Chapter 1

Physical World

Solutions (Set-1)

SECTION - A

School/Board Exam. Type Questions

Very Short Answer Type Questions :

1. Name the scientist and the country of his origin whose field of work was 'elasticity'.

Sol. Robert Hooke, England

2. Name the scientist and the country of his origin whose field of work was 'Cosmic rays'.

Sol. Victor Francis Hess, Austria

3. Name the scientist and the country of his origin whose field of work was 'measurement of electronic charge'.

Sol. R.A. Millikan, USA

4. What is the scientific principle behind 'Aeroplane'?

Sol. Bernoulli's principle in fluid dynamics.

5. What is the scientific principle behind 'Optical fibres'?

Sol. Total internal reflection of light.

6. What is the range of strong nuclear force?

Sol. Short nuclear size ($\approx 10^{-15}$ m).

7. What is the range of weak nuclear force?

Sol. Very short, sub-nuclear size ($\sim 10^{-16}$ m).

8. What is the range of gravitational and electromagnetic force?

Sol. Infinite

9. Name the physicist who showed that the same laws of motion and the law of gravitation apply to celestial and terrestrial mechanics.

Sol. Isaac Newton

10. Who predicted the existence of a new particle called neutrino (emitted in β-decay of a nucleus) using the conservation laws of energy and momentum?

Sol. Wolfgang Pauli (1900–1958) in 1931.

Short Answer Type Questions :

11. Explain mesoscopic domain.

Sol. It is the domain intermediate between the macroscopic and microscopic domains. It deals with a few tens or hundreds of atoms.

12. What is the difference between physical sciences and biological sciences?

Sol. The sciences which deal with non-living things are called **physical sciences**, *e.g.*, Physics, Chemistry, Astronomy etc. The sciences which deal with living things are called **biological sciences**, *e.g.*, Botany, Zoology, etc.

13. Give examples where small discrepancies have led to new theories in physics.

Sol. (i) Geocentric theory assuming earth to be at the centre of the universe was replaced by Heliocentric theory assuming sun to be stationary and all planets revolving around it.

(ii) The corpuscular theory of light given by Newton was replaced first by Huygens wave theory of light, which was replaced later by Planck's quantum theory of light. Finally, dual theory of light was given by de Broglie to account for all the phenomena observed in case of light.

14. Explain the strategy of approximation.

Sol. Most of the observed phenomena in daily life are rather complex manifestations of the simple basic laws. Therefore, it is good to focus first on the essential feature, discover the basic principles and then introduce modifications to build a more refined theory of the phenomena.

15. How is the study of physics useful?

Sol. (i) Live transmission of events, thousands of kilometres away, on the T.V.

(ii) S.T.D.; I.S.D.; Fax; Cellular phones etc.

(iii) Speed and memory of the computers.

(iv) Technological advances in health sciences.

(v) Robotics

(vi) Exploring new sources of energy.

16. Mention some great physicists and their major contribution.

Sol.

	Physicist	Contribution/Discovery
(i)	Archimedes	Principle of buoyancy
(ii)	Isaac Newton	Newton's laws of motion, universal law of gravitation etc.
(iii)	Huygens	Wave theory of light
(iv)	Faraday	Laws of electromagnetic induction
(v)	W.K. Roentgen	X-rays
(vi)	J.C. Bose	Ultra short radiowaves

17. Mention major contribution/discovery of following physicists – Marie Curie, Albert Einstein, R.A. Millikan, S.N. Bose, Wolfgang Pauli.

Sol.

Physicist	Major Contribution/Discovery
(i) Marie Curie	Natural radioactivity
(ii) Albert Einstein	Explanation of photoelectric effect; theory of relativity
(iii) R.A. Millikan	Measurement of electronic charge
(iv) S.N. Bose	Quantum statistics
(v) Wolfgang Pauli	Exclusion principle

18. What is the scientific principle involved in particle accelerators, electron microscope and Bose Einstein condensate?

Sol. Scientific principle

Particle accelerators : Motion of charged particles in electromagnetic fields.

Electron microscope : Wave nature of electrons

Bose Einstein condensate : Trapping and cooling of atoms by laser beams and magnetic fields.

19. What is the scientific principle involved in steam engine, nuclear reactor and radio and T.V.?

Sol. Scientific principle

Steam engine : Laws of thermodynamics.

Nuclear reactor : Controlled nuclear fission.

Radio and T.V. : Generation, propagation and detection of electromagnetic waves.

20. What is the scientific principle involved in computers, lasers and production of ultra high magnetic fields?

Sol. Scientific principle

Computers : Digital logic

Lasers : Light amplification by stimulated emission of radiation.

Production of ultra high magnetic fields : Superconductivity

21. What is the scientific principle involved in hydroelectric power, sonar and non-reflecting coatings?

Sol. Scientific principle

Hydroelectric power : Conversion of gravitational potential energy into electrical energy.

Sonar : Reflection of ultrasonic waves.

Non-reflecting coatings : Thin film optical interference.

22. What is the scientific principle involved in Fusion test reactor (Tokamak), Giant Metrewave Radio Telescope (GMRT) and Genetic engineering?

Sol. Fusion test reactor (Tokamak) : Magnetic confinement of plasma.

Giant Metrewave Radio Telescope (GMRT) : Detection of cosmic radio waves.

Genetic engineering : Role of DNA in heredity.

23. Mention major contribution/discovery of following physicists – Galileo Galilei, James Clerk Maxwell and Heinrich Rudolf Hertz with their country of origin.

Sol.

Physicist	Major Contribution/Discovery	Country of Origin
Galileo Galilei	Law of inertia	Italy
James Clark Maxwell	Electromagnetic theory; Light an electromagnetic wave	U.K.
Heinrich Rudolf Hertz	Generation of electromagnetic wave	Germany

24. Mention major contribution/discovery of following physicists – J.J. Thomson, M.N. Saha and Enrico Fermi along with their country of origin.

Sol.

Physicist	Major Contribution/Discovery	Country of Origin
J.J. Thomson	Electron	U.K.
M.N. Saha	Thermal ionisation	India
Enrico Fermi	Controlled nuclear fission	Italy

25. Mention major contribution/discovery of following physicists – Werner Heisenberg, Paul Dirac and Edwin Hubble along with their country of origin.

Sol.

Physicist	Major Contribution/Discovery	Country of Origin
Werner Heisenberg	Quantum mechanics; Uncertainty principle	Germany
Paul Dirac	Relativistic theory of electron; Quantum statistics	U.K.
Edwin Hubble	Expanding Universe	U.S.A.

26. Mention major contribution/discovery of following physicists – Ernest Orlando Lawrence, Hideki Yukawa and Homi Jehangir Bhabha along with their country of origin.

Sol.

Physicist	Major Contribution/Discovery	Country of Origin
Ernest Orlando Lawrence	Cyclotron	U.S.A.
Hideki Yukawa	Theory of nuclear forces	Japan
Homi Jehangir Bhabha	Cascade process of cosmic radiation	India

27. Mention major contribution/discovery of following physicists – Lev Davidovich Landau, S. Chandrasekhar and John Bardeen along with their country of origin.

Sol.

Physicist	Major Contribution/Discovery	Country of Origin
Lev Devidovich Landau	Theory of condensed matter; Liquid helium	Russia
S. Chandrasekhar	Chandrasekhar limit; Structure and evolution of stars	India
John Bardeen	Transistors; Theory of superconductivity	U.S.A.

28. Mention the role of Indian scientists in Physics.

Sol.

Physicist	Major Contribution/Discovery
(i) J.C. Bose	Ultra short radiowaves
(ii) C.V. Raman	Inelastic scattering of light by molecules
(iii) M.N. Saha	Thermal ionisation
(iv) S.N. Bose	Quantum statistics
(v) Homi Jehangir Bhabha	Cascade process of cosmic radiation
(vi) S. Chandrasekhar	Chandrasekhar limit, Structure and evolution of stars

29. Mention the views of some great scientists regarding science.

Sol. Albert Einstein : Science is not just a collection of laws, a catalogue of unrelated facts. It is a creation of human mind, with its freely invented ideas and concepts.

Bruce Lindsay : Science is a method for describing, creating and understanding human experience.

Neils Bohr : The task of science is both to extend the range of our experience and to reduce it to order.

Gerald Holton : Science is ever unfinished quest to discover all facts, the relationship between things and the laws by which the world runs.

30. "The two processes, that of Science and of Art are not very different. Both Science and Art, form in the course of centuries, a human language, by which we can speak about the more real part of reality." Who said this? What was his major contribution/discovery. Mention his country of origin.

Sol. Werner Heisenberg said these words. His major contribution was in Quantum Mechanics. He discovered uncertainty principle. He was from Germany.

Long Answer Type Questions :

31. What are the properties of electromagnetic forces?

Sol. Properties of electromagnetic forces :

(i) They are charge dependent.

(ii) They may be attractive or repulsive.

(iii) They are central forces.

(iv) They are conservative forces.

(v) They obey inverse square law.

32. What are the properties of strong nuclear forces?

Sol. Properties of strong nuclear forces :

(i) They are charge independent.

(ii) They are non-central forces.

(iii) They are non-conservative forces.

(iv) They are basically attractive forces.

(v) They are the strongest forces - 100 times stronger than electrostatic force, 10^{13} times stronger than weak nuclear force and 10^{39} times stronger than gravitational force.

(vi) They have short range (Nuclear size) ~10^{-15} m.

33. What are the properties of weak nuclear forces?

Sol. Properties of weak nuclear forces :

(i) They have the shortest range ~10^{-16} m.

(ii) They exist between leptons and leptons; leptons and mesons etc.

(iii) They are 10^{26} times stronger than gravitational forces, 10^{11} times weaker than electromagnetic forces and 10^{13} times weaker than strong nuclear forces.

34. What are the steps involved in scientific method?

Sol. Steps involved in scientific method are :

(i) Systematic observations is setting up our study so that we eliminate or reduce bias.

(ii) Controlled experiment : It generally compares the results obtained from an experimental sample against a control sample, which is practically identical to experimental sample except for the one aspect whose effect is being tested.

(iii) Qualitative and Quantitative reasoning

(iv) Mathematical modelling : It is a description of a system using mathematical concepts and language.

(v) Prediction

(vi) Verification or falsification of theories

35. Explain the two main thrusts in Physics.

Sol. Two main thrusts in Physics are :

(i) **Unification** is explaining diverse physical phenomena in terms of a few concepts and laws, *e.g.*, same law of gravitation given by Newton explains planetary motion, motion of moons around a planet and a body falling to the ground.

(ii) **Reduction** is deriving the properties of bigger, more complex system from the properties and interaction of its constituent simpler parts, *e.g.*, in thermodynamics, the temperature is related to the average kinetic energy of molecules of the system.

36. Explain macroscopic domain in detail.

Sol. Macroscopic domain : It includes the study of phenomena involving objects of finite size at terrestrial and even on an astronomical scale. It includes Mechanics, Electrodynamics, Optics and Thermodynamics. **Mechanics** deals with the study of general system of particles, rigid and deformable bodies, rocket propulsion etc. **Electrodynamics** deals with charged and magnetic bodies and electric and magnetic phenomena associated with them. **Optics** deals with phenomena associated with light, *i.e.*, reflection, refraction, interference, diffraction, polarisation and optical instruments. **Thermodynamics** deals with system in macroscopic equilibrium and related with changes in temperature, entropy etc.

37. Explain microscopic domain in detail.

Sol. Microscopic domain : It includes atomic, molecular and nuclear phenomena. It deals with the constitution and structure of matter at atomic and nucleic scale (and even lower scales of length) and their interaction with the elementary particles like electrons, protons. Classical physics could not handle this domains so we now have quantum theory as the proper framework for microscopic world. We have phenomena at very small scale of length (10^{-14} m or even less) involving elementary particles and masses in the range of 10^{-30} kg.

38. Compare the basic forces in terms of their relative strength, range and mediated particle.

Sol.

Force	Relative strength	Range	Mediated particle
1. Strong nuclear force	1	Short ($\approx 10^{-15}$ m)	π-meson
2. Electromagnetic force	10^{-2}	Infinite	Photons
3. Weak nuclear force	10^{-13}	Very short ($\approx 10^{-16}$ m)	Boson
4. Gravitational force	10^{-39}	Infinite	Graviton

39. Discuss weak nuclear forces in detail.

Sol. Weak nuclear force is the force between elementary particles of short life times. It appears in some nuclear processes like β-decay of nucleus, in which the nucleus emits an electron and an uncharged particle called neutrino. It is also responsible for the decay of many unstable particles (muons into electrons, pions into muons, and so on). It is not as weak as the gravitational force, but much weaker than the strong nuclear and electromagnetic force. It is extremely short ranged force, of the order of 10^{-16} m.

Properties :

(i) They exist between leptons and leptons; leptons and mesons etc.

(ii) They are 10^{26} times stronger than gravitational forces, 10^{11} times weaker than electromagnetic forces and 10^{13} times weaker than strong nuclear forces.

(iii) They are mediated by the particle 'Boson'.

40. Discuss the nature of physical laws.

Sol. Physicists find facts about the universe through observation and experiments. They also aim to discover the laws which summarise these facts. A remarkable fact about any physical phenomena is the invariance of some special physical quantities. They are the conserved quantities of nature, *i.e.*, energy, linear momentum etc.

In classical physics, we have following conservation laws :

(i) Law of conservation of energy : The sum (total) of energy of all kinds in this universe or of an ideal isolated system remains constant.

(ii) Law of conservation of linear momentum : The linear momentum of a system remains unchanged in the absence of an external force.

(iii) Law of conservation of angular momentum : Angular momentum of a system remains constant if the total external torque acting on it is zero.

(iv) Law of conservation of charge : Charges (in the form of electrons) are neither created nor destroyed but are simply transferred from one body to the other.

41. Discuss the connection of conservation laws with symmetries of nature.

Sol. Conservation laws have deep connection with symmetries of nature, *e.g.*, laws of nature do not change with time. The result of an experiment (on the same object under same conditions) will remain the same when performed at different times. This symmetry of nature w.r.t. translation in time is equivalent to the law of conservation of energy. Likewise the laws of nature are same everywhere in the universe (space is homogeneous and there is no (intrinsically) preferred location in the universe. *e.g.*, The law of gravitation is the same both on the earth and the moon. This symmetry of the law of nature w.r.t. translation in space gives rise to the conservation of linear momentum. In the same way, isotropy of space (no intrinsically preferred direction in space) underlies the law of conservation of angular momentum.

42. Explain hypothesis, axiom and models.

Sol. **Hypothesis :** It is a supposition without assuming that it is true. *e.g.*, The universal law of gravitation is an assumption or hypothesis. Newton explained several observations, experiments and data of the planetary motion by making an assumption that any two bodies in the universe attract each other with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between them. With this he was able to explain all the observations.

An **axiom** is a self-evident truth. An axiom or a postulate is a preposition that is not and cannot be proven within the system based on them.

A **model** is a theory proposed to explain observed phenomena.

43. Explain theory in connection with physics.

Sol. In physics, this term is generally used for a mathematical framework - derived from a small set of basic **postulates** (usually symmetries - like equality of location in space or in time, or identity of electrons etc.) - which is capable of producing experimental predictions for a given category of physical systems. Einstein's special theory of relativity is based on two postulates, the constancy of the speed of electromagnetic radiation and the validity of physical laws in all inertial frames of reference. You cannot ask somebody to prove that the speed of light in vacuum is constant, independent of the speed of the source or observer.

44. What do you mean by verification or falsification of theories?

Sol. Falsification or refutability of an assertion, hypothesis or a theory is the logical possibility that it can be contradicted by an observation or the outcome of a physical experiment. That something is 'falsifiable' does not mean it is false, rather if it is false, then some observation or experiment will produce a reproducible result, that is in conflict with it, *e.g.*, the assertion that 'all swans are white' is falsifiable because it is logically possible that a swan can be found which is not white. If one finds one single black swan, deductive logic admits the conclusion that the statement that all swans are white is false. Falsification thus strives for questioning, for falsification of hypothesis, instead of proving them. The statement 'all swans are white' is falsifiable because it can come in conflict with the observation that 'this swan is black'. In contrast, the statement 'white swans do exist' is not falsifiable as no counter example is logically possible.

45. Discuss the role of 'mathematical modelling' in scientific method.

Sol. A **mathematical model** is description of a system using mathematical concepts and language. The process of developing a mathematical model is termed as **mathematical modelling**, *e.g.*, predicting the position of a vehicle from its initial position, direction and speed of travel, using the equation that distance travelled is the product of speed and time. It is common to use idealized models in physics to simplify things. Massless ropes, point particles, ideal gases are among the many simplified models used in physics. The laws of physics are represented with simple equations such as Newton's laws, Maxwell's equations. Many real situations are very complex and thus modelled approximate on a computer, a model that is computationally feasible to computer is made from the basic laws, *e.g.*, molecules can be modelled by molecular orbital models that are approximate solutions to the Schrödinger equation.

SECTION - B

Model Test Paper

Very Short Answer Type Questions :

1. What are the main branches of physics?

Sol. (i) Mechanics, (ii) Electrodynamics, (iii) Optics, (iv) Thermodynamics.

2. Name the scientist and the country of his origin whose field of work was 'X-rays'.

Sol. W.K. Roentgen, Germany

3. What is the scientific principle behind 'Radio and T.V.'?

Sol. Generation, propagation and detection of electromagnetic waves.

4. What is the range of 'strong nuclear force'?

Sol. Short, nuclear size (~ 10^{-15} m)

5. What is the range of electromagnetic force?

Sol. Infinite

6. Name the weakest force in nature.

Sol. Gravitational force

7. Is strong nuclear force charge independent?

Sol. Yes

8. What happens to the gravitational force between two objects when their masses as well as the distance between them is halved?

Sol. It remains same

9. Who verified experimentally the predictions of the theory of electro-weak force?

Sol. Carlo Rubia, Simon van der Meer

10. What are conserved quantities?

Sol. Conserved quantities are special physical quantities which remain constant in time in any physical phenomena.

Short Answer Type Questions :

11. Explain macroscopic domain.

Sol. It includes the study of phenomena involving objects of finite size at terrestrial and even on astronomical scale.

12. What are the fundamental forces in nature?

Sol. (i) Gravitational force

(ii) Electromagnetic force

(iii) Strong muscular force

(iv) Weak muscular force

13. Name the conservation laws in physics.

Sol. (i) Law of conservation of energy

(ii) Law of conservation of linear momentum

(iii) Law of conservation of angular momentum

(iv) Law of conservation of charge

14. Give some examples where physics has been used in technology.

Sol. Computers (Digital logic), Photocell (Photoelectric effect), Electric generator (Faraday's laws of electromagnetic induction), Optical fibres (Total internal reflection of light).

15. What are physical sciences? Give six examples.

Sol. Physical sciences are those sciences which deal with non-living things, *e.g.*, Physics, Chemistry, Geography, Geology, Astronomy, Oceanology.

Short Answer Type Questions :

16. Compare and contrast electromagnetic and gravitational forces.

Sol. Points of similarity :

(i) Both obey inverse square law of distance.

(ii) Both are conservative forces.

(iii) Both are central forces.

(iv) Both can operate even in vacuum.

Points of dissimilarity

Gravitational Forces	Electromagnetic Forces
1. They are always attractive in nature.	1. They can be attractive or repulsive.
2. They are the weakest force.	2. They are 10^{37} times stronger than gravitational forces.
3. They do not depend upon the medium.	3. They depend upon the medium.

17. Mention a few examples of physics in relation to other sciences.

Sol. (i) Physics in relation to Astronomy : Giant astronomical telescopes developed in physics are used for observing celestial bodies. Radio telescopes have enabled astronomers to observe distant limits of the universe.

(ii) Physics in relation to Chemistry : The study of structure of atoms, radioactivity, diffraction etc. in Physics have enabled Chemists to have better understanding about chemical bonding and rearrange elements in periodic table.

18. Explain the efforts made towards unification of forces.

Sol.

Year	Researcher	Achievement
1687	Newton	Unified celestial and terrestrial mechanics.
1820 1830	Oersted Faraday	Showed that electricity and magnetism are inseparable aspects of 'electromagnetism'.
1873	Maxwell	Unified electricity, magnetism and optics into 'electromagnetism'.
1979	Glashow, Salam, Weinberg	Weak nuclear and electromagnetic force could be viewed as a single force, 'electroweak force'.
1984	Rubia, Simon, van der Meer	Verified experimentally the predictions of the theory of 'electroweak force'.

19. State two important conservation laws used in classical physics.

Sol. Law of conservation of energy : The sum (total) of energy of all kinds in this universe or of an ideal isolated system remains constant. Energy can neither be created nor be destroyed. It can only be transformed from one form into another.

Law of conservation of linear momentum : The linear momentum of a system remains unchanged in the absence of an external force.

20. What are the properties of weak nuclear forces?

Sol. Properties

(i) They exist between leptons and leptons; leptons and mesons etc.

(ii) They have the shortest range ~10^{-16} m.

(iii) They are 10^{26} times stronger than gravitational forces; 10^{11} times weaker than electromagnetic forces and 10^{13} times weaker than strong nuclear forces.

(iv) They are mediated by the particle 'Boson'.

Long Answer Type Questions :

21. Give some examples of gravitational, electromagnetic and nuclear forces.

Sol. Examples of gravitational force : Force of gravity on any object due to Earth, Force which acts on Earth and other planets and keeps them revolving around the Sun, Forces that keeps satellites, and Moon moving around a planet.

Examples of electromagnetic force : Electrostatic force of attraction between electrons in an atom and the nucleus, electrostatic force of repulsion between protons in a nucleus.

Examples of nuclear force : Strong nuclear force of attraction between nucleons (two protons, two neutrons or a proton and a neutron), weak nuclear force between leptons and leptons; leptons and mesons etc.

22. Explain electromagnetic force in detail.

Sol. Electromagnetic force is the force between charged particles. For charges at rest, electromagnetic force is given by Coulomb's law; attractive for unlike charges, repulsive for like charges, charges in motion produce magnetic effects and magnetic field gives rise to a force on a moving charge. Electric and magnetic effects are inseparable, hence the name electromagnetic force. It does not need any medium, but is affected by change of medium. It is 10^{37} times the gravitational force. It underlies the basic forces like tension, friction, normal force, spring force etc. They are mediated by the particle, 'photon'. They obey inverse square law of distance. They are central and conservative forces.

23. Explain the two main thrusts in physics.

Sol. Two main thrusts in Physics are :

(i) Unification in explaining diverse physical phenomena in terms of a few concepts and laws, *e.g.*, same law of gravitation given by Newton, explains planetary motion, motion of moons around a planet and a body falling to the ground.

(ii) Reduction in deriving the properties of bigger more complex system from the properties and interaction of its constituent simpler parts, *e.g.*, in thermodynamics, the temperature is related to the average kinetic energy of molecules of the system.

❑ ❑ ❑

Solutions (Set-2)

Objective Type Questions

(Physics, Technology and Society)

1. Origin of the word 'Science' is from
   (1) French word 'Scientia'
   (2) Greek word 'Scientia'
   (3) Latin word 'Scientia', which means 'scientific'
   (4) Latin word 'Scientia', which means 'to know'

Sol. Answer (4)

2. Scientific method involves
   (1) Systematic observations, controlled experiments, qualitative and quantitative reasoning, mathematical modelling and prediction
   (2) Systematic observations, controlled experiments, qualitative and quantitative reasoning and mathematical modelling
   (3) Systematic observations, controlled experiments, qualitative and quantitative reasoning, mathematical modelling, prediction and verification
   (4) Systematic observations, controlled experiments, qualitative and quantitative reasoning

Sol. Answer (3)

3. Origin of the word 'Physics' is from
   (1) French word 'Fusis'
   (2) Latin word 'Fusis'
   (3) Greek word 'Fusis', which means 'Nature'
   (4) Greek word 'Fusis', which means 'Physical'

Sol. Answer (3)

4. Main thrust in physics is on
   (1) Unification
   (2) Reduction
   (3) Both (1) & (2)
   (4) Experiments

Sol. Answer (3)

5. Explaining diverse physical phenomena in terms of a few concepts and laws is
   (1) Reduction
   (2) Unification
   (3) Law
   (4) Fact

Sol. Answer (2)

6. Deriving the properties of a bigger, more complex system from the properties and interaction of its constituent simpler parts is

(1) Unification (2) Reduction (3) Law (4) Fact

Sol. Answer (2)

7. Logical possibility that an assertion, hypothesis or a theory can be contradicted by an observation or the outcome of a physical experiment is

(1) Law (2) Hypothesis (3) Fact (4) Falsifiability

Sol. Answer (4)

8. A theory proposed to explain observed phenomena is

(1) Postulate (2) Hypothesis (3) Law (4) Model

Sol. Answer (4)

9. A truth, which is self-evident is a/an

(1) Axiom (2) Postulate (3) Either (1) or (2) (4) Hypothesis

Sol. Answer (3)

10. A thought experiment in Physics is one which is

(1) Theoretically possible but experimentally not feasible

(2) Neither theoretically possible nor experimentally feasible

(3) Performed by a non-physicist

(4) Performed by a chemist

Sol. Answer (1)

11. In 'Mesoscopic Physics', we deal with

(1) Phenomena at laboratory (2) Molecular phenomena

(3) Nuclear phenomena (4) Few tens or hundreds of atom

Sol. Answer (4)

12. "Classical Physics" deals with

(1) Macroscopic phenomena (2) Mesoscopic phenomena

(3) Microscopic phenomena (4) Sometimes mesoscopic sometimes microscopic

Sol. Answer (1)

13. The scope of physics covers almost

(1) 10^{-14} m (or even less) to 10^{26} m range of length

(2) 10^{-22} s to 10^{18} s range of time

(3) 10^{-30} kg to 10^{55} kg range of mass

(4) All of these

Sol. Answer (4)

14. Strategy of approximation involves
    (1) All the complexities of a phenomena
    (2) Extracting essential features of a phenomena from its less significant aspects
    (3) Qualitative thinking
    (4) Both (1) & (3)

Sol. Answer (2)

15. An Indian scientist who won Nobel Prize for Physics is
    (1) Sir J.C. Bose (2) H.J. Bhaba (3) M.N. Saha (4) Sir. C.V. Raman

Sol. Answer (4)

16. Which of the following statements is not true?
    (1) Solar cells may be future source of power for cars
    (2) Development in medicine may increase average life expectancy
    (3) X-rays were discovered by Roentgen
    (4) Radioactivity was discovered by Madam Curie

Sol. Answer (4)

17. Albert Einstein was awarded Nobel Prize for his work on
    (1) Special theory of relativity (2) General theory of relativity
    (3) Photoelectric effect (4) Mass-energy equivalence

Sol. Answer (3)

18. The India born and USA based Nobel LaureateProf. Chandrasekhara is known for his work on
    (1) Study of cosmic rays
    (2) Development of relativistic theory of electron
    (3) Prediction of tachyons
    (4) Stability of stars and existence of a stable mass limit for white dwarfs

Sol. Answer (4)

19. Abdus Salam, a Pakistan national won Nobel Prize in the field of
    (1) Inelastic scattering of light by molecules (2) Unification of weak and electromagnetic interaction
    (3) Superconductivity (4) Laser technology

Sol. Answer (2)

20. Who gave quantum model of atom?
    (1) Rutherford (2) Bohr (3) Newton (4) Faraday

Sol. Answer (2)

21. The country, which awards the prestigious Nobel prize, is
    (1) USA (2) UK (3) Sweden (4) Germany

Sol. Answer (3)

22. The scientific principle involved in radio and TV broadcast is

(1) Superconductivity (2) Propagation of electromagnetic waves

(3) Electromagnetic induction (4) Amplification by population inversion

Sol. Answer (2)

23. It has been postulated that there may be some particle moving with speed greater than the speed of light. Such particles have been named as

(1) Mesons (2) Pions (3) Tachyons (4) Leptons

Sol. Answer (3)

24. The scientific principle involved in LASER is

(1) Newton's laws of motion (2) Faraday's laws of induction

(3) Coulomb's laws of induction (4) Amplification by population inversion

Sol. Answer (4)

(Fundamental Forces in Nature)

25. Which of the following statements is/are correct?

(1) Universal law of gravitation is an assumption or hypothesis

(2) Universal law of gravitation can be proved

(3) Universal law of gravitation can be verified

(4) Both (1) & (3)

Sol. Answer (4)

26. If F_g, F_N, F_W and F_E be the gravitational, nuclear, weak and electromagnetic forces respectively, then arrange them in proper order as per their strength.

(1) $F_g > F_N > F_W > F_E$ (2) $F_g < F_W < F_E < F_N$ (3) $F_E > F_N > F_W > F_g$ (4) $F_W < F_g < F_E < F_N$

Sol. Answer (2)

27. Forces which obey inverse square law are

(1) Gravitational forces (2) Electromagnetic forces

(3) Nuclear forces (4) Both (1) & (2)

Sol. Answer (4)

28. Choose the correct statement.

(1) Gravitational force is weakest force (2) Electrostatic force is weakest force

(3) Nuclear force is weakest force (4) Electromagnetic force is strongest force

Sol. Answer (1)

29. Choose the correct statement.

(1) Strong nuclear forces are charge independent (2) Weak nuclear forces are charge independent

(3) Gravitational forces are charge independent (4) All of these

Sol. Answer (4)

30. Choose the correct statement.
    (1) Gravitational forces are attractive forces
    (2) Nuclear forces are attractive forces
    (3) Electromagnetic forces can be attractive as well as repulsive
    (4) All of these

Sol. Answer (4)

31. Choose the correct statement.
    (1) Strong nuclear force is 100 times stronger than electrostatic force
    (2) Strong nuclear force is 10^{13} times stronger than weak nuclear force
    (3) Strong nuclear force is 10^{39} times stronger than gravitational force
    (4) All of these

Sol. Answer (4)

32. Choose the correct statement.
    (1) Range of strong nuclear force is $\approx 10^{-15}$ m
    (2) Range of weak nuclear force is $\approx 10^{-16}$ m
    (3) Gravitational and electromagnetic force have infinite range
    (4) All of these

Sol. Answer (4)

(Discoveries and Nature of Physical Laws)

33. Choose the correct statement.
    (1) Hans Lippershey is associated with the discovery of telescope
    (2) Kepler is associated with the discovery of telescope
    (3) C.V. Raman is associated with the discovery of telescope
    (4) Hubble is associated with the discovery of telescope

Sol. Answer (1)

34. Choose the correct statement.
    (1) C.V. Raman is associated with scattering of light by the molecules
    (2) Neil Bohr is associated with scattering of light by the molecules
    (3) S. Chandrashekhar is associated with scattering of light by the molecules
    (4) Heisenberg is associated with radioactivity

Sol. Answer (1)

35. Choose the correct statement.
    (1) F. Caree is associated with refrigerator
    (2) H. Hertz is associated with electromagnetic waves
    (3) James Chadwick is associated with the discovery of neutron
    (4) All of these

Sol. Answer (4)

36. Choose the correct statement.
    (1) Scientific principle involved in refrigerator is laws of thermodynamics
    (2) Scientific principle involved in steam engine is laws of thermodynamics
    (3) Scientific principle involved in rocket propulsion is Newton's laws of motion
    (4) All of these

Sol. Answer (4)

37. Choose the correct statement.
    (1) Newton unified celestial and terrestrial mechanics
    (2) Maxwell verified experimentally the predictions of the theory of 'electroweak force'
    (3) Glashow showed that electricity and magnetism are inseparable aspects of 'electromagnetism'
    (4) Rubia unified celestial and terrestrial mechanics

Sol. Answer (1)

38. Choose the correct statement.
    (1) Law of conservation of linear momentum is valid in the presence of an external force also
    (2) For angular momentum of a system to remain constant, it is not necessary that external torque acting on it be zero
    (3) Charge can be created and destroyed
    (4) A conservation law cannot be proved

Sol. Answer (4)

39. Choose the correct statement.
    (1) Symmetry of nature w.r.t. translation in time is equivalent to law of conservation of energy
    (2) Symmetry of nature w.r.t. translation in space is equivalent to law of conservation of linear momentum
    (3) Isotropy of space is equivalent to law of conservation of angular momentum
    (4) All of these

Sol. Answer (4)

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