CHAPTER › 01

Physical World

KEY NOTES

- The word science originates from the Latin verb *Scientia* meaning 'to know'.
- **Science** is a systematic attempt to understand natural phenomena in as much detail and depth as possible; and use the knowledge so gained to predict, modify and control the phenomena.
- The scientific method involves several steps; systematic observation, controlled experiment, qualitative and quantitative reasoning, mathematical modelling, prediction and verification or falsification of theories.
- **Physics** is a basic discipline in the category of natural sciences, which also includes other disciplines like Chemistry and Biology.
- Physics refers to the study of the physical world, i.e. the study of the basic laws of nature and their manifestation in different natural phenomena.
- In physics, we attempt to explain diverse physical phenomenon in terms of a few concepts and laws. The attempts to unify fundamental forces of nature due to which various phenomenon exists is called **unification**.
- When we try to derive the properties of a bigger, more complex system from the properties and interactions of its constituent simpler parts, this approach is called **reductionism**.

Scope and Excitement of Physics

- Macroscopic domain includes phenomena at the laboratory, terrestrial and astronomical scales. It includes the subjects like mechanics, electrodynamics, thermodynamics and optics, etc.
- Classical physics deals mainly with macroscopic phenomena and includes the following subjects
  (i) **Mechanics** founded on Newton's laws of motion and the law of gravitation is concerned with the motion (or equilibrium) of particles, rigid and deformable bodies and general systems of particles.
  (ii) **Electrodynamics** deals with electric and magnetic phenomena associated with charged and magnetic bodies.
  (iii) **Optics** deals with the phenomena involving light.
  (iv) **Thermodynamics** deals with systems in macroscopic equilibrium and is concerned with changes in internal energy, temperature, entropy, etc. of the system through external work and transfer of heat.
- The microscopic domain of physics deals with the constitution and structure of matter at the minute scales of atoms and nuclei and their interaction with different probes such as electrons, protons and other elementary particles.
- Everything in physics cannot be proved. There are some facts or assumptions from which we can derive certain relationships or formulae. These assumptions are called **hypothesis** or **axioms** or **postulates** and models, etc.
- A **hypothesis** is a supposition without assuming that it is true. An axiom is a self- evident truth. A model is a theory proposed to explain observed phenomena.

Physics, Technology and Society

- The connection between physics, technology and society can be seen in many examples. Sometimes technology gives rise to new physics; at other times physics generates new technology**.**
- The most significant area to which physics has and will contribute is the development of alternative energy resources.

Fundamental Forces in Nature

- In the macroscopic world, besides the gravitational force, we encounter several kinds of forces : muscular forces, contact forces between bodies, friction (a contact force parallel to the surfaces in contact), the forces exerted by compressed or elongates springs or taut strings and ropes (tension), etc.
- In the microscopic domain again, we have electric and magnetic forces, nuclear forces involving protons and neutrons, interatomic and intermolecular forces, etc.
- The laws for derived forces (such as spring force, friction) are not independent of the laws of fundamental forces in nature. The origin of these derived forces is however, very complex.
- The force of mutual attraction between any two objects by virtue of their masses is called **gravitational force**. It is a universal force and it acts on all objects in the universe.

  Strength $\rightarrow 10^{-39}$ and Range $\rightarrow$ Infinite
- Gravitational force plays a key role in the large scale phenomena of the universe, such as formation and evolution of stars, galaxies and galactic clusters.
- The force between two charged particles is called **electromagnetic force.** It acts over large distances and does not need any intervening medium.

  It is enormously strong as compared to gravity. This force is 10^{36} times greater than gravitational force.

  Strength $\rightarrow 10^{-2}$ and Range $\rightarrow$ Infinite
- It is mainly the electromagnetic force that governs the structure of atoms & molecules, the dynamics of chemical reactions & the mechanical and thermal & other properties of materials.
- Gravity is always attractive, while electromagnetic force can be attractive or repulsive.
- The force that binds protons and neutrons in a nucleus is called **strong nuclear force.** This is the strongest of all the fundamental forces.

  Strength $\rightarrow$ 1 and Range $\rightarrow$ Short, nuclear size ($\sim 10^{-15}$ m)
- The **weak nuclear force** appears only in certain nuclear processes such as the β-decay of a nucleus. In β-decay, the nucleus emits an electron and an uncharged particle called **neutrino**.

  Strength $\rightarrow 10^{-13}$ and Range $\rightarrow$ Very short, sub-nuclear size ($\sim 10^{-16}$ m)
- Great advances in physics often amount to unification of different theories and domains**.**
  (i) Newton unified terrestrial and celestrial domains under a common law of gravitation.
  (ii) The experimental discoveries of Oersted and Faraday showed that electric and magnetic phenomena are in general inseparable.
  (iii) Maxwell unified electromagnetism and optics with the discovery that light is an electromagnetic wave.
  (iv) The electromagnetic and the weak nuclear force have now been unified and are seen as aspects of a single electroweak force.

Nature of Physical Laws

- The physical quantities that remain constant in a process are called **conserved quantities.**
- When all forms of energy, e.g. heat, mechanical energy, electrical energy, etc are counted, it turns out that energy is conserved.
- The general laws of conservation of energy is true for all forces and for any kind of transformation between different forms of energy.

  It is valid across all domains of nature, from the microscopic to the macroscopic. Such as
  (i) A chemical reaction is basically a rearrangement of atoms among different molecules. If the total binding energy of the reacting molecules is less than the total binding energy of the product molecules, the difference appears as heat and the reaction is exothermic. The opposite is true for energy absorbing (endothermic) reactions.
  (ii) According to Einstein's theory, mass m is equivalent to energy E given by the relation $E = mc^2$, where c is speed of light in vacuum.
  (iii) In a nuclear process, mass gets converted to energy (or *vice-versa*). This is the energy which is released in a nuclear power generation and nuclear explosions.
- Conservation laws have a deep connection with symmetries of nature.
- Symmetry of nature with respect to translation (i.e. displacement) in time is equivalent to the law of conservation of energy.
- Laws of nature are the same everywhere in the universe, while the phenomena may differ from place to place because of differing conditions at different locations.
- The symmetry of the laws of nature with respect to translation in space gives rise to 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.
- Symmetries of space and time and other abstract symmetries play a central role in modern theories of fundamental forces in nature.

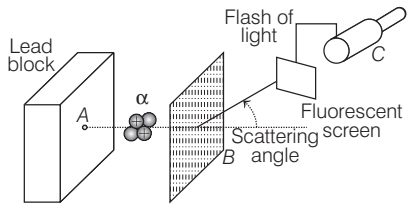
Mastering NCERT

MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Physics : Scope and Excitement*

1 In 1913, Niels Bohr gave a theory on the basis of
(a) quantum theory of helium atom
(b) nuclear model of atom
(c) classical theory of helium atom
(d) classical theory of hydrogen atom

2 In Rutherford, α-scattering experiment as shown in figure.



Here, *A*, *B* and *C* refer to
(a) polonium sample, aluminium foil, microscope
(b) polonium sample, gold foil, microscope
(c) uranium sample, gold foil, microscope
(d) polonium sample, aluminium foil, telescope

3 Maxwell's set of equation encapsulated basic laws such as
(a) Coulomb and Oersted's laws
(b) Ampere and Faraday's laws
(c) Faraday's and Optic laws
(d) Both (a) and (b)

4 In Physics, quantitative measurement is central to the growth of science because
(a) laws of nature are expressible in precise mathematical equations
(b) basic laws universally apply in different contexts
(c) strategy of approximation turned out to be very successful
(d) All of the above

5 What is full form of GMRT?
(a) Ground Mobile Receive Terminal
(b) Geometric Mean Reciprocal Titer
(c) Giant Metrewave Radio Telescope
(d) General Maintenance and Repair Technician

TOPIC 2 ~ *Fundamental Forces in Nature*

6 Macroscopic forces are
(a) contact forces between bodies
(b) viscous force
(c) surface tension of a liquid
(d) All of the above

7 Forces acting on microscopic domain are
(a) electric forces (b) magnetic forces
(c) nuclear forces (d) All of these

8 The elastic spring force arises due
(a) to net attraction between the neighbouring atoms of the spring
(b) to net repulsion between the neighbouring atoms of the spring
(c) Both (a) and (b)
(d) None of the above

9 In gravitational force,
(a) there is mutual force of attraction between any two objects by virtue of their masses
(b) it is a universal force
(c) it causes formation and evolution of stars, galaxies and galactic clusters
(d) All of the above

10 Gravitational force dominates in terrestrial phenomena because
(a) masses involved are quite large
(b) distances are quite large
(c) masses are small
(d) distances are small

11 Electromagnetic force is
(a) the force between charged particles
(b) due to charges in motion
(c) 10^{36} times the gravitational force between two protons for any fixed distance
(d) All of the above

12 Electromagnetic force dominates microscopic phenomena because
(a) masses involved are quite large
(b) distances are quite large
(c) masses are small
(d) distances are small

13 Which of the following is the weakest force?
(a) Gravitational force (b) Strong nuclear force
(c) Weak nuclear force (d) Electric force

14 Electric force manifest itself in atmosphere, where
(a) atoms are non-ionised
(b) atoms are ionised and that leads to lightning
(c) atoms are ionised
(d) atoms are electrically neutral

15 When we hold a book in our hand, we are balancing the gravitational force on the book due to
(a) normal force provided by our hand
(b) friction force provided by our book
(c) Both (a) and (b)
(d) None of the above

16 Protons and neutrons are built out of
(a) neutrino (b) quarks (c) anti-neutrino (d) electron

17 The unification of electromagnetism and optics leads to the
(a) celestial and terrestrial mechanics
(b) discovery of uncertainty principle
(c) discovery of optical fibres
(d) discovery of light as an electromagnetic wave

TOPIC 3 ~ *Nature of Physical Laws*

18 For motion under an external conservative force, which quantity is conserved?
(a) Kinetic energy
(b) Mechanical energy
(c) Potential energy
(d) None of the above

19 Prior to the advent of the Einstein's theory of relativity, it was concluded that
(a) matter was thought to be indestructible
(b) total binding energy of the reacting molecules is greater than total binding energy of product molecules
(c) small change in the binding energy are too small to be measured as changes in mass
(d) All of the above

20 According to law of conservation of energy and momentum for β-decay, the existence of a new particle along with electron was predicted, which was
(a) electron (b) proton (c) neutron (d) neutrino

21 Conservation laws are such that
(a) it cannot be proved but can be verified
(b) it can neither be proved nor can be verified
(c) it can be proved and verified
(d) it can be proved but not verified

22 Energy evolved in a chemical reaction comes from
(a) conversion of mass into energy
(b) conversion of binding energy into heat energy
(c) Both (a) and (b)
(d) Neither (a) nor (b)

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

■ **Direction** (Q. Nos. 23-26) *In the following questions, a statement of Assertion is followed by a corresponding statement of Reason. Of the following statements, choose the correct one.*
(a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
(c) Assertion is correct but Reason is incorrect.
(d) Assertion is incorrect but Reason is correct.

23 **Assertion** Spring force, friction force, normal force, tension in rope, etc. are similar forces.
Reason They arise out of the gravitational force between the particles.

24 **Assertion** Electric force and magnetic force are jointly called electromagnetic force.
Reason Electric and magnetic effects are inseparable.

25 **Assertion** In universe, gravitational force dominates in long distance and electric force dominates in short distance.

Reason For gravitational force $\propto \frac{(\text{mass})^2}{\text{distance}^2}$

and electric force $\propto \frac{\text{charge}^2}{\text{distance}^2}$

26 **Assertion** In spite of repulsion between two protons in the nucleus, it is difficult to kick them out of the nucleus.

Reason Nuclear force is weaker than electromagnetic force.

II. Statement Based Questions

27 I. Science is ever static.

II. There is no final theory in science and no unquestioned authority among scientists.

Which of the following statement(s) is/are correct?

(a) Only I (b) Only II

(c) Both I and II (d) Neither I nor II

28 I. Optics deal with the phenomena involving light.

II. The efficiency of heat engines and refrigerator, the direction of a physical or chemical process, etc., involves thermodynamics.

III. Macroscopic domain of physics deals with the constitution and structure of matter at the minute scales of atoms and nuclei.

Which of the following statement(s) is/are incorrect?

(a) Both I and II (b) Only II (c) Only I (d) Only III

29 I. In 1938, Hahn and Meitner discovered the phenomenon of neutron-induced fission of uranium.

II. In 20th century, silicon chip triggered revolutionary changes in technology of computer system.

III. The fossil fuels of the planet are dwindling fast and there is an urgent need to discover new source of energy.

IV. The international year of physics was declared as 2005.

Which of the following statement(s) is/are correct?

(a) Only I (b) Both I and II

(c) Only III (d) I, II, III and IV

30 I. Aristotle had given wrong ideas about the concept of force.

II. The corrective notion of force was arrived at by Isaac Newton in his famous laws of motion.

Which of the following statement(s) is/are correct?

(a) Only I (b) Both I and II

(c) Only II (d) Neither I nor II

31 I. Strong nuclear force binds protons and neutrons in a nucleus.

II. Nuclear force is charge independent and acts equally between a proton and a proton.

III. Nuclear range is extremely small of about nuclear dimensions (10^{-15} m).

Which of the following statement(s) is/are correct?

(a) Only I (b) Both I and II

(c) Only III (d) I, II and III

32 Which of the following statement(s) is/are correct?

I. The concept of energy is central to physics and expression for energy can be written for every physical system.

II. Law of conservation of energy is not valid for all forces and for any kind of transformation between different forms of energy.

(a) Only I (b) Only II

(c) Both I and II (d) None of these

33 Which one of the following statement(s) is/are incorrect?

I. Conservation laws have a deep connection with symmetries of nature.

II. Space is heterogeneous and there is no preferred location in the universe.

(a) Only I (b) Only II

(c) Both I and II (d) None of these

34 Which of the following statement(s) is/are correct?

I. Symmetry of laws of nature with respect to translation in space give rise to conservation of linear momentum.

II. Isotropy of space underlies the law of conservation of angular momentum.

(a) Only I (b) Only II

(c) Both I and II (d) Neither I nor II

35 Which of the following statement is incorrect?

(a) Science originates from the Greek word *Scientia* meaning ''to know''.

(b) Science is a systematic attempt to understand natural phenomena.

(c) The scientific method involves; systematic observation, controlled experiment, qualitative and quantitative reasoning, mathematical modeling, prediction and verification, etc.

(d) Physics is a study of the basic laws of nature and their manifestation in different natural phenomena.

36 Which of the following statement is correct?

(a) Physics is a basic discipline in the category of natural sciences, which does not induced other disciplines.

(b) In physics, we attempt to explain similar physical phenomena in terms of a few concepts and laws.

(c) The attempts to unify fundamental forces of nature is called unification.

(d) An approach to derive the properties of a smaller system from the properties and interactions of its bigger part is called reductionism.

37 Which of the following statement is correct?

(a) The same law of gravitation does not describes the fall of an apple to the ground, the motion of the moon around the sun.

(b) The basic laws of electromagnetism governs only magnetic phenomena.

(c) The subjects of thermodynamics, deals with bulk systems in terms of macroscopic quantities such as temperature, internal energy, entropy, etc.

(d) The subjects of kinetic energy and statistical mechanics interpreted microscopic quantities in terms of the properties of the molecular constituents of the bulk system.

38 Which of the following statement is incorrect?

(a) Physics is the study of nature and natural phenomena.

(b) Physics and technology are not related to each other.

(c) Electrodynamics deals with electric and magnetic phenomena associated with charged and magnetic bodies.

(d) The most significant area to which physics has and will contribute is the development of alternative energy resources.

39 Which of the following statement is incorrect?

(a) Classical physics deals mainly with macroscopic phenomena and includes subject like mechanics, electrodynamics, optics and thermodynamics.

(b) All physics and also mathematics, is based on assumptions, each of which is variously called hypothesis or axiom or postulate, etc.

(c) A hypothesis is a supposition with assuming that it is true.

(d) An axiom is a self-evident truth while a model is a theory proposed to explain observed phenomena.

40 Which of the following statement is incorrect?

(a) The universal law of gravitation proposed by Newton is an assumption or hypothesis.

(b) Universal law of gravitation can be verified and substantiated by experiments and observations.

(c) Einstein's special theory of relativity is also based on two postulates, the constancy as the speed of electromagnetic radiation and the validity of physical laws in all inertial frame of reference.

(d) Euclid's statement that parallel lines never meet is a supposition with assuming that it is true.

41 Which of the following statement is correct?

(a) Technology gives rise to new physics.

(b) Wireless communication followed the discovery of basic laws of electricity and magnetism.

(c) Bohr had dismissed the possibility of tapping energy from atoms.

(d) Both (a) and (b)

42 Which of the following statement is correct?

(a) The laws for derived forces are independent as the laws of fundamental forces in nature.

(b) Like gravitational force, electromagnetic force acts over large distances and does not need any intervening medium.

(c) Gravity is always attractive while electromagnetic force is repulsive.

(d) The weak nuclear force is not as weak as electromagnetic force but weaker than the strong nuclear force.

43 Which of the following statement is incorrect?

(a) Some special physical quantities, however remain constant in time. They are the conserved quantities of nature.

(b) The law of conservation of energy is thought to be valid across all domains of nature, from the microscopic to the macroscopic.

(c) All conserved quantities are scalars.

(d) Symmetry of nature with respect to translation (i.e. displacement) in time is equivalent to the law of conservation of energy.

44 Which of the following statement is correct?

(a) Conservation of energy, momentum, angular momentum, charge, etc, are considered to be fundamental laws in physics.

(b) The phenomena are the same everywhere in the universe.

(c) Law of gravitation is different on the moon and the earth.

(d) Symmetries of space and time and other abstract symmetries does not play a central role in modern theories as fundamental forces in nature.

III. Matching Type

45 Match the Column I (domains) with Column II (relation) and select the correct answer from the codes given below.

	Column I		Column II
A.	Mechanics	1.	electric and magnetic fields
B.	Electrodynamics	2.	macroscopic equilibrium
C.	Thermodynamics	3.	minute scales of atoms and nuclei
D.	Microscopic	4.	Newton's law of motion

	A	B	C	D		A	B	C	D
(a)	4	2	3	1	(b)	4	1	2	3
(c)	1	2	4	3	(d)	2	3	1	4

46 Match the Column I (physical quantities) with Column II (scale) and select the correct answer from the codes given below.

	Column I		Column II
A.	Size of electron or proton	1.	10^{-30} kg
B.	Mass of an electron	2.	10^{-14} m
C.	Extent of universe	3.	10^{26} m
D.	Mass of observable universe	4.	10^{55} kg

	A	B	C	D
(a)	2	1	3	4
(b)	2	3	1	3
(c)	4	1	3	2
(d)	2	1	2	3

47 Match the Column I (name of physicists) with Column II (contribution/discovery) and select the correct answer from the codes given below.

	Column I		Column II
A.	Galileo Galilei	1.	explanation of photoelectric effect
B.	JC Bose	2.	law of inertia
C.	Albert Einstein	3.	discovery of ultra short radiowaves
D.	JJ Thomson	4.	discovery of electron

	A	B	C	D		A	B	C	D
(a)	2	3	1	4	(b)	1	2	4	3
(c)	1	2	3	4	(d)	3	4	1	2

48 Match the Column I (name of physicists) with Column II (contribution/discovery) and select the correct answer from the codes given below.

	Column I		Column II
A.	SN Bose	1.	discovery of neutron
B.	James Chadwick	2.	contribution in quantum statistics
C.	John Bardeen	3.	theory of superconductivity and transistors
D.	Abdus Salam	4.	unification of weak and electromagnetic interactions

	A	B	C	D		A	B	C	D
(a)	2	1	3	4	(b)	1	2	4	3
(c)	4	3	2	1	(d)	1	4	3	2

49 Match the Column I (technology) with Column II (scientific principle) and select the correct answer from the codes given below.

	Column I		Column II
A.	Nuclear reactor	1.	photoelectric effect
B.	Rocket propulsion	2.	reflection of ultrasonic waves
C.	SONAR	3.	controlled nuclear fission
D.	Photocell	4.	Newton's laws of motion

	A	B	C	D		A	B	C	D
(a)	1	3	2	4	(b)	3	1	2	4
(c)	1	2	3	4	(d)	3	4	2	1

50 Match the Column I (force) with Column II (relative strength) and select the correct answer from the codes given below.

	Column I		Column II
A.	Gravitational force	1.	10^{-13}
B.	Weak nuclear force	2.	1
C.	Electromagnetic force	3.	10^{-2}
D.	Strong nuclear force	4.	10^{-39}

	A	B	C	D		A	B	C	D
(a)	4	1	3	2	(b)	4	1	2	3
(c)	1	3	2	4	(d)	4	2	3	1

Answers

› *Mastering NCERT with MCQs*

1 (b) 2 (b) 3 (d) 4 (d) 5 (c) 6 (d) 7 (d) 8 (c) 9 (d) 10 (a)
11 (d) 12 (d) 13 (a) 14 (b) 15 (a) 16 (b) 17 (d) 18 (b) 19 (a) 20 (d)
21 (a) 22 (b)

› *Special Types Questions*

23 (c) 24 (a) 25 (a) 26 (c) 27 (b) 28 (d) 29 (d) 30 (b) 31 (d) 32 (a)
33 (b) 34 (c) 35 (a) 36 (c) 37 (d) 38 (b) 39 (c) 40 (d) 41 (d) 42 (b)
43 (c) 44 (a) 45 (b) 46 (a) 47 (a) 48 (a) 49 (d) 50 (a)

Hints & Explanations

1 (*b*) Using the result of experiment of scattering of alpha particles by gold foil, in 1911 Ernest Rutherford established the nuclear model of the atom. This nuclear model then became the basis of the quantum theory of hydrogen atom given by Niels Bohr in 1913.

10 (*a*) Gravitational force becomes very high in terrestrial and astronomical phenomena because the bodies involved are huge like planets, stars, etc.

Their masses are quite large and gravitational force is proportional to products of masses involved.

12 (*d*) At microscopic level, it is electromagnetic force which dominates gravitational force. The reason is that the distance between bodies under electromagnetic force is very small at this level.

13 (*a*) Gravitational force is the weakest among these forces. The correct order of strength of four fundamental forces is

Gravitational force < Weak nuclear force < Electromagnetic force < Strong nuclear force

15 (*a*) When we hold a book in our hand, we are balancing the gravitational force on the book due to the huge mass of the earth by the 'normal force' provided by our hand.

17 (*d*) The unification of electromagnetism and optics is done by James Clerk Maxwell in 1873. It showed that light is an electromagnetic wave.

18 (*b*) For motion under an external conservative force, the total mechanical energy, i.e. the sum of kinetic and potential energy of a body is a constant. The familiar example is the free fall of an object under gravity.

19 (*a*) Until the advent of Einstein's theory of relativity, the law of conservation of mass was regarded as basic conservation law of nature, since matter was thought to be indestructible.

A chemical reaction is basically a rearrangement of atoms among different molecules. If the total binding energy of the reacting molecules is less than the total binding energy of the product molecules, the difference appears as heat.

However, since the atoms are merely rearranged but not destroyed, the total mass of the reactants is the same as the total mass of the products in a chemical reaction. The change in the binding energy are too small to be measured as changes in mass.

20 (*d*) Using the conservation laws of energy and momentum for β-decay, Wolfgang Pauli (1900-1958) correctly predicted in 1931, the existence of a new particle called neutrino emitted in β-decay along with the electron.

21 (*a*) A conservation law is a hypothesis based on observation and experiments. It is important to remember that a conservation law cannot be proved. It can be verified or disproved by experiments.

23 (*c*) The origin of spring force, friction force, normal force, tension in rope is electromagnetic force

which is one of the four fundamental forces found in nature.

Therefore, Assertion is correct but Reason is incorrect.

24 (*a*) Charges in motion produces magnetic effects and a magnetic field gives rise to a force on a moving charge. So, electric and magnetic effects are inseparable.

Therefore, it is named as electromagnetic force.

Therefore, Assertion and Reason are correct and Reason is the correct explanation of Assertion.

25 (*a*) Gravitational force = $\frac{k\, m_1\, m_2}{r^2}$. In case of

measurement regarding stars and galaxies, gravitational force dominates due to large mass of stars, etc.

And electric force = $\frac{k\, q_1\, q_2}{r^2}$ is due to infinite-simal

small distances, thus electric field dominates at microscopic level.

Therefore, Assertion and Reason are correct and Reason is the correct explanation of Assertion.

26 (*c*) Nuclear force which is attractive in nature at nuclear level keeps all the protons together in the nucleus in spite of their mutual repulsion. So, it is difficult to kick them out of the nucleus.

This is because these are stronger than the electromagnetic force.

Therefore, Assertion is correct but Reason is incorrect.

27 (*b*) Statement II is correct but I is incorrect and it can be corrected as,

Science is ever dynamic.

28 (*d*) Statement III is incorrect and it can be corrected as, The macroscopic domain of physics includes phenomenon at the laboratory, terrestrial and astronomical scales.

Rest statements are correct.

32 (*a*) Statement I is correct but II is incorrect and it can be corrected as,

the general law of conservation of energy is valid for all forces and for any kind of transformation between different forms of energy.

33 (*b*) Statement I is correct but II is incorrect and it can be corrected as,

Space is homogeneous and there is no preferred location in the universe i.e. the laws of nature are the same everywhere in the universe.

35 (*a*) The statement given in option (a) is incorrect and it can be corrected as,

The word science originates from the Latin verb *Scientia* meaning ''to know''.

36 (*c*) Statement given in option (c) is correct and rest are incorrect and these can be corrected as,

Physics is a basic discipline in the category of natural sciences, which also includes other disciplines like Chemistry and Biology. The word physics comes from a Greek word meaning nature.

In physics, we attempt to explain diverse physical phenomena in terms of a few concepts and laws.

A related effect is to derive the properties of a bigger, more complex system from the properties and interactions of its constituent simpler parts. This approach is called reductionism.

37 (*d*) Statement given in option (d) is correct and rest are incorrect and these can be corrected as,

The same law of gravitation (given by Newton) describes the fall of an apple to the ground, the motion the of moon around the earth and the motion of planets around the sun.

Similarly, the basic laws of electromagnetism (Maxwell's equations) governs all electric and magnetic phenomena.

The subjects of thermodynamics, deals with bulk systems in terms of microscopic quantities such as temperature, internal energy, entropy, etc.

38 (*b*) The statement given in option (b) is incorrect and it can be corrected as,

Physics and technology are related with each other, like the discipline of thermodynamics arose from the need to understand and improve the working of heat engines.

Sometimes technology gives rise to new physics, at other times physics generates new technology.

39 (*c*) The statement given in option (c) is incorrect and it can be corrected as,

A hypothesis is a supposition without assuming that it is true.

40 (*d*) The statement given in option (d) is incorrect and it can be corrected as,

Euclid's statement that parallel lines never meet is a hypothesis. This means that, if we suppose this without assuming it is true, then with this statement, we can explain several properties of straight lines.

41 (*d*) Both statements given in options (a) and (b) are correct but statement in option (c) is incorrect, which can be is corrected as,

The Ernest Rutherford had dismissed the possibility of tapping energy from atoms.

42 (*b*) The statement given in option (b) is correct, rest are incorrect and these can be corrected as,

The laws for derived forces (such as spring force, friction) are not independent of the law of fundamental forces in nature.

Gravity is always attractive while electromagnetic force can be attractive or repulsive.

The weak nuclear force is not as weak as the gravitational force, but much weaker than the strong nuclear and electromagnetic forces.

43 (*c*) The statement given in option (c) is incorrect and it can be corrected as,

All conserved quantities are not necessarily scalars.

44 (*a*) Only statement given in option (a) is correct, rest are incorrect. These can be corrected as,

The laws of nature are the same everywhere in the universe. The phenomena may differ from place to place because of different conditions at different locations.

e.g. the acceleration due to gravity at the moon is one-sixth that at the earth, but the law of gravitation is the same both on the moon and the earth.

Symmetries of space and time and other abstract symmetries play a central role in modern theories of fundamental forces in nature.

45 (*b*) Mechanics founded on Newton's laws of motion and the law of gravitation is concerned with the motion (or equilibrium) of particles, rigid and deformable bodies and general systems of particles.

Electrodynamics deals with electric and magnetic phenomena associated with charged and magnetic bodies.

Thermodynamics in contrast to mechanics, does not deal with the motion of bodies as a whole. Rather, it deals with systems in macroscopic equilibrium and is concerned with changes in internal energy, temperature, entropy, etc., of the system through external work and transfer of heat.

The microscopic domain of physics deals with the constitution and structure of matter at the minute scales of atoms and nuclei.

Hence, A $\rightarrow$ 4, B $\rightarrow$ 1, C $\rightarrow$ 2 and D $\rightarrow$ 3.