

Unit # 09

Nature of Science and Physics

Q# 1 What is acoustics?

Ans. Acoustics is the study of sound waves, their generation, propagation, and reception, as well their interaction with different environments and materials

Q# 2 Explain computational physics ?

Ans. Computational physics utilizes numerical methods and computer simulations to solve

Complex physical problems that are difficult to solve analytically

Q# 3 What is a scientific theory? Give two examples.

Ans: A theory is a well-substantiated explanation of some aspect of the natural world, based on a Body of evidence.

Examples: It include the theory of evolution and the theory of general relativity.

Q# 4 Define a scientific law and provide two examples.

Ans, A scientific law is a statement that describes a consistent and universal relationship between variables, often expressed mathematically.

Examples: It include Newton's laws of motion and the Law of conservation of energy.

Q# 5 How does physics impact our daily lives?

Ans. Physics underpins many technology we use daily (electronics, appliances), helps us understand natural phenomena (weather, movement), and enables engineering solutions (infrastructure, vehicles).

Q# 6 What are the limitations of classical physics?

Ans: Classical physics fails to accurately describe phenomena at the atomic/subatomic level, at high Speeds (approaching the speed of light), in strong gravitational fields, and with high- energy Phenomena.

Q# 7 How does physics contribute to other scientific disciplines?

Ans: Physics provides foundational principles and methods for chemistry (atomic interactions), Biology (biophysics), astronomy (celestial phenomena), engineering (design and analysis), and Other fields.

Q# 8 What factors determine the validity of a scientific theory?

Ans: A theory's validity is determined by empirical evidence, predictive power, falsifiability, Consistency with other theories, scope, simplicity, peer review, reproducibility, and adaptable.

Q# 9 What is the primary difference between classical and quantum mechanics?

Ans: Classical mechanics describes the motion of macroscopic objects, while quantum mechanics describes the behaviour of particles at the atomic and subatomic levels.

Q# 10 What are some key concepts in classical mechanics?

Ans: Key concepts in classical mechanics include determinism continuity, Newton's laws of motion, the law of universal gravitation, and the principle of energy conservation.

Q# 11 What are some key concepts in quantum mechanics?

Ans: Key concepts in quantum mechanics include probability, uncertainty, wave-particle duality, Quantization, and the Schrödinger equation.

Q# 12 In what situations does classical mechanics break down?

Ans: Classical mechanics breaks down when dealing with the very small (atomic/subatomic), the very fast (near the speed of light), the very massive (strong gravitational fields), or the very energetic.

Q# 13 How is quantum mechanics used in technology?

Ans: Quantum mechanics is the foundation for technologies like lasers, transistors, and quantum Computers.

Q# 14 Explain the role of physics in environmental science.

Ans: Physics helps understand climate dynamics energy transfer, and natural processes development of sustainable solutions and predicting the consequences of climate

Q# 15 What are some practical applications of acoustics?

Ans: Practical applications of acoustics include soundproofing, architectural acoustics (designing spaces with good sound quality), and the development of audio technologies (speakers, microphones).

Q# 16 How is biophysics used in biological research?

Ans: Biophysics uses physics principles to study biological processes at the molecular, cellular, and organismal levels, providing insights into protein folding, cell membrane transport, and neural Signalling.

Q # 17 What are some challenges in computational physics?

Ans: Challenges in computational: physics include developing's accurate: models, dealing with Computational complexity, and- validating results against experimental data.

Q# 18 What are some ethical considerations in nuclear physics?

Ans: Ethical considerations in nuclear physics include the potential for nuclear weapons proliferation, The safe handling and disposal of nuclear waste, and the responsible use of nuclear energy.

Q #19 How does relativity impact our understanding of space and time?

Ans: Relativity shows that space and time are not absolute but are relative to the observer's motion and the presence of gravity. It also reveals the equivalence of mass and energy.

Q#20 What are some current research areas in astrophysics?

Ans: Current research areas in astrophysics include dark matter and dark energy, exoplanets, the early universe, black holes, and the origins of cosmic rays.

Q# 21 How does optics contribute to our understanding of vision?

Ans: Optics explains how light enters the eye, is focused by the lens, and is detected by the retina, allowing us to understand how we see and perceive the world

Q# 22 How is physics used in forensic science?

Ans: Physics is used in forensic science to analyse blood spatter patterns, firearm ballistics, and other evidence to reconstruct crime scenes and determine the cause of death.

Q23.Differentiate the terms ‘science’, ‘technology’, and ‘engineering’ with suitable examples

Ans: Science:

Science is the systematic study of the natural world through observation, and experimentation It aims to expand knowledge and explain how the universe works

Example:

The study of gravity Scientists investigate how gravitational forces affect objects in Space and on Earth, leading to a deeper understanding of fundamental forces.

Technology:

Technology is the application of scientific knowledge for practical purposes to solve problems and improve human life.

Example:

Smartphones: These devices utilize principles of physics, chemistry, and computer science to provide communication, internet access, and

various applications. The development of Smartphones involves applying scientific knowledge to create practical tools.

Engineering:

Engineering is the application of scientific and mathematical principles to design, build, and maintain structures, machines, systems, and processes. It focuses on solving specific problems and creating functional solutions.

Example:

Civil Engineering: The design and construction of bridges. Engineers apply principles of physics and material science to ensure the bridges can support loads and withstand environmental conditions, translating scientific knowledge into practical infrastructure.

Q24- Write some objectives of Physics?

Ans Physics helps us understand the world around us by creating ideas based on experiments and observations. It is important in our daily lives and explains everything around us. Physics studies both very small things, like atoms (too small to see even with a powerful Microscope), and very big things, like galaxies. It applies to natural things like the sky, stars, Planets, birds, and oceans, as well as man-made things like cars, phones, satellites, and Computers.

Q# 25 How do birds fly?

Ans: Birds stay high in the air by using the Difference in air pressure above and below their Wings. Their feathers keep them warm, especially When fluffed up in winter.

Q# 26 Why sky seems blue?

Ans: The sky looks blue because sunlight reaches earth's atmosphere and is scattered in all directions by gases and particles in the air.

Q #27 How lakes help humans?

Ans: Large bodies of water, like lakes and seas, help keep nearby land temperatures steady because water can absorb and release heat slowly.

Q#28 How vehicles move?

Ans: Vehicles use the principles of mechanics and thermodynamics to convert the chemical energy stored in fuel into kinetic energy, which powers the movement of the vehicle.

Conceptual Questions

Q1.Different branches of physics.

Ans. Biophysics:

Biophysics is the field that use physics to understand how biological systems work.

Astrophysics:

Astrophysics is a science that use the methods and Principles of physics to the Study of astronomical objects and phenomena.

Optics:

Optics is the branch of physics that studies the nature and properties of light and its interactions with matter.

Relativistic mechanics:

Relativistic mechanics is the branch of physics in which we study the System of bodies whose relative velocities approaches to the speed of light.

OR

The branch of Physics in which we study the system of bodes whose kinetic energies are comparable with the product of their masses and the square of the velocity of light (c).

Nuclear physics:

Nuclear physics is the study of the structure, properties and behaviour of, atomic nuclei.

Acoustics:

Acoustics is the branch of physics that deals with the production Transmission, control, reception, and effects of sound.

Computational physics:

Computational physics is the study and implementation of numerical analysis to solve complex problems in physics.

Q 2: Define theory, and law?

Ans.

Theory:

A theory explains how nature behaves under specific conditions.

Example Theory of General Relativity.

Law:

A law is a statement that summarizes an observed regularity or pattern in nature and gives the relationship between variables.

Examples: Newton's Law of Universal Gravitation Newton's Laws of Motion. Boyle's Laws of Thermodynamics

Q# 3 Define hypothesis?

Ans, A hypothesis is a tentative assumption or explanation made before any research that can be verified by further investigation It is a foundational element in the scientific method and serves as a starting point for investigation A hypothesis should be testable and falsifiable, meaning it can be supported or refuted through experimentation or observation

Key Characteristics of a Hypothesis:

- 1) Testable: It must be possible to design an experiment or study to determine if the Hypothesis is true or false.
- 2) Falsifiable: There must be a possibility to prove the hypothesis wrong if it is incorrect.
- 3) Specific: It should be clear and focused, addressing a particular aspect of the problem being investigated

Example of a Hypothesis:

“If plants are exposed to red light, then they will grow faster than plants exposed to blue light this hypothesis suggests a specific, testable relationship between the colour of light and plant growth rate.

Q# 4 What is the difference between classical mechanics and quantum mechanics?

Ans:

Classical mechanics:

- ⇒ This branch deals with the motion of visible Objects and the forces that act upon them
- ⇒ It helps explain everyday occurrences, such as Why a ball rolls down a hill etc.
- ⇒ Classical mechanics deals with a universe of What appears to be certainties.

Quantum mechanics:

- ⇒ Quantum mechanics is the branch of physics in which we study the mathematical description of motion and behaviour of microscopic particles.
- ⇒ It is a field which Investigates the physics of the very small objects, such as atoms and subatomic particles.
- ⇒ Quantum mechanics deals with probabilistic rules in the unfolding of the universe.

Q# 5 What determines the validity of a theory?

Ans: The validity of a theory is determined by its ability to explain and predict natural phenomena accurately, consistently, and reliably based on empirical evidence and experimental testing.

Q# 6 What part of the study is not handled by the classical study of physics?

Ans, The microscopic study of the physical world is not handled by classical physics. A new field called quantum theory handles the study of physics at the microscopic level. In classical theory theories of mechanics, relativity, field theory is not included These are the category of subject

which comes under Quantum mechanics where we study small particles and classical physics also include electromagnetism (light, heat).