.
- Uniform motion means equal distances in equal intervals of time; non-uniform motion means unequal distances.
- First equation of motion: vf = vi + at. Second: S = vi t + (1/2) a t2. Third: 2 a S = vf^2 - vi^2.
- In a distance-time graph, the slope gives speed. In a velocity-time graph, the slope gives acceleration and the area under the graph gives distance.
- A freely falling body accelerates at g = 10 m/s2 (approximately) towards the Earth.

Short Questions with Answers

Q1. Define kinematics.

Answer: Kinematics is the study of motion of bodies without considering the forces that cause the motion.

Q2. What is the difference between distance and displacement?

Answer: Distance is the total path length and is a scalar; displacement is the shortest distance in a given direction and is a vector.

Q3. Define velocity.

Answer: Velocity is the rate of change of displacement, that is displacement covered per unit time in a given direction.

Q4. Write the first equation of motion.

Answer: vf = vi + at, where vf is final velocity, vi is initial velocity, a is acceleration and t is time.

Q5. What does the slope of a velocity-time graph give?

Answer: The slope of a velocity-time graph gives the acceleration of the body.

Long Questions with Answers

Q1. Derive the first equation of motion by the graphical method.

Consider a velocity-time graph of a uniformly accelerated body. Let vi be the initial velocity at time zero and vf the final velocity at time t. Acceleration is the slope of the graph, so a = (change in velocity) / (time taken) = (vf - vi) / t. Rearranging gives vf - vi = a t, so vf = vi + at. This is the first equation of motion and it is used when acceleration, time and one velocity are known.

Q2. Explain the difference between speed and velocity, and between uniform and non-uniform motion, with examples.

Speed is distance per unit time and has no direction, so it is a scalar; velocity is displacement per unit time in a stated direction, so it is a vector. A car moving at 60 km/h has a speed of 60 km/h, but its velocity is 60 km/h towards the north. Uniform motion is motion in which a body covers equal distances in equal intervals of time, like a car on a clear road at steady speed.

Multiple Choice Questions

1. Kinematics studies motion
   (a) and its causes (b) without its causes (c) of fluids only (d) of the Earth only
2. Displacement is a
   (a) scalar (b) vector (c) constant (d) unit
3. The SI unit of acceleration is
   (a) m/s (b) m/s2 (c) m2/s (d) km/h
4. vf = vi + at is the
   (a) first equation (b) second equation (c) third equation (d) fourth equation
5. The area under a velocity-time graph gives
   (a) acceleration (b) distance (c) speed (d) force
6. A body moving in a circle at constant speed has
   (a) constant velocity (b) changing velocity (c) zero acceleration (d) zero speed
7. The value of g is about
   (a) 9.8 m/s2 (b) 10 m/s2 (c) 5 m/s2 (d) 20 m/s2
8. Speed is defined as
   (a) displacement/time (b) distance/time (c) force/time (d) mass/time
9. The slope of a distance-time graph gives
   (a) acceleration (b) speed (c) force (d) displacement
10. Motion of a body is always
    (a) absolute (b) relative (c) circular (d) uniform

Answer Key (Chapter 3): 1-b, 2-b, 3-b, 4-a, 5-b, 6-b, 7-b, 8-b, 9-b, 10-b

Chapter 4: Dynamics and Forces

Study Notes

- Dynamics is the branch of mechanics that studies motion and the forces that cause it.
- Force is a push or a pull that can change the state of motion or the shape of a body. Its SI unit is the newton (N).
- Newton's first law (law of inertia): a body remains at rest or in uniform motion unless acted on by an unbalanced force.
- Inertia is the tendency of a body to resist a change in its state of rest or motion; it depends on mass.
- Newton's second law: the acceleration of a body is directly proportional to the applied force and inversely proportional to its mass, F = ma.
- One newton is the force that produces an acceleration of 1 m/s2 in a mass of 1 kg.
- Newton's third law: to every action there is an equal and opposite reaction.
- Momentum is the product of mass and velocity, p = mv. Its SI unit is kg m/s.
- Friction is a force that opposes motion between two surfaces in contact; it depends on the nature of the surfaces and the normal force.
- The fundamental forces of nature are gravitational, electromagnetic, strong nuclear and weak nuclear forces.

Short Questions with Answers

Q1. Define force and state its SI unit.

Answer: Force is a push or a pull that can change the state of motion or shape of a body; its SI unit is the newton (N).

Q2. State Newton's first law of motion.

Answer: A body remains at rest or in uniform motion in a straight line unless acted upon by an unbalanced external force.

Q3. What is inertia?

Answer: Inertia is the property of a body by which it resists any change in its state of rest or of uniform motion.

Q4. State Newton's second law.

Answer: The acceleration produced in a body is directly proportional to the force applied and inversely proportional to the mass of the body, F = ma.

Q5. Define momentum.

Answer: Momentum is the product of the mass and velocity of a body, p = mv.

Long Questions with Answers

Q1. State and explain Newton's three laws of motion with one example of each.

First law (inertia): a body stays at rest or keeps moving uniformly unless an unbalanced force acts on it; for example, a passenger jerks forward when a moving bus stops suddenly. Second law: F = ma; the greater the force, the greater the acceleration, and the greater the mass, the smaller the acceleration for the same force; for example, a small force moves a bicycle easily but hardly moves a truck.

Q2. What is friction? Describe its advantages and disadvantages and methods of reducing it.

Friction is the force that opposes the relative motion between two surfaces in contact. Its advantages are that we can walk, vehicles can stop, and we can hold objects; without friction, walking and driving would be impossible. Its disadvantages are that it wastes energy as heat, wears out machine parts and reduces efficiency.

Multiple Choice Questions

1. The SI unit of force is
   (a) joule (b) newton (c) watt (d) pascal
2. F = ma is Newton's
   (a) first law (b) second law (c) third law (d) law of gravitation
3. Inertia depends on
   (a) speed (b) mass (c) force (d) volume
4. Momentum is the product of
   (a) mass and speed (b) mass and velocity (c) force and time (d) mass and acceleration
5. The SI unit of momentum is
   (a) kg m/s (b) kg m/s2 (c) N m (d) kg m2
6. A rocket works on Newton's
   (a) first law (b) second law (c) third law (d) law of inertia
7. Friction always
   (a) helps motion (b) opposes motion (c) increases speed (d) removes weight
8. One newton produces in 1 kg mass an acceleration of
   (a) 1 m/s2 (b) 10 m/s2 (c) 9.8 m/s2 (d) 100 m/s2
9. Which is a fundamental force?
   (a) friction (b) gravitational force (c) tension (d) normal force
10. A body at rest stays at rest because of
    (a) friction (b) inertia (c) gravity (d) momentum

Answer Key (Chapter 4): 1-b, 2-b, 3-b, 4-b, 5-a, 6-c, 7-b, 8-a, 9-b, 10-b

Chapter 5: Momentum

Study Notes

- Momentum is the product of mass and velocity, p = mv. It is a vector quantity and its SI unit is kg m/s.
- A heavy slow truck and a light fast car can have the same momentum if the products of their mass and velocity are equal.
- The law of conservation of momentum states that the total momentum of an isolated system remains constant if no external force acts on it.
- When two bodies collide, the total momentum before the collision equals the total momentum after the collision.
- Impulse is the product of force and the time for which it acts: J = F x t. It equals the change in momentum, J = mvf - mvi.
- The SI unit of impulse is newton-second (N s), which is the same as kg m/s.
- A large force acting for a short time and a small force acting for a long time can produce the same change in momentum.
- Seat belts, air bags and soft landing surfaces increase the time of impact, so they reduce the force felt by the body.
- In an elastic collision both momentum and kinetic energy are conserved; in an inelastic collision only momentum is conserved.
- A gun recoils when a bullet is fired because the total momentum before firing is zero, so the backward momentum of the gun equals the forward momentum of the bullet.

Short Questions with Answers

Q1. Define momentum and state its SI unit.

Answer: Momentum is the product of mass and velocity of a body, p = mv; its SI unit is kg m/s.

Q2. State the law of conservation of momentum.

Answer: The total momentum of an isolated system remains constant if no external force acts on it.

Q3. What is impulse?

Answer: Impulse is the product of the force applied and the time for which it acts, J = F x t; it equals the change in momentum.

Q4. Why do vehicles have air bags?

Answer: Air bags increase the time of impact during a collision, which reduces the force acting on the passengers.

Q5. Why does a gun recoil when fired?

Answer: The total momentum before firing is zero, so the gun gains backward momentum equal to the forward momentum of the bullet.

Long Questions with Answers

Q1. State and explain the law of conservation of momentum with the example of a gun and a bullet.

The law states that in an isolated system the total momentum before an event equals the total momentum after it, provided no external force acts. Before firing, the gun and the bullet are at rest, so the total momentum is zero. When the bullet is fired forward with momentum mv, the gun must gain an equal momentum in the opposite direction, MV, so that mv + MV = 0 in total. That is why the gun recoils backwards.

Q2. What is impulse? Show that impulse equals the change in momentum and explain its daily-life use.

Impulse is defined as the product of force and the time it acts: J = F x t. From Newton's second law, F = m(vf - vi)/t, so F x t = m(vf - vi), which is the change in momentum. Hence impulse equals the change in momentum. This explains safety devices: a cricket fielder pulls his hands back while catching the ball to increase the time of impact and reduce the force on his hands.

Multiple Choice Questions

1. Momentum is
   (a) mass/velocity (b) mass x velocity (c) force x time only (d) mass + velocity
2. The SI unit of momentum is
   (a) N s (b) kg m/s (c) both N s and kg m/s (d) joule
3. Impulse equals
   (a) force/time (b) force x time (c) mass x time (d) velocity/time
4. In an isolated system, total momentum
   (a) increases (b) decreases (c) remains constant (d) becomes zero
5. A gun recoils because of the conservation of
   (a) energy (b) momentum (c) mass (d) charge
6. In an elastic collision, conserved are
   (a) momentum only (b) kinetic energy only (c) both momentum and kinetic energy (d) neither
7. Impulse is measured in
   (a) joule (b) newton-second (c) watt (d) pascal
8. A fielder pulls his hands back to
   (a) increase force (b) increase time of impact (c) decrease momentum (d) increase mass
9. Momentum is a
   (a) scalar (b) vector (c) constant (d) unit
10. If mass is doubled at the same velocity, momentum
    (a) halves (b) stays the same (c) doubles (d) becomes four times

Answer Key (Chapter 5): 1-b, 2-c, 3-b, 4-c, 5-b, 6-c, 7-b, 8-b, 9-b, 10-c

Chapter 6: Turning Effect of Forces

Study Notes

- The turning effect of a force about a point is called its moment or torque. Moment = force x perpendicular distance from the pivot.
- The SI unit of moment of force is newton-metre (N m). A large force or a long distance from the pivot gives a large turning effect.
- A couple is a pair of equal, opposite and parallel forces that produce rotation without translation, as when turning a steering wheel.
- The centre of gravity of a body is the point at which its whole weight appears to act.
- The centre of gravity of a uniform rod is at its midpoint; of a uniform circular disc at its centre; of a uniform ring at its centre.
- A body is in equilibrium when the resultant force and the resultant moment acting on it are both zero.
- There are two conditions of equilibrium: the sum of all forces is zero and the sum of all moments about any point is zero.
- Stable equilibrium: a body returns to its original position after a small displacement (low centre of gravity, wide base). Unstable equilibrium: it moves further away.
- Neutral equilibrium: a body stays in its new position after displacement, like a ball on a flat surface.
- A body is more stable if its centre of gravity is low and its base is wide; this is why racing cars are built low and wide.

Short Questions with Answers

Q1. Define moment of a force.

Answer: The moment of a force is its turning effect about a pivot, equal to force multiplied by the perpendicular distance from the pivot.

Q2. What is the SI unit of moment?

Answer: The SI unit of moment of force is the newton-metre (N m).

Q3. What is centre of gravity?

Answer: The centre of gravity is the point of a body at which its whole weight appears to act.

Q4. State the two conditions of equilibrium.

Answer: The resultant force on the body must be zero and the resultant moment about any point must be zero.

Q5. What is a couple?

Answer: A couple is a pair of equal, opposite and parallel forces that produces rotation without moving the body as a whole.

Long Questions with Answers

Q1. Explain the principle of moments and describe an experiment to verify it.

The principle of moments states that a body is in equilibrium when the sum of the clockwise moments about a point equals the sum of the anticlockwise moments about the same point. To verify it, a metre rule is balanced on a pivot at its centre of gravity. Known weights are hung on one side at measured distances, and a weight on the other side is moved until the rule balances horizontally.

Q2. Explain stable, unstable and neutral equilibrium and how stability can be increased.

In stable equilibrium a body returns to its original position after a small push, because its centre of gravity rises and gravity pulls it back; a cone resting on its base is an example. In unstable equilibrium a small push moves the body further away, as a cone balanced on its point. In neutral equilibrium the body stays wherever it is put, as a ball on a level table.

Multiple Choice Questions

1. Moment of force equals
   (a) force + distance (b) force x distance (c) force/distance (d) force - distance
2. The SI unit of moment is
   (a) newton (b) newton-metre (c) joule (d) watt
3. The centre of gravity of a uniform rod is at its
   (a) one end (b) midpoint (c) quarter point (d) edge
4. A couple produces
   (a) translation only (b) rotation only (c) both translation and rotation (d) no motion
5. For equilibrium, the resultant force must be
   (a) maximum (b) zero (c) positive (d) negative
6. A cone on its base is in
   (a) unstable equilibrium (b) stable equilibrium (c) neutral equilibrium (d) no equilibrium
7. Stability increases when the centre of gravity is
   (a) raised (b) lowered (c) removed (d) shifted sideways
8. A ball on a flat surface is in
   (a) stable equilibrium (b) unstable equilibrium (c) neutral equilibrium (d) dynamic equilibrium
9. Turning a steering wheel is an example of a
   (a) single force (b) couple (c) friction (d) moment of inertia
10. The principle of moments says clockwise moments equal
    (a) zero (b) anticlockwise moments (c) the weight (d) the force

Answer Key (Chapter 6): 1-b, 2-b, 3-b, 4-b, 5-b, 6-b, 7-b, 8-c, 9-b, 10-b

Chapter 7: Centripetal Force

Study Notes

- A body moving in a circle is in circular motion; its direction changes continuously, so its velocity changes and it is accelerating.
- Centripetal force is the force that keeps a body moving in a circle; it acts towards the centre of the circle.
- Centripetal acceleration is a = v2 / r, where v is the speed and r is the radius of the circle.
- Centripetal force is F = m v2 / r. The larger the mass or speed, or the smaller the radius, the larger the force needed.
- Centrifugal force is the apparent outward force felt in a rotating frame; it is not a real force but a reaction to the centripetal force.
- A stone tied to a string and whirled around needs the tension in the string to provide the centripetal force; if the string breaks, the stone flies off along a tangent.
- A car turning a corner needs friction between the tyres and the road to provide the centripetal force; on a wet road the friction is less and the car may skid.
- Banked roads and the tilting of a cyclist or aeroplane while turning help provide the centripetal force.
- The Moon stays in orbit around the Earth because gravity provides the centripetal force.
- The time for one complete circle is the period T, and the speed is v = 2 pi r / T.

Short Questions with Answers

Q1. Define centripetal force.

Answer: Centripetal force is the force that keeps a body moving in a circular path; it always acts towards the centre of the circle.

Q2. Write the formula for centripetal force.

Answer: F = m v2 / r, where m is mass, v is speed and r is the radius of the circle.

Q3. What is centrifugal force?

Answer: Centrifugal force is the apparent outward force felt by a body in a rotating frame; it is the reaction to the centripetal force.

Q4. What happens if the string breaks while a stone is whirled?

Answer: The stone flies off along the tangent to the circle at that point, because no centripetal force acts on it anymore.

Q5. What provides the centripetal force for the Moon's orbit?

Answer: The gravitational pull of the Earth provides the centripetal force for the Moon.

Long Questions with Answers

Q1. Explain centripetal force and derive its formula, giving two daily-life examples.

When a body moves in a circle at constant speed, its direction keeps changing, so its velocity changes and it has an acceleration towards the centre, called centripetal acceleration, a = v2 / r. By Newton's second law, the force needed is F = ma = m v2 / r, directed towards the centre.

Q2. Distinguish between centripetal and centrifugal force and explain why roads are banked at bends.

Centripetal force is a real force acting towards the centre of the circular path, such as tension, friction or gravity. Centrifugal force is not a real force; it is the apparent outward push felt inside a turning vehicle, the reaction to the centripetal force.

Multiple Choice Questions

1. Centripetal force acts
   (a) away from the centre (b) towards the centre (c) along the tangent (d) upwards
2. Centripetal acceleration is
   (a) v/r (b) v2/r (c) v2 r (d) v r2
3. Centripetal force F equals
   (a) m v/r (b) m v2/r (c) m v2 r (d) m r/v
4. If the radius is doubled at the same speed, centripetal force
   (a) doubles (b) halves (c) stays the same (d) becomes four times
5. Centrifugal force is
   (a) a real inward force (b) an apparent outward force (c) the same as gravity (d) the same as friction
6. A stone whirled on a string flies off along the
   (a) radius (b) tangent (c) diameter (d) chord
7. The Moon's centripetal force is provided by
   (a) friction (b) gravity (c) tension (d) magnetism
8. Banking a road at a bend helps to provide
   (a) friction (b) centripetal force (c) weight (d) air resistance
9. The period T of circular motion is the time for
   (a) half a circle (b) one complete circle (c) one radian (d) one metre
10. If speed is doubled, centripetal force becomes
    (a) double (b) four times (c) half (d) the same

Answer Key (Chapter 7): 1-b, 2-b, 3-b, 4-b, 5-b, 6-b, 7-b, 8-b, 9-b, 10-b

Chapter 8: Work, Energy and Power

Study Notes

- Work is done when a force moves a body through a distance in the direction of the force: W = F x S. Its SI unit is the joule (J).
- No work is done if there is no displacement, or if the force is perpendicular to the displacement, as when carrying a load on level ground.
- Energy is the ability to do work. Its SI unit is also the joule.
- Kinetic energy is the energy of a moving body: K.E. = (1/2) m v2.
- Potential energy is stored energy due to position: gravitational P.E. = mgh, where h is the height above a reference level.
- The law of conservation of energy states that energy can neither be created nor destroyed; it can only change from one form to another.
- A falling body loses potential energy and gains kinetic energy; the total mechanical energy stays constant if air resistance is ignored.
- Power is the rate of doing work: P = W / t. Its SI unit is the watt (W); 1 watt = 1 joule per second.
- The efficiency of a machine is (useful output energy / input energy) x 100%. No machine is 100% efficient because some energy is lost as heat and sound.
- Sources of energy: renewable sources such as sunlight, wind, water and biomass, and non-renewable sources such as coal, oil and natural gas.

Short Questions with Answers

Q1. Define work and state its SI unit.

Answer: Work is the product of force and the distance moved in the direction of the force, W = F x S; its SI unit is the joule (J).

Q2. What is kinetic energy? Write its formula.

Answer: Kinetic energy is the energy possessed by a moving body; K.E. = (1/2) m v2.

Q3. State the law of conservation of energy.

Answer: Energy can neither be created nor destroyed; it can only be changed from one form into another.

Q4. Define power and state its SI unit.

Answer: Power is the rate of doing work, P = W/t; its SI unit is the watt (W).

Q5. Name two renewable and two non-renewable sources of energy.

Answer: Renewable: sunlight and wind. Non-renewable: coal and natural gas.

Long Questions with Answers

Q1. Explain kinetic and potential energy and show how energy changes when a body falls.

Kinetic energy is the energy of motion, K.E. = (1/2) m v2, so it grows quickly with speed. Potential energy is stored energy due to position; a body of mass m at height h has gravitational potential energy P.E. = mgh. When the body is dropped, its height decreases so its potential energy decreases, while its speed increases so its kinetic energy increases.

Q2. Define power and efficiency. Why can no machine be 100% efficient?

Power is the rate at which work is done, P = W/t, measured in watts; a 100 W bulb uses 100 joules of energy every second. Efficiency is the ratio of useful energy output to total energy input, multiplied by 100%. No machine is 100% efficient because some input energy is always wasted, mostly as heat due to friction and as sound.

Multiple Choice Questions

1. The SI unit of work is the
   (a) newton (b) joule (c) watt (d) pascal
2. Work is done when force acts
   (a) without displacement (b) with displacement in its direction (c) perpendicular to displacement (d) on a fixed body
3. Kinetic energy equals
   (a) m v2 (b) (1/2) m v2 (c) m g h (d) m v
4. Potential energy of a body at height h is
   (a) (1/2) m v2 (b) m g h (c) m g (d) m h
5. The SI unit of power is the
   (a) joule (b) newton (c) watt (d) horsepower only
6. Energy can be
   (a) created (b) destroyed (c) changed from one form to another (d) lost completely
7. 1 watt equals
   (a) 1 J/s (b) 1 J x s (c) 1 N (d) 1 J
8. Which is a renewable source?
   (a) coal (b) oil (c) sunlight (d) natural gas
9. Efficiency is
   (a) output/input x 100% (b) input/output x 100% (c) output + input (d) output - input
10. If the speed of a body is doubled, its kinetic energy becomes
    (a) double (b) four times (c) half (d) eight times

Answer Key (Chapter 8): 1-b, 2-b, 3-b, 4-b, 5-c, 6-c, 7-a, 8-c, 9-a, 10-b

Chapter 9: Pressure

Study Notes

- Pressure is force per unit area: P = F / A. Its SI unit is the pascal (Pa); 1 Pa = 1 N/m2.
- A small area gives a large pressure for the same force, which is why a sharp knife cuts easily and a nail has a pointed tip.
- A large area gives a small pressure, which is why heavy vehicles have wide tyres and a person lying on a bed of nails is not hurt.
- Pressure in a liquid increases with depth: P = rho g h, where rho is the density of the liquid and h is the depth.
- At the same depth, the pressure in a liquid is the same in all directions.
- Atmospheric pressure is the pressure of the air around us; at sea level it is about 101,325 Pa (1 atmosphere).
- Atmospheric pressure decreases as altitude increases, because the air above becomes thinner.
- A barometer measures atmospheric pressure; a manometer measures the pressure of a gas in a container.
- Pascal's principle: pressure applied to an enclosed liquid is transmitted equally in all directions; it is used in hydraulic brakes and hydraulic lifts.
- A hydraulic lift uses a small force on a small piston to produce a large force on a large piston, because the pressure is the same throughout the liquid.

Short Questions with Answers

Q1. Define pressure and state its SI unit.

Answer: Pressure is force per unit area, P = F/A; its SI unit is the pascal (Pa).

Q2. Why does a sharp knife cut better than a blunt one?

Answer: The sharp edge has a very small area, so the same force produces a much larger pressure.

Q3. Write the formula for pressure in a liquid at depth h.

Answer: P = rho g h, where rho is the density of the liquid, g is the acceleration due to gravity and h is the depth.

Q4. What is atmospheric pressure at sea level?

Answer: At sea level atmospheric pressure is about 101,325 Pa, which is called one atmosphere.

Q5. State Pascal's principle.

Answer: Pressure applied to an enclosed liquid is transmitted equally in all directions throughout the liquid.

Long Questions with Answers

Q1. Explain why pressure in a liquid depends on depth and density, and describe one application of Pascal's principle.

Pressure in a liquid at a depth h is P = rho g h, so it increases with depth and with the density of the liquid, but it does not depend on the shape or the total volume of the container. At the same depth the pressure is equal in all directions, which is why a dam is built thicker at its base, where the water pressure is greatest.

Q2. Why do wide tyres, snow shoes and the flat feet of camels help? Explain with the idea of pressure.

Pressure equals force divided by area, so spreading the same weight over a larger area reduces the pressure. Wide tyres spread a vehicle's weight and prevent it sinking into soft ground. Snow shoes spread a person's weight over the snow so they do not sink. A camel's wide flat feet spread its weight over the sand, which is why it can walk easily in the desert.

Multiple Choice Questions

1. The SI unit of pressure is the
   (a) newton (b) pascal (c) joule (d) watt
2. Pressure equals
   (a) force x area (b) force/area (c) area/force (d) force + area
3. Pressure in a liquid at depth h is
   (a) rho g h (b) rho g/h (c) rho h/g (d) g h/rho
4. Atmospheric pressure decreases with
   (a) increasing altitude (b) decreasing altitude (c) increasing temperature only (d) time
5. A barometer measures
   (a) liquid pressure (b) atmospheric pressure (c) gas volume (d) temperature
6. Pascal's principle is used in
   (a) hydraulic lift (b) barometer (c) thermometer (d) screw gauge
7. A sharp knife cuts because it produces
   (a) less force (b) more pressure (c) less pressure (d) more area
8. At sea level, atmospheric pressure is about
   (a) 101 Pa (b) 1013 Pa (c) 101325 Pa (d) 1000000 Pa
9. Pressure at the same depth in a liquid is
   (a) greater on the sides (b) the same in all directions (c) zero (d) greater at the top
10. A dam is thicker at the base because water pressure
    (a) is zero there (b) is greatest there (c) is least there (d) does not act there

Answer Key (Chapter 9): 1-b, 2-b, 3-a, 4-a, 5-b, 6-a, 7-b, 8-c, 9-b, 10-b

Chapter 10: Deformation of Solids

Study Notes

- A deforming force is a force that changes the size or shape of a body.
- Elasticity is the property of a solid by which it returns to its original shape and size when the deforming force is removed.
- The elastic limit is the maximum force (or extension) up to which a body behaves elastically; beyond it the deformation becomes permanent.
- Stress is the deforming force per unit area: stress = F / A. Its SI unit is the pascal.
- Strain is the ratio of the change in length to the original length: strain = change in length / original length. It has no unit.
- Hooke's law states that within the elastic limit, the extension of a spring is directly proportional to the applied force: F = k x.
- In Hooke's law, k is the spring constant; its SI unit is N/m. A stiff spring has a large value of k.
- A load-extension graph is a straight line through the origin up to the elastic limit; its slope gives the spring constant.
- Beyond the elastic limit the graph bends; the point where the material breaks is the breaking point.
- Hooke's law is used in spring balances, car suspension systems and weighing machines.

Short Questions with Answers

Q1. What is a deforming force?

Answer: A deforming force is a force that changes the size or shape of a body.

Q2. Define elasticity.

Answer: Elasticity is the property of a solid by which it returns to its original shape and size after the deforming force is removed.

Q3. What is the elastic limit?

Answer: The elastic limit is the maximum deforming force up to which a body behaves elastically; beyond it the change becomes permanent.

Q4. State Hooke's law.

Answer: Within the elastic limit, the extension produced in a spring is directly proportional to the applied force, F = k x.

Q5. What is stress?

Answer: Stress is the deforming force per unit area of a body, stress = F/A.

Long Questions with Answers

Q1. State and explain Hooke's law. How is the spring constant found from a load-extension graph?

Hooke's law states that within the elastic limit the extension of a spring is directly proportional to the force applied: F = k x, where x is the extension and k is the spring constant. To find k, weights are hung from a spring and the extension is measured for each weight. A graph of force against extension is a straight line through the origin while the spring is within its elastic limit.

Q2. Explain stress and strain and describe what happens to a wire as the load on it is increased.

Stress is the force applied per unit cross-sectional area, stress = F/A, measured in pascals. Strain is the fractional change in length, strain = change in length / original length, and it has no unit. When a load on a wire is increased slowly, the wire first stretches elastically and returns to its length when unloaded. Up to the elastic limit, stress is proportional to strain.

Multiple Choice Questions

1. Hooke's law is F =
   (a) k/x (b) k x (c) k + x (d) k - x
2. The SI unit of the spring constant is
   (a) N m (b) N/m (c) N m2 (d) m/N
3. Stress is defined as
   (a) force x area (b) force/area (c) extension/length (d) force x extension
4. Strain has
   (a) unit metre (b) unit pascal (c) no unit (d) unit newton
5. Elasticity is the property of returning to
   (a) original shape (b) new shape (c) larger size (d) smaller size
6. The elastic limit is the point beyond which deformation becomes
   (a) zero (b) temporary (c) permanent (d) elastic
7. The slope of a force-extension graph gives the
   (a) extension (b) spring constant (c) stress (d) strain
8. A spring balance works on
   (a) Pascal's principle (b) Hooke's law (c) Archimedes' principle (d) Newton's third law
9. Beyond the elastic limit, a load-extension graph
   (a) stays straight (b) bends (c) becomes vertical (d) goes to zero
10. A stiff spring has a
    (a) small k (b) large k (c) zero k (d) negative k

Answer Key (Chapter 10): 1-b, 2-b, 3-b, 4-c, 5-a, 6-c, 7-b, 8-b, 9-b, 10-b

Chapter 11: Density

Study Notes

- Density is mass per unit volume: density = mass / volume. Its SI unit is kg/m3; g/cm3 is also commonly used.
- 1 g/cm3 = 1000 kg/m3. Water has a density of 1 g/cm3, or 1000 kg/m3.
- The density of a regularly shaped solid is found by measuring its mass with a balance and its volume from its dimensions.
- The density of an irregularly shaped solid is found by the displacement method: the solid is lowered into water in a measuring cylinder and the rise in water level gives its volume.
- The density of a liquid is found by measuring the mass of a known volume of the liquid with a measuring cylinder and a balance.
- A substance floats in a liquid if its density is less than the density of the liquid; it sinks if its density is greater.
- Ice floats on water because the density of ice (0.92 g/cm3) is less than the density of water (1 g/cm3).
- A hydrometer measures the density of a liquid; it floats higher in a denser liquid.
- Ships float because their average density, including the air inside them, is less than the density of water.
- Density changes with temperature: most substances expand on heating, so their density decreases.

Short Questions with Answers

Q1. Define density and state its SI unit.

Answer: Density is mass per unit volume, density = mass/volume; its SI unit is kg/m3.

Q2. What is the density of water?

Answer: The density of water is 1 g/cm3, which equals 1000 kg/m3.

Q3. How is the volume of an irregular solid found?

Answer: By the displacement method: the rise in water level in a measuring cylinder when the solid is immersed gives its volume.

Q4. Why does ice float on water?

Answer: Ice floats because its density (0.92 g/cm3) is less than the density of water (1 g/cm3).

Q5. What does a hydrometer measure?

Answer: A hydrometer measures the density (relative density) of a liquid.

Long Questions with Answers

Q1. Describe how to determine the density of a regularly shaped solid and of an irregularly shaped solid.

For a regularly shaped solid, such as a rectangular block, first find the mass with a balance. Then measure its length, width and height with a ruler and calculate the volume as length x width x height. Density is mass divided by volume. For an irregularly shaped solid, find the mass with a balance, then pour water into a measuring cylinder and note the level.

Q2. Explain why some objects float and others sink, with examples.

Whether an object floats or sinks depends on its density compared with the density of the liquid. If the object's average density is less than the liquid's density, it floats; if greater, it sinks. Ice floats on water because its density is 0.92 g/cm3 against water's 1 g/cm3. A piece of iron sinks because its density is about 7.8 g/cm3.

Multiple Choice Questions

1. Density equals
   (a) mass x volume (b) mass/volume (c) volume/mass (d) mass + volume
2. The SI unit of density is
   (a) g/cm3 (b) kg/m3 (c) kg/m (d) N/m2
3. 1 g/cm3 equals
   (a) 10 kg/m3 (b) 100 kg/m3 (c) 1000 kg/m3 (d) 1 kg/m3
4. The density of water is
   (a) 0.92 g/cm3 (b) 1 g/cm3 (c) 7.8 g/cm3 (d) 13.6 g/cm3
5. An object floats if its density is
   (a) greater than the liquid (b) less than the liquid (c) equal to the liquid (d) zero
6. The volume of an irregular solid is found by the
   (a) ruler method (b) displacement method (c) balance method (d) graph method
7. A hydrometer measures the density of a
   (a) solid (b) liquid (c) gas (d) vacuum
8. Ice floats because its density is
   (a) greater than water (b) less than water (c) equal to water (d) zero
9. On heating, the density of most substances
   (a) increases (b) decreases (c) stays the same (d) becomes zero
10. A ship floats because its average density is
    (a) greater than water (b) less than water (c) equal to iron (d) zero

Answer Key (Chapter 11): 1-b, 2-b, 3-c, 4-b, 5-b, 6-b, 7-b, 8-b, 9-b, 10-b

Chapter 12: Particle Theory of Matter

Study Notes

- Matter is made of tiny particles (atoms and molecules) that are in constant motion.
- There are three states of matter: solid, liquid and gas. A fourth state, plasma, exists at very high temperatures.
- In a solid, particles are closely packed in fixed positions and vibrate about their mean positions; solids have a fixed shape and volume.
- In a liquid, particles are close together but can move past each other; liquids have a fixed volume but no fixed shape.
- In a gas, particles are far apart and move freely at high speeds; gases have neither a fixed shape nor a fixed volume.
- The motion of particles increases with temperature; heating a substance makes its particles move faster.
- Temperature is a measure of the average kinetic energy of the particles of a substance.
- Heat is the energy transferred from a hotter body to a colder body because of a temperature difference.
- A thermometer measures temperature. Common scales are Celsius (freezing point 0, boiling point 100) and Kelvin (freezing point 273 K).
- The Kelvin scale is the SI scale of temperature; to convert Celsius to kelvin, add 273: T(K) = T(C) + 273.

Short Questions with Answers

Q1. What is the particle theory of matter?

Answer: Matter is made of tiny particles that are in constant motion; the arrangement and motion of the particles decide the state of matter.

Q2. Name the three states of matter.

Answer: Solid, liquid and gas.

Q3. How do particles move in a solid?

Answer: In a solid, particles are closely packed in fixed positions and only vibrate about their mean positions.

Q4. Define temperature.

Answer: Temperature is the measure of the average kinetic energy of the particles of a substance.

Q5. Convert 25 C to kelvin.

Answer: T = 25 + 273 = 298 K.

Long Questions with Answers

Q1. Compare the particle arrangement and movement in solids, liquids and gases.

In a solid the particles are tightly packed in a regular arrangement and can only vibrate about fixed positions, so a solid keeps its shape and volume. In a liquid the particles are still close together but are not fixed; they can slide past each other, so a liquid keeps its volume but takes the shape of its container.

Q2. Explain the difference between heat and temperature and describe how a thermometer works.

Temperature measures how hot a body is; it is the average kinetic energy of its particles. Heat is the energy that flows from a hotter body to a colder body because of a temperature difference. Two bodies can have the same temperature but different amounts of heat if their masses differ.

Multiple Choice Questions

1. Matter is made of
   (a) large blocks (b) tiny particles in motion (c) waves only (d) empty space
2. In a solid, particles
   (a) move freely (b) vibrate about fixed positions (c) are far apart (d) do not move at all
3. A liquid has
   (a) fixed shape and volume (b) fixed volume, no fixed shape (c) no fixed volume (d) fixed shape only
4. Temperature measures the average
   (a) potential energy (b) kinetic energy (c) heat (d) mass
5. Heat flows from a
   (a) cold body to a hot body (b) hot body to a cold body (c) small body to a large body (d) solid to a gas
6. 0 C in kelvin is
   (a) 0 K (b) 100 K (c) 273 K (d) 373 K
7. The fourth state of matter is
   (a) plasma (b) vapour (c) ice (d) steam
8. In a gas, particles are
   (a) closely packed (b) far apart and moving freely (c) fixed in place (d) arranged in rows
9. A thermometer measures
   (a) heat (b) temperature (c) mass (d) pressure
10. Heating a substance makes its particles move
    (a) slower (b) faster (c) in circles only (d) not at all

Answer Key (Chapter 12): 1-b, 2-b, 3-b, 4-b, 5-b, 6-c, 7-a, 8-b, 9-b, 10-b

Chapter 13: Magnetism

Study Notes

- A magnet is a material that attracts iron, nickel and cobalt. Its two ends are called the north pole and the south pole.
- Like poles repel each other and unlike poles attract each other.
- Magnetic materials are attracted by a magnet; non-magnetic materials such as wood, plastic and copper are not attracted.
- A magnet can be made by stroking a piece of steel with a magnet, or by passing an electric current through a coil around the steel.
- A magnet can be demagnetised by heating it strongly, by hammering it, or by passing alternating current through a coil around it.
- The space around a magnet in which its magnetic force can be felt is called the magnetic field.
- Magnetic field lines come out of the north pole and go into the south pole; they never cross each other.
- A temporary magnet, such as soft iron, loses its magnetism quickly; a permanent magnet, such as steel, keeps its magnetism for a long time.
- An electromagnet is a coil of wire wound around a soft iron core; it becomes a magnet when current flows and loses magnetism when the current stops.
- The Earth behaves like a giant magnet: its magnetic south pole is near the geographic north pole, which is why a compass needle points north.
- Uses of magnets: compasses, electric motors, generators, loudspeakers, magnetic recording on tapes and hard disks, and magnetic door catches.

Short Questions with Answers

Q1. Name the two poles of a magnet.

Answer: The north pole and the south pole.

Q2. What happens between like poles?

Answer: Like poles repel each other; unlike poles attract each other.

Q3. Name three magnetic materials.

Answer: Iron, nickel and cobalt.

Q4. What is a magnetic field?

Answer: The magnetic field is the space around a magnet in which its magnetic force can be felt.

Q5. What is an electromagnet?

Answer: An electromagnet is a coil of wire wound on a soft iron core that acts as a magnet only while electric current flows through it.

Long Questions with Answers

Q1. Describe the domain theory of magnetism and explain how a magnet can be made and destroyed.

According to the domain theory, a magnetic material is made of tiny regions called domains, each acting like a small magnet. In an unmagnetised piece the domains point in random directions and their effects cancel out. When the piece is stroked with a magnet or placed in a strong magnetic field, the domains line up in the same direction and the piece becomes a magnet.

Q2. Explain the Earth's magnetic field and the working of a compass.

The Earth behaves like a huge bar magnet buried inside it, with its magnetic south pole near the geographic north pole. A freely suspended magnet, such as a compass needle, lines up with the Earth's magnetic field, so its north pole points towards the geographic north. This is how sailors and travellers find direction. The Earth's field also shields us from charged particles coming from the Sun.

Multiple Choice Questions

1. Like poles
   (a) attract (b) repel (c) have no effect (d) become neutral
2. Which is a magnetic material?
   (a) copper (b) wood (c) iron (d) plastic
3. Magnetic field lines leave the
   (a) south pole (b) north pole (c) centre (d) edge
4. A compass needle points north because of the Earth's
   (a) gravity (b) magnetic field (c) rotation (d) atmosphere
5. A temporary magnet is made of
   (a) steel (b) soft iron (c) copper (d) aluminium
6. A magnet can be demagnetised by
   (a) cooling (b) heating strongly (c) stroking (d) freezing
7. Magnetic field lines never
   (a) leave the north pole (b) enter the south pole (c) cross each other (d) form loops
8. An electromagnet works only when
   (a) current flows (b) it is heated (c) it is hammered (d) it is cooled
9. A permanent magnet is made of
   (a) soft iron (b) steel (c) copper (d) zinc
10. The Earth's magnetic south pole is near the geographic
    (a) south pole (b) north pole (c) equator (d) centre

Answer Key (Chapter 13): 1-b, 2-c, 3-b, 4-b, 5-b, 6-b, 7-c, 8-a, 9-b, 10-b

Chapter 14: Space Physics

Study Notes

- Space physics is the study of the Sun, the Moon, the planets and other bodies in space, and the forces that govern them.
- The solar system consists of the Sun and the bodies that orbit it: eight planets, dwarf planets, moons, asteroids and comets.
- The inner (terrestrial) planets are Mercury, Venus, Earth and Mars; they are small and rocky.
- The outer planets are Jupiter, Saturn, Uranus and Neptune; they are large and made mostly of gases.
- The Earth orbits the Sun once in about 365 days, which gives us the year; it spins on its axis once in 24 hours, which gives us day and night.
- The Moon orbits the Earth once in about 27 days; its phases change as the Sun lights different parts of it.
- The Sun is a star at the centre of the solar system; it produces energy by nuclear fusion in its core.
- The orbital speed of a planet depends on its distance from the Sun: planets closer to the Sun move faster.
- The orbital speed is v = 2 pi r / T, where r is the radius of the orbit and T is the period of one revolution.
- Gravity holds the planets in their orbits; the gravitational pull of the Sun provides the centripetal force for each planet.
- Artificial satellites orbit the Earth and are used for communication, weather forecasting, navigation and television.

Short Questions with Answers

Q1. Name the eight planets in order from the Sun.

Answer: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

Q2. Which planets are called terrestrial planets?

Answer: Mercury, Venus, Earth and Mars; they are small and rocky.

Q3. How long does the Earth take to orbit the Sun?

Answer: About 365 days, which is one year.

Q4. What provides the centripetal force for a planet's orbit?

Answer: The gravitational pull of the Sun provides the centripetal force.

Q5. Write the formula for the orbital speed of a planet.

Answer: v = 2 pi r / T, where r is the radius of the orbit and T is the period.

Long Questions with Answers

Q1. Describe the solar system and compare the inner and outer planets.

The solar system is made of the Sun and all the bodies that move around it under gravity: eight planets, their moons, dwarf planets such as Pluto, asteroids and comets. The Sun sits at the centre and contains almost all the mass of the system. The four inner planets, Mercury, Venus, Earth and Mars, are called terrestrial planets because they are small, rocky and close to the Sun.

Q2. Explain the orbital speed of a planet and why planets nearer the Sun move faster.

A planet moves around the Sun in a nearly circular orbit. Its orbital speed is the distance of one orbit divided by the time for one orbit: v = 2 pi r / T, where r is the radius of the orbit and T is the period. Gravity from the Sun pulls the planet inwards and provides the centripetal force, m v2 / r, that keeps it in orbit.

Multiple Choice Questions

1. The Sun is at the
   (a) edge of the solar system (b) centre of the solar system (c) outside the galaxy (d) centre of the Earth
2. The terrestrial planets are
   (a) Jupiter, Saturn, Uranus, Neptune (b) Mercury, Venus, Earth, Mars (c) Earth and Mars only (d) Mercury and Venus only
3. The Earth takes about 365 days to
   (a) spin once (b) orbit the Sun (c) orbit the Moon (d) orbit Mars
4. Orbital speed v equals
   (a) 2 pi r T (b) 2 pi r / T (c) pi r2 / T (d) 2 pi T / r
5. The largest planet is
   (a) Saturn (b) Neptune (c) Jupiter (d) Mars
6. The Moon orbits the Earth in about
   (a) 7 days (b) 27 days (c) 365 days (d) 24 hours
7. The Sun produces energy by
   (a) burning coal (b) nuclear fusion (c) chemical reactions (d) friction
8. A planet nearer the Sun moves
   (a) slower (b) faster (c) at the same speed (d) backwards
9. Artificial satellites are used for
   (a) communication and weather forecasting (b) digging mines (c) fishing (d) farming only
10. The asteroid belt lies between
    (a) Earth and Mars (b) Mars and Jupiter (c) Venus and Earth (d) Jupiter and Saturn

Answer Key (Chapter 14): 1-b, 2-b, 3-b, 4-b, 5-c, 6-b, 7-b, 8-b, 9-a, 10-b

Formula Summary

- Speed = distance / time; velocity = displacement / time
- Acceleration a = (vf − vi) / t
- vf = vi + at; S = vi t + (1/2) a t^2; 2 a S = vf^2 − vi^2
- Force F = m a; momentum p = m v; impulse J = F × t = change in momentum
- Moment of force = force × perpendicular distance
- Centripetal force F = m v^2 / r; orbital speed v = 2 π r / T
- Work W = F × S; kinetic energy = (1/2) m v^2; potential energy = m g h
- Power P = W / t; efficiency = (useful output / input) × 100%
- Pressure P = F / A; pressure in a liquid P = ρ g h
- Hooke's law F = k x; stress = F / A; strain = change in length / original length
- Density = mass / volume; temperature in kelvin T(K) = T(°C) + 273

A note to students

These notes cover the whole Balochistan Textbook Board Class 9 Physics book. They are original study notes: read your textbook along with them, practise the numerical problems from your book, and perform the practical work in your school laboratory. Good preparation is regular: a little work every day is better than a long rush at the end.

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