BRILLIANT PUBLIC SCHOOL, SITAMARHI

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IX Physics Chapter Notes

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Class IX: Physics
Chapter 1: Motion

Chapter Notes

Key Learnings:

1. If the position of an object does not change with time, it is said to be at rest.

2. If the position of an object changes as time passes, it is said to be in motion.

3. Reference point is a fixed point with respect of which a body is at rest or in motion.

4. Rest and Motion are relative terms.

5. Distance is the length of actual path traveled by a body in a given time.

6. Displacement is the shortest distance between the initial and final positions of the body in a known direction.

7. A physical quantity which has both magnitude and direction is called as vector quantity.

8. A physical quantity which has only magnitude is called as scalar quantity.

9. The S.I unit of distance and displacement is metre.

10. A body is said to be in uniform motion, if travels equal distances in equal intervals of time.

11. A body is said to have non-uniform motion if it travels unequal distances in equal intervals of time.

12. Speed is the ratio of distance traveled to the time taken to cover that distance.

13. In non-uniform motion, speed of an object is not constant. The S.I. unit of speed is m/s or ms^{-1}.

14. Average speed of a body is the total distance traveled divided by the total time taken.

15. Velocity is displacement per unit time. The S.I. unit of velocity is meter per second.

16. Average velocity is displacement divided by the time taken.

17. Speed is a scalar quantity and velocity is a vector quantity.

18. Time is independent variable, plotted along X-axis. Distance is dependent variable, plotted along Y-axis.

19. Graphs are designed to make it easier for the reader to interpret and understand numerical data.

20. The distance-time graph is a straight line parallel to time axis when the object is at rest.

$$\text{Slope of a straight line} = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope of position-time graph is zero if the object is at rest.

21. The nature of distance-time graph is a straight line when the object is in the state of uniform motion.

22. Slope of the distance-time graph gives the speed of the object.

23. A more steeply inclined distance-time graph indicates greater speed. The nature of distance-time graph is a curve having varying slope when the object has non-uniform motion.

24. If the velocity of a body remains constant, the velocity-time graph is a horizontal line parallel to the time axis.

25. If the velocity of the body changes uniformly at a constant rate, the velocity-time graph is a straight line.

26. If the velocity of the object changes non-uniformly, the velocity-time graph is a curve having increasing slope.

27. The area enclosed by the velocity-time graph and the time axis represents the displacement.

28. The slope of the velocity-time graph gives the acceleration

29. When a body travels along a circular path of constant radius with a constant speed v then its motion is uniform circular motion.

30. In a uniform circular motion, velocity of a particle is not constant but its speed is constant, hence it is an accelerated motion.

Top Formulae

1. Average Speed = $\frac{\text{Total distance travelled}}{\text{Total time taken}}$

If an object travels a distance s in time t then its speed v is given by

$$v = \frac{s}{t}$$

2. Average Velocity (V_{av}) = $\frac{\text{initial velocity (u)} + \text{ final velocity (v)}}{2}$

3. Acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$

If the velocity of an object changes from an initial value u to the final value v in time t, the acceleration $a = \frac{v - u}{t}$.

4. Three equations of motion

$$v = u + at \quad \ldots\ldots\ldots(1)$$

$$s = ut + \frac{1}{2}at^2 \ldots\ldots\ldots(2)$$

$$v^2 = u^2 + 2aS \ldots\ldots\ldots(3)$$

Where u is the initial velocity of the object which moves with uniform acceleration a for time t. v is the final velocity, and s is the distance traveled by the object in time t.

5. We know that the circumference of a circle of radium r is given by 2πr. If a person takes t seconds to go once around the circular path of radius r, the velocity v is given by

$$v = \frac{2\pi r}{t}$$

Class IX: Science
Chapter 2: Force and Laws of Motion
Chapter Notes

Key Learning:

1. Force is a push or pull acting upon an object.

2. Balanced forces: The resultant of all the forces acting on a body is zero.

3. Unbalanced forces: The resultant of all the forces acting on a body is not zero.

4. Newton's first law of motion states that A body at rest will remain at rest and a body in motion will remain in uniform motion unless acted upon by an unbalanced force.

5. The property by the virtue of which an object tends to remain in the state of rest or of uniform motion unless acted upon by some force is called inertia.

6. The mass of a body is a measure of inertia.

7. The momentum of an object is the product of its mass and velocity and has the same direction as that of the velocity. Its SI unit is kg m s^{-1}.

8. Newton's second law of motion states that the rate of change of momentum of a body is directly proportional to the force and takes place in the same direction as the force.

9. Force is also defined as the product of mass and acceleration.

10. The SI unit of force is kg m s^{-2}. This is also known as newton and represented by the symbol N. A force of one newton produced an acceleration of 1 m s^{-2} on an object of mass 1 kg.

11. Force of friction always opposes motion of objects.

12. Two forces resulting from the interaction between two objects are called action and reaction forces respectively.

13. Action and reaction forces act on two different bodies but they are equal in magnitude.

14. Newton's third law: For every action there is an equal and opposite reaction; but action and reaction acts on different bodies.

15. Law of conservation of momentum: The sum of momenta of the two objects before collision is equal to the sum of momenta after the collision provided there is no external unbalanced force acting on them.

16. The velocity with which gun moves in the backward direction is known as the recoil velocity.

Top Formulae:

1. Momentum p = m v;

   m = mass of the body; v = velocity of the body

2. Force $F = \frac{dp}{dt}$

3. Force F = m a; where a = acceleration

4. Law of conservation of momentum

   Total momentum before collision = Total momentum after collision

   $$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

   Where m_1, m_2: masses of the bodies

   u_1, u_2: initial velocities of bodies

   v_1, v_2: final velocities of bodies

Class IX: Science

Chapter 11: Work and Energy

Chapter notes

Key Learning:

1. Work is done when force acting on a body produces displacement in it.
2. Work done = Force $\times$ displacement in the direction of force
3. Work is a scalar quantity.
4. The SI unit of work is joule (j).
5. Work done is positive if the angle between force and displacement is acute.
6. Work done is negative if the angle between force and displacement is obtuse.
7. Work done on an object by a force would be zero if the displacement of the object is zero.
8. When a body moves along a circular path, the force acts along the radius of the circular path and the motion of the body is along the tangential direction. Therefore, the angle between the direction of motion and the force is 90°. Hence, no work is done on a body when it moves in a circular path.
9. An object having a capability to do work is said to possess energy.
10. The energy possessed by a body by virtue of its motion is called kinetic energy.
11. The energy possessed by a body by virtue of its position or change in configuration is called potential energy.
12. Power is defined as the rate at which work is done.
13. The change of one form of energy into another is called transformation of energy.
14. Law of conservation of energy states that energy can neither be created nor be destroyed but can be transformed from one form to another.
15. Energy exists in nature in several forms such as kinetic energy, potential energy, heat energy, chemical energy etc. The sum of the

kinetic and potential energies of an object is called its mechanical energy.

16. The energy used in one hour at the rate of 1kW is called 1 kW h.

Top Formulae:

1. The amount of work done, W = FS cos θ

2. If θ = 90°, W = FS cos 90°

   = 0, as cos 90° = 0

3. Kinetic energy of an object of mass m and moving with velocity v

$$\text{K. E.} = \frac{1}{2}mv^2$$

4. Gravitational potential energy of an object of mass m at height h

$$\text{P. E.} = m\ g\ h$$

5. Law of conservation of energy

$$\frac{1}{2}mv^2 + m\ g\ h = \text{constant}$$

6. $$\text{Power (P)} = \frac{\text{Energy spent (E)}}{\text{Time taken (t)}}$$

7. 1 watt = 1 joule/second or 1 W = 1 J / s
8. 1 kilowatt = 1000 watts
9. 1 kW = 1000 W
10. 1 kW = 1000 J / s
11. 1 KWh = 3.6×10^6 J
12. 1 hp = 746 W = 0.746 KW

Class IX: Science
Chapter : Sound
Chapter Notes

Key Learning:

1. Sound is a wave motion, produced by a vibrating source.
2. A medium is necessary for the propagation of sound waves.
3. Sound is a longitudinal wave in which the particles of medium move along the direction of motion of wave.
4. The part or region of a longitudinal wave in which the density of the particles of the medium is higher than the normal density is known as compression.
5. The part or region of a longitudinal wave in which the density of the particles of the medium is lesser than the normal density is called a rarefaction.
6. The point of maximum positive displacement on a transverse wave is known as crest.
7. The point of maximum negative displacement on a transverse wave is known as through.
8. A wave or short duration which is confined to a small portion of a medium at any given time is known as a pulse.
9. The maximum displacement of particles of the medium from their mean positions during the propagation of a wave is known as amplitude of the wave.
10. The distance traveled by a wave in one second is called wave velocity. It depends upon the nature of the medium through which it passes.
11. The speed of sound depends primarily on the nature and the temperature of the transmitting medium.

12. Sound travels faster in solids than in air. The speed of sound in solids is much more than the speed of sound in liquids or gases.
13. The distance between two consecutive compressions or two consecutive rarefactions is called the wavelength.
14. Frequency is defined as the number of oscillations per second.
15. The time taken by the wave for one complete oscillation of the density or pressure of the medium is called the time period, T.
16. How the brain interprets the frequency of an emitted sound is called the pitch of sound.
17. Loudness is the degree of sensation of sound produced.
18. Sound properties such as pitch, loudness and quality are determined by the corresponding wave properties.
19. Sound gets reflected and follows the same law as the reflection of light.
20. The persistence of sound due to repeated reflection and its gradual fading away is called reverberation of sound.
21. Echo is a repetition of sound due to the reflection of original sound by a large and hard obstacle.
22. The audible range of hearing for average human beings is in the frequency range of 20 Hz – 20 kHz.
23. The amount of sound energy passing each second through unit area is called the intensity of sound.
24. Sound of frequency less than 20 Hz is known as infrasound and greater than 20 kHz is known as ultrasound.
25. Ultrasound has many medical and industrial applications.
26. SONAR stands for Sound Navigation and Ranging and it works on the principle of reflection of sound waves.
27. The SONAR technique is used to determine the depth of the sea and to locate under water hills, valleys, submarines, icebergs sunken ships etc.

Top Formulae:

a. Frequency and time period are related as follows

$$\nu = \frac{1}{T}$$

b. Speed, v = distance / time

$$v = \frac{\lambda}{T}$$

3. The wave velocity (v), frequency of the wave (f) and its wavelength (λ) are related by the formula, v = f λ.

Class IX: Science

Chapter 10: Gravitation

Points to remember

Key Learning:

1. According to the law of gravitation the force of attraction between any two objects is proportional to the product of their masses and inversely proportional to the square of the distance between them. The law applies to objects anywhere in the universe. Such a law is said to be universal.
2. Universal gravitational constant G = $6.673\times10^{-11}\ Nm^2kg^{-2}$
3. Gravitation is a weak force unless large masses are involved.
4. Acceleration with which a body falls towards the centre of the earth is called acceleration due to gravity (g).
5. The force of gravity decreases with altitude. It also varies on the surface of the earth, decreasing from poles to the equator.
6. Mass is the quantity of matter contained in the body.
7. Weight of the body is the force with which the earth attracts the body.
8. The weight is equal to the product of mass and acceleration due to gravity.
9. Mass of a body does not change but weight of a body is different at different places.
10. The force acting on a body perpendicular to its surface is called thrust.
11. The force acting per unit area of the object is known as pressure.
12. The upward force exerted by a liquid when a body is immersed in the liquid is called up thrust or buoyant force.
13. Objects having density less than that of the liquid in which they are immersed, float on the surface of the liquid. If the density of the object is more than the density of the liquid in which it is immersed then it sinks in the liquid.
14. According to Archimedes' principle, when a body is partially or fully immersed in a fluid, it experiences an up thrust which is equal to the weight of the fluid displaced by the body.

Top Formulae:

1. Newton's Law of gravitation $F = G\frac{m \times M}{R^2}$
2. Acceleration due to gravity – $g = \frac{GM_E}{R_E{}^2}$
3. Equations of motion under free fall
   i. $v = u + gt$
   ii. $s = u\,t + (½)\,g\,t^2$
   iii. $v^2 = u^2 + 2\,g\,s$
4. Weight of an object $W = m\,g$
5. Pressure = thrust / area
6. Density = mass / volume
7. Relative density = density of a substance / density of water