

Railways & SSC Exams 2019

Complete Physics Notes PDF



Keeping the upcoming RRB NTPC, SSC CHSL, Group D Exam in mind, we have designed the Physics Digest which contains all the essential topics. This PDF includes all the important topics from Physics part that will help you boost your score in the upcoming exams.

PHYSICS

WORK

Work is said to be done, if force acting on a body is able to actually move it through some distance in the direction of the force. Its SI unit is a **joule**.

ENERGY

- Energy is a scalar quantity and its unit is **Joule**.
- The sum of all kinds of energies in an isolated system remains constant at all times. This is the law of conservation of energy.

POWER

Its unit is **watt**.

- **1 watt hour** = 3600 Joule
- **1 kilowatt hour** = 3.6×10^6 joule
- **1HP** = 746 watt

GRAVITATION

- Everybody in the universe attracts other body by a force called force of gravitation.
- The gravitational force of the earth is called **gravity**.
- The acceleration produced in a body due to force of gravity is called **acceleration** due to gravity (g) and its value is **9.8 m/s^2**
- Acceleration due to gravity is independent of shape, size and mass of the body.
- Escape velocity is the minimum velocity with which an object just crosses the Earth's gravitational field and never returns. Escape velocity at the Earth's surface is **11.2 km/s** .
- Escape velocity at the **Moon's** surface is **2.4 km/s** . Due to low escape velocity there is no atmosphere on the moon.
- Value of g decreases with height or depth from Earth surface.
- g is maximum at **poles**.
- g is minimum at **equator**.
- g decreases due to **rotation of Earth**.
- g decreases if angular speed of Earth increases and increases if angular speed of Earth decreases.
- The acceleration due to gravity at the moon is **one-sixth** that of the Earth. So, the weight of a person on the surface of the moon will be **$1/6$** of his actual weight on the Earth.

SATELLITE

- Satellites are natural or artificial bodies revolving around a planet under its gravitational force of attraction.
- **Moon** is a **natural satellite**, while **INSAT-B** is an artificial satellite of Earth.
- The period of revolution of satellite revolving near the surface of earth is 1 hour 24 minutes (34 minutes).
- Geo-stationary satellite revolves around the Earth at a height 36000 km (approx).
- Time period of rotation of geo-stationary satellite is 24 hours.
- The Earth rotates on its axis from **West to East**. This rotation makes the Sun and the stars appear to be moving across the sky from **East to West**.
- A **geosynchronous satellite** is a satellite in geosynchronous orbit, with an orbital period the same as the Earth's rotation period.
- A special case of geosynchronous satellite is the **geostationary satellite**, which has a geostationary orbit – a circular geosynchronous orbit directly above the Earth's equator.
- **Geo-stationary satellite is used** to telecast. TV programmes from one part of the world to another, in weather forecasting, in predictions of floods and droughts.
- Polar Satellite Revolves around the earth in polar orbit at a height of **800km** (app.) Time periods of these satellites is **84 min**.

ATOMIC AND NUCLEAR PHYSICS

Cathode Rays

Cathode rays, discovered by Sir William Crooke and its properties are

- travel in **straight lines**.
- Produce fluorescence.
- can penetrate through thin foils of metal and deflected by both electric and magnetic fields.
- have velocity ranging **$1/30\text{th}$ to $1/10\text{th}$** of the velocity of light.

Positive or Canal Rays

- These rays were discovered by **Goldstein**.
- The positive ray consists of **positively charged particles**.
- These rays travel in **straight line**.
- These rays are deflected by **electric and magnetic fields**.
- These rays can produce ionization in gases.

X-Rays

- X-rays are electromagnetic waves with wavelength **range 0.1 A-100 A**.
- X-rays were discovered by **Roentgen**.
- X-rays travels in **straight line**.
- Long exposures of X – rays in injurious for human body.
- X – rays shows **photoelectric effect**.

Uses of X-Rays

- **In medical sciences** X-rays are used in surgery for the detection of fracture, diseased organs, foreign matter like bullet, stones etc. They are used in treatment of cancer and in skin diseases.
- **In Engineering**, X-rays are used in detecting faults, cracks, flaws and gas pockets in the finished metal products and in heavy metal sheets.
- **In Scientific Work**, X-rays are used in studying crystal structure and complex molecules.
- **In Custom Department** X-rays are used in custom department for detection of banned materials kept hidden.

Radioactivity

- Radioactivity was discovered by **Henry Becquerel**, **Madame Curie** and **Pierre Curie** for which they jointly won Nobel Prize.

Nuclear Fission

- Atom Bomb is based on nuclear fission. U^{235} and Pu^{239} are used as fissionable material.
- Nuclear fission was first demonstrated by Halin and Fritz Strassmann.

Nuclear Fusion

- When two or more light nuclei combined together to form a heavier nucleus is called as **nuclear fusion**.
- For the nuclear fusion, a temperature of the order of **10^8 K** is required.
- **Hydrogen Bomb** was made by the American Scientist in **1952**. This is based on **nuclear fusion**. It is **1000** times more powerful than atom bomb.

Nuclear Reactor or Atomic Pile

- Nuclear reactor is an arrangement, in which controlled nuclear fission reaction takes place.
- **First nuclear reactor was** established in Chicago University under the supervision of **Prof Enrico Fermi**.
- Heavy water, graphite and beryllium oxide are used to slow down the fast moving neutrons. They are called moderate.

Uses of Nuclear Reactor

- (i) To produce electrical energy from the energy released during fission.
- (ii) To produce different isotopes, this can be used medical, physical and agriculture science.

There are several components of nuclear reactor which are as follows

- Fissionable Fuel U^{235} or U^{239} is used.
- Moderator decreases the energy of neutrons, so that they can be further used for fission reaction.
- **Heavy water** and graphite are used as moderator.
- **Control Rod rods of cadmium** or boron are used to absorb the excess neutrons produced in fission of uranium nucleus, so that the chain reaction.

NEWTON'S LAWS OF MOTION

- **First Law:** Everybody maintains its initial state of rest or motion with uniform speed on a straight line unless an external force acts on it. It is also called Galileo's law or law of inertia.

Example While jumping from a slowly moving train/bus one must run for short distance, in the direction of motion.

- **Second Law:** The force acting on an object is directly proportional to the product of the mass of the object and the acceleration produced on it.
- **Third Law:** To every action, there is an equal and opposite reaction.

Example : Bogies of the trains are provided with buffers to avoid severe jerks during shunting of trains. Rocket moves up due to reaction of downward ejection of gas.

CIRCULAR MOTION

- When an object moves along a circular path, its motion is called circular motion.
- The external force required to act radially inward over the circular motion of the body is called **Centripetal force**.
- **Centrifugal force** is such a pseudo force that is equal and opposite to **Centripetal force**.
- Cream separator, centrifugal dryer work on the principle of centrifugal force.

FRICTION

- In the opposing force that is set-up between the surfaces of contact, when one body slides or rolls or tends to do so on the surface of another body.
- Due to friction, we are able to move on the surface of Earth.
- While applying brakes in automobiles, it stops only due to friction.

Pascal's Law of Pressure

- Hydraulic lift, hydraulic press and hydraulic brakes are based on the **Pascal's law of pressure**.

Archimedes Principle

- When a body is immersed partly or wholly in a liquid, there is an apparent loss in the weight of the body, which is equal to the weight of liquid displaced by the body.
- The weight of water displaced by an iron ball is less than its own weight. Whereas water displaced by the immersed portion of a ship is equal to its weight. So, small ball of iron ball sink in water, but large ship float.
- A fat person will quickly learn the swimming as compared to a slim person because he will displace more water. So, it will be more balanced.
- Hydrogen filled balloon float in air because hydrogen is lighter than air. A person can lift more weight in water.

WAVE

A wave is a disturbance, which propagates energy from one place to the other without the transportation of matter.

Waves are broadly of two types:

- Mechanical wave (longitudinal wave and transverse wave)
- Electromagnetic wave
- Following are the electromagnetic (Non-mechanical) waves-
 - a. Gama rayas (**Highest frequency**)
 - b. X-rays
 - c. UV rays
 - d. Visible radiation
 - e. infra-red rays
 - f. short radio waves
 - g. Long radio waves (**Lowest frequency**)

All are in decreasing order of the frequency

Following waves are not electromagnetic.

- a. Cathode rays
- b. Canal rays

- c. alpha rays
- d. beta rays
- e. sound wave
- f. ultrasonic wave

Longitudinal Waves

- In this wave the particles of the medium vibrate in the direction of propagation of wave.
- Waves on springs or sound waves in air are examples of longitudinal waves.

Transverse Waves

- In this wave, the particles of the medium vibrate perpendicular to the direction of propagation of wave.
- Waves on strings under tension, waves on the surface of water are the examples of transverse waves.

Electromagnetic Waves

- The waves, which do not require medium for their propagation i.e., which can propagate even through the vacuum are called electromagnetic waves.
- Light radio waves, X-rays etc are the examples of electromagnetic wave. These waves propagate with the velocity of light in vacuum.

Sound Waves

Sound waves are longitudinal mechanical waves. Eased on their frequency range sound waves are divided into following categories.

- The sound waves which lie in the frequency range 20 Hz to 20000 Hz are called audible waves.
- The sound waves having frequencies less than 20 Hz are called infrasonic
- The sound waves having frequencies greater than 20000 Hz are called ultrasonic waves.
- Ultrasonic waves are used for sending signals, measuring the depth of see, cleaning clothes and machinery parts, remaining lamp short from chimney of factories and in ultrasonography.

Speed of Sound

- Speed of sound is **maximum in solids minimum in gases**.
- When sound goes from one medium to another medium, its speed and wave length changes, but frequency remain unchanged. The speed of sound remains unchanged by the increase or decrease of pressure.
- The speed of sound increases with the increase of temperature of the medium.
- The speed of sound is more in humid air than in dry air because the density of humid air is less than the density.

Echo: The repetition of sound due to reflection of sound waves is called an echo.

Intensity: It is defined as amount of energy passing normally per unit area held around that point per source unit time.

Pitch: The sensation of a frequency is commonly referred to as the pitch of a sound.

Sonar: It stands for sound navigation and ranging. It is used to measure the depth of a sea, to locate the enemy submarines and shipwrecks.

Doppler's Effect

If there is a relative motion between source of sound and observer, the apparent frequency of sound heard by the observer is different from the actual frequency of sound emitted by the source. This phenomenon is called **Doppler's Effect**.

LIGHT

- Light is a form of energy, which is propagated as **electromagnetic wave**.
- It is the radiation which make our eyes able to 'see' the object. Its speed is **$3 \times 10^8 \text{ m/s}$** . It is the form of energy. It is a **transverse wave**.
- It takes **8 min 19s** to reach on the earth from the sun and the light reflected from moon takes **1.28s** to reach earth.
- **Primary Colours-** Blue, Red, Green
- **Secondary Colours-** The colour produced by mixing any two primary colors
- **Complementary Colours-** Any two colours when added produce white light.
- Blue colour of sky is due to scattering of light.
- The brilliant red colour of rising and setting sun is due to scattering of light.

Human Eye

- Least distance of distinct vision is 25 cm.
- Myopia or short sightedness- far objects cannot see clear
- Hyperopia or hypermetropia or Long-sightedness- Near objects cannot see clear
- Presbyopia- in elder person, both far and near cannot see clear

Reflection of Light

- When a ray of light falls on a boundary separating two media comes back into the same media, then this phenomenon is called reflection of light.

Reflection from Plane Mirror

- If an object moves towards a plane mirror **with speed v** , relative to the object it moves towards it with **speed $2v$** .

- To see his full image in a plane mirror, a person required a mirror of at least half of his height.

Spherical Mirror

Spherical mirrors are of two types

1. **Concave mirror**
2. **Convex mirror**

- Image formed by a convex mirror is always virtual, erect and diminished.
- Image formed by a concave mirror is generally real and inverted.

Uses of Concave Mirror

- (i) As a shaving mirror
- (ii) As a reflector for the head lights of a vehicle, search light
- (iii) In ophthalmoscope to examine eye, ear, nose by doctors.
- (iv) In solar cookers.

Uses of Convex Mirror

- (i) As a rear-view mirror in vehicle because it provides the maximum rear field of view and image formed is always erect.
- (ii) In sodium reflector lamp.

Refraction of Light

- The bending of the ray of light passing from one medium to other medium is called refraction. When a ray of light enters from one medium to other medium, its frequency and phase do not change, but wavelength and velocity change. Due to refraction from Earth's atmosphere, the stars appear to twinkle.

Critical Angle

- The angle of incidence in a denser medium for which the angle of refraction in rarer medium becomes 90° , is called the critical angle.

Total Internal Reflection

- Sparkling of diamond, mirage and looming, shining of air bubble in water and optical Fiber are examples of total internal reflection.

Power of a lens

- Power of a lens is its capacity to deviate a ray. It is measured as the reciprocal of the focal length in meters.
- SI Unit of Power is diopter.

ELECTRICITY AND MAGNETISM

Charge

Charge is the basic property associated with matter due to which it produces and experiences electrical and magnetic effects. Similar charges repel each other and opposite charges attract each other. The SI unit of charge is **coulomb**.

Conductor: Conductors are those materials, which allow electricity to pass through them. Metals like silver, iron, copper and earth acts like a conductor. Silver is the best conductor.

Insulator: Insulators are those materials which do not allow electricity to flow through them. Metals like wood, paper, mica, glass, ebonite are insulators.

Electric Current

- Its unit is Ampere. It is a scalar quantity.
- **An electric bulb makes a bang when it is broken** because there is a vacuum inside the electric bulb, when the bulb is broken air rushes at great speed from all sides to fill the vacuum. The rushing of air produces a noise generally referred to as the bang.
- Shunt is a wire of very small resistance
- A Galvanometer can be converted into an ammeter by connecting a shunt parallel to it.
- A Galvanometer can be converted into a voltmeter by connecting a very high resistance in its series.
- The sodium and mercury street lamps light up due to atomic emission.
- The purpose of choke coil in fluorescent is to produce high voltage to ionize the gas in the tube required for high current to flow through filament.

Magnetism

- Diamagnetic substance- when placed in magnetic field, acquire feeble magnetism opposite to the direction of the magnetic field.
Examples- Gold, Diamond, Copper, Water, Mercury etc.
- Paramagnetic substance- when placed in magnetic field, acquire feeble magnetism in the direction of the magnetic field.
Example- Al, Na, Mn etc.
- Ferromagnetic substance-when placed in magnetic field, are strongly magnetized in the direction of the magnetic field.
Examples- Iron, Cobalt, Nickel
- Curie temp- the Curie temperature (TC), or Curie point, is the temperature at which certain materials lose their permanent magnetic properties, to be replaced by induced magnetism.

- **Isogonic lines** are lines on the Earth's surface along which the declination has the same constant value, and lines along which the declination is zero are called **agonic lines**.
- **Isoclinic lines** are imaginary lines on the earth's surface connecting points where the earth's magnetic field has the same angle.
- **The aclinic line** is the magnetic equator, where the magnetic field is inclined neither north or south, so it's a special case of an isoclinic line.
- **Isodynamic line-** A line on a map connecting points of equal strength of the earth's magnetic field.

Surface Tension and capillary

- Lubricating oil spread easily on all parts because of their low surface tension.
- Dirt get removed when detergents are added while washing clothes because surface tension of water is reduced.
- The absorption of ink by a blotting paper is due to capillary action
- The supply of water to the leaves at the top of even a tall tree is through capillary rise.

Heat

- Unit of heat-
C.G.S- Calorie
F.P.S- British Thermal Unit (B. Th. U)
- Absolute Zero Temp- minus 273 K (-273 K)
- 1 calorie= 4.2 J
- The specific heat is the amount of heat per unit mass required to raise the temperature by one degree Celsius.
- Consider 1 kg of water at 0 °C. When it is heated from 0 °C, it actually contracts rather than expanding, up to 4 °C. The volume of water is minimum at 4 °C. Beyond 4 °C, water starts expanding. This behaviour of water between 0 °C and 4 °C is called **anomalous expansion of water**.
- **Newton's Law of Cooling** states that the rate of change of the temperature of an object is proportional to the difference between its own temperature and the ambient temperature (i.e. the temperature of its surroundings).
- **Hoar Frost**-is the reverse process of sublimation.

MEASUREMENT UNITS

- **Angstrom** : For measuring length of light waves
- **Barrel** : For measuring liquids. One barrel is equal to 31½ gallons or 7,326.5 cubic inches
- **Cable:** For measuring length of cables. It is about 183m. in length
- **Carat** : Used for measuring precious stones. It is also a measure for the purity of gold alloy

- **Fathom** : It is used for measuring depth of water. One fathom is equal to 4 inches
- **Knot**: For measuring speed of ships
- $1 \text{ nm} = 10^{-9} \text{ m}$
- $1 \text{ pm} = 10^{-12} \text{ m}$
- $1 \text{ light year} = 9.46 \times 10^{15} \text{ m}$
- $1 \text{ L} = 1000 \text{ mL} = 35.3 \text{ fl oz} = 264 \text{ gal}$

SOME CONVERSION FACTORS

Mass and Density

- $1 \text{ Kg} = 1000 \text{ g} = 6.02 \text{ u}$
- $1 \text{ Slug} = 14.6 \text{ kg}$
- $1 \text{ u} = 1.66 \text{ kg}$

Length and Volume

- $1 \text{ m} = 100 \text{ cm} = 39.4 \text{ inch} = 3.28 \text{ ft}$
- $1 \text{ mile} = 1.61 \text{ km} = 5280 \text{ ft}$
- $1 \text{ inch} = 2.54 \text{ cm}$

Angular Measure

- $1 \text{ m/s} = 3.28 \text{ ft/s} = 2.24 \text{ mi/h}$
- $1 \text{ km/h} = 0.621 \text{ mi/h} = 0.278 \text{ m/s}$

Force and Pressure

- $1 \text{ lb} = 4.45 \text{ N}$
- $1 \text{ ton} = 2000 \text{ lb}$
- $1 \text{ Pa} = 1 \text{ N/m}^2 = 10 \text{ dyne/cm}^2 = 1.45 \text{ lb/ft}^2$
- $1 \text{ atm} = 1.01 \times 10^5 \text{ Pa} = 14.7 \text{ lb/in}^2 = 76 \text{ cm - Hg}$

SOME IMPORTANT SCIENTIFIC INSTRUMENTS

- **Accumulator**: Electrical energy is stored
- **Altimeter**: Used in aircraft for measuring altitudes
- **Ammeter**: Measuring the electrical current in amperes
- **Anemometer**: Measuring the strength of winds
- **Audiometer**: Measuring intensity of wind
- **Audiophone**: It is used for improving imperfect sense of hearing.
- **Barometer**: Measuring atmospheric pressure
- **Binocular**: An optical instrument designed for magnified view of distant objects by both eyes simultaneously
- **Bolometer**: To measure heat radiation
- **Cardiogram**: For recording the heart movements
- **Calorimeter**: Measuring of quantities of heat
- **Chronometer**: A clock that keeps very accurate time as the one that is used to determine longitude at sea.
- **Colorimeter**: An instrument for comparing intensities of colour.
- **Commutator**: An instrument to change or remove the direction of an electric current, in dynamo used to convert alternating current into direct current.
- **Cyclotron**: Studying the properties of atoms by smashing them.
- **Dynamo**: A device for converting mechanical energy into electrical energy
- **Dynamometer**: An instrument for measuring the electrical power
- **Electroscope**: An instrument for detecting the presence of electric charge.
- **Endoscope**: To examine internal parts of the body
- **Fathometer**: Measure depth of the ocean
- **Galvanometer**: For detecting and measuring electric current
- **Hygrometer**: Measure level of humidity
- **Phonograph**: For reproducing sound
- **Pyrometer**: Measure very high temperature
- **Quartz Clock**: A highly accurate clock used in astronomical observations and other precision work
- **Radar**: Radio, angle, detection and range is used to detect the direction and range of an approaching aeroplane by means of radio micro waves
- **Radiometer**: An instrument for measuring the emission of radiant energy
- **Radio Micrometer**: An instrument for measuring heat radiations

- **Rain Gauge:** An instrument for measuring rainfall
- **Rectifier:** An instrument used for the conversion of AC into DC.
- **Refractometer:** An instrument used to measure the refractive index of a substance
- **Resistance Thermometer:** Used for determining the electrical resistance of conductors
- **Salinometer:** A type of hydrometer used to determine the concentration of salt solutions by measuring their densities
- **Seismometer (Seismograph):** An Apparatus for measuring and recording earthquake shock
- **Sextant:** For guiding ships or surveying land.
- **Spectroscope:** An instrument used for spectrum analysis
- **Speedometer:** It registers the speed at which the vehicle is moving
- **Spherometer:** For measuring curvature of surfaces
- **Sphygmomanometer:** An instrument used to detect blood pressure in a human body. It is also called B.P.Apparatus
- **Sphygmophone:** Instrument with the help of which, a pulse beat makes a sound
- **Spring Balance:** Useful for measuring weight
- **Stereoscope:** It is used to view two dimensional pictures.
- **Stethoscope:** An instrument which is used by the doctors to hear and analyze heart and lung sounds.
- **Stroboscope:** It is used to view rapidly moving objects.
- **Tachometer:** An instrument used in measuring speeds of aero planes and motor boats.
- **Teleprinter:** This instrument receives and sends typed messages from one place to another.
- **Telescope:** It views distant objects in space.
- **Theodolite:** It measures horizontal and vertical angles.
- **Transistor:** A small device which may be used to amplify currents and perform other functions usually performed by a thermionic valve
- **Vernier:** An adjustable scale for measuring small sub divisions of scale
- **Viscometer:** For measuring viscosity
- **Voltmeter:** To measure potential difference between two points
- **Udometer:** Rain guage

Some Previous Year Questions asked in Railways & SSC Exams

1. **SI unit of luminous intensity is _____ ?**

- A. lumen
- B. lux
- C. candela
- D. watt

Ans. C

Luminous intensity is a measure of the wavelength-weighted power emitted by a light source in a particular direction per unit solid angle, based on the luminosity function, a standardized model of the sensitivity of the human eye. The SI unit of luminous intensity is the candela (cd).

2. **If a bomb dropped from an airplane explodes in mid-air _____?**

- A. its KE increases
- B. its total energy increases
- C. its total energy decreases
- D. its total momentum decreases

Ans. A

The kinetic energy of an object is the energy that it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its stated velocity. Having gained this energy during its acceleration, the body maintains this kinetic energy unless its speed changes.

3. **Fat can be separated from milk in a cream separator because of _____?**

- A. cohesive force
- B. gravitational force
- C. centripetal force
- D. centrifugal force

Ans. D

The centrifugal separator was invented in 1897. By the turn of the century it had altered the dairy industry by making centralised dairy processing possible for the first time. It also allowed removal of cream and recovery of the skim milk in a fresh state.

4. **Melting point of ice _____.**
A. increases with increase of pressure
B. decreases with increase of pressure
C. is independent of pressure
D. None of these

Ans. B

The melting point of ice at 1 atmosphere of pressure is very close to 0 °C (32 °F, 273.15 K); this is also known as the ice point.

5. **Radioactivity was discovered by _____?**
A. J.J. Thomson B. W.Roentgen
C. H.Becquerel D. M. Curie

Ans. C

Antoine-Henri Becquerel is known for his discovery of radioactivity, for which he received the Nobel Prize for Physics in 1903.

Unstable atomic nuclei will spontaneously decompose to form nuclei with a higher stability. The decomposition process is called radioactivity.

6. **If the temperature inside a room is increased, the relative humidity will _____?**
A. increase B. decrease
C. remain unchanged D. none of these

Ans. B

This is because temperatures in the home can be much different than the temperature outside. This is because of that important relationship between temperature and how much maximum moisture can be in the air.

7. **In a transistor, the base is _____.**
A. an insulator
B. a conductor of low resistance
C. a conductor of high resistance
D. an extrinsic semiconductor

Ans. D

A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit.

8. **Nights are cooler in the deserts than in the plains because _____.**
A. Sand radiates heat more quickly than the earth
B. The sky remains clear most of the time
C. Sand absorbs heat more quickly than the earth
D. Of none of the above reasons

Ans. A

Because desert air contains less moisture and because cloud cover is less frequent in deserts, temperatures vary more widely between day and night in deserts than in other areas. Deserts may experience temperature variations of 30-40 degrees between day and night (vs 20-30 degrees in other areas), this means a nighttime low of 70-80 degrees after a 110-degree day

9. **When we hear a sound, we can identify its source from _____.**
A. wave length of sound
B. the overtones present in the sound
C. the intensity of sound
D. the amplitude of sound

Ans. B

An overtone is any frequency higher than the fundamental frequency of a sound. Using the model of Fourier analysis, the fundamental and the overtones together are called partials. Harmonics, or more precisely, harmonic partials, are partials whose frequencies are integer multiples of the fundamental.

10. **A boy is standing in front of a plane mirror at a distance of 3 m from it. What is the distance between the boy and his image?**
A. 3 m B. 6 m
C. 4.5 m D. None of these

Ans. B

The image formed by a plane mirror is always virtual upright, and of the same shape and size as the object it is reflecting. A virtual image is a copy of an object formed at the location from which the light rays appear to come

11. **Energy is continuously generated in the sun due to _____.**
A. Nuclear fusion B. Nuclear fission
C. Radioactivity D. Artificial radioactivity

Ans. A

Nuclear fusion is a nuclear reaction in which two or more atomic nuclei come very close and then collide at a very high speed and join to form a new type of atomic nucleus. During this process, matter is not conserved because some of the matter of the fusing nuclei is converted to photons.

12. **Hydrogen bomb is based upon the principle of _____.**
A. Nuclear fission
B. Nuclear fusion
C. Controller nuclear reaction
D. None of these

Ans. B

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The hydrogen bomb eventually relies upon atomic fusion (adding to the atomic nucleus) to release energy. Nuclear fusion is a nuclear reaction in which two or more atomic nuclei come very close and then collide at a very high speed and join to form a new type of atomic nucleus. During this process, matter is not conserved because some of the matter of the fusing nuclei is converted to photons

13. The south pole of the earth's magnet is near the geographical _____.

- A. south
- B. east
- C. west
- D. north

Ans. D

The South Pole of the Earth's magnet is in the geographical North because it attracts the North Pole of the suspended magnet and vice versa. Thus, there is a magnetic S-pole near the geographical North, and a magnetic N-pole near the geographical South

14. Number of basic SI unit is _____.

- A. 4
- B. 7
- C. 6
- D. 5

Ans. B

International System of Units (SI) is the modern metric system of measurement and the dominant system of international commerce and trade. It has seven base units.

15. The wire having a green plastic covering is a _____.

- A. Line wire
- B. Neutral wire
- C. Earth wire
- D. None of these

Ans. C

The earth wire is a crucial part of the home electrical system and is designed to protect against electric shock.

16. The working principle of a Washing Machine is _____.

- A. Centrifugation
- B. Dialysis
- C. Reverse osmosis
- D. Diffusion

Ans. A

Washing machine works on the principle of centrifugal force.

17. Sound and light waves both _____.

- A. have similar wavelength
- B. obey the laws of reflection
- C. travel as longitudinal waves
- D. travel through vacuum

Ans. B

The two laws of reflection of light are applicable to sound waves as well. The incident wave, the normal to the reflecting surface and the reflected wave at the point of incidence lie in the same plane. The angle of incidence is equal to the angle of reflection $\angle r$.

18. In an electric motor, the energy transformation is from _____.

- A. electrical to chemical
- B. chemical to light
- C. mechanical to electrical
- D. electrical to mechanical

Ans. D

An electric motor is an electrical machine that converts electrical energy into mechanical energy. The reverse of this would be the conversion of mechanical energy into electrical energy and is done by an electric generator.

19. The focal length of a plane mirror is _____.

- A. Positive
- B. Negative
- C. Zero
- D. Infinity

Ans. D

A plane mirror is a mirror with a flat reflective surface. The focal length of a plane mirror is infinity. Its optical power is zero.

20. A dynamo converts _____.

- A. Mechanical energy into sound energy
- B. Mechanical energy into electrical energy
- C. Electrical energy into mechanical energy
- D. None of these

Ans. B

The dynamo, by attaching it in between the two tires, converts the mechanical energy (which of course, is produced by paddling) into electrical energy, and by connecting the wires going out of the dynamo to light, it glows without any flaw.

21. Which of the following is used in oven?

- A. X-rays
- B. UV-rays
- C. Microwaves
- D. Radio waves

Ans. C

An oven is a thermally insulated chamber used for the heating, baking or drying of a substance and most commonly used for cooking.

22. Decibel is the unit of _____.

- A. Speed of light
- B. Intensity of sound
- C. Intensity of heat
- D. None of these

Ans. B

Decibel (dB) unit is used for expressing the ratio between two amounts of electric or acoustic power for measuring the relative loudness of sounds.

23. The ozone layer in the atmosphere is at a height of about _____.

- A. 25 km
- B. 50 km
- C. 100 km
- D. 200 km

Ans. B

Ozone is mainly found in two regions of the Earth's atmosphere. Most ozone (about 90%) resides in a layer that begins between 10 to 17 kilometers above the Earth's surface and extends up to about 50 kilometers

24. A camera uses a _____ to form an image on a piece of film at the back.

- A. convex lens
- B. concave lens
- C. diverging lens
- D. none of these

Ans. A

A camera consists of three main parts.

- The body which is light tight and contains all the _____ mechanical parts.
- The lens which is a convex lens.
- The film or a charged couple device in the case of a digital camera.

25. Newton is used to measure_____.

- A. Speed
- B. Volume
- C. Force
- D. Area

Ans. C

The newton (N) is the International System of Units (SI) derived unit of force. It is named after Isaac Newton in recognition of his work on classical mechanics, specifically Newton's second law of motion.

26. X- rays are _____waves.

- A. Longitudinal
- B. Transverse
- C. Electromagnetic
- D. Elastic

Ans. C

X-rays are a form of electromagnetic radiation as are radio waves.

27. The technique used by bats to find their way or to locate food is _____.

- A. SONAR
- B. RADAR
- C. Echolocation
- D. Flapping

Ans. C

Bats use echolocation to navigate and find food in the dark. To echolocate, bats send out sound waves from their mouth or nose. When the sound waves hit an object they produce echoes

28. Radian per second is unit of _____.

- A. Momentum
- B. Moment of Inertia
- C. Frequency
- D. Angle Velocity

Ans. D

The SI unit of angular velocity is radians per second.

29. Which law states, "The rate of loss of heat by a body is directly proportional to the difference in temperature between the body and the surroundings"?

- A. Doppler's Effect
- B. Newton's law of cooling
- C. Kirchhoff's Law
- D. Stefan's Law

Ans. B

Newton's Law of Cooling states that the rate of change of the temperature of an object is proportional to the difference between its own temperature and the ambient temperature.

30. The loudness of sound depends upon_____.

- A. Velocity
- B. Pitch
- C. Amplitude
- D. Wavelength

Ans. C

Loudness is the characteristic of a sound that is primarily a psychological correlate of physical strength (amplitude).

31. SI Unit of Time is _____.

- A. Second
- B. Meter
- C. Kilogram
- D. Angstrom

Ans. A

The SI unit of time is second, symbol is (s).

32. SI unit for the surface tension is _____.

- A. kg/m²
- B. kg/m³
- C. N/m
- D. kg/m

Ans. C

Surface tension is measured in force per unit length. Its SI unit is newton per meter.

33. A player making a long jump is an example of _____.

- A. Projectile motion
- B. Rotatory motion
- C. Spinning motion
- D. Horizontal motion

Ans. A

Projectile motion is a form of motion in which an object or particle is thrown near the earth's surface and it moves along a curved path under the action of gravity only.

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34. The angular velocity depends upon the rate of change of the _____.

- A. Angular Distance
- B. Angular acceleration
- C. Angular Displacement
- D. torque

Ans. C

The angular velocity is defined as the rate of change of angular displacement and is a vector quantity which specifies the angular speed of an object and the axis about which the object is rotating.

35. Radio waves, microwaves, infra-red spectrum, ultraviolet rays, X-rays and gamma rays are classified as _____.

- A. light waves
- B. electromagnetic waves
- C. electric waves
- D. magnetic waves

Ans. B

Electromagnetic radiation is the radiant energy released by certain electromagnetic processes. It consists of electromagnetic waves which are synchronized oscillations of electric and magnetic fields that propagate at the speed of light through a vacuum.

36. A rocket works on the principle of conservation of _____.

- A. mass
- B. linear momentum
- C. energy
- D. angular momentum

Ans. B

A rocket works by expelling gases from one end at a very high velocity. The escaping gases have a very high speed and this with their mass translates to a very large momentum. Due to the principle of conservation of momentum the body of the rocket is pushed forward. If both the momentum of the gases as well as that of the rocket are added the sum is zero.

37. Sound waves in air are _____.

- A. transverse
- B. longitudinal
- C. electromagnetic
- D. polarised

Ans. B

Sound can propagate through compressible media such as air, water and solids as longitudinal waves and also as a transverse wave in solids.

38. Who among the following is the scalar quantity _____.

- A. force
- B. pressure
- C. velocity
- D. acceleration

Ans. B

Pressure is a scalar quantity. It relates the vector surface element with the normal force acting on it.

39. Sound of frequency below 20 Hz is called _____.

- A. audio sounds
- B. infrasonic
- C. ultrasonic
- D. supersonics

Ans. B

The term "infrasonic" applied to sound refers to sound waves below the frequencies of audible sound and nominally includes anything under 20 Hz.

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