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Acad-53/2021, dated July 22, 2021



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Strictly as per the Termwise Syllabus
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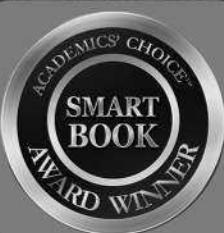
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1ST EDITION

YEAR 2021-22



ISBN

"978-93-5463-875-6"



SYLLABUS
COVERED

CENTRAL BOARD OF
SECONDARY EDUCATION
DELHI



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PUBLISHED BY

OSWAAL BOOKS &
LEARNING PVT. LTD.



1/11, Sahitya Kunj, M.G. Road,
Agra - 282002, (UP) India



1/1, Cambourne Business Centre
Cambridge, Cambridgeshire
CB 236DP, United kingdom



0562-2857671



contact@oswaalbooks.com



www.OswaalBooks.com

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TABLE OF CONTENTS

- Latest CBSE Circular & Syllabus released on 22nd July, 2021 for Academic Year 2021-2022
(CBSE Cir. No. Acad 53/2021)

6 - 8

Unit I : Matter : Its Nature and Behaviour

1. Atoms and Molecules	1 - 15
Topic 1. Chemical Combination, Atom and Molecules, Valency and Chemical Formula	
Topic 2. Atomic and Molecular Masses, Mole Concept	
2. Structure of Atom	16 - 30
3. Health and Diseases	31 - 46
Topic 1. Health and its Failure : Disease and its Causes and Means of Spread	
Topic 2. Manifestation, Treatment and Prevention of Diseases	
4. Gravitation	47 - 59
5. Work Energy and Power	60 - 73
Topic 1. Work	
Topic 2. Energy, Types of Energy and Law of Conservation of Energy	
Topic 3. Power	
● Practice Test Paper-1	74 - 76
● Practice Test Paper-2	77 - 79



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TACKLING TERM- II BOARD EXAMS



Banking on Better Systems

"Improvise, Adapt, overcome" has been the mantra of education boards and schools everywhere. Conducting lectures as well as assessments online was still pretty uncommon in our country. But now teachers and students have got familiar with the new ways. What is pushing 'Change' even further is the new National Education Policy (NEP) of 2020. The intention of shifting from rote learning to competency-based development will prove beneficial to the coming generations; and in turn, to the country.

Term-II exams will be conducted around March-April 2022 for the latter 50% of syllabus. The two hours examination will consist of MCQs (Case-based, Assertion based, and Stand-alone), very short, short and long answer questions. Though, if the Covid-19 situation does not allow for a physical exam at that time, a 90-minute online MCQs test will be conducted for Term-II, just like Term-I.

To score well in Term-II, students need to start by acquiring the latest and most relevant study material. The focus should be on conceptual clarity rather than mugging up facts. Students should find out their preparation level by conducting regular self-assessments and practicing questions from this question bank. Breaking down the syllabus in a systematic way right from the beginning will help students learn better and secure a high score.

Oswaal Question Banks for CBSE Term-II exams include

1. Objective Questions based on new typologies introduced by the board
 - **MCQs (Stand- alone)**
 - **MCQs (Assertion-reason)**
 - **MCQs (Case-based)**
2. Subjective Questions
 - **Short Answer Questions**
 - **Long Answer Questions**
3. Previous Years' Questions with Board Marking Scheme Answers
4. Revision Notes for in-depth study
5. Modified & Empowered Mind Maps
6. Practice Papers to decode the paper pattern
7. Concept videos for blended learning

Our Heartfelt Gratitude

Thank you to our authors, editors, and reviewers, who always work towards the goal of "**Making Learning Simple**" for every student.

Wish you all Happy Learning!

Wish you a Successful 2021-22!!

CBSE CIRCULAR 2021-22



केन्द्रीय माध्यमिक शिक्षा बोर्ड
CENTRAL BOARD OF SECONDARY EDUCATION



NO.: E1001/CBSE-Acad/Curriculum/2021

Date: July 22, 2021

Circular No: Acad- 53/2021

All the Heads of Schools affiliated to CBSE

Subject: Term wise syllabus for Board Examinations to be held in the academic session 2021-22 for Secondary and Senior Secondary classes and guidelines for the conduct of the Internal Assessment/Practicum/Project.

This is in continuation to Board's circular number Acad 51/2021 dated July 05, 2021 regarding Special Scheme of Assessment for Board Examination for Classes X and XII for the Session 2021- 22. The syllabus for the two terms mentioned in the scheme in all subjects for classes IX to XII are hereby notified vides this circular. In addition to syllabus for term end board examinations, guidelines for the conduct of Internal Assessment/Practicum/Project are also enclosed.

Schools are requested to share the term wise syllabus and guidelines for the conduct of board examinations and Internal Assessment / Practicum / Project available on CBSE Academic Website <http://www.cbseacademic.nic.in> at the link http://cbseacademic.nic.in/Term-wise-curriculum_2022.html with all their teachers and students.

A handwritten signature in black ink, appearing to read "Dr. Joseph Emmanuel".

(Dr. Joseph Emmanuel)
Director (Academics)



SYLLABUS

Latest Syllabus issued by CBSE for Academic Year 2021-22

SCIENCE

CLASS IX (Code No. 086) 2021-22

COURSE STRUCTURE

EVALUATION SCHEME		
Theory		
Units	Term-II	Marks
I	Matter-Its Nature and Behaviour: Chapter 3 and 4	18
II	Organization in the Living World: Chapter -13	08
III	Motion, Force and Work: 10 and 11	14
Total Theory (Term I+II)		80
Internal Assessment: Term II		10
Grand Total		100

TERM – II

Theme : Materials

Unit I: Matter- It's Nature and Behaviour

Chapter – 3 Atoms and Molecules

Particle nature and their basic units: Atoms and molecules, Law of constant proportions, Atomic and molecular masses. Mole concept: Relationship of mole to mass of the particles and numbers.

Chapter – 4 Structure of Atom

Structure of atoms: Electrons, protons and neutrons, valency, chemical formula of common compounds. Isotopes and Isobars.

Theme : Moving Things, People and Ideas

Unit III: Motion, Force and Work

Chapter – 10 Gravitation

Gravitation: Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall.

Chapter – 11 Work and Energy

Work, energy and power: Work done by a Force, Energy, power; Kinetic and Potential energy; Law of conservation of energy.

SYLLABUS

Theme : The World of the Living

Unit II: Organization in the Living World

Chapter – 13 Why do we fall ill

Health and Diseases: Health and its failure. Infectious and Non-infectious diseases, their causes and manifestation. Diseases caused by microbes (Virus, Bacteria and Protozoans) and their prevention; Principles of treatment and prevention. Pulse Polio programmes.

ONLY FOR INTERNAL ASSESSMENT

Note: Learners are assigned to read the below listed part of Unit IV. They can be encouraged to prepare a brief write up on any one concept of this Unit in their Portfolio. This may be an assessment for Internal Assessment and credit may be given (Periodic assessment/Portfolio). This portion of the Unit is not to be assessed in the year-end examination.

Theme : Natural Resources: Balance in nature

Unit IV: Our Environment

Chapter -14 Natural Resources

Physical resources: Air, Water, Soil. Air for respiration, for combustion, for moderating temperatures; movements of air and its role in bringing rains across India.

Air, water and soil pollution (brief introduction).Holes in ozone layer and the probable damages.

Bio-geo chemical cycles in nature: Water, Oxygen, Carbon and Nitrogen.

TERM – II

LIST OF EXPERIMENTS

1. Determination of the density of solid (denser than water) by using a spring balance and a measuring cylinder. Unit-III: (Chapter-10)
2. Establishing the relation between the loss in weight of a solid when fully immersed in
 - (a) Tap water
 - (b) Strongly salty water with the weight of water displaced by it by taking at least two different solids.Unit-III: (Chapter-10)
3. Verification of the law of conservation of mass in a chemical reaction. Unit-I: (Chapter-3)



UNIT I : Matter-It's Nature and Behaviour

CHAPTER

1

ATOMS AND MOLECULES

Syllabus

- Atoms and molecules, law of constant proportions, atomic and molecular masses. Mole concept and Relationship of mole to mass of the particles and numbers.

Revision Notes

Chemical Combination, Atom and Molecules, Valency and Chemical Formula

- Laws of chemical combination : There are two laws of chemical combination :
 - (i) Law of conservation of mass : Mass can neither be created nor destroyed in a chemical reaction.
 - (ii) Law of constant proportions or Law of definite proportions : In a chemical substance, the elements are always present in a definite proportion by mass.
- Postulates of Dalton's atomic theory :
 - (i) Every matter is made up of very tiny particles called atoms.
 - (ii) Atoms are indivisible particles, which cannot be created or destroyed in a chemical reaction.
 - (iii) Atoms of a given element are identical in mass and chemical properties.
 - (iv) Atoms of different elements have different masses and chemical properties.
 - (v) Atoms combine in the ratio of small whole numbers to form compounds.
 - (vi) The relative number and kinds of atoms are constant in a given compound.

Atoms

- Atoms are building blocks of all matters.
- Atomic radius is measured in nanometre ($1 \text{ m} = 10^{-9} \text{ nm}$).

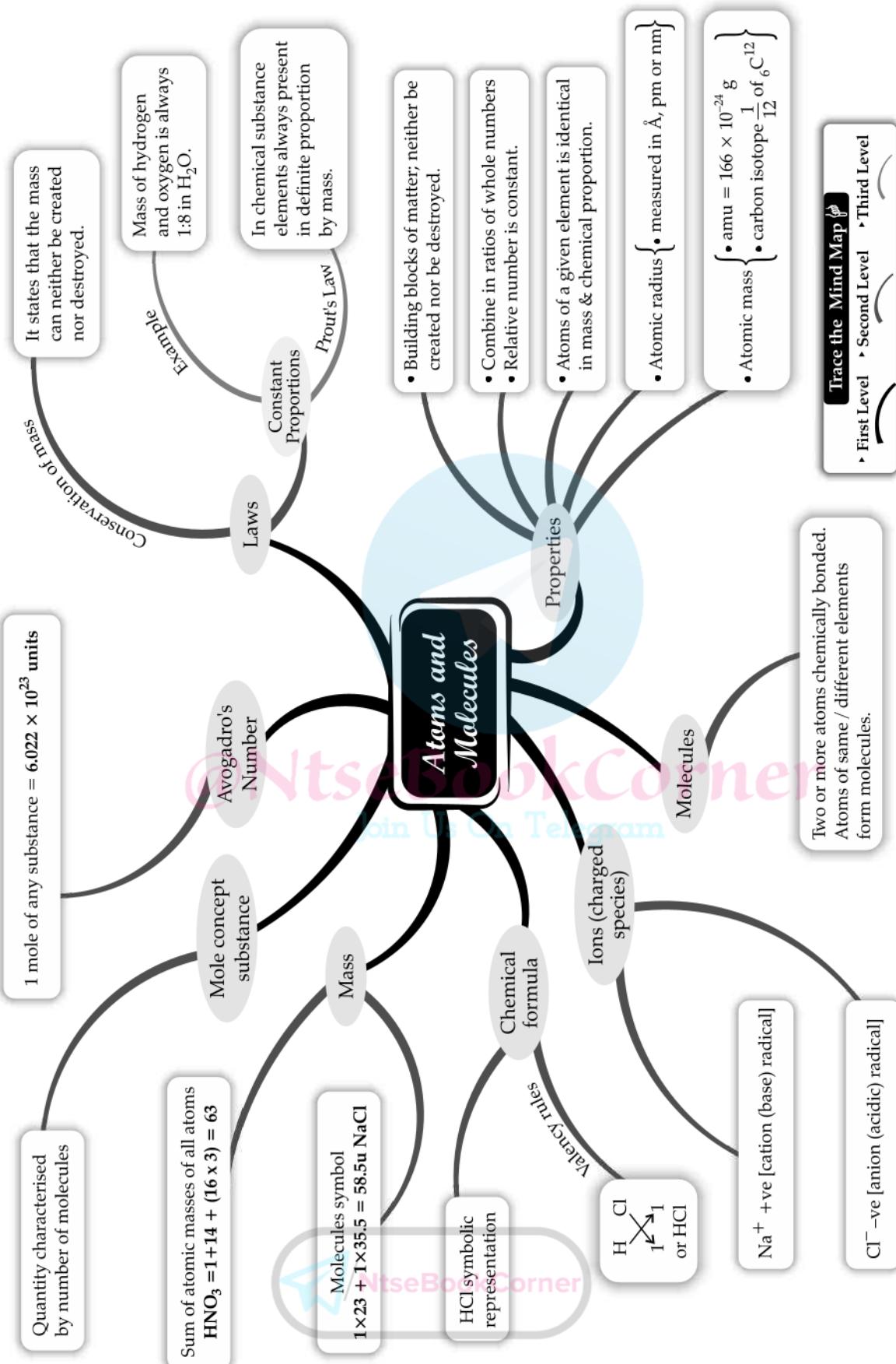
Elements and their naming

- Each element has a unique name and a unique symbol.
- IUPAC (International Union of Pure and Applied Chemistry) approves name of the elements.
- Rules for assigning symbols for atoms of various elements are as follows :
 - (i) The abbreviation used to represent an element is generally the first letter of the element's name in English.



English name of element	Symbol
Hydrogen	H
Boron	B
Oxygen	O
Nitrogen	N
Fluorine	F

- (ii) When the names of two or more elements begins with the same initial letter, the initial letter is followed by the letter appearing later in the name :



Name of element	Symbol
Barium	Ba
Bismuth	Bi
Bromine	Br
Silicon	Si
Cadmium, Calcium	Cd, Ca



(iii) Symbols of some elements are derived from their Latin / German or Greek names :

Name of element	Latin/German/Greek name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Copper	Cuprum	Cu
Iron	Ferrum	Fe
Gold	Aurum	Au
Silver	Argentum	Ag

- One atomic mass unit is a mass unit exactly equal to 1/12th the mass of one C-12 atom.
- Atoms of most elements are not able to exist independently. Atoms form molecules and ions.

Molecules

- Molecules of an element are formed by the atoms of the same type.
- Atoms of same or different elements join together in definite proportions to form molecules of compounds.
- The number of atoms constituting a molecule is known as its atomicity.

Ions

- An ion is a charged particle and can be negatively or positively charged.
- Ions may consist of a single charged atom or a group of atoms that have a net charge on them.
- Ionic compounds contain charged species called ions as their smallest unit.
- A group of atoms carrying a fixed charge on them are called polyatomic ions or radicals.
- The chemical formula of a compound is a symbolic representation of its composition.
- Valency is the combining capacity of an element. It can be used to find out how the atom(s) of an element will combine with the atom(s) of another element to form a chemical compound.
- Names and symbols of some ions :

Valency	Name of ion	Symbol	Non-metallic element	Symbol	Polyatomic ions	Symbol
1	Sodium	Na ⁺	Hydrogen	H ⁺	Ammonium	NH ₄ ⁺
	Potassium	K ⁺	Hydride	H ⁻	Hydroxide	OH ⁻
	Silver	Ag ⁺	Chloride	Cl ⁻	Nitrate	NO ₃ ⁻
	Copper (I)*	Cu ⁺	Bromide	Br ⁻	Hydrogen	HCO ₃ ⁻
			Iodide	I ⁻	Carbonate	
2	Magnesium	Mg ²⁺	Oxide	O ²⁻	Carbonate	CO ₃ ²⁻
	Calcium	Ca ²⁺	Sulphide	S ²⁻	Sulphite	SO ₃ ²⁻
	Zinc	Zn ²⁺			Sulphate	SO ₄ ²⁻
	Iron (II)*	Fe ²⁺				
	Copper (II)*	Cu ²⁺				
3	Aluminium	Al ³⁺	Nitride	N ³⁻	Phosphate	PO ₄ ³⁻
	Iron (III)*	Fe ³⁺				

* Some elements show variable valency which is represented by a roman numerical brackets.

- Rules for writing the formula of a compound :

- (i) Formula of compound is given by writing side by side the symbols of constituent elements.
- (ii) Symbol of the more metallic element is written first in the formula.
- (iii) Number of atoms of each of the constituent element present in the molecule is indicated by subscript.
- (iv) When either of the ions or both the ions are polyatomic and their valency is more than one, we enclose the polyatomic ions in brackets. No brackets are necessary if the valency(ies) of polyatomic ion (s) is (are) 1.

- (v) While writing the formula of a compound if the valency numbers have a Highest Common Factor (HCF), divide the valency numbers by HCF so as to get the simplest ratio between the combining elements.
- The charges or valencies on the ion must be balanced.
 - Formula of a binary compound is written by criss-crossing the valencies of elements present in a molecule of the compound.
 - A chemical compound is always electrically neutral; hence the positive and negative valencies or charges of the ions in the compound must add upto zero.

Atomic and Molecular Masses, Mole Concept

- Scientists use the relative mass scale to compare the masses of different atoms of elements.
- Atoms of C-12 isotopes are assigned a relative atomic mass of 12 and the relative masses of all other atoms are obtained in comparison with the mass of a C-12 atom.
- Relative mass of a molecule is expressed in atomic mass unit (u).
- $1 \text{ mole of any substance} = 6.022 \times 10^{23} \text{ units}$ (Avogadro's number).
- The mole is the amount of substance that contains the same number of particles (atoms/ ions/ molecules/ formula units, etc.) as there are atoms in exactly 12 gm of carbon-12.
- Mass of 1 mole of a substance is called its molar mass. It is expressed in g/mol.
- Mass of 1 mole of a particular substance is also fixed.
- Atoms of different elements are of different sizes and masses. A mole of one type of atoms will have a different mass from a mole of another type of atoms.

Scan to know
more about
this topic



Mole Concept

Know the Terms

- **Atom** : Smallest particle of an element that shows all the properties of an element.
- **Atomic number** : Number of protons in an atom of an element.
- **Molecule** : Smallest particle of an element/compound that is capable of an independent existence and shows all the properties of that substance.
- **Anion** : Negatively charged ion.
- **Cation** : Positively charged ion.
- **Atomicity** : Number of atoms present in one molecule of an element.
- **Radical** : An atom or a group of atoms carrying positive or negative charge that behaves as a single unit in a chemical reaction.
- **Mole** : Amount of substance that contains the same number of units as there are atoms in exactly 12 gm of carbon-12 isotope.
- **Chemical formula** : Expression of the composition of a substance by chemical symbols and numerical subscript.
- **Diatom** : A molecule which contains two atoms.
- **Triatomic** : A molecule which contains three atoms.
- **Polyatomic** : A molecule which contains more atoms.
- **Valency** : Measure of combining capacity of an element with other atoms when it forms compounds or molecules.
- **Binary compound** : Simplest compounds made up of two different elements. e.g., HCl, H₂O.
- **Molar mass** : Mass of one mole of a substance.
- **Gram atomic mass** : Atomic mass of an element expressed in terms of grams.
- **Molecular mass** : Sum of the atomic masses of all the atoms in a molecule of the substance.
- **Formula unit mass** : Sum of the atomic masses of all the atoms in a formula unit of a compound.
- **Mole** : One mole of any species (atoms, molecules, ions or particles) is that quantity in number having a mass equal to its atomic or molecular mass in grams. Mole can also be defined as the amount of substance that contains Avogadro number (6.022×10^{23}) of particles.
- **Avogadro's constant** : Number of atoms in exactly 12 gm of carbon – 12.

Explanation: Nitrate ion is NO_3^- . It is a monovalent ion.

- Q. 10. Which of the following would weigh the highest?**

- (A) 0.2 mole of sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$)
- (B) 2 moles of CO_2
- (C) 2 moles of CaCO_3
- (D) 10 moles of H_2O

Ans. Option (C) is correct.

Explanation: 2 moles of CaCO_3 would weigh the highest. It is because,

- (A) Mass of 1 mole of sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) = $(12 \times 12) + (1 \times 22) + (16 \times 11) = 342 \text{ g}$
Mass of 0.2 mole of sucrose = $342 \times 0.2 = 68.4 \text{ g}$
- (B) Mass of 1 mole of CO_2 = $12 + (16 \times 2) = 44 \text{ g}$
Therefore, mass of 2 moles of CO_2 = $44 \times 2 = 88 \text{ g}$
- (C) Mass of 1 mole of CaCO_3 = $40 + 12 + (16 \times 3) = 100 \text{ g}$
Mass of 2 moles of CaCO_3 = $100 \times 2 = 200 \text{ g}$
- (D) Mass of 1 mole of H_2O = $2 + 16 = 18 \text{ g}$
Mass of 10 moles of H_2O = $18 \times 10 = 180 \text{ g}$
Therefore, mass of 2 moles of CaCO_3 is the highest, i.e., 200 g.

- Q. 11. Which of the following has maximum number of atoms?**

- (A) 18 g of H_2O
- (B) 18 g of O_2
- (C) 18 g of CO_2
- (D) 18 g of CH_4

Ans. Option (D) is correct.

Explanation: It is because,

- (A) Number of atoms in 18 g of H_2O
 $= \frac{18}{18} \times 6.022 \times 10^{23} \times 3 = 18.066 \times 10^{23} = 1.8066 \times 10^{24}$
- (B) Number of atoms in 18 g of O_2
 $= \frac{18}{32} \times 6.022 \times 10^{23} \times 2 = 3.387 \times 10^{23} \times 2 = 6.774 \times 10^{23}$
- (C) Number of atoms in 18 g of CO_2
 $= \frac{18}{44} \times 6.022 \times 10^{23} \times 3 = 7.390 \times 10^{23}$
- (D) Number of atoms in 18 g of CH_4
 $= \frac{18}{16} \times 6.022 \times 10^{23} \times 5 = 3.387 \times 10^{24}$

Thus, 18 g of CH_4 contains the maximum number of atoms.

- Q. 12. Which of the following contains maximum number of molecules?**

- (A) 1 g CO_2
- (B) 1 g N_2
- (C) 1 g H_2
- (D) 1 g CH_4

Ans. Option (C) is correct.

Explanation: Number of molecules in 44 g CO_2
 $= 6.022 \times 10^{23}$

Number of molecules in 1 g CO_2 = $6.022 \times 10^{23} / 44 = 1.37 \times 10^{22}$

Number of molecules in 28 g N_2 = 6.022×10^{23}

Number of molecules in 1 g N_2 = $6.022 \times 10^{23} / 28 = 2.15 \times 10^{22}$

Number of molecules in 2 g H_2 = 6.022×10^{23}

Number of molecules in 1 g H_2 = $6.022 \times 10^{23} / 2 = 3.011 \times 10^{23}$

Number of molecules in 16 g CH_4 = $6.022 \times 10^{23} / 16 = 3.76 \times 10^{22}$

Hence, 1 g of H_2 contains maximum number of molecules.

- Q. 13. Mass of one atom of oxygen is**

- (A) $\frac{16}{6.023 \times 10^{23}} \text{ g}$
- (B) $\frac{32}{6.023 \times 10^{23}} \text{ g}$
- (C) $\frac{1}{6.023 \times 10^{23}} \text{ g}$
- (D) $\frac{16}{6.023 \times 10^{-23}} \text{ g}$

Ans. Option (A) is correct.

Explanation: Mass of 6.023×10^{23} atoms of Oxygen = Gram atomic mass of Oxygen
Mass of 6.023×10^{23} atoms = 16 g.

Mass of 1 atom of oxygen = $\frac{16}{6.023 \times 10^{23}} \text{ g}$

- Q. 14. 3.42 g of sucrose are dissolved in 18 g of water in a beaker. The number of oxygen atoms in the solution is**

- (A) 6.68×10^{23}
- (B) 6.09×10^{22}
- (C) 6.022×10^{23}
- (D) 6.22×10^{21}

Ans. Option (A) is correct.

Explanation: Molecular mass of sucrose = 342 g/mol

Molar mass = 342 g

Given mass = 3.42 g

Given mass in terms of molar mass = $\frac{1}{100}$ of molar mass

Number of molecules in 1 mole = 6.022×10^{23}

Number of molecules in given mass = $\frac{1}{100} \times 6.022 \times 10^{23} = 6.022 \times 10^{21}$

Number of oxygen atoms in 1 molecule of sucrose = 11

Number of oxygen atoms in 6.022×10^{21} molecules = $11 \times 6.022 \times 10^{21} = 6.6242 \times 10^{22}$ atoms

ATOMS AND MOLECULES

Now, given mass of water = 18 g = 1 mole
 Molecular mass of water = 18 u
 Number of oxygen atoms in 1 molecule of water = 1
 Number of oxygen atoms in 6.022×10^{23} molecules = $1 \times 6.022 \times 10^{23} = 6.022 \times 10^{23}$ atoms
 Total no. of oxygen atoms in the solution = $6.022 \times 10^{23} + 0.66242 \times 10^{23} = 6.68442 \times 10^{23}$ atoms

Q. 15. A change in the physical state can be brought about

- (A) Only when energy is given to the system
- (B) Only when energy is taken out from the system
- (C) When energy is either given to, or taken out from the system
- (D) Without any energy change

Ans. Option (C) is correct.

Explanation: A change in the physical state can be brought about when energy is either given to, or taken out from the system. It is because energy change helps in changing the magnitude of attraction forces between the particles, thus helps in changing the physical states (e.g. solid, liquid, gas) of matter.

Q. 16. One mole of acetic acid contains :

- (A) 1 mole of oxygen atoms.
- (B) 2 moles of oxygen atoms.
- (C) 3 moles of oxygen atoms.
- (D) 6 moles of oxygen atoms

Ans. Option (B) is correct.

Explanation: One molecule of (acetic acid) CH₃COOH contains 2 oxygen atoms. One mole of CH₃COOH contains 2 moles of oxygen atoms.

Q. 17. Dalton's atomic theory successfully explained:

- (i) law of conservation of mass
 - (ii) law of constant composition
 - (iii) law of radioactivity
 - (iv) law of multiple proportion
- (A) (i), (ii) and (iii)
 - (B) (i), (iii) and (iv)
 - (C) (ii), (iii) and (iv)
 - (D) (i), (ii) and (iv)

Ans. Option (D) is correct.

Explanation: Dalton's atomic theory successfully explained the laws of chemical combination but no point about radioactivity was mentioned by Dalton in his theory.

(A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(B) Both assertion (A) and reason (R) are true but reason (R) is NOT the correct explanation of assertion (A).

(C) Assertion (A) is true but reason (R) is false.

(D) Assertion (A) is false but reason (R) is true.

Q. 1. **Assertion:** Water molecules always contain hydrogen and oxygen in the ratio 1:8.

Reason: Water obeys law of constant proportions irrespective of source and method of preparation.

Ans. Option (A) is correct

Explanation: Hydrogen and oxygen combine in the ratio of 1 : 8 by mass to form water. This indicates the law of definite proportions.

According to this law, the elements are always present in definite proportion by mass in a chemical substance. All pure samples of a compound contain the same elements combined together in the same proportion by mass.

Q. 2. **Assertion:** Atoms can neither be sub-divided, created nor destroyed.

Reason: This postulate of Dalton's theory is the result of law of constant proportion.

Ans. Option (C) is correct

Explanation: Atoms can neither be subdivided, created nor destroyed. This postulate of Dalton's atomic theory is the result of law of conservation of mass.

Q. 3. **Assertion:** Carbonates are polyatomic ions.

Reason : The carbonate ion consists of one carbon atom and three oxygen atoms and carries an overall charge of 2⁻.

Ans. Option (A) is correct

Explanation: The carbonate ion consists of one carbon atom and three oxygen atoms and carries an overall charge of 2⁻. The formula of the carbonate ion is CO₃²⁻. The atoms of a polyatomic ion are tightly bonded together and so the entire ion behaves as a single unit.

Q. 4. **Assertion:** Relative atomic mass of the atom of element is the average masses of the atom as compared to $\frac{1}{12}$ th the mass of one carbon-12 atom.

Reason : Carbon-12 isotope is the standard reference for measuring atomic masses.

Ans. Option (B) is correct

Explanation: Carbon-12 is taken as standard reference because no other nuclide have exactly whole number.

Assertion and Reason Based MCQs

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

Q. 5. Assertion: Atoms always combine to form molecule and ions.

Reason : Atoms of most element are not able to exist independently.

Ans. Option (D) is correct

Explanation: Atoms of inert gases do not combine. Atoms combine to attain noble gas configuration.

Q. 6. Assertion: Atomicity of ozone is three while that of oxygen is two.

Reason : Atomicity is the number of atoms constituting a molecule.

Ans. Option (A) is correct

Explanation: Atomicity is the number of atoms constituting a molecule. An oxygen molecule (written as O₂) consists of 2 atoms of oxygen (O) and hence has an atomicity of 2. Similarly, an ozone molecule (O₃) consists of 3 atoms of oxygen and has an atomicity of 3.

Q. 7. Assertion : The number of particles present in one mole of a substance is fixed.

Reason : The mass of one mole of a substance is equal to its relative atomic mass in grams.

Ans. Option (A) is correct

Explanation: One mole of any species (atoms, molecules, ions or particles) is that quantity in number having a mass equal to its atomic or molecular mass in grams. The number of particles (atoms, molecules or ions) present in 1 mole of any substance is fixed, with a value of 6.022×10^{23} .

(D) None of these

Ans. Option (A) is correct.

Explanation: According to this law, the elements are always present in definite proportion by mass in a chemical substance. All pure samples of a compound contain the same elements combined together in the same proportion by mass.

Q. 3. In a chemical substance, elements are present in a definite proportion by _____.

- | | |
|-------------------|--------------|
| (A) Atomic number | (B) Electron |
| (C) Mass | (D) Neutron |

Ans. Option (C) is correct.

Explanation: The elements are present in a definite proportion by mass.

Q. 4. In a compound water, at what ratio hydrogen and oxygen combine to form water:

- | | |
|-----------|-----------|
| (A) 1 : 2 | (B) 1 : 8 |
| (C) 2 : 1 | (D) 8 : 1 |

Ans. Option (B) is correct.

Explanation: The molecular formula of water is H₂O and its molecular mass is 18g. So, when 2 g of Hydrogen combines with 16 g of Oxygen then 18 g of water is formed. So, the ratio is

$$\begin{array}{l} \text{H} : \text{O} \\ 2 : 16 \\ 1 : 8 \end{array}$$

II. Two class students of class 9th, Aashi and Sheena, were asked to take 5.3 g of sodium carbonate and 6 g of ethanoic acid to make 2.2 g of carbon dioxide, 0.9 g of water and 8.2 g of sodium ethanoate. Aashi followed the instructions but Sheena took the chemicals without measuring their amounts.

Q. 1. Whose activity do you think will be in agreement with the law?

- | | |
|----------------------|------------|
| (A) Sheena | (B) Aashi |
| (C) Both (A) and (B) | (D) No one |

Ans. Option (B) is correct.

Explanation: Aashi's activity will be in agreement with the law of conservation of mass as she has followed the instructions and took the chemical in correct amount.

Q. 2. Which law does this agreements shows?

- | |
|---------------------------------|
| (A) Law of Constant Proportion |
| (B) Law of Conservation of mass |
| (C) Dalton's atomic theory |
| (D) Avogadro's Law |

Ans. Option (B) is correct.

Explanation: $5.3 \text{ g} + 6 \text{ g} \rightarrow 2.2 \text{ g} + 0.9 \text{ g} + 8.2 \text{ g}$
 $11.3 \text{ g} \rightarrow 11.3 \text{ g}$

This agreement shows the "Law of Conservation of Mass".

Q. 3. The law states that _____ can neither be created nor be destroyed in a chemical reaction.

- | |
|-------------------|
| (A) Atomic number |
|-------------------|



Case-based MCQs

I. Sanjana observed that when 3.0 gm of carbon is burnt in 8.0 gm of oxygen, 11.0 gm of carbon dioxide is produced. Based on the given information, answer the following questions from (i) to (iv).

Q. 1. In what ratio does carbon and oxygen combine to form carbon dioxide?

- | | |
|-----------|-----------|
| (A) 2 : 3 | (B) 3 : 8 |
| (C) 3 : 2 | (D) 8 : 3 |

Ans. Option (B) is correct.

Explanation: When 3.0 gm of carbon is burnt in 8.0 gm oxygen, 11.0 gm of carbon dioxide is produced. It means carbon and oxygen are combined in the ratio of 3 : 8 to form carbon dioxide. Thus, when there is 3 gm carbon and 50 gm oxygen, then also only 8 gm of oxygen will be used and 11 gm of carbon dioxide will be formed. The remaining oxygen is not used.

Q. 2. Name the Law of Chemical Combination shown in the above passage:

- | |
|---------------------------------|
| (A) Law of definite proportion |
| (B) Law of Conservation of mass |
| (C) Dalton's atomic theory |

ATOMS AND MOLECULES

- (B) Electron
(C) Proton
(D) Mass

Ans. Option (D) is correct.

Explanation: The law states that mass can neither be created nor be destroyed. For example: When wood burns, the mass of the soot, ashes, and gases equals the original mass of the charcoal and the oxygen when it first reacted. It means the total masses of reactants is equal to the sum of masses of products in a chemical reaction.

III. Rahul took 5 moles of carbon atoms in a container and Sohan also took 5 moles of sodium atoms in another container of same weight.

Q. 1. Which container is heavier?

- (A) 5 moles of carbon container
(B) 5 moles of sodium container
(C) Both (A) and (B)
(D) None of these

Ans. Option (B) is correct.

Explanation: Mass of container containing 5 moles of C atoms

$$= 5 \times 12 = 60 \text{ g}$$

Mass of container containing 5 moles of Na atoms

$$= 5 \times 23 = 115 \text{ g}$$

Hence, container containing 5 moles of sodium is heavier.

Q. 2. Whose container has more number of atoms?

✓ (B) SUBJECTIVE QUESTIONS



Very Short Answer Type Questions (1 Mark Each)

AI Q. 1. State the Law of Conservation of Mass.

[R] [Board Term-II 2016] (DDE 2017)

Ans. It states that mass can neither be created nor destroyed in a chemical reaction. 1

Commonly Made Error

- Students often write incorrect law or sometimes they miss the important operative words.

Answering Tip

- Students should learn all the laws thoroughly. Understand and state law of conservation of mass in simple words, giving importance to operative words.

Q. 2. State the law of constant proportion. [DDE 2017] [R]

Ans. Law of constant proportion states that in a chemical compound the elements are always present in a

- (A) Rahul's container
(B) Sohan's container
(C) Both (A) and (B)
(D) None of these

Ans. Option (C) is correct.

Explanation: Both containers have same number of atoms since they contain same number of moles.

Q. 3. The exact number of atoms present in 12 gm of Carbon-12:

- (A) Number of Valence electrons
(B) Valency
(C) Avogadro's constant
(D) Electronic configuration

Ans. Option (C) is correct.

Explanation: The exact number of atoms present in 12 gm of Carbon-12 is called Avogadro's constant.

Q. 4. Number of atoms in one mole:

- (A) 6.022×10^{23} atoms
(B) 3.011×10^{23} atoms
(C) 3.011×10^{24} atoms
(D) 6.022×10^{22} atoms

Ans. Option (A) is correct.

Explanation: 1 mole = N_A number of particles where particles can be atom, ions or molecules such as

$$1 \text{ mole} = 6.022 \times 10^{23} \text{ atoms.}$$

definite proportion by mass. 1

Q. 3. Write the symbols of : (i) Lead, (ii) Boron

[R] [Board Term-II 2016]

Ans. (i) Lead — Pb

(ii) Boron — B $(\frac{1}{2} + \frac{1}{2})$

AI Q. 4. Mention the postulate of Dalton's atomic theory which can successfully explain the law of definite proportions. [R] [Board Term-II 2014] (NCERT) OR

Which postulate of Dalton's atomic theory can explain the law of definite proportions ?

Ans. The Law of Definite Proportions is explained by the following postulate of Dalton : "The relative number and kinds of atoms are constant in a given compound." [CBSE Marking Scheme, 2014] 1

Q. 5. 10 gm of silver nitrate solution is added to 10 gm of sodium chloride solution. What change in mass do you expect after the reaction and why ?

[U+A] [Board Term-II 2013]

Ans. No change in mass will take place because law of conservation of mass holds good. 1

Q. 6. Give an example of (i) triatomic, (ii) polyatomic molecules of elements. R [O.E.B.]

Ans. (i) Triatomic – Ozone (O_3)
(ii) Polyatomic – Sulphur (S_8) $(\frac{1}{2} + \frac{1}{2})$
[CBSE Marking Scheme, 2012]

Q. 7. An element 'X' has a valency 3. Write the formula of its oxide. U [O.E.B.]

Ans. X_2O_3 . [CBSE Marking Scheme, 2012] 1

Q. 8. Name the anion and cation that constitute the molecule of magnesium oxide. U [O.E.B.]

Ans. Magnesium oxide $\rightarrow MgO$, Cation \rightarrow magnesium (Mg^{2+}), Anion \rightarrow oxide (O_2^-). $(\frac{1}{2} + \frac{1}{2})$
[CBSE Marking Scheme, 2012]

Q. 9. Define formula unit mass. R [Board Term-II 2016]

Ans. Sum of atomic masses of all the atoms in a formula unit of a compound is called formula unit mass.

Q. 10. Define the term molecular mass. R [Board Term-II 2015]

Ans. The molecular mass of a substance is the sum of the atomic masses of all the atoms in a molecule of the substance.

[CBSE Marking Scheme, 2015]

Q. 11. Interpret the number of moles of oxygen atoms in PO_4^{3-} . U [Board Term-II 2015]

Ans. Each mole of phosphate ion possesses 4 moles of oxygen atoms as represented by the formula.

[CBSE Marking Scheme, 2015]

Q. 12. Define the atomic mass unit. R [O.E.B.]

Ans. Atomic mass unit is equal to $1/12^{\text{th}}$ the mass of one atom of carbon-12.

Q. 13. How many atoms are there in 1 gm of hydrogen?

A [Board Term-II 2012]

Ans. 6.022×10^{23} atoms or one mole.

[CBSE Marking Scheme, 2012]

Short Answer Type Questions-I

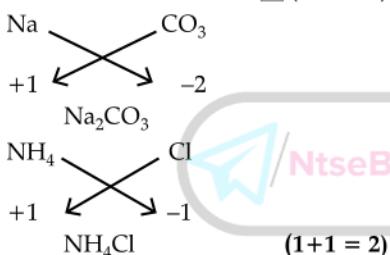
(2 Marks Each)

Q. 1. Write the chemical formula of:

- (i) Sodium carbonate
- (ii) Ammonium chloride

R [NCERT]

Ans. (i)



Q. 2. Write the chemical formula for:

(i) Zinc phosphate

(ii) Lead carbonate

R [O.E.B.]

Ans. (i) $Zn_3(\text{PO}_4)_2$

(ii) $Pb\text{CO}_3$

1

1

Q. 3. (i) Write down the name of compounds represented by the following formulae:

- (a) $\text{Ca}(\text{OH})_2$
- (b) $K_2\text{SO}_4$

(ii) Give two examples of bivalent cations.

R (NCERT)

Ans. (a) (i) Calcium hydroxide

1/2

(ii) Potassium sulphate

1/2

(b) Bivalent cation = Mg^{2+} , Ca^{2+} , Zn^{2+} , Fe^{2+} , Cu^{2+}

(Any two) $(\frac{1}{2} + \frac{1}{2})$

Q. 4. (i) Write the chemical formula of a compound using zinc ion and phosphate ion.

(ii) Calculate the ratio by mass of atoms present in a molecule of carbon dioxide. (Given : C = 12, O = 16)

R+A [O.E.B.]

Ans. (i) $Zn_3(\text{PO}_4)_2$

1

(ii) The ratio by mass of constituting elements in carbon dioxide is:

$\text{CO}_2 = 12 : 32$

$3 : 8$

Q. 5. State the law of conservation of mass. If 12 gm of carbon is burnt in the presence of 32 gm of oxygen, how much carbon dioxide will be formed?

R+A [O.E.B.]

Ans. The law states that matter can neither be created nor destroyed or mass of reactants is always equal to that of product.



1

Carbon + Oxygen \rightarrow Carbon dioxide

1/2

Mass of reactants = $12 + 32 = 44$ g

1/2

Mass of product (CO_2) = 44 g

1/2

(One mole of C reacts with one mole of oxygen to form one mole of CO_2)

Q. 6. (i) Calculate the number of moles in 17 gm of H_2O_2 (Atomic weight of H = 1 u, O = 16 u)

A [O.E.B.]

Ans. 1 mole of $H_2O_2 = 2 \times 1 + 2 \times 16 = 34$ gm

1/2

34 gm of H_2O_2 = 1 mole

1/2

$$\therefore 17 \text{ gm of } H_2O_2 = \frac{1}{34} \times 17$$

1/2

$$= \frac{1}{2} = 0.5 \text{ moles}$$

1/2

Q. 7. (a) Write the chemical formula of potassium sulphate.

(b) Calculate the molar mass of:

(i) Ethyne (C_2H_2)

(ii) Phosphorus molecule (P_4)

(Atomic mass of C = 12 u, H = 1 u and

P = 31 u).

R+A [NCERT]

Ans. (a) K_2SO_4 .

(b) (i) $C_2H_2 = 2 \times 12 + 2 \times 1 = 24 + 2 = 26$ u

1/2

(ii) $P_4 = 4 \times 31 = 124$ u

1/2





Short Answer Type Questions-II

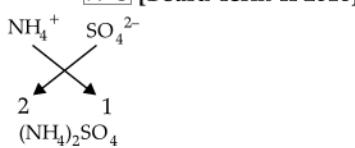
(3 Marks Each)

Q. 1. Show the formation of chemical formulae of following compounds using their ions :

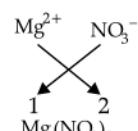
- (i) Ammonium sulphate
- (ii) Magnesium nitrate
- (iii) Aluminium sulphide

R+U [Board Term-II 2016]

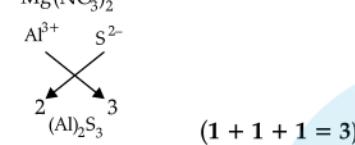
Ans. (i)



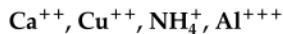
(ii)



(iii)



Q. 2. Define valency. Classify the following cations on the basis of their valencies :



[KVS 2018-19]

A [Board Term-II 2016]

Ans. The combining power (or capacity) of an element to displace or combine with number of hydrogen atoms is known as its valency.



$$(1 + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3)$$

Q. 3. (i) What are polyatomic ions ? Give one example.

[KVS 2018-19] [NCERT]

(ii) In an experiment, 14 gm of sodium bicarbonate was allowed to react with 10 gm of acetic acid. After the reaction was completed, it was found that only 16.67 gm of the solution was left because a gas escaped from the container. What was the mass of the gas that escaped into the atmosphere ? Name the law applied. **A**

Ans. (i) Polyatomic ions are a group of atoms carrying charge. They are also called molecular ion.

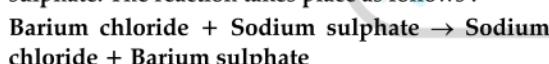
Example : Carbonate or phosphate or nitrate ion.

(ii) Mass of the gas that escaped into the atmosphere
 $= 24 - 16.67 = 7.33 \text{ gm}$

The law of conservation of mass is applied in this expression. $(\frac{1}{2} + \frac{1}{2} + 1 + 1 = 3)$

[CBSE Marking Scheme, 2012]

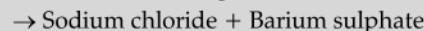
Q. 4. In a reaction 4.6 gm of barium chloride reacted with 3.4 gm of sodium sulphate. The products were 2.8 gm of sodium chloride and 5.2 gm of barium sulphate. The reaction takes place as follows :



Show that the above observation is in agreement with law of conservation of mass. State the law.

U [Board Term-II 2016] [NCERT]

Ans. Barium chloride + Sodium sulphate



$$4.6 \text{ g} + 3.4 \text{ g} \rightarrow 2.8 \text{ g} + 5.2 \text{ g}$$

$$8 \text{ g} \rightarrow 8 \text{ g}$$

$$8 = 8$$

This is in agreement with the 'Law of Conservation of Mass' that states matter can neither be created nor destroyed in a chemical reaction.

[CBSE Marking Scheme, 2016] (2 + 1 = 3)

Q. 5. Derive the molecular formulae for the following compounds :

- (i) Copper (II) bromide

- (ii) Ammonium carbonate

- (iii) Aluminium oxide.

[NCERT Exemplar]

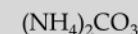
R [Board Term-II 2015]

Ans. (i) $\text{Cu}^{+2} \text{Br}^-$



1

(ii) $\text{NH}_4^+ \text{CO}_3^{-2}$



1

(iii) $\text{Al}^{+3} \text{O}^{-2}$



1

[CBSE Marking Scheme, 2015]

Q. 6. (a) Define atomicity.

(b) Name the elements whose atomicity is :

- (i) Tetra atomic (ii) Monatomic

(c) State the number of atoms present in each of the following chemical species :

- (i) CO_3^{2-} (ii) HNO_3 [NCERT Exemplar]

R+U [Board Term-II 2015] [NCERT]

Ans. (a) The number of atoms constituting a molecule is known as atomicity. 1

(b) (i) P_4 (ii) Ar

$$(\frac{1}{2} + \frac{1}{2})$$

(c) (i) 4 (ii) 5

$$(\frac{1}{2} + \frac{1}{2})$$

[CBSE Marking Scheme, 2015]

Q. 7. Write the chemical symbols of the following elements : Gold, Copper, Potassium, Silver, Platinum and Iron. **R** [Board Term-II 2014]

Ans. Gold = Au, Copper = Cu, Potassium = K,
 Silver = Ag, Platinum = Pt, Iron = Fe. 3

[CBSE Marking Scheme, 2014]

Q. 8. Write the chemical formulae of the following :

- (i) Aluminium nitrate

- (ii) Magnesium hydrogen carbonate

- (iii) Sodium sulphate

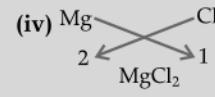
- (iv) Magnesium chloride

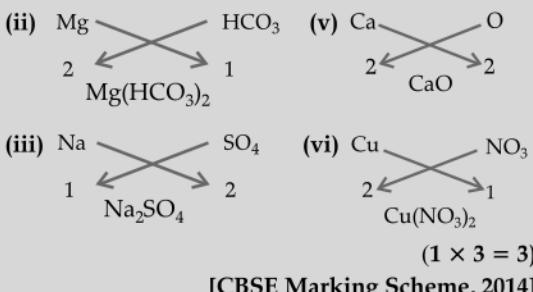
- (v) Calcium oxide

- (vi) Copper nitrate

[NCERT]

R [Board Term-II 2014]





[CBSE Marking Scheme, 2014]

Q. 9. Write the chemical formula of bicarbonates (HCO_3^{-1}) of Na^{+1} , K^{+1} , Al^{+3} , Mg^{+2} , Ca^{+2} , Zn^{+2} .

[Board Term-II 2013]

Ans. NaHCO_3 , KHCO_3 , $\text{Al}(\text{HCO}_3)_3$, $\text{Mg}(\text{HCO}_3)_2$, $\text{Ca}(\text{HCO}_3)_2$, $\text{Zn}(\text{HCO}_3)_2$. $(\frac{1}{2} \times 6 = 3)$

Q. 10. Write the chemical formula of the following compounds :

(i) Iron (III) chloride

(ii) Magnesium hydrogen carbonate

(iii) Sodium phosphate

[Board Term-II 2013]

Ans. (i) FeCl_3 (ii) $\text{Mg}(\text{HCO}_3)_2$ (iii) Na_3PO_4 $(1 \times 3 = 3)$

Q. 11. (a) Define the atomic mass unit.

(b) Write the chemical formulae of :

(i) Ammonium carbonate

(ii) Sodium oxide

(iii) Calcium carbonate

(c) Write the name of the compound $\text{Al}_2(\text{SO}_4)_3$ and mention the ions present in it.

[NCERT]

Ans. (a) Atomic mass unit is exactly equal to one-twelfth the mass of one atom of Carbon-12. 1

(b) (i) $(\text{NH}_4)_2\text{CO}_3$ (ii) Na_2O (iii) CaCO_3 $(\frac{1}{2} + \frac{1}{2})$

(c) Aluminium sulphate. The ions present are Al^{3+} , SO_4^{2-} .

[CBSE Marking Scheme, 2012] $(\frac{1}{2} + \frac{1}{2})$

Q. 12. (a) Which postulate of Dalton's atomic theory is the basis of law of conservation of mass ?

(b) Write the name of compounds represented by the following formulae :

(i) KNO_3 (ii) $\text{Al}_2(\text{SO}_4)_3$ (iii) CCl_4 (iv) H_2S .

[NCERT]

Ans. (a) Atom can neither be created nor destroyed. 1

(b) (i) Potassium nitrate

(ii) Aluminium sulphate

(iii) Carbon tetrachloride

(iv) Hydrogen sulphide

 $(\frac{1}{2} \times 4 = 2)$

Q. 13. (i) Hydrogen and oxygen combine in the ratio of 1 : 8 by mass to form water. What mass of oxygen

gas would be required to react completely with 5 gm of hydrogen gas ?

(ii) An element 'X' shows variable valency of 4 and 6. Write the chemical formulae of its two oxides.

[R+U] [NCERT]

Ans. (i) 1 gm of hydrogen gas requires 8 gm of oxygen; Therefore, 5 gm of hydrogen gas will require $5 \times 8 = 40$ gm of oxygen. 2

(ii) XO_2 ($\text{X}^{+4} \text{O}_2^{-2}$) and XO_3 ($\text{X}^{+6} \text{O}_3^{-2}$). 1

Q. 14. Give the names of the elements present in the following compounds:

(a) Quick lime

(b) Hydrogen bromide

(c) Baking powder

[R+U] [NCERT]

Ans. (a) Calcium and oxygen [CaO] 2

(b) Hydrogen and bromine [HBr](c) Sodium, hydrogen, carbon and oxygen [NaHCO_3]

Q. 15. The percentage of three elements—calcium, carbon and oxygen in a sample of calcium carbonate is given as :

Calcium = 40%; Carbon = 12.0%; Oxygen = 48%
If the law of constant proportion is true, what weight of these elements will be present in 1.5 gm of another sample of calcium carbonate ? (Atomic mass of Ca = 40 u, C = 12 u, O = 16 u) A

[O.E.B.]

Ans. Mass of calcium in 1.5 gm of sample

$$= \frac{40}{100} \times 1.5 = 0.6 \text{ gm}$$

Mass of carbon in 1.5 gm of sample

$$= \frac{12}{100} \times 1.5 = 0.18 \text{ gm}$$

Mass of oxygen in 1.5 gm of sample

$$= \frac{48}{100} \times 1.5 = 0.72 \text{ gm}$$

 $(1 \times 3 = 3)$

Q. 16. (i) Explain what do you understand by Avogadro constant ?

(ii) Calculate the number of moles for 56 g of Ne. (Atomic mass Ne = 20 u)

[R+A] [Board Term-II 2016]

Ans. (i) The exact number of atoms present in 12 g of carbon-12 is called Avogadro constant. 1

(ii) No. of moles = $\frac{m}{M} = \frac{\text{Given mass}}{\text{molar mass}}$

$$= \frac{56}{20} = 2.8 \text{ moles} \quad 2$$

Q. 17. (i) Write the chemical formula of magnesium hydroxide.

(ii) Calculate the number of aluminium ions present in 0.051 g of aluminium oxide [Atomic Mass of Al = 27 u] $U+R$ [Board Term-II 2016]

ATOMS AND MOLECULES

Ans. (i) $Mg(OH)_2$ (ii) **Step I :**(Gram molecular mass of Al_2O_3)

$$= 2 \times 27 + 3 \times 16$$

$$= 102 \text{ g}$$

$$\therefore 102 \text{ g of } Al_2O_3 = 1 \text{ mol}$$

$$\therefore 0.051 \text{ g of } Al_2O_3 = \frac{1}{102} \times 0.051 \text{ mol}$$

$$= 0.0005 \text{ mol}$$

Step II :1 mol. of Al_2O_3 contain Al atom

$$= 2 \times \text{Avogadro No.}$$

0.0005 eq. mol of Al_2O_3 contain Al atoms

$$= 2 \times 0.0005 \times 6.022 \times 10^{23}$$

$$= 6.022 \times 10^{20} \text{ atoms.}$$

The number of Al ions (Al^{+3}) present is same as the number of Al atoms.

$$\text{No. of } Al^{+3} \text{ ions} = 6.022 \times 10^{20} \text{ ions.}$$

Q. 18. John placed 10 moles of sulphur molecules (S_8) and 5 moles of glucose ($C_6H_{12}O_6$) in the two different pans of a physical balance. Find which pan of the balance would be heavier; support your answer with calculations.

(atomic masses : O = 16 u, C = 12 u, H = 1 u, S=32 u)

[A] [Board Term-II 2014]

Ans. Molecular mass of S_8 = $32 \times 8 = 256 \text{ g}$

$$\text{Molecular mass of } C_6H_{12}O_6 = 6 \times 12 + 1 \times 12 + 6 \times 16$$

$$= 72 + 12 + 96 = 180 \text{ g}$$

Weight of 10 moles of S_8 = $10 \times 256 = 2560 \text{ g}$ andWeight of 5 moles of glucose = $5 \times 180 = 900 \text{ g}$.

Therefore, 10 moles of sulphur would weigh more.

[CBSE Marking Scheme, 2014] 3

Q. 19. Define formula unit mass. Calculate formula unit mass of NaCl, (Atomic mass of Na = 23 u, Cl = 35.5 u) (NCERT) [R+A] [Board Term-II, 2013]

Ans. The sum of the atomic masses of all atoms in a formula unit of a compound is called formula unit mass. 1

$$NaCl = (1 \times 23) + (1 \times 35.5) \quad \frac{1}{2}$$

$$= 23 + 35.5 \quad \frac{1}{2}$$

$$= 58.5 \text{ u} \quad 1$$

[AI] Q. 20. A 0.24 g sample of a compound of oxygen and boron was found, by analysis, to contain 0.096 g of boron and 0.144 g of oxygen.

(i) Calculate the percentage composition of the compound by weight. [NCERT]

(ii) Find the number of moles in 0.144 g of oxygen gas. [A] [Board Term-II 2012]

Ans. (i) % composition of B = $\frac{0.096 \times 100}{0.24} = 40\% \quad 1$

$$\% \text{ composition of O} = \frac{0.144}{0.24} \times 100 = 60\% \quad 1$$

$$\text{(ii) Number of moles of } O_2 = \frac{0.144}{32} = 0.0045 \text{ mole}$$

$$= 4.5 \times 10^{-3} \text{ mole} \quad 1$$

Q. 21. A gold sample contains 90% of gold and the rest copper. How many atoms of gold are present in one gram of this sample of gold ?

[R] [NCERT Exemplar]

Ans. One gram of gold sample will contain $\frac{90}{100} = 0.9 \text{ g}$ of gold.

$$\text{Number of moles of gold} = \frac{\text{Mass of gold}}{\text{Atomic mass of gold}}$$

$$= \frac{0.9}{197} = 0.0046$$

One mole of gold contains Na atoms = 6.022×10^{23} $\therefore 0.0046 \text{ mole of gold will contain} = 0.0046 \times 6.022 \times 10^{23} \text{ atoms} = 2.7 \times 10^{21} \text{ atoms.}$

Q. 22. Compute the number of ions present in 5.85 g of sodium chloride. [R] [NCERT Exemplar]

$$\text{Ans. } 5.85 \text{ g of NaCl} = \frac{5.85}{58.5} = 0.1 \text{ moles}$$

or 0.1 moles of NaCl particle

Each NaCl particle is equivalent to one Na^+ and one Cl^- i.e., 2 ionsTotal moles of ions = $0.1 \times 2 = 0.2 \text{ moles}$

$$\text{No. of ions} = 0.2 \times 6.022 \times 10^{23}$$

$$= 1.2042 \times 10^{23} \text{ ions}$$

Q. 23. A sample of ethane (C_2H_6) gas has the same mass as 1.5×10^{23} molecules of methane (CH_4). How many C_2H_6 molecules does the sample of gas contain ?

[R] [NCERT Exemplar]

$$\text{Ans. Mass of 1 molecule of } CH_4 = \frac{16g}{N_A}$$

$$\text{Mass of } 1.5 \times 10^{23} \text{ molecules of methane}$$

$$= \frac{1.5 \times 10^{23} \times 16}{N_A} \text{ g}$$

$$\text{Mass of 1 molecule of } C_2H_6 = \frac{30}{N_A} \text{ g}$$

$$\text{Mass of molecules of } C_2H_6 \text{ is} = \frac{1.5 \times 10^{23} \times 16}{N_A} \text{ g}$$

Number of molecules of ethane

$$= \frac{1.5 \times 10^{23} \times 16}{N_A} \text{ g} \quad \frac{N_A}{30}$$

$$= 0.8 \times 10^{23} \text{ molecules}$$

Q. 24. (a) Convert into mole 22 g of carbon dioxide.

(b) Write the chemical formula of following compounds.

(i) Quick lime

(ii) Magnesium chloride

(iii) Calcium Carbonate

[R+U] [NCERT Exemplar] [KVS - 2018-19]

$$\text{Ans. (a) Atomic mass of } CO_2 = 1 \times 12 + 2 \times 16$$

$$= 12 + 32 = 44 \text{ u}$$

$$\text{No. of moles} = \frac{22}{44} = 0.5$$

(b) (i) CaO (ii) $MgCl_2$ (iii) $CaCO_3$



Long Answer Type Questions

(5 Marks Each)

- Q. 1.** (i) Name the international organization who approves names of elements.
(ii) Give an example with explanation to show that the law of conservation of mass applies to physical changes also.

R+U [Board Term-II 2015]

- Ans. (i)** International Union of Pure and Applied Chemistry (IUPAC).

(ii) When ice melts into water it is a physical change. Take a piece of ice in a small flask, cork it and weigh it and denote it as W_{ice} gm.

Heat the flask gently and ice (solid) slowly melts into water (liquid). Then, weigh the flask again as W_{water} gm.

$$\text{Ice} \xrightarrow{\text{Heat } \Delta} \text{Water}$$

This shows law of conservation of mass holds true for physical changes. 5

[CBSE Marking Scheme, 2015]

- Q. 2.** (i) If 18 gm of pure water is electrolysed, 2 gm of hydrogen and 16 gm of oxygen is obtained. Which law of chemical combination is illustrated by this statement ?

(ii) State the law of constant proportion. Illustrate with the help of an example.

(iii) Which postulate of Dalton's atomic theory is the result of law of conservation of mass ?

(iv) Which point of Dalton's atomic theory came from law of constant proportions ? [Board Term-II 2013]

Ans. (i) Law of constant proportion.

- (ii) A compound prepared by any method contains the same elements in the fixed ratio by mass.
For example, H_2O contains hydrogen and oxygen in the ratio 2 : 16 i.e., 1 : 8 by mass.

(iii) Atoms can neither be sub-divided, created nor destroyed.

(iv) Atoms of different elements combine in simple whole number ratios to form chemical compound.

$$(1 + 2 + 1 + 1 = 5)$$

- Q. 3. Verify by calculating that :**

- (i) 5 mole of CO_2 and 5 mole of H_2S do not have the same mass.

(ii) 240 gm of Ca and 240 gm of Mg elements have molar ratio 3 : 5.
(Atomic mass of C = 12 u, O = 16 u, H = 1 u,
S = 32 u, Ca = 40 u, Mg = 24 u)

A [Board Term-II, 2013]

- Ans. (i)** Molecular mass of $\text{CO}_2 = 44 \text{ u}$

$$5 \text{ mole of } \text{CO}_2 = 5 \times 44 = 220 \text{ gm}$$

Molecular mass of $\text{H}_2\text{S} = 34 \text{ u}$

$$5 \text{ mole of H}_2\text{S} = 5 \times 34 = 170 \text{ gm}$$

Hence, both do not have same mass.

- $$\text{(ii) } \begin{aligned} 40 \text{ gm of Ca} &= 1 \text{ mole} \\ 240 \text{ gm of Ca} &= 1/40 \times 240 = 6 \text{ mole} \\ 24 \text{ gm of Mg} &= 1 \text{ mole} \\ 240 \text{ gm of Mg} &= 1/24 \times 240 = 10 \text{ mole} \\ \therefore \text{Molar ratio is } 6 : 10 \text{ i.e., } 3 : 5 & \quad (2\frac{1}{2} + 2\frac{1}{2}) \end{aligned}$$

- Q. 4.** (a) What are polyatomic ions ? List two examples.
 (b) Find the mass of 10 moles of sodium sulphite (Na_2SO_3).
 $(\text{Na} = 23 \text{ u}; \text{S} = 32 \text{ u}; \text{O} = 16 \text{ u})$
 (c) (i) Calculate the number of molecules in 8 gm of oxygen gas.
 (ii) Convert 22 gm of CO_2 into moles.
 $(\text{C} = 12 \text{ u}, \text{O} = 16 \text{ u}, N_0 = 6.022 \times 10^{23} \text{ per mole})$

[A] [Board Term-II, 2012]

- Ans. (a)** A group of atoms carrying a charge is known as polyatomic ion. 1 + 1

e.g., PO_4^{3-} , SO_4^{2-} , NH_4^+ .

(b) Mass of 10 moles of Na_2SO_3

$$\begin{aligned} &= 10 (23 \times 2 + 32 + 16 \times 3) \\ &= 1260 \text{ gm} \end{aligned} \quad \text{1}$$

(c) (i) $m = 8 \text{ gm}$, $M = 32 \text{ gm}$, $N = ?$, $N_0 = 6.022 \times 10^{23}$

$$\therefore n = \frac{m}{M} = \frac{8}{32} = 0.25 \quad \text{1}$$

$$\begin{aligned} N &= n \times N_A \\ &= 0.25 \times 6.022 \times 10^{23} \\ &= 1.50550 \times 10^{23} \text{ molecules} \end{aligned}$$

(ii) $m = 22 \text{ gm}$, $M = 44$, $n = ?$

[CBSE Marking Scheme, 2012]

- Q. 5. (i) Define mole.**

(ii) How is it related to Avogadro's constant, relative mass and molecular mass ?

(iii) What is the number of molecules in 0.25 moles of oxygen ? Avogadro's No. = 6.022×10^{23}

A [Board Term-II, 2012]

- Ans. (i) Mole :** One mole of any species (atoms, molecules, ions or particles) is that quantity in number having a mass equal to its atomic or molecular mass in grams. 1

(ii) $1 \text{ mole} = 6.022 \times 10^{23}$ in number – Relative mass in g. 2

(iii) 1 mole of oxygen contain 6.022×10^{23} molecules
 0.25 mole of oxygen contain $6.022 \times 10^{23} \times 0.25 = 1.505 \times 10^{23}$ molecules. 2

Q. 6. (i) What do the following symbols / formulae stand for?

- (ii) Give the chemical formula of the following compounds :

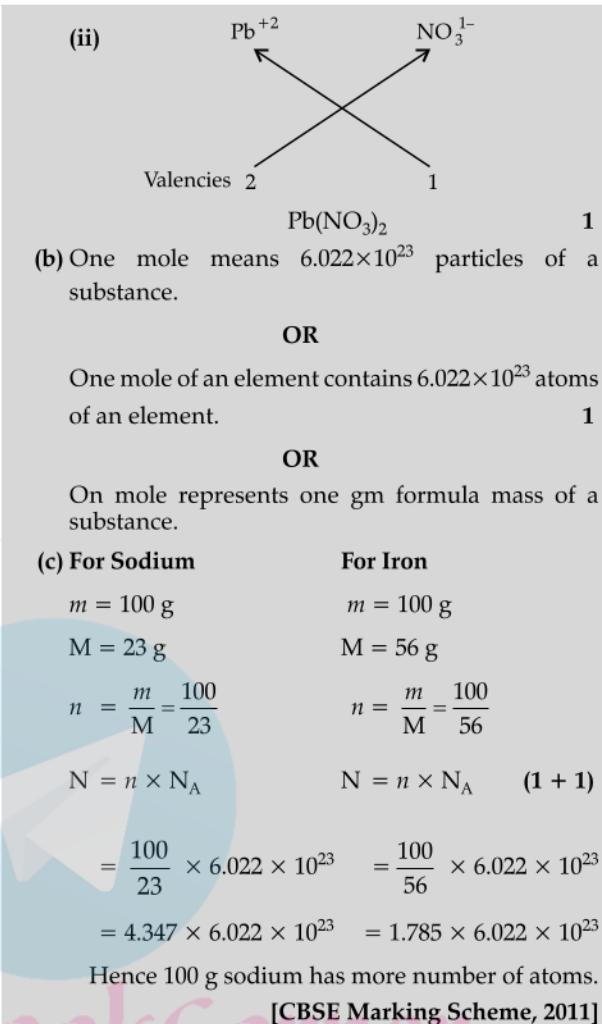
ATOMS AND MOLECULES

- (a) Potassium carbonate
 (b) Calcium chloride
 (iii) Calculate the formula unit mass of $\text{Al}_2(\text{SO}_4)_3$
 (Given : Atomic mass of Al = 27 u, S = 32 u, O = 16 u)
 [R+U] (Board Term-II, 2012)

Ans. (i) (a) Two atoms of oxygen : 2O $\frac{1}{2}$
 (b) Diatomic oxygen : O_2 molecule $\frac{1}{2}$
 (c) Triatomic oxygen : O_3 molecule $\frac{1}{2}$
 (d) Two atoms of hydrogen and one atom of oxygen forming one molecule of water (H_2O). $\frac{1}{2}$
 (ii) (a) K_2CO_3 : Potassium carbonate $\frac{1}{2}$
 (b) CaCl_2 : Calcium chloride $\frac{1}{2}$
 (iii) $\text{Al}_2(\text{SO}_4)_3$
 $\text{Al} = 27 \times 2 = 54 \text{ u}$
 $\text{S} = 32 \times 3 = 96 \text{ u}$
 $\text{O} = 16 \times 12 = 192 \text{ u}$
 Formula unit mass = $54 + 96 + 192 = 342 \text{ u}$. 2
 [CBSE Marking Scheme, 2012]

- Q. 7. (a) Write the formula of the compounds formed by the following ions.
 (i) Cr^{3+} and SO_4^{2-} (ii) Pb^{2+} and NO_3^-
 (b) State the significance of one mole.
 (c) Which has more number of atoms 100g of sodium or 100 g of iron. (At. mass : Na = 23 u, Fe = 56 u) A (Board Term-II, 2011)

Ans. (i) Cr^{3+} SO_4^{2-}
 Valencies 3 2
 $\text{Cr}_2(\text{SO}_4)_3$ 1



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CHAPTER**2****STRUCTURE
OF ATOM****Syllabus**

- *Electrons, protons and neutrons, Valency, chemical formula of common compounds, Isotopes and Isobars.*

Revision Notes

- An atom is divisible and consists of charged particles.
- Ionization of gases in the discharge tube proved that atoms have sub-atomic particles.
- **Summary of characteristics of electrons, protons and neutrons :**

Characteristics	Electron	Proton	Neutron
Symbol	e	p	n
Relative charge	- 1	+ 1	0
Nature	Negatively charged	Positively charged	Neutral
Discovered by	J. J. Thomson	E. Goldstein	James Chadwick
Mass	1/2000 times mass of hydrogen atom	1 unit	Mass is nearly equal to that of proton

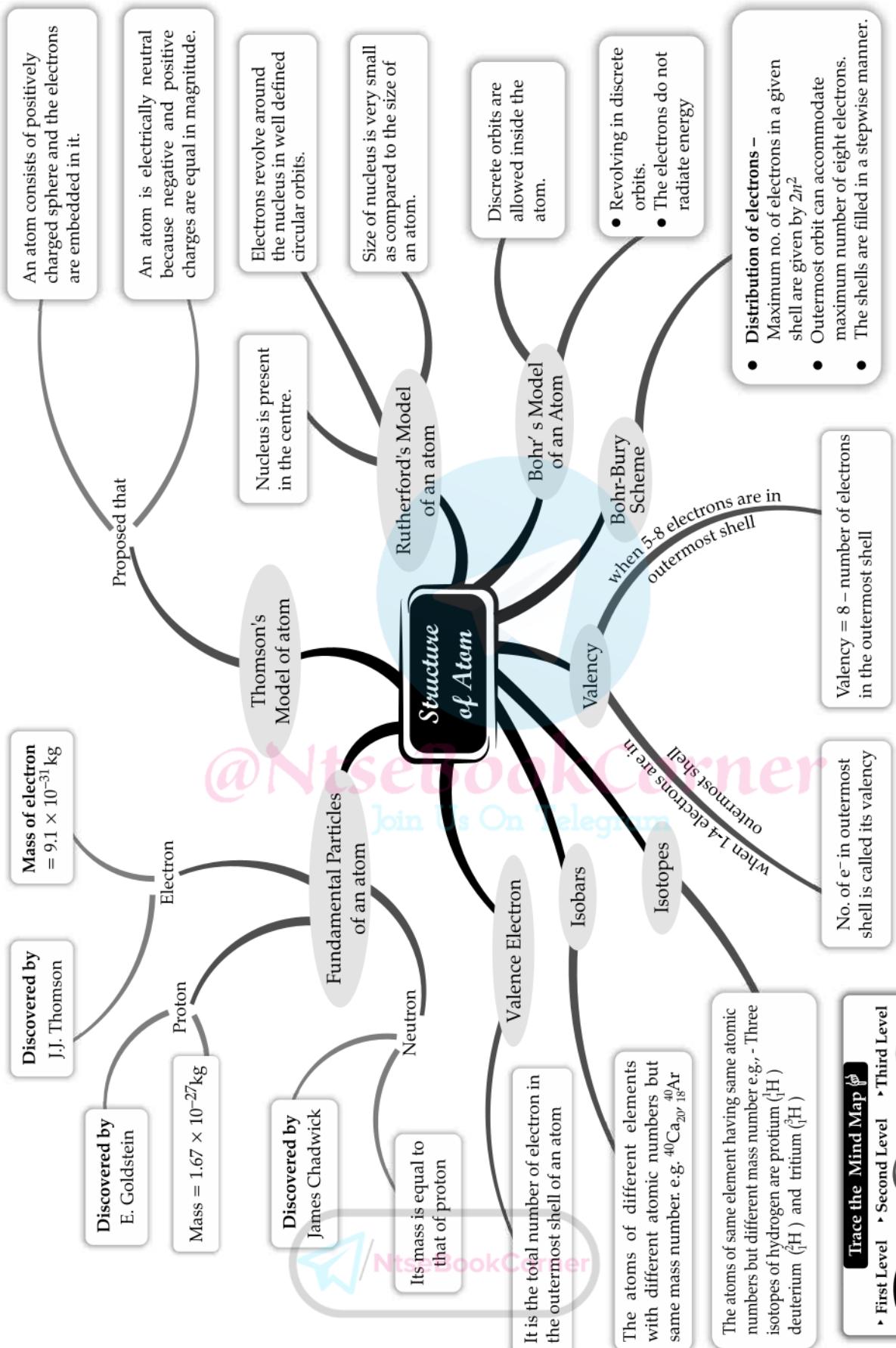
- **Thomson's model of atom :**
 - (i) An atom is a uniform sphere of positive charges (due to the presence of protons) as well as negative charges (due to the presence of electrons) which are embedded in it. This model is often called the 'Watermelon Model'.
 - (ii) An atom, as a whole, is electrically neutral because the negative and positive charges are equal in magnitude.
- **Limitations of Thomson's model of atom :** The model failed to explain how protons and electrons could be arranged in an atom so close to each other.
- α -particles are charged particles having two units of positive charge and four units of mass, i.e., they are double-charged helium ions (He^{2+}).
- **Observations predicted from α -particle scattering experiment by Rutherford based on Thomson's model of atom are :**
 - (i) Rutherford expected that if the model proposed earlier by J. J. Thomson, according to which there is uniform distribution of positive and negative charge, was correct then α -particles striking the gold atoms would be uniformly deflected which was not the case.
 - (ii) Since the α -particles were much heavier than the protons, he did not expect to see large deflections.
- **Selection of gold metal for Rutherford's α -particle scattering experiment :** Gold is easily malleable and can be beaten into very thin sheets.

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Rutherford's Model of Atoms

STRUCTURE OF ATOM



➤ **Observations made by Rutherford from α -particle scattering experiment :**

- (i) Most of the α -particles passed straight through gold foil without suffering any deflection from their original path.
- (ii) Some of the α -particles were deflected by the foil at small angles.
- (iii) One out of every 12000 particles appeared to rebound.

➤ **Conclusions from Rutherford's α -particle scattering experiment :**

- (i) Most of the space inside the atom is empty. Hence, it allows the α -particles to pass straight through it without any deflection.
- (ii) Very few particles were deflected from their path, which suggests that the positive charge of the atom occupies very little space.
- (iii) The total volume occupied by a nucleus is very small compared to the total volume of the atom, as very few α -particles are reflected by 180° , and all the positive charge and mass of the gold atom were concentrated in a very small volume within the atom.

➤ **Rutherford's nuclear model of an atom :**

- (i) There is a positively charged centre in an atom called the nucleus and the entire mass of atom resides in the nucleus.
- (ii) Electrons revolve around the nucleus in well-defined circular orbits.
- (iii) Size of the nucleus is very small as compared to the size of an atom.

➤ **Defects in Rutherford's model of atom :**

- (i) Rutherford had proposed that electrons move around a positively charged nucleus at a very high speed in circular orbits. Electron would have to be accelerated centripetally (tending to move toward a center) to remain in a circular orbit, but according to electromagnetic theory, if charged body (electron) is accelerated around another charged body (nucleus) then there would be continuous radiation of the moving body (i.e. electron). This loss of energy would slow down the speed of electron and eventually electron would fall into nucleus. But Rutherford's model could not explain such a collapse.
- (ii) Rutherford had proposed that electrons revolve around the nucleus in fixed orbits. He did not specify the number of electrons in each orbit.

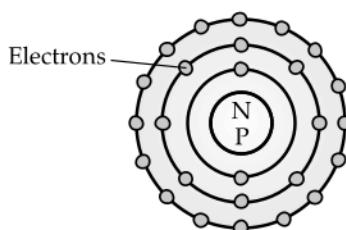
➤ **Postulates put forward by Bohr regarding model of atom :**

- (i) Electrons revolve around the nucleus in a limited number of orbits called discrete orbits of electrons that are also called as permissible orbits.
- (ii) While revolving in discrete orbits, the electrons do not radiate energy i.e., energy of an electron remains constant so long as it stays in a given orbit. Electrons present in different orbits have different energies.
- (iii) When an electron jumps from lower energy level to higher energy level, some energy is absorbed, while energy is released when electron jumps from higher energy level to lower one.

➤ **Orbits or shells are represented by the letters K, L, M, N... or the numbers, $n = 1, 2, 3, 4, \dots$**

➤ **Bohr-Bury scheme for distribution of electrons in different orbits :**

- (i) Maximum number of electrons that can be accommodated in a shell is given by $2n^2$, where n is the shell number i.e., first shell can accommodate two electrons, second shell can accommodate eight electrons, third shell can accommodate 18 electrons and so on.



- (ii) Outermost orbit of an atom can accommodate a maximum number of eight electrons.
- (iii) Electrons are not accommodated in a given shell, unless the inner shells are filled i.e. the shells are filled in a step-wise manner.
- Outermost shell of an atom is called valence shell.
- Neutrons are situated in the nucleus of all the atoms, except hydrogen.
- If the outermost shell of an atom is completely filled, its valency is 0.
- **Valency of elements having 1 to 4 electrons in the outermost shell are generally determined by the rule :**
Valency = Number of electrons in the outermost shell.

STRUCTURE OF ATOM

- **Vency of elements having number of electrons in outermost shell close to 8** is determined by the formula :
Valency = 8 – Number of electrons in the outermost shell.
- **Significance of valence electrons :**
 - (i) Valence electrons are responsible for chemical changes.
 - (ii) Elements having same number of valence electrons in their atoms possess similar chemical properties because chemical properties of an element are determined by the number of valence electrons in an atom.
 - (iii) Elements having different number of valence electrons in their atoms possess different chemical properties.
- Protons and neutrons together are called nucleons.
- All atoms of an element have the same atomic number.
- Atomic number is denoted by 'Z' ($Z = n_p$).
- For a neutral atom, number of protons and electrons are equal.
- Mass number is denoted by 'A' ($A = n_p + n_N$).
- n_p = No. of protons
 n_N = No. of neutrons
- **Isotopes:**
 - (i) Isotopes are the atoms of same element having same atomic number but different mass number.
 - (ii) Isotopes have similar chemical properties because they have same number of valence electrons.
 - (iii) Isotopes have different physical properties such as boiling point and melting point because they have different mass numbers.
 - (iv) Atomic masses of elements are fractional, due to the fact that all elements have isotopes.
 - (v) **Applications of isotopes:**
 1. An isotope of uranium is used in nuclear reaction.
 2. An isotope of cobalt is used to remove brain tumours and their treatment.
 3. Isotope of sodium has been used to diagnose restricted circulation of blood.
 - (vi) **Example:** 3 isotopes of hydrogen–protium, deuterium and tritium.
- **Isobars:** Isobars are the atoms of different elements with different atomic numbers, but same mass number.
Example : $^{20}_{\text{Ca}}{}^{40}$, $^{18}_{\text{Ar}}{}^{40}$.

**Know the Terms**

- **Canal rays** : Positively charged radiations discovered by Goldstein in a gas discharge tube at low pressure and high voltage.
- **Electron** : Negatively charged particle.
- **Proton** : Positively charged particle.
- **Neutron** : Neutral particle.
- **Nucleon** : Proton and neutron
- **Energy level** : Possible locations around an atom where electrons having specific energy values may be found.
- **Octet** : Shell which has eight electrons in the outermost shell.
- **Valency** : Combining capacity of an atom.
- **Valence shell** : Outermost shell of an atom.
- **Valence electrons** : Electrons present in the valence shell.
- **Atomic number** : Total number of protons present in the nucleus of an atom.
- **Nucleons** : A nucleon is one of the particles that make up the atomic nucleus.
- **Mass number** : Sum of the total number of protons and neutrons present in the nucleus of an atom.

**(A) OBJECTIVE QUESTIONS****1 Mark Each****Stand Alone MCQs**

- Q. 1. Which of the following correctly represent the electronic distribution in the Mg atom?

- (A) 3, 8, 1 (B) 2, 8, 2
(C) 1, 8, 3 (D) 8, 2, 2

Ans. Option (B) is correct.

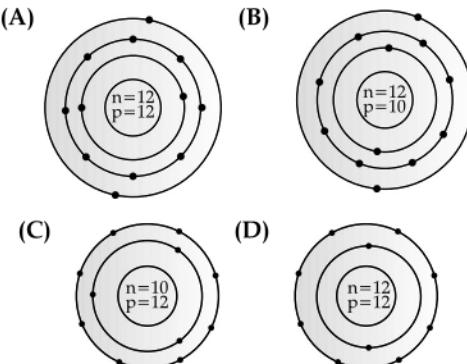
Explanation: Atomic number and the number of electrons in magnesium atom is 12. So, electronic configuration is 2, 8, 2 (because $12=2+8+2$).

- Q. 2. Rutherford's alpha particles scattering experiment resulted into discovery of:

STRUCTURE OF ATOM

Number of electrons in the Al^{3+} ion = $13 - 3 = 10$ as it is formed from the neutral atom by loss of 3 electrons.

- Q. 9.** Identify the Mg^{2+} ion from the figure where, n and p represent the number of neutrons and protons respectively.



Ans. Option (D) is correct.

Explanation: Electronic configuration of Mg atom = 2, 8, 2 and that of Mg^{2+} ion = 2, 8
Number of protons in Mg atom = $2 + 8 + 2 = 12$ Number of neutrons in Mg atom = $24 - 12 = 12$ [as mass number of Mg atom = 24 and number of neutrons = mass number – number of protons].

- Q. 10.** In a sample of ethyl ethanoate ($\text{CH}_3\text{COOC}_2\text{H}_5$) the two oxygen atoms have the same number of electrons but different number of neutrons, which of the following is the correct reason for it?

- (A) One of the oxygen atoms have gained electrons.
- (B) One of the oxygen atoms has gained two neutrons.
- (C) The two oxygen atoms are isotopes.
- (D) The two oxygen atoms are isobars.

Ans. Option (C) is correct.

Explanation: The two O-atoms in $\text{CH}_3\text{COOC}_2\text{H}_5$ can have different number of neutrons only if the two O-atoms are isotopes. It is because; isotopes of an element have same number of protons (and electrons) but different number of neutrons.

- Q. 11.** Elements with valency 1 are :

- (A) Always metals.
- (B) Always metalloids.
- (C) Either metals or non-metals.
- (D) Always non-metals.

Ans. Option (C) is correct.

Explanation: Metals and non-metals both can have valency 1. Metals which have 1 valence electron and non-metals which have 7 valence electrons have valency 1. It is because; metals lose their $1 e^-$ and non-metals gain $1 e^-$ to complete their octet.

- Q. 12.** The first model of an atom was given by :

- (A) N. Bohr
- (B) E. Goldstein
- (C) Rutherford
- (D) J.J. Thomson

Ans. Option (D) is correct.

Explanation: The first model of an atom was given by J.J. Thomson. According to him, an atom consists of a sphere of positive charge with negatively charged electrons embedded in it.

- Q. 13.** An atom with 3 protons and 4 neutrons will have a valency of

- (A) 3
- (B) 7
- (C) 1
- (D) 4

Ans. Option (C) is correct.

Explanation: Given that, number of protons in an atom = 3 and number of neutrons = 4, K, L Electronic configuration of ${}^3\text{Li}$ = 2, 1. As, it has one valence electron, therefore its valency is also 1.

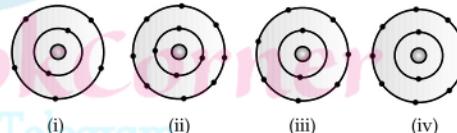
- Q. 14.** The electron distribution in an aluminium atom is

- (A) 2, 8, 3
- (B) 2, 8, 2
- (C) 8, 2, 3
- (D) 2, 3, 8

Ans. Option (A) is correct.

Explanation: Aluminium atom has 13 protons and 13 electrons. Therefore, Electronic configuration of ${}^{13}\text{Al}$ = 2, 8, 3

- Q. 15.** Which of the following in figure does not represent Bohr's model of an atom correctly?



- (A) (i) and (ii)
- (B) (ii) and (iii)
- (C) (ii) and (iv)
- (D) (i) and (iv)

Ans. Option (C) is correct.

Explanation: Figures (ii) and (iv) do not correctly represent the Bohr's model of an atom. It is because maximum number of electrons in K (I) shell is 2, not 4, so (ii) is wrong and maximum capacity of L (II) shell is 8 electrons, not 9. So, (iv) is also wrong.

- Q. 16.** Which of the following statement is always correct?

- (A) An atom has equal number of electrons and protons.
- (B) An atom has equal number of electrons and neutrons.
- (C) An atom has equal number of protons and neutrons.
- (D) An atom has equal number of electrons, protons and neutrons.

Ans. Option (A) is correct.

STRUCTURE OF ATOM

Commonly Made Error

- Students may get confuse in the symbolic representation of atomic number and mass number of an atom.

Answering Tip

- Students should practice writing the symbolic representation of atomic number and mass number to avoid confusion.

Q. 10. What will be the number of neutrons if an atom has mass number = 23 and the number of electrons = 11 ? A [O.E.B.]

Ans. Number of electrons = 11

Mass number = 23

Atomic number = number of electrons = 11

Hence, number of neutrons

$$\begin{aligned} &= \text{mass number} - \text{atomic number} \\ &= 23 - 11 = 12 \end{aligned} \quad \frac{1}{2}$$

Q. 11. Write the formula for calculating the maximum number of electrons in an orbit. R [O.E.B.]

Ans. The formula for calculating the maximum number of electrons in an orbit is $2n^2$. 1

Commonly Made Error

- Students may get confuse in finding the maximum capacity of a particular shell.

Answering Tip

- Students should remember the formula for calculating maximum number of electrons in an orbit. It helps them to find out the capacity of a particular shell in an atom.

Q. 12. Explain what do you understand by valence electrons ? R [Board Term-II 2015]

Ans. The electrons present in the outermost shell of an atom are called as valence electrons. 1

[CBSE Marking Scheme, 2015]

Q. 13. Write down the electron distribution of oxygen atom. How many valence electrons does it have ? (Atomic number of oxygen is 8) U [Board Term-II 2015]

Ans. O(8) = 2, 6 ½
K L

Number of valence electrons = 6 ½

[CBSE Marking Scheme, 2015]

Q. 14. If 'K' and 'L' shells of an atom are completely filled with electrons then :

- what will be the total number of electrons in the atom ?

- find its valency. U [Board Term-II 2013]

Ans. (i) Valence electrons = 2 (K), 8 (L) = 10
(ii) Valency = 0 (½ + ½)

Commonly Made Error

- Students often calculate incorrect values of valence electrons and valency. It seems they are confused between these two terms.

Answering Tip

- Lay stress on understanding the concept instead of rote learning.

Q. 15. What is the valency of oxygen [Atomic number of oxygen = 8] ? U [O.E.B.]

Ans. Electronic configuration of oxygen is = 2, 6. Hence, valency = 8 – 6 = 2 1

Short Answer Type Questions-I

(2 Marks Each)

Q. 1. Which atom, Na^+ or He, has completely filled K and L shells ? Give reason to support your answer.

A [Board Term-II 2011, Set-A]
OR

Na^+ has completely filled K and L shells. Explain. [NCERT]

Ans. K L M K L K
 $\text{Na} = 2, 8, 1$ $\text{Na}^+ = 2, 8$ $\text{He} = 2$
 Na^+ has completely filled K and L shells. Na atom gets converted into Na^+ by losing one electron from its outermost shell. He atom has only K shell. 2

Q. 2. An atom of an element has three electrons in its 3rd orbit, which is the outermost shell. Write :

- the electronic configuration
- atomic number
- number of protons
- valency

A [Board Term-II 2011]

Ans. (i) Electronic configuration - 2, 8, 3

(ii) Atomic number - 13

(iii) Number of protons - 13

(iv) Valency - 3

$\frac{1}{2} \times 4 = 2$

[CBSE Marking Scheme, 2011]

Q. 3. An element 'Z' forms the following compound when it reacts with hydrogen, chlorine, oxygen and phosphorus. R [Board Term-II 2011, Set-B]
 ZH_3 , ZCl_3 , Z_2O_3 and ZP

- What is the valency of element Z ?
- Element 'Z' is metal or non metal?

Ans. (i) The valency of Z is 3. 1

(ii) Z is a metal because it is electropositive and reacts with non-metals.

[CBSE Marking Scheme, 2011] 1

Q. 4. An atom of an element has one electron in the outer most M shell. State its:

- Electronic configuration
- Number of protons
- Atomic number
- Valency of this element

A [Board Term-II 2011, Set-B]

Ans. (i) Electronic configuration - 2, 8, 1

(ii) Number of protons - 11

(iii) Atomic number - 11

(iv) Valency of this element - 1

$$\frac{1}{2} \times 4 = 2$$

Q. 5. Give one word for the following :

(i) Positively charged atom.

(ii) A group of atoms carrying a charge.

R

Ans. (i) Positively charged atom : Cation

1

(ii) Group of atoms carrying a charge : Polyatomic ion.

Q. 6. How many electrons, protons and neutrons will be there in an element ${}_{9}^{19}X$? What will be the valency of the element ?

A

Ans. No. of protons = Atomic number = 9

No. of protons + neutrons = Mass number = 19

Number of electrons = 9

Number of protons = 9

Number of neutrons = Mass number - Atomic number

$$= 19 - 9 = 10$$

Electronic configuration of X = 2, 7

Valency of X = 1 (since it requires one electron to complete its octet) $\frac{1}{2} \times 4 = 2$

Q. 7. (a) J. Chadwick discovered a sub-atomic particle that has no charge and has mass nearly equal to that of a proton. Name the particle and give its location in the atom .

(b) If 'K' and 'L' shells of an atom are completely filled, then what would be :

(i) the total number of electrons in the atom and

(ii) its valency?

A [O.E.B.]

Ans. (a) Particle is neutron.

Neutron is present in the nucleus of an atom.

(b) (i) Total number of electrons = 10

(ii) Valency is zero.

$$\frac{1}{2} \times 4 = 2$$

Q. 8. Composition of the nuclei of two atoms 'X' and 'Y' are given below :

	X	Y
Protons	4	4
Neutrons	4	6

Give the mass number of X and Y. Mention the relationship between the two atoms.

A [O.E.B.]

Ans. (i) Mass number i.e., Atomic mass of element X = Number of protons + Number of neutrons

$$= 4 + 4 = 8 \text{ u} \quad \frac{1}{2}$$

(ii) Mass number i.e., Atomic mass of element Y =

Number of protons + Number of neutrons

$$= 4 + 6 = 10 \text{ u} \quad \frac{1}{2}$$

Relationship between X and Y: Isotope.

The atomic number of both the elements is same, but their atomic masses are different.

1

Short Answer Type Questions-II

(3 Marks Each)

AT Q. 1. The discovery of subatomic particles led to a revolution in the study of matter. Name the scientists who discovered these sub-atomic particles.

R [Board Term-II 2016]

Ans. Electron : by J.J Thomson in 1897

Proton : by E. Goldstein in 1886

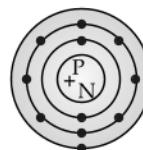
Neutron : by James Chadwick in 1932 (1 + 1 + 1)

Q. 2. Illustrate that Na atom has completely filled K and L shells.

U [Board Term-II 2016]

Ans. Electronic configuration of Na is : 2, 8, 1

K L M



K shell of Na has 2, L shell has 8 and M shell has one electron. 3

Q. 3. Write the electronic configuration and valency of the following :

(i) Chlorine

(ii) Sodium and

(iii) Silicon

U [Board Term-II 2016]

Ans. (i) E.C. of Cl = 2, 8, 7

Valency = -1

(ii) E.C. of Na = 2, 8, 1

Valency = 1

(iii) E.C. of Si = 2, 8, 4

Valency = 4 3

AT Q. 4. List the observations in α -particle scattering experiment which led Rutherford to make the following conclusions :

(i) Most of the space in an atom is empty.

(ii) Whole mass of an atom is concentrated in its centre.

(iii) Centre is positively charged.

A [Board Term-II 2016]

Ans. (i) Most of the alpha-particles passed through the gold foil without getting deflected.

(ii) Very few particles were deflected from their path by 180° , indicating that whole mass of the atom is present at its centre.

(iii) Few particles deflected at small and large angles from their path indicating that centre is positively charged. (1 × 3 = 3)

Q. 5. There are two elements A_{13}^{26} and B_{14}^{26} . Find the number of sub-atomic particles in each of these elements. What is the relationship between the two ?

A [Board Term-II 2015]

Ans. A_{13}^{26} electrons = 13 protons + 13 neutrons

Atomic number = $26 - 13 = 13$

B_{14}^{26} electrons = 14 protons + 12 neutrons

Atomic number = $26 - 14 = 12$

3

They are isobars. [CBSE Marking Scheme, 2015]

Q. 6. (i) Why chemical properties of all the isotopes of an element are same ?

(ii) Name the isotopes used in the treatment of goitre and cancer.

(iii) An element 'X' has 2 electrons in its M shell. What is its atomic number ? R [Board Term-II 2015]

STRUCTURE OF ATOM

Ans. (i) This is because isotopes have same atomic number, so the number of valence electrons present in them is same and it is the valence electrons which take part in chemical reactions. So the isotopes of an element have same chemical properties.

(ii) Goitre – Isotope of iodine

Cancer – Isotope of cobalt

(iii) Atomic number of X = 12. $(1 \times 3 = 3)$

[CBSE Marking Scheme, 2015]

Q. 7. (i) What are canal rays ? State the nature of the constituents of canal rays.

(ii) Who discovered canal rays ?

R [Board Term-II 2014]

Ans. (i) The positively charged radiations produced in the discharge tube at low pressure and high voltage are called canal rays. The canal rays have positively charged sub-atomic particles known as protons (p).

(ii) E. Goldstein. [CBSE Marking Scheme, 2014] 2 + 1

Q. 8. (i) Both Helium and Beryllium have two electrons in the valence shells. Helium is a noble gas whereas Beryllium is a metal, justify.

(ii) Hydrogen exists in three isotopic forms. Why are the isotopes of hydrogen chemically alike ?

A [Board Term-II 2014]

Ans. (i) ${}_2\text{He} = 2$ ${}_4\text{Be} = 2, 2$

In case of He, its first shell is the last shell with $2 e^-$ (stable).

(ii) Hydrogen isotopes = H_1^1 , H_1^2 , H_1^3 , are chemically similar because they have same atomic number.

[CBSE Marking Scheme, 2014] 3

Q. 9. (i) Which isotope is used in the treatment of cancer ?

(ii) A particle contains 11 protons and 10 electrons. Write the symbol and the name of the particle.

(iii) What do you think will be the observation if the alpha-particle scattering experiment is carried out using a foil of a metal other than gold ?

A [Board Term-II 2013]

Ans. (i) Cobalt.

(ii) Element is Na (Sodium) and due to less electrons than proton, the particle is Na^+ (Sodium ion).

(iii) The observation will be the same with the foil of any heavy metal, but in case of the foil of lighter metal, the massive alpha-particles may push the nucleus and may not be deflected. $(1 \times 3 = 3)$

Q. 10. An element 'X' has a mass number 27 and it contains 13 protons.

(i) Write the symbolic representation of the element.

(ii) Find the number of neutrons and electrons in the element.

(iii) Write electronic configuration of the element.

A [Board Term-II 2013]

Ans. (i) Symbolic representation : ${}_{13}^{27}\text{X}$.

(ii) Number of neutrons : 14; Number of electrons : 13

(iii) Electronic configuration : 2, 8, 3 $(1 \times 3 = 3)$

Q. 11. (a) Mention the postulates that Niels Bohr put forward to overcome the objections raised against Rutherford's atomic model.

(b) Write the electronic configuration of magnesium atom. R [Board Term-II 2013]

Ans. (a) (i) Only certain special orbits known as discrete orbits of electrons are allowed inside the atom.

(ii) While revolving in discrete orbits, the electrons do not radiate energy.

(b) Electronic configuration of Mg atom is 2, 8, 2.

$(1 \times 3 = 3)$

Q. 12. Answer the following questions :

(a) What are the postulates of Bohr's atomic model ?

(b) Who discovered neutron ?

(c) Name the scientist who concluded that the size of nucleus is very small as compared to the size of an atom.

R [KVS-2018-19]

Ans. (a) Postulates of Bohr's atomic model :

(i) Only certain special orbits known as discrete orbits of electrons are allowed inside the atom.

(ii) While revolving in discrete orbits the electrons do not radiate energy. 2

(b) J. Chadwick $\frac{1}{2}$

(c) Rutherford. [CBSE Marking Scheme, 2014] $\frac{1}{2}$

Q. 13. List Bohr-Bury rules for distribution of electrons in different shells (any two). Draw the atomic structure of an atom with atomic number 11.

R [DDE 2017]

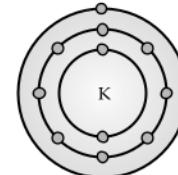
Ans. The following rules were given by Bohr-Bury :

(i) The maximum number of electrons present in a shell is given by $2n^2$ where 'n' represents orbit number 1, 2,.....

(ii) The maximum number of electrons that can be accommodated in the outermost orbit is 8.

(iii) Electrons are not accommodated in a given shell, unless the inner shells are filled i.e., shells are filled in a stepwise manner. (any two)

Atomic number : 11.	K	L	M
	2	8	1



Atomic structure (Atomic number 11) (2 + 1)

Q. 14. Given that the percentage abundance of the isotope ${}_{10}\text{Ne}^{20}$ is 90% and that of isotope ${}_{10}\text{Ne}^{22}$ is 10%. Calculate the average atomic mass of Neon.

R [KVS-2018-19]

Ans. Average atomic mass is given by :

$$20 \times \frac{90}{100} + 22 \times \frac{10}{100}$$

$$(18 + 2.2)u = 20.2u$$

3

Q. 16. Atomic number and mass number of an element are 18 and 40 respectively. Identify the element

STRUCTURE OF ATOM

Q. 4. Describe Rutherford's α -particle scattering experiment and mention the important observations and conclusions drawn from this experiment.

[Board Term-II 2014]

Ans. In this experiment, fast moving α -particles were made to fall on a thin gold foil.

The following observations were made :

- Most of the fast moving α -particles passed straight through the gold foil.
- Some of the α -particles were deflected by the foil by small angles.
- One out of every 12000 particles appeared to rebound.

Conclusions :

- Most of the space inside the atom is empty because most of the α -particles passed through the gold foil without getting deflected.
- Very few particles were deflected from their path, indicating that the positive charge of the atom occupies very little space.
- A very small fraction of α -particles was deflected by 180° , indicating that all the positive charge and mass of the gold atom were concentrated in a very small volume within the atom. 5

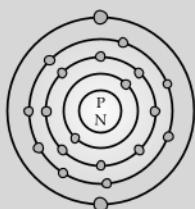
[CBSE Marking Scheme, 2014]

Q. 5. (i) Calculate the number of electrons, protons and neutrons in an atom of an element with atomic number 20 and mass number 40. Write electronic configuration and draw the structure of the atom.

- An atom has complete K and L shells. Is this an atom of a metal, non-metal or noble gas? Justify.

[Board Term-II 2014]

Ans. (i) $e = 20$, $p = 20$, $n = 40 - 20 = 20$, Electronic Configuration = 2, 8, 8, 2.



(ii) Atom has K = $2 e^-$ L = $8 e^-$

\therefore Total electrons = $2 + 8 = 10 e^- \Rightarrow$ complete shell with $8 e^-$

\therefore Noble gas. [CBSE Marking Scheme, 2014] 5

Commonly Made Error

- Students often overlook the parts of question in hurry.

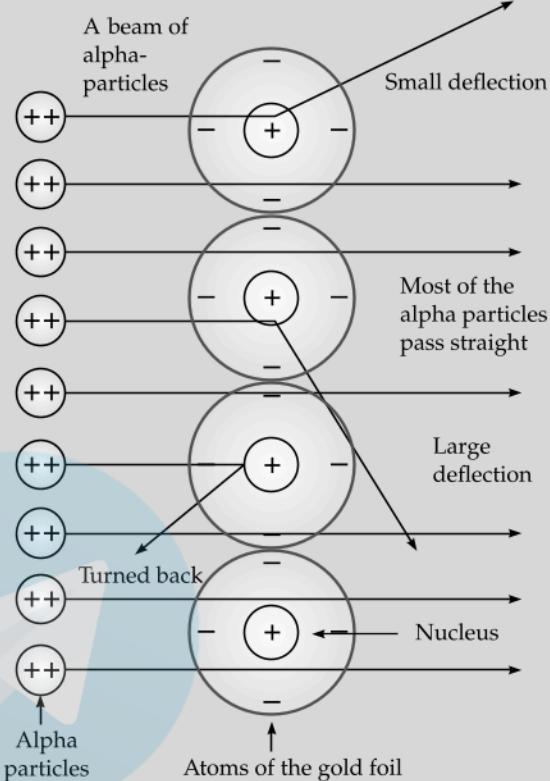
Answering Tip

- Comprehend what is being asked before answering by reading the question carefully. Write all events in points. Don't waste time in elaborating the answer. Do not overlook any part of a question. Avoid being in a hurry to conclude the answer.

Q. 6. Explain Rutherford's α -particles scattering experiment with diagram and observations.

[NCERT Exemplar]

Ans. Rutherford bombarded a stream of α -particles on a thin gold foil. ½



(i) Most of the α -particles passed through the foil without any deflection. ½

(ii) A few α -particles were deflected through small angles and few through larger angles. ½

(iii) The number of α -particles that bounced back was very small. ½

The important conclusions drawn from the experiment are :

- An atom consists of positively charged centre called nucleus. 1
- The electrons revolve around the nucleus in well defined orbits. 1
- The size of the nucleus is very small as compared to the size of the atom. 1

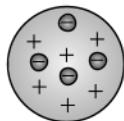
[CBSE Marking Scheme, 2011]

Q. 7. Write postulates of Thomson's model of an atom with diagram. What were the limitations of this model?

[O.E.B.]

Ans. Postulates of Thomson's model of an atom are :

- An atom is uniform sphere of positive charges (due to presence of protons) as well as negative charges (due to presence of electrons), which are embedded in it. This model is called, watermelon or plum pudding model.
- An atom, as a whole, is electrically neutral because the negative and positive charges are equal in magnitude.



Limitations of Thomson's model of atom were :

(i) The model failed to explain how protons and electrons could be arranged in an atom so close to each other.

(ii) α -particles are charged particles having two units of positive charge and four units of mass, i.e., they are double charged helium ions (He^{2+}). (3 + 2)



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UNIT II : Organization in the Living World

CHAPTER

3

HEALTH AND DISEASES

Syllabus

- *Health and its failure, Infectious and non-infectious diseases, their causes and manifestation. Diseases caused by microbes (Virus, Bacteria and Protozoans) and their prevention; Principles of treatment and prevention, Pulse Polio programmes.*

Revision Notes

Health and its Failure : Disease and its Causes and Means of Spread

Health:

- The well being of our body is dependent on the proper functioning of its cells and tissues.
- All our body parts and activities are greatly interconnected. Hence, disfunction of any body part can affect the entire body.
- When we are healthy, we are able to perform our physical, mental and social functions well.
- Our physical and social environment plays an important role in maintaining good health.
- In addition to personal hygiene, public cleanliness should also be maintained to ensure that we remain healthy.
- Many other factors such as financial conditions, availability of nutritious food and social equality also influence the health of an individual.

Scan to know more about this topic



Diseases : Signs and Symptoms

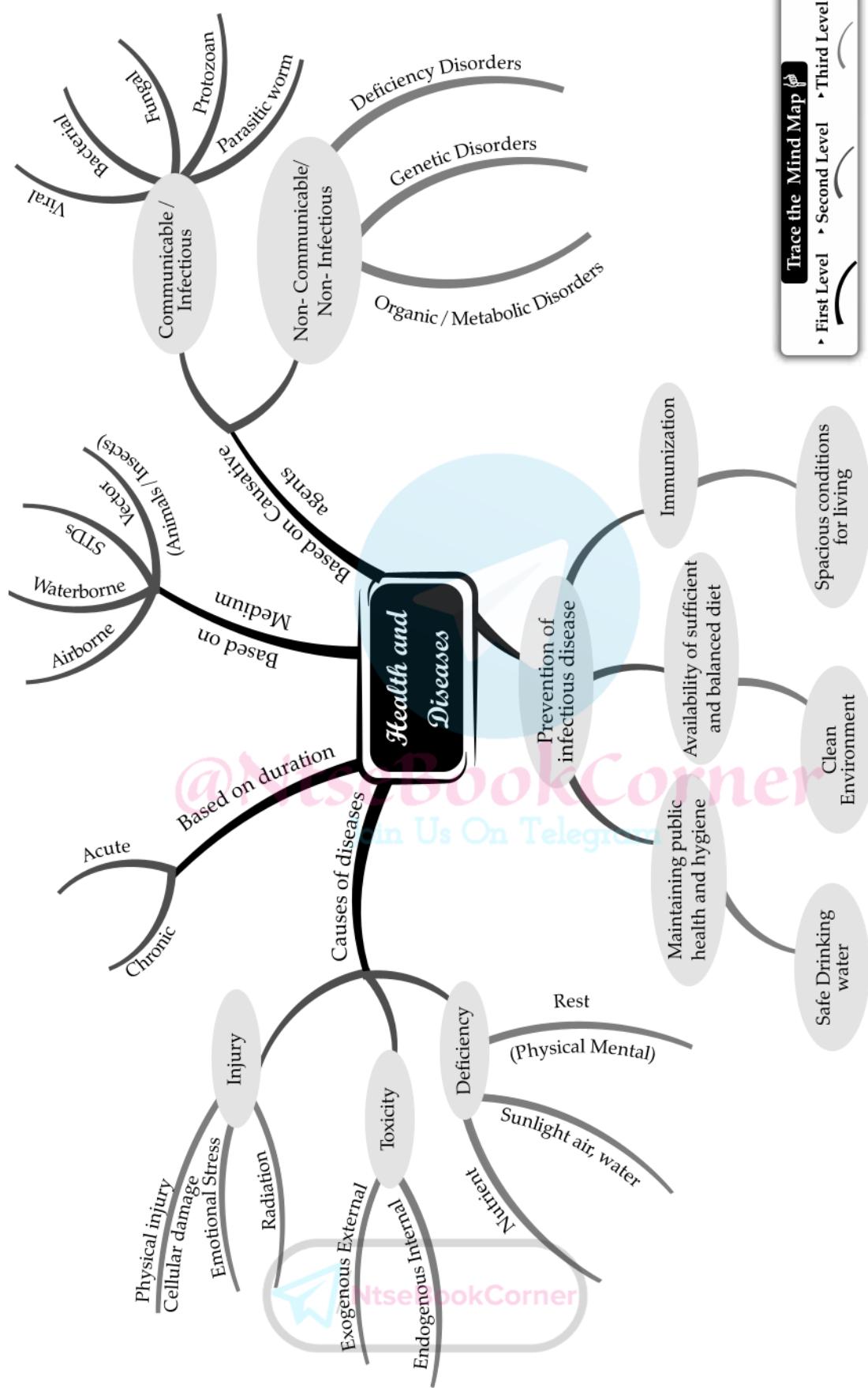
Disease and its causes:

- A person suffering from a disease is in a state of discomfort.
- Being in poor health is different from being diseased.
- Symptoms and signs of the disease appear as a result of disfunction of the affected body parts. These help to identify the disease that a person is suffering from.
- Depending on their duration, diseases may be classified as acute or chronic.
- **Acute diseases** last for a short time and do not cause major health effects. e.g., common cold.
- **Chronic diseases** persist for a long time, and hence, cause prolonged ill health. e.g., TB in lungs.
- Causes of diseases may be immediate (first-level cause) or contributory. e.g., the immediate or direct cause of a person suffering from diarrhoea is the causative agent.
- **The contributory causes could be :**
 - Lack of adequate nourishment or genetic difference (second-level cause).
 - Poverty or lack of public services (third-level cause).
- **Diseases** may be infectious or non-infectious.

Scan to know more about this topic



Life Cycle of Mosquito



HEALTH AND DISEASES

- Infectious diseases are caused by microbes or other infectious agents (e.g., Malaria) whereas non-infectious diseases have internal, non-infectious causes (e.g., High blood pressure).
- The **infectious agents** may be viruses, bacteria, fungi, protozoans or multicellular organisms such as worms.

Category of infectious agent	Examples of diseases caused
Virus	Common cold, influenza, dengue fever, AIDS
Bacteria	Typhoid, cholera, tuberculosis, anthrax
Fungi	Skin infections
Protozoans	Malaria, kala-azar
Worms	Intestinal worm infections, elephantiasis

- Many infectious diseases are called 'communicable diseases' since they can spread from one person to another.
- **Communicable diseases** can spread through air, water, food, sexual contact or vectors.
- The droplets released during coughing or sneezing of an infected person can spread air-borne diseases such as common cold, pneumonia and tuberculosis.
- **Air-borne diseases** spread quickly in overcrowded and poorly-ventilated living conditions.
- **Water-borne diseases** such as cholera spread when drinking water gets contaminated with the infectious agents.
- **Sexual contact** causes the spread of diseases such as AIDS and syphilis from the infected person to a healthy one.
- AIDS virus can also spread through blood transfusions, use of infected needles or during pregnancy and breast-feeding by an infected mother.
- **Non-Communicable disease** can not be transmissible by any infectious agent from one person to another e.g., Diabetes, Cancer etc.

Manifestation, Treatment and Prevention of Diseases

Manifestation of Diseases

- The type of treatment of a disease depends on the category of the infectious agent.
- Organisms belonging to the same category will share several important life processes, which will be different from those of organisms belonging to other categories.
- **Drugs:** working by interfering with life processes of one category of organisms will not be effective against members of another category. e.g., antibiotics act against bacteria, but not against viruses, because viruses do not share bacterial pathways.
e.g., Penicillin interferes with bacterial cell wall production and thus, kills the bacteria. Due to lack of cell walls, penicillin does not affect human cells.
- **Vectors:** are intermediate animals causing the spread of disease-causing agents from an infected person to a healthy person. For example – Female *Anopheles* mosquitoes transmit many diseases like malaria when they feed on the blood of animals and humans.
- On entering the body, the infectious agents reach their specific target organs. In certain cases, the target organ is related to their point of entry. For example – Typhoid-causing bacteria enter through mouth and reside in gut lining.
- In other instances, the target organ of the microbe has no relation to their point of entry. For example, HIV enters through the sexual organs, but spreads to all the lymph nodes.
- The symptoms of a disease depend on the target organ infected by the microbe. e.g., cough and breathing problems are seen when lungs are infected. Thus, we can get an idea of the target organ of the microbe, from the signs and symptoms of a disease.
- During infection, the activated immune system of the body sends specialized cells to destroy the microbes causing inflammation with associated local effects.
- The AIDS-causing virus destroys the functioning of the immune system, due to which the body becomes unable to fight even minor infections. Ultimately the patient succumbs to such infections.
- The severity of a disease is directly proportional to the number of infectious agents present in the body.

Scan to know more about this topic

Principle of Prevention and Treatment

Treatment of Diseases:

- An infectious disease can be treated in two ways :
 - (i) Reduce the symptoms of the disease by providing treatment.
 - (ii) Kill the infectious agent causing the disease.
- Medicines used in killing an infectious agent aim to disrupt some pathway of a vital life function peculiar to that group of organisms. These pathways are not present in other microbial groups or in humans.

Scan to know more about this topic

Vaccination

- On entering human cells, viruses use our cellular machinery for carrying out all their life processes. There are very few virus-specific biochemical pathways that can be targeted to produce anti-viral drugs.
- **The approach of treatment of an infectious disease has three drawbacks :**
 - (i) Recovery of the patient may not be complete in certain cases.
 - (ii) Treatment requires time and hence, the patient suffers from the disease and may be bedridden.
 - (iii)The patient serves as the source of infection to others.
- It is desirable to prevent a disease than to treat it completely.
- There are general and specific ways of preventing diseases.

Prevention of Diseases

- Infectious diseases can be generally prevented by public health hygiene methods, which aim to reduce exposure to infectious microbes. Public hygiene measures include providing safe drinking water, clean environment and adequately spacious conditions for living.
- Another general method of preventing infectious diseases requires the availability of sufficient and balanced diet for the proper functioning of the immune system. The immune system ensures that we do not develop a disease each time we are exposed to an infectious agent, by destroying the agent before it multiplies greatly extensively.
- During small pox epidemics, it was noted that people who survived after suffering from small pox, did not get infected with it again. Such observations led to the birth of immunization, which is a specific method of preventing infectious diseases.
- **The principle of immunization** is based on the memory of the immune system on encountering an infectious agent. On subsequent encounters with the same or related microbe, the response of the immune system is multiplied extensively, leading to quick elimination of the infection.
- For immunization, a **vaccine** (containing weakened or killed pathogen or a specific part of the pathogen) is introduced into the body to fool the immune system in remembering a particular infection. Hence, the body does not suffer even on further exposures to that pathogen or its close relatives.
- Nowadays, vaccines preventing many infectious diseases including tetanus, polio and measles are used extensively, especially in child health immunization programmes.
- Everyone in the community should have access to public hygiene and immunization for effective prevention of infectious diseases.

Know the Terms

- **Health** : A state of being well enough to function well physically, mentally and socially.
- **Disease** : Lack of feeling of ease or distress due to impairment of health or a condition of abnormal functioning or structural disorder.
- **Symptoms** : A series of events occurring that often point to a disease or condition.
- **Acute disease** : Disease lasting for a short period of time.
- **Chronic disease** : Disease lasting for a long time, even as much as a lifetime.
- **Vectors** : The intermediate animals causing the spread of infecting agents from a sick person to another potential host.
- **Infectious diseases** : Disease where pathogenic microbes are the immediate causes.
- **Non-infectious diseases** : Diseases where internal causes result in the distressed disorder.
- **Communicable disease** : A disease capable of being transmitted from an infected person to a healthy person.
- **Sign** : Objective evidence of disease perceptible to the examining physician.
- **Immediate cause of disease** : The cause which immediately kindles a disease into action, when there is a predisposition towards it or the first cause or factors which are directly responsible for a particular disease.
- **Contributory cause of disease** : A cause or condition whose presence makes it more probable that a particular disorder will occur, but that cause is neither necessary nor sufficient for the occurrence of the disease.
- **Host** : An organism that is infected with or is fed upon by a parasitic or pathogenic organism.
- **Antibiotic** : Anti-microbial agent made from microorganisms and can kill and inhibit the growth of microorganisms, especially those which are infectious or disease causing.
- **Antibiotics** : A substance produced by bacteria or fungi that destroys or prevents the growth of infectious or disease causing-organisms.
- **Immunization** : The process of inducing immunity by administering a vaccine to allow the immune system to prevent infection or illness when it subsequently encounters the infectious agent.
- **Vaccine** : A preparation of a weakened or killed pathogen or of a portion of the pathogen's structure that upon administration stimulates the immune system to fight against the pathogen, but is incapable of causing severe infection.
- **Pathogen** : Any disease-causing agent such as a virus or bacteria or other micro-organism.

HEALTH AND DISEASES

- **Inflammation :** The recruitment process by an active immune system of recruiting many cells to the affected tissue to kill off the disease causing microbes.
- **Hygiene :** Condition and practices that help to maintain health and prevent the spread of diseases.
- **Epidemic :** Rapid spread of infectious disease to a large number of people in a given population within a short period of time.



(A) OBJECTIVE QUESTIONS

1 Mark Each



Stand Alone MCQs

- Q. 1.** Which one of the following is not a viral disease?

(A) Dengue (B) AIDS
 (C) Typhoid (D) Influenza

Ans. Option (C) is correct.

Explanation: Typhoid is a bacterial disease. Dengue, AIDS, and Influenza are viral diseases.

- Q. 2.** Which one of the following is not a bacterial disease?

(A) Cholera (B) Tuberculosis
 (C) Anthrax (D) Influenza

Ans. Option (D) is correct.

Explanation: Influenza is a viral disease caused by *Myxovirus influenza*. Cholera, tuberculosis and anthrax are bacterial disease.

- Q. 3.** Which one of the following disease is not transmitted by mosquito?

(A) Brain fever (B) Malaria
 (C) Typhoid (D) Dengue

Ans. Option (C) is correct.

Explanation: Typhoid is a bacterial disease caused by *Salmonella typhi*. Mosquito *Anopheles* transmits malaria, *Culex* transmits encephalitis and *Aedes* transmits dengue.

- Q. 4.** Which one of the following disease is not caused by bacteria?

(A) Typhoid (b) Anthrax
 (C) Tuberculosis (d) Malaria

Ans. Option (D) is correct.

Explanation: Malaria is a mosquito borne infectious disease caused by *Plasmodium* (a protozoan).

- Q. 5.** Which one of the following disease is caused by protozoans?

(A) Malaria (B) Influenza
 (C) AIDS (D) Cholera

Ans. Option (A) is correct.

Explanation: Malaria is caused by a protozoan *Plasmodium*. Influenza is caused by RNA virus, AIDS is caused by HIV and cholera is caused by bacterium *Vibrio cholerae*.

- Q. 6.** Which of the following has long term effect on the health of an individual?

(a) Common cold (b) Chickenpox
 (c) Chewing tobacco (d) Stress

Ans. Option (C) is correct.

Explanation: Chewing tobacco may cause long term effects on individuals. Chewing tobacco has been known to cause cancer, particularly of mouth and throat.

- Q. 7.** Which of the following can make you ill if you come in contact with an infected person?

(A) High blood pressure
 (B) Genetic abnormalities
 (C) Sneezing
 (D) Blood cancer

Ans. Option (C) is correct.

Explanation: The transmission of microbes occurs through the little droplets, sneezed out by an infected person. A person in close vicinity of such an infected person can inhale these disease causing microbes and may become infected.

- Q. 8.** AIDS cannot be transmitted by

(A) Sexual contact (B) Hugs
 (C) Breast feeding (D) Blood transfusion

Ans. Option (B) is correct.

Explanation: Sexual contact, breast feeding and blood transfusion are the mode of transmission of AIDS virus.

- Q. 9.** Which one of the following causes kala-azar?

(A) Ascaris (B) Trypanosoma
 (C) Leishmania (D) Bacteria

Ans. Option (C) is correct.

Explanation: *Leishmania*, a protozoa causes kala-azar or black fever.

- Q. 10.** Which disease is not transmitted by mosquitoes?

(A) Dengue
 (B) Malaria
 (C) Brain fever or encephalitis
 (D) Pneumonia

Ans. Option (D) is correct.

Explanation: Pneumonia is caused by a virus or bacteria. It is an air borne disease whereas dengue, malaria and brain fever are vector (mosquito) borne diseases.

- Q. 11.** Which one of the following is not important for individual health?

Ans. Option (A) is correct.

Explanation: A Contagious disease spread by transmission of a pathogen from an infected person to another person.

Q. 3. Cholera is a :

- (A) Air borne disease
- (B) Water borne disease
- (C) Animal borne disease
- (D) None of disease

Ans. Option (B) is correct.

Explanation: Cholera is a water borne disease, it is infections that leads to watery diarrhoea which further causes dehydration. It is caused by bacterium called *Vibrio cholerae*.

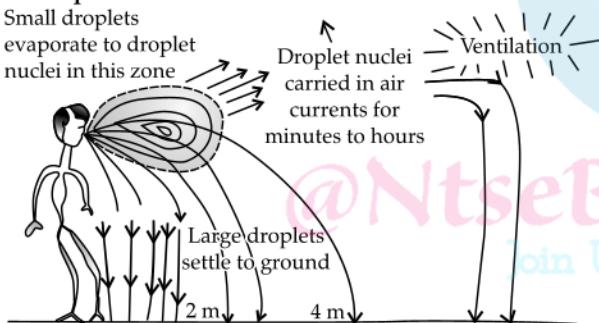
Q. 4. What type of food you have to take when you are sick?

- (A) Junk food
- (B) Spicy and Oily food
- (C) Bland and nourishing food
- (D) Liquid food.

Ans. Option (C) is correct.

Explanation: Bland and nourishing food provides adequate amount of nutrients required for regeneration of cells and tissues.

II. Study the picture and answer the following questions.



Q. 1. Identify the mode of transmission of disease in above picture :

- (A) Water
- (B) Air
- (C) Animals
- (D) Insects

Ans. Option (B) is correct.

Explanation: Droplet nuclei carried in air currents for minutes to hours.

Q. 2. Which disease you can observe through this picture :

- (A) Cough and Cold
- (B) Cancer
- (C) Cholera
- (D) Dysentery

Ans. Option (A) is correct.

Explanation: The picture shows Cough and Cold.

Q. 3. Common Cold is a :

- (A) Bacterial disease
- (B) Viral disease
- (C) Fungal disease
- (D) All of these

Ans. Option (B) is correct.

Explanation: Common cold is a Viral disease.

Q. 4. Infected Organism is a :

- | | |
|------------|-------------------|
| (A) Vector | (B) Pathogen |
| (C) Host | (D) None of these |

Ans. Option (C) is correct.

Explanation: An Organism that is infected with or is fed upon by a parasitic or pathogenic organism is known as a Host.

III. Although Sonia has been suffering from cold and cough she decided to appear for her class test. Classmates seated close to her had an exposure to the infection being carried by Sonia. However, only one of them actually suffered from cold and cough.

Q. 1. Cough and cold is a :

- (A) Acute disease
- (B) Chronic disease
- (C) Both Acute and Chronic disease
- (D) None of these

Ans. Option (A) is correct.

Explanation: Cough and Cold last for only short period of time. Hence, it is an acute disease.

Q. 2. System of an individual that fights off infection carrying microbes is known as :

- (A) Digestive system
- (B) Endocrine system
- (C) Circulatory system
- (D) Immune system

Ans. Option (D) is correct.

Explanation: Immune system of individual is fight off infection carrying microbes.

Q. 3. Preventive measure to control Cough and Cold is/ are :

- (A) We should keep our surroundings clean and hygiene
- (B) There should be periodic cleaning of toilets
- (C) We should eat healthy food
- (D) All of these

Ans. Option (D) is correct.

Explanation: To avoid communicable diseases, we should keep our surroundings neat and clean. Toilets should be kept clean and should eat healthy food.

Q. 4. Disease producing agent is called :

- | | |
|------------|--------------|
| (A) Vector | (B) Pathogen |
| (C) Host | (D) Organism |

Ans. Option (B) is correct.

Explanation: Pathogens are disease producing agent such as a virus or bacteria or other micro-organism.

IV. Read the passage and answer the following questions.

Human beings live in societies and different localities like villages or cities, which determine

HEALTH AND DISEASES

the social and physical environment, both are to be kept in harmony. Public cleanliness is important for individual health. A lot of money is required for maintaining better living conditions. We need good food for healthy body and for this we have to earn more. For the treatment of diseases also, one has to be in good economic condition.

Q. 1. State of physically, mentally and socially well being is known as :

- (A) Antibody
- (B) Health
- (C) Immunity
- (D) All of these

Ans. Option (B) is correct.

Explanation: Health is a state of being well enough to function well physically, mentally and socially, and these conditions depend upon the surrounding environmental conditions.

Q. 2. On administration of Vaccine, body develops :

- (A) Good health
- (B) Antigens
- (C) Immunity
- (D) Antibodies

Ans. Option (D) is correct.

Explanation: On administration of Vaccine, the body starts developing antibodies against it such that the person is protected from the disease, body develops a memory and immediately produces antibodies on further exposure.

Q. 3. Select a disease for which vaccine is available :

- (A) Dengue
- (B) Typhoid
- (C) AIDS
- (D) Common Cold

Ans. Option (B) is correct.

Explanation: Vaccine is available for Typhoid disease.

Q. 4. What is essential for good health?

- (A) Personal hygiene
- (B) Balanced Diet
- (C) Immunization
- (D) All of these

Ans. Option (D) is correct.

Explanation: Personal hygiene reduces exposure to infectious agents. Balanced Diet provides sufficient energy and nutrients which are required for regeneration. Immunisations against severe diseases should be taken.

✓ (B) SUBJECTIVE QUESTIONS



Very Short Answer Type Questions

(1 Mark Each)

Q. 1. What is community health ? R [O.E.B.]

Ans. An aspect of health, which deals with the well being (physical, mental and social) of people of a community is called community health. 1

Q. 2. How is a disease identified ? R [O.E.B.]

Ans. A doctor identifies a disease by its symptoms and signs. 1

Q. 3. Name the causative organism of cholera. R [O.E.B.]

Ans. *Vibrio cholerae*. 1

Commonly Made Error

- Students are not able to write correct name of pathogens. Spelling error is commonly seen.

Answering Tip

- Learn pathogens of diseases and write their biological names with correct spellings according to the rules of binomial nomenclature.

Q. 4. Which disease is caused by *Helicobacter pylori* ? R [O.E.B.]

Ans. Peptic ulcers. 1

Q. 5. What is the primary cause of haemophilia ? R [O.E.B.]

Ans. Primary cause of haemophilia is change in chromosome sequence. 1

Q. 6. What is the primary cause of marasmus ? R [O.E.B.]

Ans. Primary cause of marasmus is protein deficiency. 1

Q. 7. What is the main cause of infectious diseases ? R [O.E.B.]

Ans. Pathogens. 1

Q. 8. Which is the causative organism of acne ? R [O.E.B.]

Ans. *Staphylococci*. 1

Q. 9. Why HIV-AIDS is an incurable disease ? R [O.E.B.]

Ans. HIV-AIDS is a viral disease. Viruses do not have biochemical pathways on their own. Therefore medicines for curing it is not available. 1

Q. 10. Differentiate between acute and chronic diseases. U [Board Term-II, 2016]

Ans. Acute diseases are the diseases lasting for a short period of time while chronic diseases last for a long period even as much as lifetime. 1

Q. 11. Why are signs of a disease more important than its symptoms ? A [O.E.B.]

Ans. Signs of a disease are more important than symptoms because symptoms do not specify the disease, but through signs the disease can be easily identified. 1

Q. 12. What is the major drawback of principle of treatment ? R [O.E.B.]

Ans. Major drawback of principle of treatment is that till the person is not completely cured it acts as a source of infection for others. 1

Q. 13. How do children in many parts of India get immune to Hepatitis A by the time they are 5 years old ? A [O.E.B.]

Ans. They are exposed to the virus through uncleanned and polluted drinking water. Therefore, in their early childhood, majority of the children get exposed to Hepatitis A virus which can spread through contaminated water. 1

Short Answer Type Questions-I

(2 Marks Each)

Q. 1. What causes Japanese encephalitis ? How it can be prevented? R [Board Term-II 2014]

Ans. Causal agent : Virus.

Prevention - Mosquito bite should be avoided.
[CBSE Marking Scheme, 2012] $1+1=2$

Q. 2. Influenza or common cold, spreads faster and is difficult to control. Why? A [Board Term-II, 2013]

Ans. Influenza is an infectious air-borne disease and hence spreads easily. It is difficult to control it as it is a viral disease. 2

[CBSE Marking Scheme, 2012]

Q. 3. Which of the following diseases will cause major ill-effects on general health - Elephantiasis, Cough and cold, Tuberculosis, Diarrhoea.

What are such diseases called ? A [O.E.B.]

Ans. Elephantiasis and tuberculosis. 1
Such diseases are called chronic diseases. 1

Q. 4. Name the causal organism of AIDS. Why a person suffering from AIDS cannot fight even very minor infections ? A [O.E.B.]

Ans. Causal organism : HIV 1

A person suffering from AIDS can not fight even very minor infections because it damages the immune system of the person and destroys the important white blood cells. 1

Q. 5. State any four ways by which AIDS virus spreads from an infected person to a healthy person R

A [O.E.B.]

Ans. Four ways by which AIDS virus spreads are :

- (i) Sexual contact with infected person.
 - (ii) Pregnant mother to her foetus.
 - (iii) Blood contact with infected person.
 - (iv) Using needle or syringe of infected person.
- $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

Q. 6. AIDS is a fatal disease. Explain why. A

A [O.E.B.]

Ans. AIDS is a fatal disease because immune system of the body get highly weakened and the body suffers from severe infections repeatedly. 2

Q. 7. State two different ways by which infectious diseases spread. R [O.E.B.]

Ans. Infectious diseases can spread through air, water, vector, food etc. [Any two] 1 + 1 = 2

Q. 8. (i) What are communicable diseases ? Write its one example.

(ii) How do these spread ? R [O.E.B.]

Ans. (i) Diseases that can be spread from one person to another are called communicable diseases, e.g., cough and cold, Pneumonia.

(ii) They can spread through air, sneezing water or air contact. (1½ + 1½ = 2)

Q. 9. Write two examples of each : R [O.E.B.]

(i) Viral diseases

(ii) Bacterial diseases

Ans. (i) AIDS, dengue fever 1

(ii) Tuberculosis, typhoid, cholera 1

Q. 10. What is an antibiotic ? Give its one example. R (NCERT)

Ans. Antibiotic is a substance produced by bacteria or fungi that destroys or prevents the growth of pathogens. 1½

Example : Penicillin. ½

Q. 11. What causes encephalitis ? How does it enter the body ? Which organ does it infect ? What are the symptoms if the organ is infected ? R [O.E.B.]

Ans. Virus causes encephalitis. It enters the body through mosquito bite.

It infects the brain. (½ + ½ + ½)

Headache, fits, vomiting, unconsciousness are the symptoms. ½

Q. 12. How can we prevent water borne and vector borne infections ? A [O.E.B.]

Ans. Water borne : By providing safe drinking water. 1

Vector borne : By providing clean environment. 1

Q. 13. What are vectors ? Give two examples. R

A [O.E.B.]

Ans. Disease carrying or causing organisms are called vectors. 1

Example : Female *Anopheles* mosquito, ½

Aedes mosquito. ½

Q. 14. With the help of an example explain how disease-causing microbes spread through air ? R

A [O.E.B.]

Ans. Diseases such as influenza, tuberculosis, pneumonia can spread through talking, sneezing and coughing. 1

Q. 15. Chances of spreading of cholera are higher in a village. Give reason. A [O.E.B.]

Ans. Cholera is a water borne disease and in a village water sanitation management is not fully available. Hence, flies which acts as vector are in abundance. This leads to chances of spreading cholera higher in a village. 1

HEALTH AND DISEASES

Q. 16. "Community health is essential for good individual health." Justify this statement giving examples. A [O.E.B.]

Ans. Hygiene, sanitation and public health is essential as it checks the spread of infectious diseases. e.g., due to lack of facilities and public health, slum area is more prone to epidemic. 1 + 1

Q. 17. Health workers are exposed to more sick people than others in the community. Write any four preventive measures they take to avoid sickness. A

[O.E.B.]

- (i) Hand washing after any direct contact with patients. ½
- (ii) Wearing gloves while treating or examining the patient. ½
- (iii) Proper disposal or sterilizing the instruments. ½
- (iv) Immunization. ½

Q. 18. Explain how individual health depends on social and mental well-being. A [O.E.B.]

Ans. Social well-being : Cleanliness around the place we live, i.e., no garbage, no open defecation etc. 1

Mental well-being : For good health we have to be happy social equality and harmony are essential. 1

Q. 19. (i) How do children in many parts of India get immune to Hepatitis 'A' by the time they are 5 years old ?

(ii) Pinky suffered from chickenpox last month. Her grandmother told her that now she would not suffer from this disease again. What is the reason for such a saying ? A [O.E.B.]

Ans. (i) They are exposed to virus through water and hence, develop an immunity. 1

(ii) Immune system responds against the infectious microbe and remembers it specifically. Next time it responds with even greater vigour. (½ + ½ = 1)

Q. 20. What is immunization ? List two diseases against which vaccines are available. B [O.E.B.]

Ans. The process of inducing immunity by administering a vaccine to allow the immune system to prevent infections and illness is called immunization. 1

Example : Chicken pox, typhoid. 1

Q. 21. List any four essential factors that must be taken care of by an individual for keeping good health. A [O.E.B.]

- (i) Balanced diet. ½
- (ii) Disease free environment. ½
- (iii) Proper sanitation. ½
- (iv) Mental and social stability. ½

AT Q. 22. List any two ways of preventing the spread of air-borne diseases. A [O.E.B.]

Ans. (i) By avoiding direct contact with the infected persons. 1

(ii) By not sharing articles used by infected persons. 1

Q. 23. "Making antiviral medicines is harder than making antibacterial medicines". Justify this statement. A [O.E.B.]

Ans. Biochemical pathways of virus are different from bacteria. Virus do not have life-process, but bacteria does. Virus have few biochemical mechanisms of their own. They enter our cells and use our machinery for their life processes. Hence are difficult to be targeted. 2

AT Q. 24. Although Archana has been suffering from cold and cough she decided to appear for her class test. Classmates seated close to her had an exposure to the infection being carried by Archana. However, only one of them actually suffered from cold and cough. Explain, what prevented rest of those classmates catching cold and cough in spite of their exposure to the infection. A [O.E.B.]

Ans. Immune system of individuals fight off infection carrying microbes. 1

The immune system of those who did not suffer with cold and cough successfully fought against the microbes to which they were exposed. 1

Q. 25. Penicillin is not effective against common cold. Why ? A [O.E.B.]

Ans. Penicillin is not effective against common cold because cold is a viral disease and antibiotics are not effective in preventing viral diseases as virus do not have their own biochemical pathways. Also, it acts by blocking cell wall formation and virus do not have any cell wall. 2

Short Answer Type Questions-II

(3 Marks Each)

AT Q. 1. According to a newspaper report, some areas in Delhi received grey coloured water in their taps. It was reportedly due to mixing of contents at some points due to leakage in sewer and water supply pipes. Which kind of diseases are likely to spread due to such problems and why ? Give two specific names of diseases that can thus be spread. A [Board Term-II, 2016]

Ans. Water borne diseases;

As the pathogens present in sewage will enter drinking water supply and upon consumption, can cause diseases in humans. 1

e.g., Cholera / typhoid / diarrhoea / dysentery / any other gastro-intestinal disorder. (Any two) 2

[CBSE Marking Scheme, 2016]

Q. 2. Name an antibiotic that blocks the biochemical pathways for bacteria. Explain the effect of this antibiotic on bacteria. B [Board Term-II, 2016]

Ans. Penicillin. 1

Penicillin inhibits the enzymes that are involved in the formation of the bacterial cell wall. Bacteria with this weak cell wall die due to leakage of the cell contents. [CBSE Marking Scheme, 2016] 2

AT Q. 3. Complete the given table :

Disease	Causative organism	Mode of transmission
Dengue fever	(a)	(b)
(c)	Vibrio cholerae	Contaminated food and water

(d)	HIV	(e)
Common cold	Virus	(f)

R [Board Term-II, 2015]

- Ans. (a) Virus (b) Female mosquito
 (c) Cholera (d) AIDS
 (e) Sexual contact / Sharing of needles / blood transfusion / mother to infant.
 (f) Air. [CBSE Marking Scheme, 2015] 3

Commonly Made Error

- Students often write incorrect causative agent of the disease. Spelling errors are commonly seen.

Answering Tips

- Students should memorize various diseases, symptoms, their causative organisms and mode of transmission thoroughly as questions based on them are most frequently asked in the exams.
- Diseases of lungs or respiratory tract are mainly air borne and mostly viral. While diseases of digestive tract mainly occur due to contaminated water or food and are mainly due to bacteria.

Q. 4. (i) Which disease is more harmful : acute or chronic disease ? Why ?

(ii) Why are we advised to take bland and nourishing food when we are sick ? A [Board Term-II, 2013, 12]

Ans. (i) Chronic disease. $\frac{1}{2}$

Chronic diseases are more harmful because chronic diseases have drastic long term effects on people's health as compared to acute disease. $\frac{1}{2}$

(ii) (a) Such food does not contain oil, fat and spices so it is digested easily.

(b) It provides sufficient energy for recovery after the disease.

(c) It provides adequate amount of nutrients required for regeneration of cells and tissues.

(Any three relevant points) $\frac{1}{2} \times 3 = 1\frac{1}{2}$
 [CBSE Marking Scheme, 2013]

AQ Q. 5. Differentiate between infectious and non-infectious diseases. Give one example of each.

U [O.E.B.]

Ans.

S. No.	Infectious diseases	Non-infectious diseases
(i)	Spread easily. e.g., cold, pneumonia, tuberculosis.	Do not spread easily. e.g., cancer, heart attack.
(ii)	They are caused by pathogen. Air, water, soil and bacteria play an important role. Thus the community is also at threat.	They are not caused by pathogen hence do not spread through any agency so only host body is at threat.

Commonly Made Error

- Students often get confused and write incorrect differences and examples.

Answering Tip

- Understand the differences between infectious and non-infectious diseases in tabular form with proper examples for better understanding and retention.

Q. 6. For most microbes, the organ they target is related to their point of entry.

Furnish details of your answer under the following headings :

Organ of entry	Kind of microbe	Target organ	Disease caused
Mouth	Bacteria		
Mouth	Virus		

(b) State the two important ways by which an infectious disease can be treated.

R [Board Term-II, 2012]

Ans. (a)

Organ of entry	Microbe	Target organ	Disease caused
Mouth	Bacteria	Gut lining	Typhoid
Mouth	Virus	Liver	Jaundice

$\frac{1}{2} \times 4 = 2$

(b) (i) To reduce the effects of the disease.

(ii) To kill the cause of the disease. $\frac{1}{2} \times 2 = 1$

[CBSE Marking Scheme, 2012]

AQ Q. 7. (i) Write difference between acute and chronic diseases.

(ii) Pick out chronic diseases from the list given below:
 Japanese encephalitis, viral fever, common cold, tuberculosis.

U+A [Board 2013, 2012]

Ans. (i) Acute diseases : Diseases that last for only very short periods are called acute disease. e.g., common cold $\frac{1}{2}$

Chronic diseases : Diseases that last for long time even as much as a life time are called chronic diseases. e.g., elephantiasis $\frac{1}{2}$

(ii) Japanese encephalitis, tuberculosis are chronic diseases. [CBSE Marking Scheme, 2012] 1

Q. 8. A man is suffering from AIDS.

(i) He is not able to fight off even minor infections.

Why?

(ii) Write any two ways in which he could have got this disease.

(iii) Will the treatment by antibiotics help him in AIDS ? Justify your answer. A [O.E.B.]

Ans. (i) The HIV goes to the immune system and damages its function. $\frac{1}{2}$

(ii) Sexual contact, from infected mother to child, infected syringe/needle, blood transfusion.

(Any two) ($\frac{1}{2} + \frac{1}{2}$)

HEALTH AND DISEASES

- (iii) No, antibiotics do not respond to viral infections. They are mainly used to treat bacterial diseases or infections. 1

Commonly Made Error

- Students often overlook parts of question.

Answering Tip

- Students are advised to read the questions carefully and answer the questions part-by-part.

Q. 9. Why do some children fall ill more frequently than others living in the same locality?

[R] [Board Term-II, 2017]

Ans. If may be due to (i) Poor immune system (ii) Due to inadequate balanced diet. (iii) Due to poor personal hygienic conditions. (1 + 1 + 1)

Q. 10. Explain in brief, why is an immune system essential for our good health.

[R] [Board Term-II, 2017]

Ans. Immune system in our body is a kind of defence mechanism to fight against pathogenic microbes. It has cells that are specialised to kill infectious microbes and keep our body healthy. 3

Q. 11. Give the ways by which microbial agents can commonly move from an infected person to someone else for the following diseases.

- | | |
|-----------------------|---------------------------|
| (a) Cholera | (b) Pneumonia |
| (c) Common cold | (d) Malaria |
| (e) Fungal Infection. | [R] [Board Term-II, 2017] |

Ans. (a) Water
(b) Air
(c) Air
(d) Mosquito
(e) Touch or by using infected napkins, towels etc. (½ + ½ + ½ + ½ + 1)

Q. 12. Mention any three factors necessary for a person to live healthy life. [R] [Board Term-II, 2017]

Ans. (i) Surrounding environment should be clean.
(ii) Personal hygiene prevents infectious diseases.
(iii) Balanced diet for good immune system.
(iv) Immunisations against severe diseases (Any three) (1 + 1 + 1)

[AI] Q. 13. Which part of the body is attacked by the bacteria causing tuberculosis? If they enter :

- (a) through the nose
- (b) through the mouth. [R] [Board Term-II, 2017]

Ans. Via the nose - lungs
Through the mouth - gut lining liver. (1½ + 1½)

Q. 14. 'Prevention is better than cure'. Justify the statement with three reasons.

[A] [Board Term-II, 2016]

Ans. (i) Once someone has a disease, their body functions are damaged and may never recover completely.
(ii) Treatment will take time, which means that someone suffering from a disease is likely to be bedridden for some time even if we can give proper treatment.

- (iii) The person suffering from an infectious disease can serve as the source from where the infection may spread to other people. 3

[CBSE Marking Scheme, 2016]

Q. 15. (i) For the prevention of infectious diseases, some public health programmes of childhood immunisation are conducted in the country. Name four such diseases which are covered under this programme.

- (ii) Name a disease which has been eradicated from the world. State the principle behind its eradication.

[R] [Board Term-II, 2016]

Ans. (i) Polio, tuberculosis, measles, tetanus, diphtheria and whooping cough. (½ + ½)

- (ii) Small pox.

It is based on the principle of immunization.

(1 + 1)

Q. 16. What precautions can you take in your school to reduce the incidence of infectious diseases ?

[A] [Board Term-II, 2015]

Ans. (i) We should prevent water logging to avoid mosquito breeding.
(ii) We should keep our surroundings clean and hygienic.
(iii) There should be provision for safe drinking water.
(iv) We should consume healthy food.
(v) There should be periodic cleaning of toilets and use of disinfectants.
(vi) We should wear full sleeve shirt and full pants to avoid mosquito bite.
(vii) The infected children should take leave from school. (Any three)

[CBSE Marking Scheme, 2015] 3

Commonly Made Error

- Students write irrelevant and repeated points. Also, many of them write the answer in essay form rather than points.

Answering Tip

- Always write the answer point wise and each point must reflect a separate idea. Do not repeat the same point in different words.

[AI] Q. 17. What are the three limitations that hinder the approach to deal with infectious diseases?

[R+A] [Board Term-II, 2015]

Ans. The limitations are :

- (i) Once a person has an infectious disease, his / her body functions are damaged and may never recover completely.
- (ii) This treatment will take time, so someone suffering from a disease is likely to be bedridden for some time.
- (iii) Person suffering from an infectious disease may spread this infection to other people acting as the source. [CBSE Marking Scheme, 2015] 3

- Q. 18.** (i) While going abroad why is it essential to get vaccinated against certain diseases?
(ii) Name a vaccine which saves the life of babies from these diseases.
(iii) A person is suffering from chest pain, breathlessness, loss of body weight, persistent cough and produces blood stained sputum. Name the disease. R+A [Board Term-II, 2015]

Ans. (i) A person may be a carrier of a disease and such a person can carry disease to a foreign country. 1

- (ii) DPT Vaccine. 1
(iii) Tuberculosis. [CBSE Marking Scheme, 2015] 1

- Q. 19.** State reason for the following statements :

- (i) AIDS is considered to be a 'Syndrome' and not a disease. (NCERT)
(ii) Antibiotics are ineffective against viral infections.
(iii) Our surroundings should be free from stagnant water. A [O.E.B.]

Ans. (i) Because in AIDS, immunity of body gets reduced and a person is more susceptible to diseases. 1

- (ii) Viral diseases do not have their own body mechanism, but they use cells of the host. Hence are antibiotics ineffective against viral infections. 1
(iii) Stagnant water increases the spread of diseases such as dengue as these organisms develop in stagnant water. Thus, our surroundings should be free from stagnant water. 1



Long Answer Type Questions

(5 Marks Each)

- AI **Q. 1.** What is a disease ? How do we know that a person is diseased ? What can be the various causes for a person getting diseased ?

R [Board Term-II, 2016]

Ans. Lack of feeling of ease or distress due to impairment of health is stated as a disease. 1

When a person is suffering from disease, he shows some symptoms. These symptoms appear in the form of dysfunction or malfunction and structural changes of the organ or tissues in the body.

Therefore, the symptoms of disease are the things we feel that something is wrong in the body, such as headache, loose motion, vomiting, cough and swelling of body or body part. 2

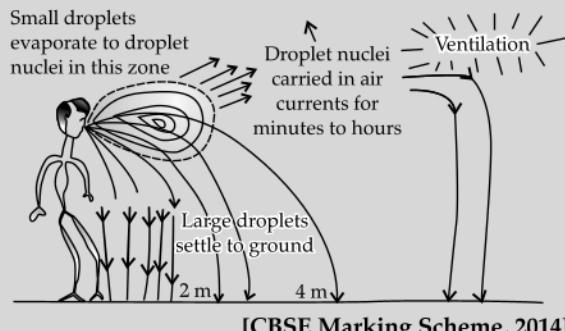
Causes :

- (i) Extrinsic factor : Water, food (Only one required).
 - (ii) Intrinsic factor : Poor eating habits, poor nourishment. (Only one)
 - (iii) Genetic constitution : Weak immune system.
 - (iv) Social reason : Poor public services. $4 \times \frac{1}{2} = 2$
- [CBSE Marking Scheme, 2016]

- AI **Q. 2.** 'Over crowded and poorly ventilated housing is a major factor in the spread of airborne diseases'. Explain the statement and support your answer with diagram also.' A [Board Term-II, 2014]

Ans. (i) When we are closer to infected person, air transmitted diseases are easily transferred.

- (ii) In closed areas, the droplet nuclei recirculate and pose a risk to everybody.



[CBSE Marking Scheme, 2014] 5

- Q. 3. (a)** What do signs and symptoms indicate if a person is suffering from any disease ?

- (b)** Based on the duration of disease what are the different categories of diseases ?

Differentiate between them with one example each. R [Board Term-II, 2014]

Ans. (a) Symptoms indicate that there may be a disease, but don't indicate what the disease is. Sign of a disease is a definite indication of the presence of a particular disease. Physicians get laboratory test done to pinpoint the disease.

- (b) Acute and Chronic diseases.

Differences :

Acute

- (i) Last for short period of time.
- (ii) Do not cause effect on general health. e.g., Common cold.

Chronic

- (i) Lasts for long time even for lifetime.
- (ii) Causes major effect on general health. e.g., Diabetes. [CBSE Marking Scheme, 2014] 5

Commonly Made Error

- Students are unable to distinguish between signs and symptoms. Many of them mention them as same.

Answering Tip

- Signs and symptoms are two different terms with different meanings. Make sure you understand the differences carefully. Also, write the differences between acute and chronic disease in tabular form.

- Q. 4. (a)** What kind of food is advised when we fall sick and why ?

- (b)** Mention any three basic conditions required for good health. R+A [Board Term-II 2016]

Ans. (a) We should take bland and nourishing food.

Such food does not contain fat, oil or spices, so digested easily.

It provides sufficient energy and nutrients which are required for recovery and regeneration. 2

HEALTH AND DISEASES

- (b) (i) Balanced diet
(ii) Personal hygiene
(iii) Clean surrounding
(iv) Clean food and water
(v) Clean air
(vi) Exercises and relaxation
(vii) No addiction
(viii) Good economic condition (Any three) 3
[CBSE Marking Scheme, 2016]

Q. 5. Explain giving reasons :

- (i) Balanced diet is necessary for maintaining healthy body.
- (ii) Health of an organism depends upon the surrounding environmental conditions.
- (iii) Our surrounding areas should be free of stagnant water.
- (iv) Social harmony and good economic conditions are necessary for good health. [NCERT]

A [Board Term-II, 2016]

- Ans.** (i) Food is necessary for the growth and development of the body. Balanced diet provides raw materials and energy in appropriate amount in the form of protein, carbohydrates, fats, minerals etc. which, in turn, are essential for the proper growth and functioning of the healthy body.
(ii) Health is a state of being well enough to function well physically, mentally and socially, and these conditions depend upon the surrounding environmental conditions. e.g., if there is an unhygienic condition in the surrounding area, it is likely we might get infected or diseased.
(iii) This is so because many water-borne diseases and insect vectors flourish in stagnant water which causes diseases in human beings.
(iv) Human beings live in societies and different localities like villages or cities, which determines the social and physical environment, both are to be kept in harmony. Public cleanliness is important for individual health. A lot of money is required for maintaining better living conditions. We need good food for healthy body and for this we have to earn more. For the treatment of diseases also, one has to be in good economic condition. 5

Commonly Made Error

- Students often give vague explanation.

Answering Tip

- Students should learn the concept of balanced diet thoroughly. Questions based on it are asked many times in the exams.

AQ. 6. Justify the following statements :

- (a) "Availability of proper and sufficient food would prevent from infectious diseases".
- (b) "The general ways of preventing infection mostly relate to preventing exposure". List three points of prevention of exposure. A [Board Term-II 2015]

Ans. (a) Yes, availability of proper and sufficient food prevents from infectious diseases because functioning of immune system will not be good if proper and sufficient food and nourishment is not available.

(b) Yes, the general ways of preventing infection mostly relate to preventing exposure because :

- (i) For air borne microbes, we can prevent exposure by providing living condition that are not over crowded.
- (ii) For water borne microbes, we can prevent exposure by providing safe drinking water.
- (iii) For vector borne microbes, we can prevent exposure by providing clean environment. 5

[CBSE Marking Scheme, 2015]

Q. 7. "Educating parents would help a lot in reducing the incidences of diseases in children. Justify the statement with five reasons.

A [Board Term-II 2015]

Ans. (i) Educated parents understand the importance of healthy and balanced diet for their children which will prevent nutritional deficiency disorders and also help in proper functioning of immune system.

- (ii) By knowing about modes of spread of diseases, one will maintain hygienic conditions.
- (iii) Parents will provide only safe uncontaminated water to avoid water borne diseases.
- (iv) Educated parents can provide symptomatic treatment first and then go for further doctors consultation to kill the cause of the disease.
- (v) Educated parents can inculcate a sense of social and moral responsibility in their children to maintain clean environment to prevent spread of infections. [CBSE Marking Scheme, 2015] 5

Q. 8. Explain the statement by giving two examples :

'It is not necessary that the pathogen may affect an organ or tissue depending upon the point of entry'. A [Board Term-II 2014]

Ans. The above statement implies that it is not necessary that, if the pathogen enters the body by different ways, it alters the site and consequence of infection.

For example :

- (i) Suppose HIV virus enters through blood or sexual intercourse person will get HIV.
- (ii) If Japanese encephalitis causing virus enters blood through mosquito bite, it reaches brain on infection.
- (iii) Herpes simplex virus can enter body orally or through sexual contacts but they affect the body inspite of different point of entry.

[CBSE Marking Scheme, 2014] 5



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UNIT III : Motion, Force and Work

CHAPTER

4

GRAVITATION

Syllabus

- **Gravitation; Universal law of gravitation; Force of Gravitation of the earth (gravity); Acceleration due to Gravity; Mass and Weight; Free fall.**

Revision Notes

Gravitation

- According to the law of gravitation, the force of attraction between any two objects is proportional to the product of their masses and inversely proportional to the square of the distance between them. The law applies to objects anywhere in the universe. Such a law is said to be universal.
- Universal gravitational constant $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$.
- Gravitation is a weak force unless large masses are involved.
- Acceleration with which a body falls towards the centre of the earth is called acceleration due to gravity (g).
- The force of gravity decreases with increasing altitude. It also varies on the surface of the earth, decreasing from poles to the equator.
- Mass is the quantity of matter contained in the body.
- Weight of the body is the force with which the earth attracts the body.
- The weight is equal to the product of mass and acceleration due to gravity.
- Mass of a body does not change but weight of a body is different at different places.
- Inverse square rule states that F is inversely proportional to the square of d .
- Weight of an object on the moon is one-sixth time of its weight on the earth.
- **Newton's universal law of gravitation :** This law states that everybody in this universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

Mathematically,

$$F = G \frac{m_1 m_2}{r^2}$$

where, G is Universal Gravitational Constant.

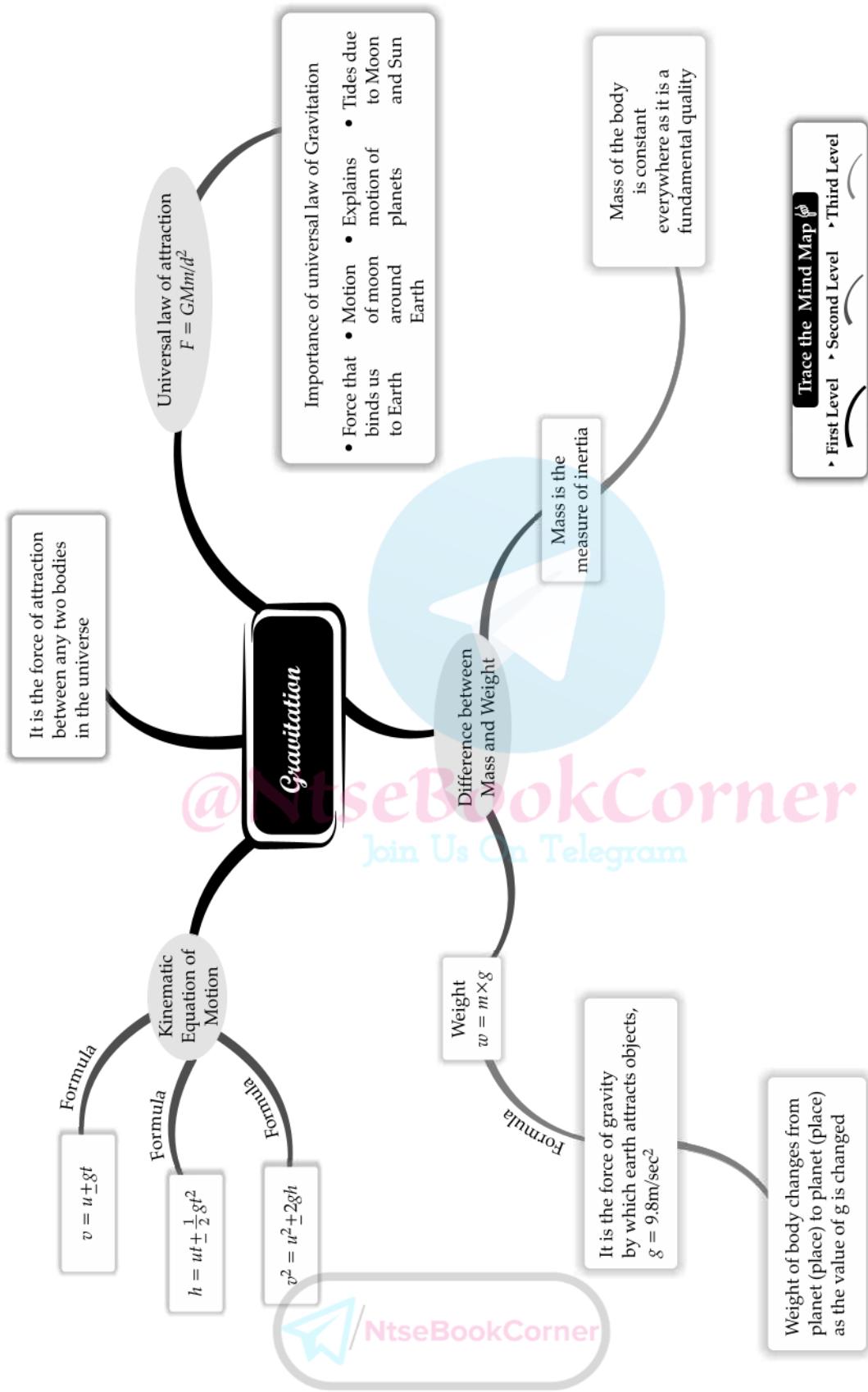
- **Universal gravitational constant :** It is equal to the force of attraction between two bodies of unit mass each placed at a unit distance apart. It is denoted by G and its value is $6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$.
- **Centripetal acceleration of the moon :** If the moon is revolving with speed v in a circular orbit of radius r , then acceleration acting on it along the radius and towards the centre of its orbit is

$$a_c = \frac{v^2}{r} .$$

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Universal Law
of Gravitation



Know the Terms

- **Gravitation** : It is the force of attraction between any two bodies in the universe.
- **Gravity** : It is the force of attraction between the earth and any object lying on or near its surface.
- **Free fall** : The motion of a body under the influence of force of gravity alone is called a 'free fall'.
- **Acceleration due to gravity** : The acceleration produced in the bodies due to earth's force of gravity is called acceleration due to gravity. Its value on earth's surface is 9.8 m/s^2 .
- **Centre of mass** : The centre of mass of a body may be defined as the point at which whole mass of the body may be assumed to be concentrated.
- **Centre of gravity** : The centre of gravity of a body is a point at which the resultant of all the parallel forces experienced by various particles of the body, due to attraction of earth, passes irrespective of the orientation of the body.
- **Projectile** : Any object thrown into space with some initial velocity and which moves thereafter under the influence of gravity alone is called a 'projectile'. The path of a projectile is a parabola. Its horizontal range is maximum when the angle of projection is 45° .
- **Weightlessness** : The state when an object does not weight anything during free fall.
- **Weight** : Force by which an object is attracted towards the earth. SI unit is Newton (N).



(A) OBJECTIVE QUESTIONS

1 Mark Each



Stand Alone MCQs

- Q. 1.** Two objects of different masses falling freely near the surface of moon would :
- Have same velocities at any instant
 - Have different accelerations
 - Experience forces of same magnitude
 - Undergo a change in their inertia.

Ans. Option (A) is correct.

Explanation: Objects of different masses falling freely near the surface of the moon would have the same velocities at any instant because they will have same acceleration due to gravity.

- Q. 2.** The value of acceleration due to gravity :
- Is same on equator and poles
 - Is least on poles
 - Is least on equator
 - Increases from pole to equator

Ans. Option (C) is correct.

Explanation: Due to structure of earth, as on the equator earth is bulging out and at poles it is a bit flattened. So the acceleration due to gravity experienced at the poles is slightly higher than that at the equator.

- Q. 3.** The gravitational force between two objects is F. If masses of both objects are halved without changing distance between them, then the gravitational force would become

- $\frac{F}{4}$
- $\frac{F}{2}$
- F
- 2 F

Ans. Option (A) is correct.

Explanation: We know that, according to force of gravitation,

$$F = \frac{Gm_1 m_2}{r^2} \quad (G = \text{Gravitational constant})$$

Where m_1 and m_2 are the masses of two objects respectively and r is the distance between the two masses.

Now, according to the question, if masses of both objects are halved. i.e.,

$$m'_1 = \frac{m_1}{2} \text{ and } m'_2 = \frac{m_2}{2}$$

New force,

$$\begin{aligned} F' &= \frac{Gm'_1 m'_2}{r^2} = \frac{G\left(\frac{m_1}{2}\right)\left(\frac{m_2}{2}\right)}{r^2} \\ &= \frac{1}{4} \frac{Gm_1 m_2}{r^2} = \frac{F}{4} \text{ where } \frac{Gm_1 m_2}{r^2} = F \end{aligned}$$

So, new force, $F' = \frac{F}{4}$

Thus, the new gravitational force will become $\frac{1}{4}$ times of its original gravitational force.

- Q. 4.** A boy is whirling a stone tied with a string in a horizontal circular path. If the string breaks, the stone
- Will continue to move in the circular path.
 - Will move along a straight line towards the centre of the circular path.
 - Will move along a straight line tangential to the circular path.

- (D) Will move along a straight line perpendicular to the circular path away from the boy.

Ans. Option (C) is correct.

Explanation: In circular motion, the direction of velocity at a point is always along the tangent at that point. If string breaks, then the centripetal force acting on the stone becomes zero and it will move along a straight line tangential to the circular path.

Q. 5. In the relation $F = GM m/d^2$, the quantity G :

- (A) Depends on the value of g at the place of observation
- (B) Is used only when the earth is one of the two masses
- (C) Is greatest at the surface of the earth
- (D) Is universal constant of nature.

Ans. Option (D) is correct.

Explanation: The quantity G is universal constant of nature. It is applied to all the bodies present in universe.

Q. 6. Law of gravitation gives the gravitational force between :

- (A) The earth and a point mass only
- (B) The earth and the sun only
- (C) Any two bodies having some mass
- (D) Two charged bodies only

Ans. Option (C) is correct.

Explanation: Law of gravitation gives the gravitational force between any two bodies having same mass.

Q. 7. The value of quantity G in the law of gravitation :

- (A) Depends on mass of the earth only
- (B) Depends on radius of earth only
- (C) Depends on both mass and radius of the earth
- (D) Is independent of mass and radius of the earth.

Ans. Option (D) is correct.

Explanation: G is called the universal gravitational constant. It is independent of mass and radius of the earth.

Q. 8. Two particles are placed at some distance. If the mass of each of the two particles is doubled, keeping the distance between them unchanged, the value of gravitational force between them will be :

- | | |
|-------------------------|---------------|
| (A) $\frac{1}{4}$ times | (B) 4 times |
| (C) $\frac{1}{2}$ times | (D) unchanged |

Ans. Option (B) is correct.

Explanation: We know that, according to gravitational force

$$F = G \frac{Mm}{r^2} \quad \dots(\text{Eq. 1})$$

Where, F = Force between two masses

M = First mass

m = Second mass

G = Gravitational constant

r = Distance between two masses

According to the question,

F' = New force when mass is doubled

If mass of each particle is doubled

i.e., $M = 2M$ and $m = 2m$

On putting these values in Eq.(1), we get

$$\therefore F' = G \frac{(2M)(2m)}{r^2}$$

$$\text{Because, } F = G \frac{Mm}{r^2}$$

$$\text{So, } F' = 4F$$

Q. 9. The atmosphere is held to the earth by :

- (A) Gravity
- (B) Wind
- (C) Clouds
- (D) Earth's magnetic field

Ans. Option (A) is correct.

Explanation: The atmosphere is held to the earth by gravity.

Q. 10. The force of attraction between two unit point masses separated by a unit distance is called :

- (A) Gravitational potential
- (B) Acceleration due to gravity
- (C) Gravitational field
- (D) Universal constant

Ans. Option (D) is correct.

Explanation: The force of attraction between two unit point masses separated by a unit distance is called universal gravitational constant.

Q. 11. The weight of an object at the centre of the earth of radius R, is :

- (A) Zero
- (B) Infinite
- (C) R times the weight at the surface of the earth
- (D) $\frac{1}{R^2}$ times the weight at the surface of the earth.

Ans. Option (A) is correct.

GRAVITATION

Explanation: The weight of an object at the centre of the earth of radius R is zero.

- Q. 12.** An apple falls from a tree because of gravitational attraction between the earth and apple. If F_1 is the magnitude of force exerted by the earth on the apple and F_2 is the magnitude of force exerted by apple on earth, then :
- F_1 is very much greater than F_2
 - F_2 is very much greater than F_1
 - F_1 is only a little greater than F_2
 - F_1 and F_2 are equal

Ans. Option (D) is correct.

Explanation: According to Newton's universal law of gravitation, force exerted by the one body to other body is equal in magnitude and opposite in direction.



Assertion and Reason Based MCQs

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- Both assertion (A) and reason (R) are true but reason (R) is NOT the correct explanation of assertion (A).
- Assertion (A) is true but reason (R) is false.
- Assertion (A) is false but reason (R) is true.

AI Q. 1. Assertion : Mass of an object is always zero.

Reason : Mass of an object is the measure of its inertia and the substance contained by the body.

Ans. Option (D) is correct

Explanation: Mass of an object can never be zero because mass of an object is the measure of its inertia and the substance contained by the body.

- Q. 2.** Assertion : On moon, man feels lighter than earth.
Reason : Due to more gravitational force exerted by moon on man.

Ans. Option (C) is correct

Explanation: On moon, man feels lighter than earth. It is due to less gravitational force exerted by moon on man.

- Q. 3.** Assertion : If the distance between two bodies of mass m_1 and m_2 is increased by a factor of 5, the gravitational force is reduced by $\frac{1}{25}$.

Reason: The gravitational force is inversely proportional to the square of the distance

between two bodies.

Ans. Option (A) is correct

Explanation: Gravitational force is given by the formula $F = \frac{GMm}{R^2}$. Gravitational force is inversely proportional to the square of the distance between two bodies.

- Q. 4.** Assertion : An object thrown vertically upward with certain velocity v , reaches maximum height and fall back with same velocity.

Reason : Whenever an object falls towards the earth, gravitational force of the earth causes acceleration.

Ans. Option (D) is correct

Explanation: When an object is thrown vertically upward with certain velocity, it will fall back freely. There will be a change in the magnitude of velocity due to gravitational force of the earth.



Case-based MCQs

- I. Read the following paragraph and choose the correct options to answer the given questions.

Amit buys few grams of gold at the poles as per the instruction of one of his friends. He hands over the same when he meets him at the equator.

- Q. 1.** At what place on the earth's surface is the weight of a body minimum?

- At the equator
- At all places the weight will be equal
- At the north pole
- At the south pole

Ans. Option (A) is correct.

Explanation: The weight of the body is directly proportional to the acceleration due to the gravity on the surface of the earth. So the weight of the body is maximum at the poles and minimum at the equator on the surface of the earth.

- Q. 2.** Will the friend agree with the weight of gold bought?

- No, he won't agree.
- Yes, he will agree.
- Cannot say
- Data is insufficient

Ans. Option (A) is correct.

Explanation: Since the acceleration due to gravity is less at equator as compared to poles, the weight of the gold will be less at the equator than at the poles. Hence, Amit's friend won't agree with the weight of the gold bought since it would be less than what he is expecting.

- Q. 3.** The weight of gold at the equator will be

- more than the weight of gold at the poles.
- less than the weight of gold at the poles.

- (C) same as the weight of gold at the poles.
 (D) zero

Ans. Option (B) is correct.

Explanation: The weight of the body is directly proportional to the acceleration due to the gravity on the surface of the earth. So the weight of the body is maximum at the poles and minimum at the equator on the surface of the earth.

Q. 4. What is the relation between mass and weight?

- (A) Weight (W) of the body is always less than the mass of the body.
 (B) Weight (W) of the body is same as that of the mass of the body.
 (C) Weight (W) of the body is inversely proportional to the mass of the body.
 (D) Weight (W) of the body is directly proportional to the mass of the body.

Ans. Option (D) is correct.

Explanation: In a uniform gravitational field, the gravitational force exerted on an object (its weight) is directly proportional to its mass. For example, object A weighs 10 times as much as object B, so therefore the mass of object A is 10 times greater than that of object B.

II. Read the following paragraph and choose the correct options to answer the questions given below:

Seema was standing on a terrace of a building. She dropped a coin and a piece of paper simultaneously from the same height.

Q. 1. Which of the two will touch the ground first ?

- (A) The coin will touch the ground first.
 (B) The piece of paper will touch the ground first.
 (C) Both will touch the ground simultaneously.
 (D) None of them will touch the ground.

Ans. Option (A) is correct.

Explanation: The coin will touch the ground first. It is because the coin has small surface area and therefore, experiences less resistance from air. Thus, its speed increases and reaches faster.

Q. 2. What will happen if they are dropped in vacuum?

- (A) The piece of paper will touch the ground first.
 (B) In vacuum both will touch the ground together.
 (C) The coin will touch the ground first.
 (D) None of them will touch the ground.

Ans. Option (B) is correct.

Explanation: In vacuum both will touch the ground together. It is because, in vacuum, all freely falling bodies have same acceleration.

Q. 3. What is meant by free fall?

- (A) This is the fall of body when many forces are acting on it from all the sides.
 (B) This is the fall of the body from one medium to other.
 (C) In this, the body is prohibited from falling down.
 (D) The falling of a body from a height towards earth under the gravitational force of earth (with no other force acting on it) is called free fall.

Ans. Option (D) is correct.

Explanation: The falling of a body from a height towards earth under the gravitational force of earth (with no other force acting on it) is called free fall.

Q. 4. An apple falls towards the earth because the earth attracts it. The apple also attracts the earth by the same force. Why do we not see the earth rising towards the apple?

- (A) Acceleration of the earth is very large when compared to that of apple.
 (B) Acceleration of the earth is equal to that of apple.
 (C) Acceleration of the earth is neither high nor too low.
 (D) Acceleration of the earth is very small when compared to that of apple.

Ans. Option (D) is correct.

Explanation: The mass of the earth is extremely large as compared to that of apple. So, acceleration of the earth is very small when compared to that of apple.



(B) SUBJECTIVE QUESTIONS



Very Short Answer Type Questions

(1 Mark Each)

Q. 1. Who formulated the universal law of gravitation? [R]



[O.E.B.]

Ans. Sir Issac Newton.

Q. 3. Who found out the value of gravitational constant (G) ? [R] [O.E.B.]

Ans. Henry Cavendish.

1

Q. 2. Which force causes the things to fall towards the earth ? [R]



[O.E.B.]

Ans. Force due to gravity.

Q. 4. What is the unit of gravitational constant (G) ? [R]



[O.E.B.]

Ans. The unit of gravitational constant is $\text{Nm}^2 \text{kg}^{-2}$.

1

Q. 5. How is gravitation different from gravity ? [U]



[O.E.B.]

Ans. Gravitation is the force of attraction between any two bodies while gravity refers to attraction between any body and the earth.

1

GRAVITATION

Q. 6. Is the value of 'G' dependent on the medium present between the two bodies?  [O.E.B.]

Ans. No. 1

Q. 7. What does a small value of G indicate?  [O.E.B.]

Ans. A small value of G indicates that the force of gravitational attraction between two ordinary sized objects is a very weak force. 1

Q. 8. Give reason for the statement, "The value of g is greater at the poles than at the equator."  [A]

(Board Term-I 2015)

Ans. At poles the radius of the earth is lesser than that at the equator. (CBSE Marking Scheme, 2015) 1

Q. 9. What is the unit of mass?  [O.E.B.]

Ans. The unit of mass is kilogram (kg). 1

Q. 10. Can the mass of an object be zero?  [O.E.B.]

Ans. No. 1

Q. 11. Why cannot the mass of an object be zero?  [O.E.B.]

Ans. Mass of an object can never be zero because mass of an object is the measure of its inertia and the substance contained by the body. 1

Q. 12. What do you mean by weight of a body?  [O.E.B.]

Ans. Weight of a body is the force with which a body is attracted towards the centre of the earth. 1

Q. 13. Write the SI unit of weight.  (Board Term I, 2015)

Ans. SI unit of weight is Newton (N). 1

Q. 14. What kind of quantity is weight – a scalar or a vector?  [O.E.B.]

Ans. Weight is a vector quantity. 1

Q. 15. Give the relation between mass and weight of a body.  [O.E.B.]

Ans. $W = mg$. 1

Q. 16. How many Newtons are there in 1 kg-wt?  [A]

Ans. 9.8 Newton. 1

Q. 17. At what place on the earth's surface is the weight of a body maximum?  [O.E.B.]

Ans. At the poles. 1

Q. 18. At what place on the earth's surface is the weight of a body minimum?  [O.E.B.]

Ans. At the equator. 1

Q. 19. If the mass of a body is 9.8 kg on the earth, what would be its mass on the moon?  [O.E.B.]

Ans. It will remain the same on the moon, i.e., 9.8 kg. 1

Q. 20. What is the nature of gravitational force?  [O.E.B.]

Ans. Gravitational force is attractive in nature always. 1

Q. 21. When does an object show weightlessness?  [A]

Ans. Weightlessness is a state when an object does not weigh anything. It occurs only when a body is in a state of free fall under the effect of only gravity. 1

Short Answer Type Questions-I

(2 Marks Each)

Q. 1. Name the positions on earth where the value of 'g' is (i) maximum (ii) minimum? Justify your answer.  [R+A] [Board Term-I 2014]

Ans. On earth, value of g is maximum at poles and minimum at the equator. At poles radius of earth is less so value of g is more, at equator radius of earth is more so value of g is less. $g \propto 1/(R^2)$

[CBSE Marking Scheme, 2014] (1+1)

Q. 2. Explain what happens to the force between two objects if : (i) the mass of one object is doubled? (ii) the distance between the objects is tripled.  [A] [DDE 2014]

$$\text{Ans. } F = \frac{Gm_1 m_2}{d^2}$$

- (i) If $m_1 = 2m$, then F becomes twice.
- (ii) If $d = 3d_1$, then F becomes one-ninth.

[CBSE Marking Scheme, 2014] (1+1)

Q. 3. An astronaut carried a pot containing soil weighing 60 N from the earth to the surface of moon. He kept it there and just before return journey from moon to earth he weighed the soil there on the surface of moon and found that it was only 10 N. Where did the rest of the soil go and how much mass of soil was lost? ($g_{\text{earth}} = 10 \text{ ms}^{-2}$) ($g_{\text{moon}} = g_{\text{earth}} / 6$)  [A] [DDE-2014]

Ans. Given that, the weight of the soil on earth is 60 N.

$$g_{\text{earth}} = 10 \text{ ms}^{-2}$$

$$\text{Mass on the earth, } m_1 = \frac{60}{10} = 6 \text{ kg}$$

Weight of the soil on moon = 10 N

$$g_{\text{moon}} = \frac{g_{\text{earth}}}{6} = \frac{10}{6} \text{ ms}^{-2}$$

$$\text{Mass on moon } m_2 = \frac{10 \times 6}{10} = 6 \text{ kg}$$

Because $m_1 = m_2$, hence there has been no loss in mass of the soil on the surface of moon and decrease in weight was due to difference in the gravity. [CBSE Marking Scheme, 2014] 2

Q. 4. An object is dropped from a tower 180 m high. How long does it take to reach the ground? [Take $g = 10 \text{ m/s}^2$]  [A] [Board Term-I, 2015]

$$\text{Ans. } h = 180 \text{ m}, t = ?, g = 10 \text{ m/s}^2, u = 0$$

$$h = ut + \frac{1}{2} gt^2$$

$$\text{or } h = \frac{1}{2} gt^2$$

$$\text{or } 180 = \frac{1}{2} \times 10 \times t^2$$

$$\text{or } t^2 = \frac{180 \times 2}{10} = 36 \\ t = 6 \text{ sec}$$

[CBSE Marking Scheme, 2015] 2

Q. 5. Account for the following :

- (i) On moon, man feels lighter than earth .
- (ii) Mass is scalar while weight is a vector quantity.

A [Board Term-I, 2016]

Ans. (i) Due to less gravitational force exerted by moon on man.

(ii) Mass do not have direction while weight has direction.[CBSE Marking Scheme, 2016] 1 + 1

Q. 6. A stone and the earth attract each other with an equal and opposite force. Why then we see only the stone falling towards the earth but not the earth rising towards the stone?

A [Board Term-I 2016]

Ans. $a = F/m$. The mass of a stone is very small due to which the gravitational force produces a large acceleration in it. Due to very large mass of earth, the same gravitational force produces very small acceleration in the earth.

[CBSE Marking Scheme, 2016] 2



Short Answer Type Questions-II

(3 Marks Each)

Q. 1. Explain :

- (i) Universal gravitational constant
- (ii) Free fall

B [Board Term-I, 2015]

Ans. (i) Universal gravitational constant is the constant 'G' appearing in Newton's law of gravitation.

$$F = \frac{GMm}{r^2},$$

where F is the force between two masses m and M at a distance r apart. The numerical value of G is equal to $6.673 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$. The value of G was found out by Henry Cavendish (1731-1810) by using a sensitive balance.

(ii) **Free fall** : Whenever objects fall towards the earth under the gravitational force alone, we can say that the objects are in free fall. While falling there is no change in the direction of motion of the objects. But due to earth's attraction, there will be a change in the magnitude of the velocity. (1½ + 1½)

Q. 2. State the universal law of gravitation. Mention four phenomena which can be explained by this law.

R+A [DDE 2017]

[Board Term-I, 2015]

Ans. Universal law of Gravitation: Refer to SAQ-II/Q. 7

- (i) The force that binds us to earth.
- (ii) The motion of the moon around the earth.
- (iii) The motion of planets around the sun.
- (iv) The tides due to the moon and the sun.

[CBSE Marking Scheme, 2015] 3

Q. 3. In which direction do the following forces act when an object is in motion ? Explain with the help of an example.

(i) Frictional force

(ii) Gravitational force R+U [Board Term-I, 2015]

Ans. (i) **Frictional force :** Backwards

Example : If a book slides across the surface of a desk, then the desk exerts a frictional force in opposite (i.e. backwards) direction of its motion.

(ii) **Gravitational force :** Downwards

Example : When we throw a ball in the air, it returns to the ground.

[CBSE Marking Scheme, 2015] (1½ + 1½)

Q. 4. A man's weight when taken at the poles is 600 N. Will his weight remain the same when measured at the equator ? Will there be an increase or decrease in his weight ? Explain. A [Board Term-I, 2015]

Ans. No, his weight will not remain same as that at the poles. There will be a decrease in his weight at the equator. As the radius of the earth increases from the poles to the equator, the value of 'g' becomes greater at poles decreasing towards equator. Also, the force of gravity decreases from poles to the equator. 3

A Q. 5. Give reasons :

- (i) A piece of paper takes much longer to fall than a stone through the same distance, when both are dropped simultaneously from roof.
- (ii) The mass is constant everywhere but the weight keeps changing.
- (iii) The value of 'g' keeps changing as we move away from the earth whereas value of 'G' remains constant all over the universe.

A [Board Term-I, 2016]

Ans. (i) This is because a piece of paper has larger surface area and therefore experiences more friction due to air than a stone which has less surface area.

(ii) Because acceleration due to gravity varies from place to place.

(iii) The value of g depends on latitude of the place and the mass of the earth while G is called universal constant as its value remains constant at all the places in the universe. 3

[CBSE Marking Scheme, 2014] (1 + 2)

Q. 6. In which direction do the following forces act when an object is in motion :

(i) Frictional force

(ii) Gravitational force

(iii) Centripetal force

R (Board Term-I, 2014)

GRAVITATION

- Ans.** (i) Opposite to the direction of motion.
 (ii) Downwards
 (iii) Towards the centre (1 + 1 + 1)

[CBSE Marking Scheme, 2014]

- Q. 7.** State universal law of Gravitation. Derive an expression for gravitational force between two bodies. [Board Term-I 2014] [NCT-2014]
[DDE 2014]

Ans. Universal law of gravitation states that the force of attraction between two bodies is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

Let the two bodies 'A' and 'B' be of masses 'M' and 'm' respectively, which are separated by a distance 'r'.

According to Universal law of Gravitation,

$$\text{Then, } F \propto M \times m \quad \dots(\text{i})$$

$$\text{and } F \propto \frac{1}{r^2} \quad \dots(\text{ii})$$

Combining (i) and (ii),

$$F = G \frac{M \times m}{r^2}$$

Where 'G' is called universal gravitation constant.

The numerical value of $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ Kg}^{-2}$

[CBSE Marking Scheme, 2014] (1 + 2)

- AI Q. 8.** What happens to the magnitude of the force of gravitation between two objects if :

- (i) mass of one of the objects is tripled ?
- (ii) distance between the objects is doubled ?
- (iii) mass of both objects is doubled ?

[DDE 2014]

Ans. The force between two objects is given by 'Universal gravitation law'. It is numerically stated as,

$$F = \frac{G(m_1 m_2)}{d^2}$$

- (i) Mass of one object is tripled :

$$F = \frac{G(3m_1)m_2}{d^2}$$

$$F = \frac{3G(m_1 m_2)}{d^2}$$

Force will be tripled.

- (ii) Distance between the objects is doubled :

$$F = \frac{G(m_1 m_2)}{2(d^2)}$$

$$F = \frac{G(m_1 m_2)}{4d^2}$$

$$F = \frac{1}{4} \left(\frac{Gm_1 m_2}{d^2} \right)$$

Force will reduce to one-fourth of its previous value.

- (iii) Masses of both objects are doubled:

$$F = \frac{G\{(2m_1)(2m_2)\}}{d^2}$$

$$F = \frac{4G\{m_1 m_2\}}{d^2}$$

Force will be four times greater than its previous value. (1 + 1 + 1)

- Q. 9.** What is meant by acceleration due to gravity ? Derive an expression for acceleration due to gravity in terms of mass M of earth and its radius R.

[DDE 2017]

Ans. The acceleration produced in the motion of a body falling freely under the force of gravity is called acceleration due to gravity. It is denoted by 'g'.

Consider the earth to be a sphere of mass M and radius R. Suppose a body of mass m situated at distance r from the centre of the earth.

As we know, according to Newton's law of gravitation, the force of attraction between the earth and the body is given by

$$F = GmM/r^2 \quad \dots(\text{i})$$

This force produces an acceleration 'g', called acceleration due to gravity in the body of mass m.

So, from Newton's second law,

$$F = mg \quad \dots(\text{ii})$$

From equations (i) and (ii), we get

$$mg = \frac{GMm}{r^2}$$

$$or \quad g = \frac{GM}{r^2} \quad \dots(\text{iii})$$

This equation gives acceleration due to gravity at points far away from the earth. Now, if body is located on the surface of the earth, then $r = R$, i.e., the radius of the earth. Then equation (iii) becomes

$$g_{\text{surface}} = \frac{GM}{R^2}$$

This equation gives acceleration due to gravity at the surface of the earth.

The value of 'g' on the earth's surface is 9.8 ms^{-2} .

(1 + 2)

- Q. 10.** Find the weight of an object at a height 6400 km above the earth's surface. The weight of the object at the surface of the earth is 20N and the radius of the earth is 6,400 km. [Board Term-I, 2016]

Ans. $W = mg = 20 \text{ N}$

$$\text{Mass} = \frac{20}{9.8} = 2.04 \text{ kg} \quad g = \frac{GM_e}{R_e^2}$$

$$W = mg \left(\frac{R_e^2}{R_e^2 + H^2} \right)$$

$$= 20 \times \left(\frac{6400}{12800} \right) = 20 \times \frac{1}{4} = 5 \text{ N}$$

[CBSE Marking Scheme, 2016] 3

Q. 11. Explain an activity to show that, during a free fall heavier and lighter objects accelerate at the same rate. U [Board Term-I, 2016]

Ans. Drop two balls with different mass from a tall building at the same time. They will reach the ground at the same time. Both the balls are at free fall and their initial velocity is same that is zero. As you know that, $s = \frac{1}{2} at^2$, so the only way that they touch the ground at the same time is that acceleration is same for both the balls. This experiment proves that during free fall objects accelerate at the same rate, irrespective of their mass. [CBSE Marking Scheme, 2016] 3

AT Q. 12. Write a mathematical expression for the universal law of gravitation between two bodies of masses m_1 and m_2 placed at a distance 'd' from each other. If this law is true then why we do not find any two objects in a room move towards each other due to this force? ($G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$) A [Board Term-I, 2016]

$$\text{Ans. } F = \frac{G \cdot m_1 \times m_2}{r^2}$$

$$G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$

The gravitational constant is extremely small with an order of magnitude of $10^{(-11)}$. For objects in a room, mass has an order of 2 in magnitude, i.e., 10^2 kg while for distance it is at best 1, i.e., 10^1 m. Thus the order of magnitude of the gravitational force is $10^{-11} \times 10^2 \times 10^2 / (10 \times 10)$, which gives an order of magnitude of 10^{-9} , which shows that the force is extremely small.

[CBSE Marking Scheme, 2016] 3

Q. 13. Two solid objects of masses 1 kg and 2 kg are dropped from a helicopter at the same time. Which one will reach the ground earlier? Justify your answer with suitable reason. A [Board Term-I, 2016]

Ans. Both will reach the earth at the same time.

This is because 'g' i.e. the acceleration due to gravity acting on a body is independent of its mass. Hence, all bodies fall with the same velocity and acceleration, which is 9.8 ms^{-2} .

[CBSE Marking Scheme, 2016] 3

Q. 14. The gravitational force between two objects is 100 N. How should the distance between these objects be changed so that the force between them becomes 50 N? A [Board Term-I, 2016]

Ans. Here $F_1 = 100 \text{ N}$ $F_2 = 50 \text{ N}$

If r_1 is the original distance and r_2 is the distance between the two objects, then $F \propto \frac{1}{r^2}$

$$\frac{F_1}{F_2} = \left(\frac{r_2}{r_1} \right)^2 = \frac{100}{50} = 2$$

$$r_2 = \sqrt{2} r_1$$

i.e. the distance between the objects should be increased to $\sqrt{2}$ times.

[CBSE Marking Scheme, 2016] 3

Q. 15. The mass of sun is $2 \times 10^{30} \text{ kg}$ and that of earth is $6 \times 10^{24} \text{ kg}$. If the average distance between the sun and the earth be $1.5 \times 10^8 \text{ km}$, calculate the force of gravitation between them. (Take $G = 6.7 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$) A [Board Term-I, 2016]

$$\begin{aligned} \text{Ans. } F &= \frac{G M_s M_e}{d^2} \\ &= \frac{6.7 \times 10^{-11} \times 2 \times 10^{30} \times 6 \times 10^{24}}{(1.5 \times 10^{11})^2} \\ &= 3.57 \times 10^{22} \text{ N} \end{aligned}$$

[CBSE Marking Scheme, 2016] 3

Q. 16. (i) Differentiate between mass and weight.

(ii) The weight of a body at a height equal to be radius of the earth is 'N'. What will be its weight at a height equal to three times the radius of the earth?

U+A [Board Term-I, 2016]

Ans. (i) Mass is the matter content of a body, while weight is the force with which the body is attracted by the earth.

Or

Mass is constant at all places

Weight keeps on changing from place to place.

$$(ii) \quad g = G \frac{M}{d^2}$$

∴ when $d = 3d$

$$\text{Then } g' = G \times \frac{M}{(3d)^2} = \frac{GM}{9d^2}$$

$$\text{Or } g' = \frac{g}{9}$$

Original Weight = $N = mg$

$$\text{Final Weight} = N' = m \times \frac{g}{9} \text{ or } N' = \frac{N}{9} \quad 3$$

[CBSE Marking Scheme, 2016] 3

Q. 18. The weight of a body on the surface of the earth is 392 N. What will be the weight of this body on a planet whose mass is double that of the earth and radius is four times that of the earth.

A [Board Term-I, 2014]

Ans. Let the mass of the earth be 'M' and its radius be 'R'. Then the acc. due to gravity (g) = $GM/R^2 = 9.8 \text{ m/s}^2$ where G is the Gravitational Constant.

Mass of the planet = $2M$

Radius of the planet = $4R$

Hence, acc. due to gravity on that planet

$$\begin{aligned} (g') &= G(2M)/(4R)^2 \\ &= 2GM/16R^2 \\ &= 1/8 (GM/R^2) \\ &= 1/8 \times 9.8 = 1.225 \text{ m/s}^2 \end{aligned}$$



GRAVITATION

Weight of the body on earth = 392 N
 Hence, its mass will be $(392/9.8) = 40 \text{ kg}$
 So, its weight on that particular planet will be $(40 \times 1.225) = 49 \text{ N}$

[CBSE Marking Scheme, 2014] 3

AI Q. 19. Write three differences between gravitational acceleration (g) and gravitational constant (G).

U [NCT-2014]

Ans.

S. No.	Acceleration due to gravity, (g)	Universal gravitational constant (G)
(i)	Acceleration due to gravity is the acceleration acquired by a body due to the earth's gravitational pull on it.	Gravitational constant is numerically equal to the force of attraction between two masses of 1 kg that are separated by a distance of 1 m.
(ii)	g is a vector quantity.	G is a scalar quantity.
(iii)	It is different at different places on the surface of the earth. Its value also varies from one celestial body to another.	The ' G ' is a universal constant i.e., its value is the same (i.e. $6.7 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$) everywhere in the universe.

(1 × 3)

Q. 20. A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate :

- (i) The maximum height to which it reaches.
- (ii) The total time it takes to return to the surface of the earth.

A [DDE-2014]

Ans. Initial velocity of the ball (u) = 49 m/s

Final velocity of the ball (v) = 0 m/s

Acceleration for upward motion (a) = -9.8 m/s^2

(i) Maximum height reached by the ball = h

$$v^2 - u^2 = 2gh$$

$$0 - (49)^2 = 2 \times (-9.8) \times h$$

$$h = \left(\frac{2401}{19.6} \right) \text{ m} = 122.5 \text{ m}$$

(ii) Time taken to reach the maximum height, t

$$v = u + gt$$

$$0 = 49 + (-9.8)t$$

[As final velocity, $v = 0 \text{ m/s}$] = 5 s

Since, same time is taken to reach the ground from the maximum height.

So, total time taken to return to the ground

$$= (2 \times 5) \text{ s} = 10 \text{ s}$$

AI Q. 21. A ball thrown vertically up returns to the thrower after 6 s. Find :

- (i) The velocity with which it was thrown up.
- (ii) The maximum height it reaches.
- (iii) Its position after 4 s.

A [NCERT]

Ans. (i) Acceleration due to gravity, $g = -9.8 \text{ ms}^{-2}$

As the time to go up and return is 6 s.

∴ The time to go up, $t = \left(\frac{6}{2} \right) = 3 \text{ s}$

Final velocity, $v = 0 \text{ ms}^{-1}$

Initial velocity, $u = ?$

As we know, by the first equation of motion,

$$v = u + gt$$

$$0 = u + (-9.8) \times 3$$

$$0 = u - 29.4$$

$$u = 29.4 \text{ ms}^{-1}$$

Thus, the velocity with which it was thrown up
 $= 29.4 \text{ ms}^{-1}$

(ii) Distance (s) = Height (h) = ?

As we know, by the second equation of motion,

$$s = ut + \frac{1}{2}gt^2$$

$$\therefore s = 29.4 \times 3 + \frac{1}{2}(-9.8) \times (3)^2$$

$$\Rightarrow s = 88.2 - 44.1$$

$$\Rightarrow s = 44.1 \text{ m}$$

(iii) Time, $t = 4 \text{ s}$

Distance, $s = ?$

Now, by second equation of motion,

$$s = ut + \frac{1}{2}gt^2$$

$$s = 29.4 \times 4 + \frac{1}{2} \times (-9.8)(4)^2$$

$$\Rightarrow s = 117.6 - 78.4$$

$$\Rightarrow s = 39.2 \text{ m}$$

(1 + 1 + 1)

Commonly Made Error

- Calculation error is commonly seen. Sign convention is often forgotten for declaration. In many answers formula is missing and no unit is seen in final answer.

Answering Tip

- Essential steps need to be shown and final answer needs to be expressed along with a proper unit.

Q. 22. What is the magnitude of the gravitational force between the earth and a 1 kg object on its surface ? ($M_E = 6 \times 10^{24} \text{ kg}$ and $R_E = 6.4 \times 10^6 \text{ m}$)

[NCERT]

Ans. R_E , radius of the planet = $6.4 \times 10^6 \text{ m}$

$$\begin{aligned} M_E &= \text{mass of the planet} \\ &= 6 \times 10^{24} \text{ kg} \end{aligned}$$

G = Universal Gravitational Constant

$$= 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$

m = mass of the object = 1 kg

According to Newton's Law of gravitation, the gravitation force (F) is

$$F = GM_E m/R_E^2$$

$$F = (6.67 \times 10^{-11})(6 \times 10^{24})(1) / (6.4 \times 10^6)^2$$

$$F = 9.8 \text{ N}$$

½



Long Answer Type Questions

(5 Marks Each)

Q. 1. (i) A bar of metal has a mass 200 g and a certain weight. Mass remains the same when weighed at equator but weight decreases. Why ?

(ii) Differentiate between mass and weight. Write any three differences. A [Board Term-I, 2016]

Ans. (i) Weight is dependent on gravitational force. Since, on equator, gravitational force is less, so the weight of the bar of metal decreases.

(ii) Difference between Mass and Weight :

S.No.	Mass	Weight
(i)	Its value remains constant at all places.	Its value changes from place to place due to change in the 'g'.
(ii)	It is a scalar quantity.	It is a vector quantity.
(iii)	It is never zero.	It is zero far away from the earth.
(iv)	Its unit is kg.	Its unit is N or kg wt.

[CBSE Marking Scheme, 2016] (2 + 3)

Q. 2. Write three points of differences between mass and weight. How much would a 70 kg astronaut weigh on moon? What would be his mass on the earth and on the moon?

U+A [Board Term-I 2016, 15]

Ans. Differences between mass and weight : Refer LAQ/Q 1 (ii).

Mass of the astronaut on moon = 70 kg, $g = 1.6 \text{ m/s}^2$ on moon

$$\begin{aligned} W &= m \times g \\ &= 70 \times 1.6 \end{aligned}$$

= 112 N is the weight of astronaut on moon. The mass of a body is constant everywhere in the universe. So, the mass of the astronaut would be same on the earth as well as on the moon i.e. 70 Kg.

[CBSE Marking Scheme, 2016] (3 + 2)

AI Q. 3. (i) Prove that if the earth attracts two bodies placed at the same distance from the centre of earth, with equal force; then their masses will be the same.

(ii) Mathematically express the acceleration due to gravity that is expressed by a free falling object.

(iii) Why is 'G' called a universal constant ?

R [Board Term-I 2014]

Ans. (i) Let mass of first body be m_1

Let mass of second body be m_2

Force on 1st body = Force on 2nd body

$$GMm_1/R^2 = GMm_2/R^2$$

G and G cancel. M and M cancel R^2 and R^2 cancel
This leaves

$$m_1 = m_2$$

Hence proved.

$$(ii) \quad g = GM/R^2$$

(iii) Its value is constant in the universe.

[CBSE Marking Scheme, 2014] (3 + 1 + 1)

AI Q. 4. (a) Write the formula to find the magnitude of gravitational force between the earth and an object on the earth's surface.

(b) Derive how does the value of gravitational force 'F' change between two objects when the :

- (i) Distance between them is reduced to half, and
- (ii) Mass of one object is increased four times.

U+A [Board Term-I 2016]

$$\text{Ans. (a)} \quad F = \frac{GMm}{R^2}$$

(b) (i) According to the law of gravitation, the force of attraction acting between two bodies is given by,

$$\begin{aligned} F' &= \frac{GM_1m_2}{R^2} = G \frac{M_1m_2}{\left(\frac{R}{2}\right)^2} \\ &= 4G \frac{M_1m_2}{R^2} = 4F \end{aligned}$$

Thus, when the distance between the objects is reduced to half, the gravitational force increases by four times the original force.

$$F' = G M \times 4m/R^2 = 4F$$

So as the mass of any one of the object is increased four times, the force is also increased four times. (3 + 2)

Q. 5. (a) A person weighs 110.84 N on moon, whose acceleration due to gravity is 1/6 of that earth. If the value of 'g' on earth is 9.8 ms^{-2} . Calculate.

(i) 'g' on moon.

(ii) Mass of person on moon

(iii) Weight of person on earth

(b) How does the value of g on the earth is related to the mass of the earth and its radius ? Derive it.

A+U [Board Term-I, 2015]

$$\text{Ans. (a)} \quad (i) \quad g_{\text{earth}} \times \frac{1}{6} = 9.8 = 1.63 \text{ ms}^{-2}$$

$$(ii) \quad \text{Mass on moon} = \frac{F}{g} = \frac{110.84}{1.63} = 68 \text{ kg}$$

$$(iii) \quad \text{Weight on earth} = mg = 68 \times 9.8 = 666.40 \text{ N.}$$

$$(b) \quad \text{Derivation of } g = GM/R^2$$

[CBSE Marking Scheme, 2015] 5

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CHAPTER**5****WORK, ENERGY
AND POWER****Syllabus**

- *Work done by a force, energy, power, kinetic and potential energy, law of conservation of energy.*

Revision Notes**Work****Work**

- Work is done when a force acting on a body produces displacement in it.
- Work done = Force \times Displacement in the direction of force.
- Work is a scalar quantity.
- Work has only magnitude and no direction. It is a scalar quantity.
- The SI unit of work is joule (J).
- Work done is positive if the angle between force and displacement is acute or when the displacement is in the direction of the applied force.
- Work done is negative if the angle between force and displacement is obtuse or when the force acts opposite to the direction of displacement.
- Work done on an object by a force would be zero if the displacement of the object is zero.
- When a body moves along a circular path, the force acts along the radius of the circular path and the motion of the body is along the tangential direction. Therefore, the angle between the direction of motion and the force is 90°. Hence, no work is done on a body when it moves in a circular path.
- An object having a capacity to do work is said to possess energy.

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this topic



**Work and
Energy**

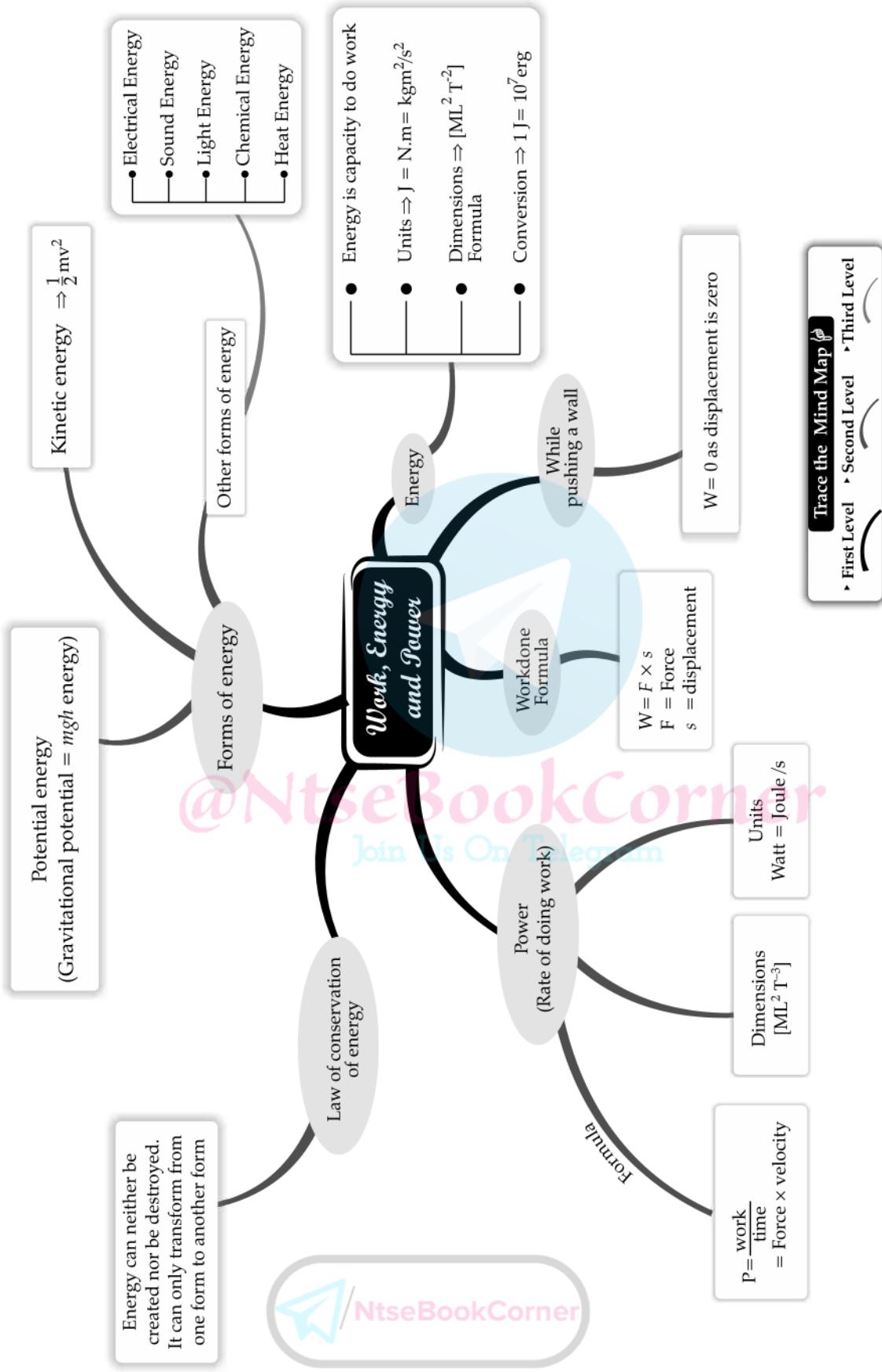
Energy, Types of Energy and Law of Conservation of Energy

- The change of one form of energy into another is called transformation of energy.
- Law of conservation of energy states that energy can neither be created nor be destroyed, but can be transformed from one form to another.
- Energy exists in nature in several forms such as kinetic energy, potential energy, heat energy and chemical energy. The sum of the kinetic and potential energies of an object is called its total mechanical energy.
- The unit of energy is same as that of work, that is Joule.

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**Conservation
of Energy**



- An object of mass ' m ' moving with velocity ' v ' has kinetic energy of $\frac{1}{2}mv^2$.
 - The gravitational potential energy of an object of mass ' m ' raised through a height ' h ' from the earth's surface is given by mgh .



Power

- Power is the ratio of work and time.
 - It is a scalar quantity.
 - In power, time is important but in work, time is not relevant.
 - The S.I. unit of power is watt.
 - Commercial unit of energy is kilowatt hour (kWh).
 - Average power is obtained by dividing the total energy consumed by the total time taken.
 - Energy used in households, industries and commercial embellishments are expressed in kWh.
 - $1 \text{ kWh} = 3.6 \times 10^6 \text{ J} = 1 \text{ unit}$.



Know the Terms

- **Joule** : One joule (J) is the amount of work done by an object when a force of one Newton displaces it by one meter along the line of action of force.
 - **Motion** : A change in position of an object with respect to time.
 - **Force** : Any interaction that tends to change or try to change the motion of an object.
 - **Displacement** : The shortest distance from the initial to the final position.
 - **Energy** : Capacity of an object / system to perform work.
 - **Kinetic energy** : Energy possessed by a body by virtue of its motion.
 - **Potential energy** : Energy possessed by a body by virtue of its position or change in configuration.
 - **Gravitational potential energy** : Work done in raising an object from the ground to a point against gravity.
 - **Mechanical energy** : Energy associated with the motion and position of an object. ($ME = K.E. + P.E.$)
 - **Power** : Rate at which work is done.
 - **1 kWh** : One kilowatt hour is the amount of electrical energy consumed when an electrical appliance of 1000 watt is used for 1 hour.
 - **1 W of power** : When one joule of work is done in one second.



(A) OBJECTIVE QUESTIONS

1 Mark Each



Stand Alone MCOs

- Q. 1.** In case of negative work, the angle between the force and displacement is

(A) 0 (B) 45°
(C) 90° (D) 180°

Ans. Option (D) is correct.

Explanation: In case of negative work, the angle between the force and displacement is 180° .

- AI** Q. 2. A girl is carrying a school bag of 3 kg mass on her back and moves 200 m on a levelled road. The work done against the gravitational force will be ($g = 10 \text{ ms}^{-2}$) :

- (A) 6×10^3 J (B) 6 J
 (C) 0.6 J (D) Zero

Ans. Option (D) is correct.

Explanation: We know that, work done = $F.d \cos \theta$

Force on school bag makes an angle 90° from

the road i.e., $\theta = 90^\circ$

$$\text{So, } W = F \cdot d \cos 90^\circ$$

Hence, work done against the gravitational force

- Q. 3.** The work done on an object does not depend upon the :

WORK, ENERGY AND POWER

- (C) Angle between force and displacement
 (D) Initial velocity of the object.

Ans. Option (D) is correct.

Explanation: We know that, $W = Fd \cos \theta$. Here, F = force applied on the object, d = displacement and θ is angle between force and displacement. So, the work done on an object does not depend upon the initial velocity of the object.

Q. 4. When a body falls freely towards the earth, then its total energy :

- (A) Increases
 (B) Decreases
 (C) Remains constant
 (D) First increases and then decreases.

Ans. Option (C) is correct.

Explanation: Since, total energy of the system is always conserved, so when a body falls freely towards the earth then its total energy remains constant i.e., the sum of the potential energy and kinetic energy of the body would be same at all points.

Q. 5. A car is accelerated on a levelled road and attains a velocity 4 times of its initial velocity. In this process, the potential energy of the car :

- (A) Does not change
 (B) Becomes twice to that of initial
 (C) Becomes 4 times that of initial
 (D) Becomes 16 times that of initial

Ans. Option (A) is correct.

Explanation: Potential energy of the car don't change and kinetic energy changes as follows : Let, initial velocity = u

$$\therefore \text{Kinetic energy } K_1 = \frac{1}{2}mu^2 \quad \dots(i)$$

Given, after sometime velocity become 4 times of its initial velocity

$$\text{i.e., final velocity } (v) = 4u$$

Now, put $v = 4u$, in Eq. (i), we get

$$\begin{aligned} \text{Kinetic energy} &= \frac{1}{2}m(4u)^2 \\ &= \frac{1}{2}m16u^2 \\ K_2 &= 16 \cdot \frac{1}{2}mu^2 \end{aligned}$$

Hence, from Eq. (i), $K_2 = 16K_1$

So in this process, the kinetic energy of car becomes 16 times that of initial kinetic energy.

Q. 6. An iron sphere of mass 10 kg has the same diameter as an aluminium sphere of mass 3.5 kg. Both spheres are dropped simultaneously from a tower. When they are 10 m above the ground, they have the same :

- (a) Acceleration
 (b) Momentum

- (c) Potential energy
 (d) Kinetic energy

Ans. Option (A) is correct.

Explanation: When both spheres are dropped simultaneously from a tower, they have same acceleration because during free fall, acceleration of body becomes equal to g and ' g ' depends on mass of earth and radius of earth.

Q. 7. Water stored in a dam possesses :

- (a) No energy
 (b) Electrical energy
 (c) Kinetic energy
 (d) Potential energy

Ans. Option (D) is correct.

Explanation: Potential energy is stored energy or the energy of position, so water stored in a dam possesses potential energy.

Q. 8. A body is falling from a height h . (After it has fallen a height $= \frac{h}{2}$) it will possess :

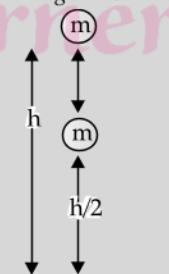
- (a) Only potential energy
 (b) Only kinetic energy
 (c) Half potential and half kinetic energy
 (d) More kinetic and less potential energy.

Ans. Option (C) is correct.

Explanation: As we know that when a body is at height h , it has total energy = KE + PE and at height ' h' , velocity of body is zero.

$$\text{So, } KE = 0 \text{ and } PE = mgh$$

$$\text{So, total energy} = mgh + 0 = mgh$$



$$\text{Now, at height} = \frac{h}{2}$$

$$\text{its, } PE = mg \frac{h}{2} = \frac{mgh}{2} \quad \dots(ii)$$

$$\text{And } KE = \frac{1}{2}mv^2$$

Where, velocity can be determined by equation of motion

$$v^2 = u^2 + 2gh \quad (\because \text{All } v, g, h \text{ are in same direction})$$

(As $u = 0$ at highest point)

$$\text{So, } v^2 = \frac{2gh}{2} \Rightarrow v = \sqrt{gh}$$

$$\text{So, } KE = \frac{1}{2}m \times (\sqrt{gh})^2 = \frac{mgh}{2} \quad \dots(ii)$$

WORK, ENERGY AND POWER

Ans. Option (C) is correct.

Explanation: No, it does not violate the law of conservation of energy. Potential energy is converted into total mechanical energy and hence, it remains conserved.

Q. 7. Assertion: A lamp consumes 1000 J of electrical energy in 10 s. Its power is 100 W.

Reason: Power is obtained by dividing the energy consumed by the time taken.

Ans. Option (A) is correct.

Explanation: Power of lamp = Energy/Time

$$P = \frac{1000}{10} = 100 \text{ W}$$

(AI) Q. 8. Assertion: SI unit of power is Joule.

Reason: One kWh is equal to 3.6×10^6 J.

Ans. Option (D) is correct.

Explanation: SI unit of power is Watt. One kWh is equal to 3.6×10^6 J.

Q. 9. Assertion: The physical quantity defined by rate of doing work is Energy.

Reason: Its SI unit is J/s.

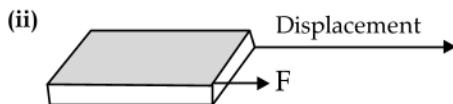
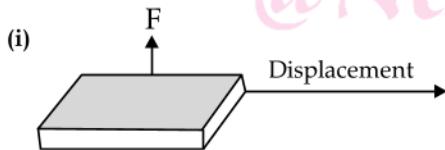
Ans. Option (D) is correct.

Explanation: The physical quantity defined by rate of doing work is power. Its SI unit is J/s or Watt.



Case-based MCQs

I. Study the given figure and answer the following questions.



Q. 1. What will be the work done in the above situations?

- (A) In fig (i), Work done is zero. In fig (ii), work done is positive.
- (B) In fig (i), Work done is zero. In fig (ii), work done is negative.
- (C) In fig (i), Work done is positive. In fig (ii), work done is negative.
- (D) In fig (i), Work done is negative. In fig (ii), work done is positive.

Ans. Option (A) is correct.

Explanation: (i) Work done is zero when applied force and displacement is perpendicular. (ii) Work done is positive when applied force and displacement is in same direction.

Q. 2. Choose the correct explanation for the above situation.

(A) In figure (i), the direction of force, (F) and displacement are perpendicular to each other. There is no displacement in the direction of force so the work done is zero. In fig (ii), the direction of force F and displacement are in the same direction. Hence, work done by the force is positive.

(B) In figure (i), the direction of force, (F) and displacement are perpendicular to each other. There is displacement in the direction of force so the work done is zero. In fig (ii), the direction of force F and displacement are in the same direction. Hence, work done by the force is negative.

(C) In figure (i), the direction of force, (F) and displacement are parallel to each other. There is no displacement in the direction of force so the work done is positive. In fig (ii), the direction of force F and displacement are in the same direction. Hence, work done by the force is negative.

(D) In figure (i), the direction of force, (F) and displacement are perpendicular to each other. There is no displacement in the direction of force so the work done is negative. In fig (ii), the direction of force F and displacement are in the opposite direction. Hence, work done by the force is positive.

Ans. Option (A) is correct.

Explanation: In figure, the direction of force, (F) and displacement are perpendicular to each other. There is no displacement in the direction of force so the work done is zero. In fig (ii), the direction of force F and displacement are in the same direction. Hence, work done by the force is positive.

Q. 3. One joule of work is said to be done on an object when :

- (A) A force of one hundred Newton displaces it by one meter along the line of action of the force.
- (B) A force of one Newton displaces it by one hundred meters along the line of action of the force.
- (C) A force of one Newton displaces it by one meter along the line of action of the force.
- (D) A force of ten Newton displaces it by one meter along the line of action of the force.

Ans. Option (C) is correct.

Explanation: A force of one Newton displaces it by one meter along the line of action of the force.

$$W = F \times S$$

Q. 4. Choose the correct expression for work in terms of force and displacement.

- (A) P.E. = $m \times g \times h$
- (B) $d = s \times t$
- (C) $F = m \times a$
- (D) $W = F \times d$

Ans. Option (D) is correct.

WORK, ENERGY AND POWER

Explanation: 1 kWh is the energy used in 1 hour at the rate of 1000 J/s (or 1 kW).

Q. 3. Relate 1 kWh to joules.

- (A) $1 \text{ kWh} = 36 \times 10^6 \text{ J}$
- (B) $1 \text{ kWh} = 0.36 \times 10^6 \text{ J}$
- (C) $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$
- (D) $1 \text{ kWh} = 3.6 \times 10^5 \text{ J}$

Ans. Option (C) is correct.

Explanation: $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$.

Q. 4. If the heater works 60 joules in one minute, what is its power?

- (A) 60W
- (B) 0.1 W
- (C) 10W
- (D) 1 W

Ans. Option (D) is correct.

Explanation: $P = W/T = 60/60 = 1 \text{ J/s} = 1 \text{ W}$.



(B) SUBJECTIVE QUESTIONS



Very Short Answer Type Questions (1 Mark Each)

Q. 1. Write a case, when is work done by a force zero ?

[O.E.B.]

Ans. Work done by a force is zero when the direction of applied force and displacement of an object is perpendicular to each other.

$$W = F s \cos 90^\circ = 0$$

1

Q. 2. When displacement is in a direction opposite to the direction of force applied, what is the type of work done ?

[O.E.B.]

Ans. Negative work.

1

Q. 3. Seema tried to push a heavy rock of 100 kg for 200 s but could not move it. Find the work done by Seema at the end of 200 s.

[O.E.B.]

Ans. Work done = 0, Since displacement, $s = 0$

1

Q. 4. State the value of commercial unit of electrical energy in Joules.

[O.E.B.]

$$\text{Ans. } 3.6 \times 10^6 \text{ Joules.}$$

1

Commonly Made Error

- Students may get confused in the measuring unit and commercial unit of various quantities such as energy, power etc.

Answering Tip

- Students should understand the concept of commercial unit and memorize the commercial units used for various quantities such as energy, power etc.

Q. 5. What is the kinetic energy of an object?

[KVS, Patna Region, SA-II]

Ans. Kinetic energy is the energy due to motion of the object.

1

Q. 6. State the energy conversions in a dry cell.

[O.E.B.]

Ans. Chemical to light energy, or chemical to sound energy.

1

Q. 7. A horse of mass 210 kg and a dog of mass 25 kg are running at the same speed. Which of the two possesses more kinetic energy ? How ?

[NCERT]

Ans. $K.E. = \frac{1}{2} mv^2$. Kinetic energy is directly proportional to mass. Therefore, horse possesses more energy, due to its large mass.

1

Q. 8. When a ball is thrown vertically upwards, its velocity goes on decreasing. What happens to its potential energy as its velocity becomes zero ?

[O.E.B.]

Ans. PE. becomes maximum.

1

Q. 9. If the speed of the body is halved, what is the change in its kinetic energy ?

[O.E.B.]

Ans. As $K.E. = \frac{1}{2} mv^2$, if the speed of the body is halved its kinetic energy is reduced to $\frac{1}{4}$ of its original value.

1

Q. 10. Define 1 watt of power.

[O.E.B.]

[NCERT Q. 2, Page 156]
[KVS, Patna Region, SA-II]

Ans. One watt is the power that it takes to do one joule of work in one second.

S.I. unit of power is Watt.

So, 1 watt = 1 Joule/1 Second.

Q. 11. How many joules make one kilowatt hour ?

[O.E.B.]

$$\text{Ans. } 1 \text{ kWh} = 3.6 \times 10^6 \text{ J.}$$

1

Short Answer Type Questions-I

(2 Marks Each)

Q. 1. Define work. Write an expression for work in terms of force and displacement. State SI unit of work done.

[Board Term-II 2016]

Ans. Work is done when a force acting on a body produces displacement in it. $W = F \times d$. SI unit of work is joule (J).

(CBSE Marking Scheme, 2016) (1 + ½ + ½)

Q. 2. A box of about 10 kg is placed at a point A on a horizontal surface. It is moved to a point B

which is at a distance of 2 m from A. If the line joining A and B is horizontal, find the work done by the gravitational force on the box. Justify your answer ($g = 10 \text{ m/s}^2$) [NCERT]

- Ans.** Work done is zero. $W = F \cos 90^\circ = 0$ 1
 $[\because \cos 90^\circ = 0]$ Displacement is perpendicular to the direction of applied force while the force of gravity is acting vertically downwards. 1

- Q. 3.** An object thrown at a certain angle from the ground moves in a curved path and falls back to the ground. The initial and the final points of the path of the object lie on the same horizontal line. What is the work done by the force of gravity on the object? Justify your answer. [NCERT]

- Ans.** Work done is zero because force and displacement are perpendicular. Also the force of gravity of an object depends on vertical displacement. Here $\theta = 90^\circ$, $W = F \cos 90^\circ = 0$. (1 + 1 = 2)

Q. 4. When do we say that work is done?

- Ans.** Work is said to be done when a force causes displacement of an object in the direction of the applied force. 1

Necessary conditions for work done :

- (i) A force should act on object and it must cause the displacement. ½
(ii) The object must be displaced. ½

- Q. 5.** Write a suitable reason for heating up of a metal when hit by a fast moving hammer.

A [Board Term-II 2016]

- Ans.** The potential energy get converted into kinetic energy during hitting a metal by a fast moving hammer due to which metal gets heated. 2

[CBSE Marking Scheme, 2016]

- Q. 6.** Identify and state the type of transformation of energy in the following cases : (i) when coal is burnt. (ii) in a thermal power plant.

A [Board Term-II 2014]

- Ans.** (i) Chemical energy to heat energy.
(ii) Chemical energy of fuel to electrical energy.

[CBSE Marking Scheme, 2014] (1 + 1 = 2)

- Q. 7.** Derive a relation between kinetic energy and momentum ' p ' of an object having mass ' m ' moving with velocity ' v '.

A [Board Term-II 2015]

Ans.

$$\begin{aligned} \text{K.E.} &= \frac{1}{2}mv^2 & (p = mv) \\ &= \frac{mv \times mv}{2m} = \frac{p^2}{2m} \\ \text{K.E.} &= \frac{p^2}{2m} \end{aligned}$$

[CBSE Marking Scheme, 2015] 2

- Q. 8.** The weight of a person on a planet A is about

half that on the earth. He can jump upto 0.4 m height on the surface of the earth. How high can he jump on the planet A?

AE [NCERT Exemplar]

- Ans.** Since, weight of the person on planet A is half that on the earth, acceleration due to gravity there will be $\frac{1}{2}$ that on the earth. Hence he can jump double the height with the same muscular force or initial velocity.

The potential energy of the person will remain the same on the earth and on planet A.

$$\text{Thus, } m g_1 h_1 = m g_2 h_2$$

$$\text{if } g_1 = g \text{ then } g_2 = \frac{1}{2} g, h_1 = 0.4$$

$$h_2 = 0.4 \times 2 = 0.8 \text{ m}$$

- PTI Q. 9.** An electrical heater is rated 1200 W. How much energy does it use in 10 hours ?

A [Board Term-II 2015]

$$\begin{aligned} \text{Ans. Electrical energy} &= \text{Power} \times \text{time taken} \\ &= 1.2 \times 10 = 12 \text{ kWh} \end{aligned}$$

[CBSE Marking Scheme, 2015] 2

- Q. 10.** If an electric appliance is rated 1000 W and is used for 2 hours. Calculate the work done in 2 hours.

A [O.E.B.]

$$\begin{aligned} \text{Ans. Work done} &= \text{Energy consumed} \\ \text{Energy} &= \text{Power} \times \text{Time taken} \\ &= 1000 \text{ W} \times 2 \text{ hour} \\ &= 2000 \text{ W-hr or } 2 \text{ kW-hour or } 2 \text{ kWh} \end{aligned}$$

1

- Q. 11.** A man of mass 62 kg climbs up a stair case of 65 steps in 12 s. If height of each step is 20 cm, find his power.

C [O.E.B.]

$$\begin{aligned} \text{Ans. P.E.} &= mgh \\ m &= 62 \text{ kg}, g = 10 \text{ m/s}^2, h = 65 \times \frac{20}{100} = 13 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{P.E.} &= 62 \times 10 \times 13 = 8060 \text{ J} \\ P &= \frac{\text{P.E.}}{t} = \frac{8060}{12} \end{aligned}$$

$$= 671.67 \text{ W}$$

1

- Q. 12.** What is power? **R** [KVS, Patna Region, SA-II]

- Ans.** The rate of doing work is called power.

Since power is the rate of doing work

Power = work / time

$$P = W/T$$

Where, P = power

W = work done

T = Time taken in doing work.

½

Short Answer Type Questions-II

(3 Marks Each)

- Q. 1.** A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some

WORK, ENERGY AND POWER

work or not? Justify your answer.

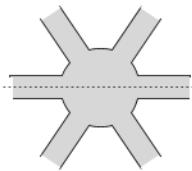
Ans. The person who is holding a bundle of hay gets tired because his muscular energy is converted into thermal energy. (1½)

And there is no displacement in the bundle of hay. So, there is no displacement at all. So, work done by the person on the bundle is zero. (1½)

Q. 2. (i) It is possible that a body is displaced and yet its work done is zero ? If yes, write an example.

(ii) A boy is moving on a straight road against a frictional force of 5 N. After travelling a distance of 1.5 km he forgot the correct path at a round of radius 100 m. However, he moves on the circular path for 1½ cycle and then he moves forward upto 2 km. Calculate the work done by him. [NCERT]

[A] (Board Term-II, 2015)



Ans. (i) Yes, it is possible, that a body is displaced and yet its work done is zero. For example, a satellite moving around the earth. 1

(ii) Frictional Force $F = 5 \text{ N}$

Total distance covered by the boy

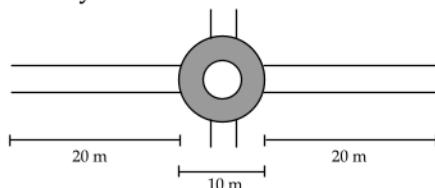
$$\begin{aligned} S &= 1.5 \text{ km} + 1.5(2\pi \times 100 \text{ m}) + 2.0 \text{ km} \\ &= 1500 \text{ m} + 942 \text{ m} + 2000 \text{ m} \\ &= 4442 \text{ m} \end{aligned}$$

Work Done; $W = FS$

$$\begin{aligned} &= (5\text{N})(4442 \text{ m}) \\ &= 22210 \text{ J} \end{aligned}$$

Note, we should take the distance covered while moving into the circular path as 1.5 times its circumference ($2\pi r$) and not its diameter since work is done against friction for the entire one and a half cycle. [CBSE Marking Scheme, 2015] 2

[AI] Q. 3. A boy is pulling a cart by supplying a constant force of 8 N on a straight path of 20 m. On a round about of 10 m diameter he forgets the path and takes 1½ turns and then continues on the straight path for another 20 m. Find the net work done by the boy on the cart. [A]



Ans. Work done,

$$W = F \times s$$

$$W_1 = 8 \times 20 = 160 \text{ J}$$

$$D = 10 \text{ m}$$

$$\frac{D}{2} = 5 \text{ m}$$

Circumference of a circle = $2\pi r$

$$= 2 \times \frac{22}{7} \times 5 \text{ m}$$

$$= 31.43 \text{ m}$$

Distance in ½ circle = πr

$$= \frac{22}{7} \times 5 = 15.71 \text{ m}$$

Total distance for 1½ circle = $31.43 + 15.71 = 47.14 \text{ m}$

$$W_2 = F \times s = 8 \times 47.14 = 377.12 \text{ J}$$

$$W_3 = 20 \times 8 = 160 \text{ J}$$

$$\begin{aligned} \text{Total work done} &= 160 + 377.12 + 160 \\ &= 697.12 \text{ J} \end{aligned}$$

Q. 4. State the law of conservation of energy.

The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy ? Why ?

[A] [NCERT]

Ans. Energy can neither be created nor be destroyed, but can be converted from one form to another. 1

No, potential energy is converted to kinetic energy. 2

Q. 5. State the law of conservation of energy. With the help of an example explain the law of conservation of energy. [U] [Board Term-II, 2016]

Ans. Energy can neither be created nor destroyed but can be transformed from one form to another.

Explanation of law : Let us take the example of simple pendulum. We draw a pendulum bob to one side and allow it to oscillate.

The pendulum bob has P.E. at the extreme positions. Then, it is converted to K.E. at the mean position and so on.

It comes to rest due to air resistance and friction with the hook.

Energy is lost in overcoming friction and air resistance.

But total energy remains constant.

[CBSE Marking Scheme, 2016] 3

[AI] Q. 6. Find the momentum of a body of mass 100 g having kinetic energy 500 J.

[A] [Board Term-II, 2015]

Ans. Using the formula for K.E. we get,

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

$$m = 100 \text{ g} = 0.1 \text{ kg}$$

$$\text{K.E.} = 500 \text{ J}$$

$$v^2 = \frac{2 \times 500}{0.1} = 10000$$

$$v = 100 \text{ m/s}$$

Momentum = Mass × Velocity

$$= 0.1 \times 100 = 10 \text{ kg m/s}$$

[CBSE Marking Scheme, 2015]

Q. 7. Define one Joule of work. Calculate the work done in lifting a box weighing 150 kg through a vertical height of 7 meters. (Take $g = 10 \text{ ms}^{-2}$)

[A] [DDE 2017]

Ans. One Joule is the amount of work done on an object when a force of 1 N displaces it by 1 m along the line of action of force.

$$P.E. = mgh \quad 1$$

$$m = 150 \text{ kg}, g = 10 \text{ ms}^{-2}, h = 7 \text{ m} \quad 1$$

$$P.E. = 150 \times 10 \times 7 = 10500 \text{ J} \quad 1$$

Q. 8. Define power. Derive its SI unit. An electric bulb is rated 15 watts. What does it mean? What is the energy consumed in joules if it is used for 10 minutes? A

Ans. Power is the rate of doing work. 1

$$\begin{aligned} \text{Power} &= \frac{\text{Work}}{\text{Time}} = \frac{1 \text{ Joule}}{1 \text{ second}} \\ &= 1 \text{ watt or } 1 \text{ W} \end{aligned}$$

If the power of an electric bulb is 15 W, it consumes 15 joules per second ½

Energy consumed by the bulb in 10 minutes = 15 W × 600 s = 9000 Joules 1

Q. 9. An electrical geyser of 1.5 kW works for 2 hours. Find the electrical energy units consumed in a day. A [Board Term-II, 2014]

Ans. Energy = power × time = $1.5 \times 2 = 3 \text{ kWh}$
= 3 units. [CBSE Marking Scheme, 2014] 3

Q. 10. (i) A woman draws water from a well of 15 m depth in 15 s. If the mass of her bucket drawn is 10 kg, calculate power used by her.

(ii) When an arrow is shot from a bow, from where will the arrow acquire its kinetic energy?

A (Board Term-II, 2016)

Ans. (i) $m = 10 \text{ kg}, t = 15 \text{ s}, d = 15 \text{ m}$.

$$P = \frac{W}{t} = \frac{mgh}{t} = \frac{10 \times 10 \times 15}{15} = 100 \text{ W}$$

[CBSE Marking Scheme, 2016] 2

(ii) Potential energy from the stretched string of the bow is converted into kinetic energy of the arrow. 1

Q. 11. A boy of mass 50 kg runs up a staircase of 45 steps in 9 s. If the height of each step of the staircase is 15 cm, find the power of the boy. ($g = 10 \text{ m/s}^2$). A [Board Term-II, 2016]

Ans. $m = 50 \text{ kg}, t = 9 \text{ sec}$.

Height of 45 staircases = $15 \times 45 = 675 = 6.75 \text{ m}$.

$$\begin{aligned} P &= \frac{W}{t} = \frac{mgh}{t} = \frac{50 \times 10 \times 6.75}{9} \\ &= 50 \times 10 \times 0.75 \\ &= 500 \times 0.75 \\ &= 375 \text{ W.} \end{aligned}$$

[CBSE Marking Scheme, 2016] 3

Long Answer Type Questions

(5 Marks Each)

Q. 1. (i) Define the work done by a constant force. Write its SI unit and define this unit.

(ii) A 3000 kg truck moving at a speed of 90 m/s stops after covering some distance. The force applied by brakes is 27000 N. Compute the distance covered and work done by this force. A

[Board Term-II, 2016, 2014]

Ans. (i) Work is said to be done when a force acts on an object and the object covers some distance.

Its SI unit is Joule.

One joule : When a force of 1 N moves a body through a distance of 1 meter in its own direction.

(ii) $u = 90 \text{ m/s}; v = 0; F = -27000 \text{ N}; m = 3000 \text{ kg}$

$$F = ma$$

$$a = F/m = -27000/3000$$

$$= -9 \text{ m/s}^2$$

$$\text{Also, } v^2 - u^2 = 2as, 0^2 - (90)^2 = 2(-9)s$$

$$s = 450 \text{ m}$$

$$W = F \times s$$

$$= -27000 \times 450$$

$$= -12150000 \text{ J}$$

$$= -12150 \text{ kJ}$$

– ve sign shows retarding force.

[CBSE Marking Scheme, 2016] 5

Q. 2. (i) An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The initial and the final points of the path of the object lie on the same horizontal line. What is the total work done against the force of gravity and by the force of gravity on the object? Explain with proper mathematical expressions.

(ii) Certain force acting on a 20 kg mass changes its velocity from 5 ms^{-1} to 2 ms^{-1} . Calculate the work done by the force. A [NCERT]

Ans. (i) Work done = mgh

Difference in height of initial and final position is zero. 1

Therefore, Work done = $mg(h_2 - h_1)$

$$= mg(0) = 0 \quad 1$$

(ii) Work done = Change in K.E

Work done = K.E final – K.E initial

$$= \frac{1}{2} \times 20 \times 4 - \frac{1}{2} \times 20 \times 25 = 40 - 250 = -210 \text{ J} \quad 1$$

WORK, ENERGY AND POWER

Q. 3. Four men lift a 250 kg box to a height of 1 m and hold it without raising or lowering it.

(a) How much work is done by the men in lifting the box?

(b) How much work do they do in just holding it?

(c) Why do they get tired while holding it?

$$(g = 10 \text{ ms}^{-2})$$

Ans. (a) Given that,

$$\text{Mass, } m = 250 \text{ kg}$$

$$\text{Height, } h = 1 \text{ m}$$

$$\text{Acceleration due to gravity, } g = 10 \text{ m/sec}^2$$

Work done by the man in lifting the box =

$$\text{Potential energy of box} \quad 1$$

$$W = m.g.h$$

Put the values,

$$W = 250 \times 1 \times 10 = 2500 \text{ J} \quad 1$$

(b) Work done will be zero because the box does not move. So, the displacement is zero that's why work done is zero. 2

(c) In holding the box, men are applying a force which is opposite and equal to the gravitational force acting on the box. While applying the force, muscular effort is involved. So, they feel tired. 1

- AI Q. 4.** (i) What is meant by mechanical energy? State its two forms. State the law of conservation of energy. Give an example in which we observe a continuous change of one form of energy into another and vice-versa.
(ii) Calculate the amount of work required to stop a car of 1000 kg moving with a speed of 72 km/h.

R+A  [O.E.B.]

Ans. (i) Sum of kinetic energy and potential energy of an object is the total mechanical energy.

Its two forms are kinetic energy and potential energy. 1

Energy can neither be created nor be destroyed but can be transformed from one form to another. 1

Example is simple pendulum. 1

$$(ii) m = 1000 \text{ kg}, u = 72 \text{ km/h} = 72 \times \frac{5}{18} \text{ m/s} = 20 \text{ m/s},$$

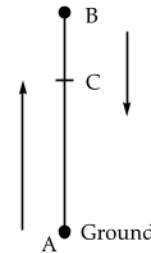
$$v = 0,$$

$$\begin{aligned} \text{Initial kinetic energy} &= \frac{1}{2} m v^2 \\ &= \frac{1}{2} \times 1000 \times 20^2 \\ &= 200000 \text{ J} = 2 \times 10^5 \text{ J} \quad 2 \end{aligned}$$

Final K.E. = 0, work done = change in

$$\text{K.E.} = 2 \times 10^5 \text{ J}$$

Q. 5. (a) A stone is thrown upwards from a point A, as shown in the figure. After reaching the highest point B it comes down. Explain the transformation of energy from A to B and B to A and also mention the type of energy possessed by the stone at point A, B and C of its journey.



- (b) A body of mass 20 kg is dropped from a height of 100 m. Find its K.E. and P.E. after
(i) 1st second
(ii) 2nd second
(iii) 3rd second

A  [O.E.B.]

Ans. (a) While going up, K.E. \rightarrow P.E. and while going down, P.E. \rightarrow K.E. ½
At A \rightarrow K.E.

$$B \rightarrow \text{P.E.} \quad (\frac{1}{2} \times 3 = 1\frac{1}{2})$$

$$C \rightarrow \text{K.E.} + \text{P.E.}$$

$$\begin{aligned} (b) \text{Total Energy} &= mgh \\ &= 20 \times 10 \times 100 \\ &= 2 \times 10^4 \text{ J} \end{aligned}$$

$$(i) \text{After 1}^{\text{st}} \text{ second : } v = u + gt \text{ ms}^{-1} = 10 \times 1$$

$$= 10 \text{ m/s} \quad (u = 0)$$

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

$$= \frac{1}{2} \times 20 \times 10 \times 10$$

$$= 1000 \text{ J}$$

$$\begin{aligned} \text{P.E.} &= \text{T.E.} - \text{K.E.} = 20,000 - 1000 \\ &= 19,000 \text{ J} \end{aligned} \quad 1$$

$$(ii) \text{After 2}^{\text{nd}} \text{ second : } v = 20 \text{ ms}^{-1}$$

$$\text{K.E.} = \frac{1}{2} mv^2 = \frac{1}{2} \times 20 \times 20 \times 20$$

$$= 4,000 \text{ J}$$

$$\text{P.E.} = \text{T.E.} - \text{K.E.}$$

$$= 20,000 - 4,000 = 16,000 \text{ J} \quad 1$$

(iii) After 3rd second : $v = 30 \text{ ms}^{-1}$

$$\begin{aligned}\text{K.E.} &= \frac{1}{2} \times 20 \times 30 \times 30 \\ &= 9,000 \text{ J}\end{aligned}$$

$$\begin{aligned}\text{P. E.} &= \text{T.E.} - \text{K.E.} \\ &= 20,000 - 9,000 = 11,000 \text{ J}\end{aligned}$$

Q. 6. (i) A light and a heavy object have the same momentum. What is the ratio of their kinetic energies? Which one has a larger kinetic energy?

(ii) A ball is dropped from a height of 10 m. If the energy of the ball reduces by 40% after striking the ground, how much high can the ball bounce back? ($g = 10 \text{ ms}^{-2}$)

A [NCERT]

Ans. $p_1 = m_1 v_1$ $p_2 = m_2 v_2$

- (i) But $p_1 = p_2$ or $m_1 v_1 = m_2 v_2$
If $m_1 < m_2$ then $v_1 > v_2$

$$(\text{K.E.})_1 = \frac{1}{2} m_1 v_1^2$$

$$(\text{K.E.})_2 = \frac{1}{2} m_2 v_2^2$$

$$(\text{K.E.})_1 = \frac{1}{2} (m_1 v_1) v_1 = \frac{1}{2} p_1 v_1;$$

$$(\text{K.E.})_2 = \frac{1}{2} (m_2 v_2) v_2 = \frac{1}{2} p_2 v_2;$$

$$\frac{(\text{K.E.})_1}{(\text{K.E.})_2} = \frac{\frac{1}{2} p_1 v_1}{\frac{1}{2} p_2 v_2} = \frac{v_1}{v_2} \quad (\text{As } p_1 = p_2)$$

But $v_1 > v_2$

Therefore, $(\text{K.E.})_1 > (\text{K.E.})_2$

(ii) $mgh = m \times 10 \times 10 = 100 \text{ mJ}$

Energy is reduced by 40%, then the remaining energy is 60 mJ.

Therefore $60 \text{ m} = m \times 10 \times h'$ or $h' = 6 \text{ m}$

Q. 7. Calculate the electricity bill amount for a month of 30 days, if the following devices are used as specified :

(i) 2 bulbs of 40 W for 6 hours.

(ii) 2 tube lights of 50 W for 8 hours.

(iii) A TV of 120 W for 6 hours.

Given the cost of electricity is ₹ 2.50 per unit.

A [Board Term-II, 2016]

Ans. (i) 2 bulbs of 40 watts for 6 hrs.

$$E_1 \text{ bulb} = 2 \times 40 \times 6 = 480 \text{ W} = 0.48 \text{ kWh}$$

$$(ii) E_2 \text{ tubelight} = 50 \times 8 \times 2 = 0.800 \text{ kWh}$$

$$(iii) E_{\text{TV}} = 120 \times 6 = 0.720 \text{ kWh}$$

$$\text{Total Energy} = 0.48 + 0.80 + 0.72 = 2.00 \text{ units}$$

$$\text{Rate} = ₹ 2.50 \text{ per unit}$$

$$\text{Cost per day} = 2 \times 2.50 = ₹ 5.00$$

$$\text{Cost of 30 days} = 5.00 \times 30 = ₹ 150 \quad 5$$

[CBSE Marking Scheme, 2016]

Commonly Made Error

- Calculation error is commonly seen. In many answers formula is missing.

Answering Tip

- Students should practise solving numerical problems, based on consumption of electricity and power.

Q. 8. (i) Give SI unit and commercial unit of electrical energy.

(ii) Calculate the power of an electric motor that can lift 800 kg of water to store in a tank at a height of 1500 cm in 20 s. ($g = 10 \text{ m/s}^2$)

(iii) A lamp consumes 500 J of electrical energy in 20 seconds. What is the power of the lamp ?

A [Board Term-II, 2015]

Ans. (i) SI unit of electrical energy is Joule (J)

Commercial unit of electrical energy is kilowatt hour (kWh)

(ii) $m = 800 \text{ kg}$, $h = 1500 \text{ cm} = 15 \text{ m}$, $t = 20 \text{ sec}$, $g = 10 \text{ m/s}^2$

$$\begin{aligned}P &= \frac{W}{t} = \frac{mgh}{t} \\ &= \frac{800 \times 10 \times 15}{20} = 6000 \text{ W}\end{aligned}$$

(iii) $E = 500 \text{ J}$, $t = 20 \text{ sec}$

$$\text{Power}, \quad P = \frac{W}{t} = \frac{500}{20} = 25 \text{ W}$$

[CBSE Marking Scheme, 2015] (1 + 2 + 2)

Q. 9. (i) Define kinetic energy. Derive an expression for the kinetic energy of an object.

(ii) The power of a motor pump is 5 kW. How much water per minute the pump can raise to height of 20m? Take $g = 10 \text{ ms}^{-2}$

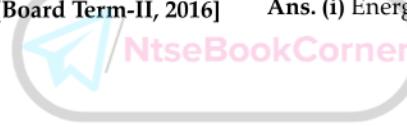
A [O.E.B.]

Ans. (i) Energy possessed by a body by virtue of motion.

$$F = ma$$

$$W = F.s = \text{energy}$$

½



WORK, ENERGY AND POWER

But $v^2 - u^2 = 2as$ or, as = $\frac{1}{2} (v^2 - u^2)$

1

Therefore, $W = \text{energy}$ or, $s = \frac{v^2}{2a}$

½

$$W = m.a. \frac{v^2}{2a} = \frac{1}{2} mv^2$$

1

(ii) Energy = power × time

$$= 5 \text{ kw} \times 1 \text{ min}$$

$$= 3 \times 10^5 \text{ J}$$

Therefore, mass of water drawn in 1 min,

$$m = \frac{E}{gh} = \frac{3 \times 10^5}{10 \times 20} \\ = 1.5 \times 10^3 \text{ kg}$$

½

Therefore,

$$\text{Volume of water} = \frac{\text{Mass}}{\text{Density}} = \frac{1.5 \times 10^3}{10^3}$$

$$= 1.5 \text{ m}^3$$

1

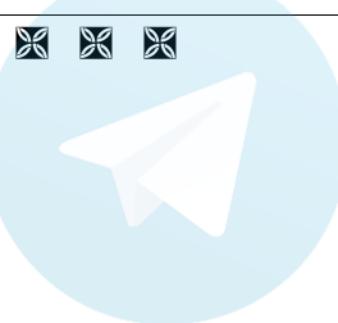


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PRACTICE TEST PAPER - 1

Maximum Time: 1½ hour

MM: 40

General Instructions:

The Question paper comprises of two parts-A and B

- (i) Part A Objective Types Questions 1 to 12. These questions contains Multiple choice questions, Assertion-Reason & Case-based Questions-Internal choices are given in Case -based questions.
- (ii) Part B Subjective Questions 13-26. These Questions comprises of –
 - Very short Answer Type carrying 1 mark each
 - Short Answer Type Questions-I carrying 2 marks each
 - Short Answer Type Questions -II carrying 3 marks each
 - Long Answer Type Questions carrying 5 marks each



(A) OBJECTIVE QUESTIONS



Stand Alone MCQs

(1 mark each)

Q. 1. Which of the following statements is not true about an atom?

- (A) Atoms are not able to exist independently.
- (B) Atoms are the basic units from which molecules and ions are formed.
- (C) Atoms are always neutral in nature.
- (D) Atoms aggregate in large numbers to form the matter that we can see, feel or touch.

Q. 2. The electron distribution in an aluminium atom is:

- | | |
|-------------|-------------|
| (A) 2, 8, 3 | (B) 2, 8, 2 |
| (C) 8, 2, 3 | (D) 2, 3, 8 |

1

Q. 3. Which of the following can make you ill if you come in contact with an infected person?

- (A) High blood pressure
- (B) Genetic abnormalities
- (C) Sneezing
- (D) Blood cancer

1

Q. 4. The atmosphere is held to the earth by :

- (A) Gravity
- (B) Wind
- (C) Clouds
- (D) Earth's magnetic field

1

Q. 5. In case of negative work, the angle between the force and displacement is:

- | | |
|---------|----------|
| (A) 0 | (B) 45° |
| (C) 90° | (D) 180° |

1



Assertion and Reason Based MCQs

(1 mark each)

Directions: In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Q. 6. Assertion: Atoms always combine to form molecule and ions.

Reason : Atoms of most element are not able to exist independently.

1

Q. 7. Assertion: Tuberculosis is an acute disease.

Reason: Disease that lasts for a short period is called acute disease.

1

Q. 8. Assertion : Energy possessed by a rolling stone is kinetic energy.

Reason : Kinetic energy possessed by an object is due to its motion.

1





Case-based MCQs

(1 mark each)

Attempt any 4 sub-parts from each question.**Each question carries 1 mark.****Note :** Three case based MCQs are given. You have to attempt any one Case.**I.** Read the following passage and answer the following questions.

In order to overcome the objections raised against Rutherford's model of the atom, Neil Bohr put forward the following postulates about the model of an atom.

Q. 9. Atoms are made up of _____, _____ and _____.

- (A) Atomic number, mass number, nucleus
- (B) Electrons, nucleus, shells
- (C) Electrons, protons and neutrons
- (D) None of these

Q. 10. Who amended Rutherford's short comings?

- (A) Dalton
- (B) James Chadwick
- (C) Neils' Bohr
- (D) J.J. Thomson

Q. 11. The number of electrons that K-shell and L-shell can accommodate:

- (A) 8, 2
- (B) 2, 8
- (C) 8, 8
- (D) 2, 2

Q. 12. Atomic mass is the sum of:

- (A) Number of electrons and protons
- (B) Number of protons and neutrons
- (C) Number of electrons and neutrons
- (D) Number of electrons, protons and neutrons

OR**II.** Read the given situations and answer the following questions.

- (i) Seema of class IX was having common cold. She sits with Sarika who also develops the disease.
- (ii) Meena of class IX shifted to a new residence, with her family, where water purification system has not been installed yet. He develops cholera and dysentery.

Q. 9. The mode of transmission of common cold is :

- (A) Water
- (B) Air
- (C) Insects
- (D) All of these

Q. 10. Communicable diseases that transmitted from person to person is :

- (A) Contagious
- (B) Acute
- (C) Fungal
- (D) None of these

1
1**Q. 11.** Cholera is a :

- (A) Air borne disease
- (B) Water borne disease
- (C) Animal borne disease
- (D) None of disease

1

Q. 12. What type of food you have to take when you are sick?

- (A) Junk food
- (B) Spicy and Oily food
- (C) Bland and nourishing food
- (D) Liquid food.

1

OR**III.** Read the following paragraph and choose the correct options to answer the questions given below:

Amit buys few grams of gold at the poles as per the instruction of one of his friends. He hands over the same when he meets him at the equator.

Q. 9. At what place on the earth's surface is the weight of a body minimum?

- (A) At the equator
- (B) At all places the weight will be equal
- (C) At the north pole
- (D) At the south pole

1

Q. 10. Will the friend agree with the weight of gold bought?

- (A) No, he won't agree.
- (B) Yes, he will agree.
- (C) Cannot say
- (D) Data is insufficient

1

Q. 11. The value of g is greater at the poles than at the equator, so the mass of gold at the equator will be

- (A) More than the mass of gold at the poles.
- (B) Less than the mass of gold at the poles.
- (C) Same as the mass of gold at the poles.
- (D) Zero

1

Q. 12. What is the relation between mass and weight?

- (A) Weight (W) of the body is always less than the mass of the body.
- (B) Weight (W) of the body is same as that of the mass of the body.
- (C) Weight (W) of the body is inversely proportional to the mass of the body.
- (D) Weight (W) of the body is directly proportional to the mass of the body.

1

**(B) SUBJECTIVE QUESTIONS****Very Short Answer Type Questions**

(1 Mark Each)

Q. 13. What is the major drawback of principle of treatment ? 1

Q. 14. If the mass of a body is 9.8 kg on the earth, what would be its mass on the moon ? 1

**Short Answer Type Questions-I**

(2 Marks Each)

Q. 15. Calculate the number of moles in 17 gm of H_2O_2 (Atomic weight of H = 1 u, O = 16 u). 2

Q. 16. An atom of an element has three electrons in its 3rd orbit, which is the outermost shell. Find out:

- (i) The electronic configuration
- (ii) Atomic number
- (iii) Number of protons
- (iv) Valency 2

Q. 17. Explain how individual health depends on social and mental well-being. 2

Q. 18. What is immunization ? List two diseases against which vaccines are available. 2

Q. 19. Account for the following :

- (i) On moon, man feels lighter than on the earth.
- (ii) Mass is scalar while weight is a vector quantity. 2

Q. 20. Derive a relation between kinetic energy and momentum ' p ' of an object having mass ' m ' and moving with velocity ' v '. 2

**Short Answer Type Questions-II**

(3 Marks Each)

Q. 21. (a) State the law of conservation of energy.
(b) The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy ? Why ? 3

Q. 22. A man is suffering from AIDS.

(i) He is not able to fight off even minor infections. Why?

(ii) Write any two ways in which he could have got this disease.

(iii) Will the treatment by antibiotics help him in AIDS ? Justify your answer. 3

Q. 23. (i) Which isotope is used in the treatment of cancer ?

(ii) A particle contains 11 protons and 10 electrons. Write the symbol and the name of the particle.

(iii) What do you think will be the observation if the alpha-particle scattering experiment is carried out using a foil of a metal other than gold ? 3

**Long Answer Type Questions**

(5 Marks Each)

Q. 24. Calculate the electricity bill amount for a month of 30 days, if the following devices are used as specified :

- (i) 2 bulbs of 40 W for 6 hours.
- (ii) 2 tube lights of 50 W for 8 hours.
- (iii) A TV of 120 W for 6 hours.

Given the cost of electricity is Rupees 2.50 per unit. 5

OR

Q. 25. (i) Define valency. What conclusions can be drawn about the reactivity of an atom from its valency?

(ii) Why does an atom of Argon have zero valency? Explain using the electronic configuration of Argon. 5

OR

Q. 26. (a) What do signs and symptoms indicate if a person is suffering from any disease ?

(b) Based on the duration of the disease, what are the different categories of diseases ? Differentiate between them with one example each. 5



Finished Solving the Paper ?
Time to evaluate yourself !

OR

For detailed solutions
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PRACTICE TEST PAPER - 2

Maximum Time: 1½ hour

MM: 40

General Instructions:

The Question paper comprises of two parts-A and B

- (i) Part A Objective Types Questions 1 to 12. These questions contains Multiple choice questions, Assertion-Reason & Case-based Questions-Internal choices are given in Case -based questions.
- (ii) Part B Subjective Questions 13-26. These Questions comprises of –
 - Very short Answer Type carrying 1 mark each
 - Short Answer Type Questions-I carrying 2 marks each
 - Short Answer Type Questions -II carrying 3 marks each
 - Long Answer Type Questions carrying 5 marks each



(A) OBJECTIVE QUESTIONS



Stand Alone MCQs

Q. 1. A change in the physical state can be brought about

- (A) Only when energy is given to the system.
- (B) Only when energy is taken out from the system.
- (C) When energy is either given to, or taken out from the system.
- (D) Without any energy change. 1

Q. 2. Which of the following statements about Rutherford's model of atom are correct?

- (i) Considered the nucleus as positively charged.
 - (ii) Established that the α -particles are four times as heavy as a hydrogen atom.
 - (iii) Can be compared to solar system.
 - (iv) Was in agreement with Thomson's model.
- | | |
|-------------------|---|
| (A) (i) and (iii) | (B) (ii) and (iii) |
| (C) (i) and (iv) | (D) Only (i) 1 |

Q. 3. If you live in a overcrowded and poorly ventilated house, it is possible that you may suffer from which of the following diseases?

- | | |
|------------------------|---|
| (A) Cancer | (B) AIDS |
| (C) Air borne diseases | (D) Cholera. 1 |

Q. 4. An object weighs 10 N in air. When immersed fully in water, it weighs only 8 N. The weight of the liquid displaced by the object will be :

- | | |
|----------|---|
| (A) 2 N | (B) 8 N |
| (C) 10 N | (D) 12 N 1 |

Q. 5. When a body falls freely towards the earth, then its total energy :

- (A) Increases
- (B) Decreases
- (C) Remains constant
- (D) First increases and then decreases. 1



Assertion and Reason Based MCQs

Directions: In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

- (A) Both A and R are true and R is the correct explanation of A.
- (B) Both A and R are true but R is NOT the correct explanation of A.
- (C) A is true but R is false.
- (D) A is false but R is true. 1

Q. 6. Assertion: Valency of fluorine is one.

Reason: Fluorine atom contain seven valence electrons. 1

Q. 7. Assertion: AIDS is a syndrome and not a disease.

Reason: AIDS affect many parts of the body. 1

Q. 8. Assertion: The physical quantity defined by rate of doing work is Energy.

Reason: SI unit of energy is J/s. 1



Case-based MCQs

**Attempt any 4 sub-parts from each question.
Each question carries 1 mark.**

Note : Three case based MCQs are given. You have to attempt any one Case.

- I. The following data represents the distribution of electrons, protons and neutrons in atoms of four elements A, B, C, D. Understand the data carefully and answer the following questions.

Element	Protons	Neutrons	Element
A	9	10	9
B	16	16	16
C	12	12	12
D	17	22	17

II. Study the given statement and answer the four questions given below :

In the month of September, four devices of power 100 W each is used for 10 hours daily.

- Q. 9.** Find the energy in kWh.
(A) 120 kWh. (B) 100 kWh.
(C) 10 kWh. (D) 1 kWh. 1

Q. 10. Define 1 kWh.
(A) 1 kWh is the energy used in 1 second at the rate of 1000 J/s (or 1 kW).

- (B) 1 kWh is the energy used in 1 hour at the rate of 1000 J/s (or 1 kW).

(C) 1 kWh is the energy used in 1 minute at the rate of 1000 J/s (or 1 kW).

(D) 1 kWh is the energy used in 1 day at the rate of 1000 J/s (or 1 kW). 1

OR

- III.** Read the passage and answer the following questions.
Human beings live in societies and different localities like villages or cities, which determine the social and physical environment, both are to be kept in harmony. Public cleanliness is important for individual's health. A lot of money is required for maintaining better living conditions. We need good food for healthy body and for this, we have to earn more. For the treatment of diseases also, one has to be in a good economic condition.

- Q. 9. State of physically, mentally and socially well being is known as :
(A) Antibody (B) Health
(C) Immunity (D) All of these 1

Q. 10. On administration of Vaccine, body develops :
(A) Good health (B) Antigens
(C) Immunity (D) Antibodies 1

Q. 11. Select a disease for which vaccine is available :
(A) Dengue (B) Typhoid
(C) AIDS (D) Common Cold 1

Q. 12. What is essential for good health?
(A) Personal hygiene (B) Balanced Diet
(C) Immunisation (D) All of these 1



(B) SUBJECTIVE QUESTIONS



Very Short Answer Type Questions

(1 Mark Each)



Short Answer Type Questions-I

(2 Marks Each)

- Q. 13.** Name the causative organism of cholera.

- Q. 14.** How is gravitation different from gravity?

- Q. 15.** (i) Write down the name of compounds represented by the following formulae:

(a) Ca(OH)_2 (b) K_2SO_4

(ii) Give two examples of bivalent cations. 2

Q. 16. (a) J. Chadwick discovered a sub-atomic particle that has no charge and has mass nearly equal to that of a proton. Name the particle and give its location in the atom.

(b) If 'K' and 'L' shells of an atom are completely filled, then what would be :

(i) the total number of electrons in the atom, and

(ii) its valency? 2

Q. 17. Influenza or common cold spreads faster and is difficult to control. Why? 2

Q. 18. Although Archana has been suffering from cold and cough she decided to appear for her class test. Classmates seated close to her had an exposure to the infection being carried by Archana. However, only one of them actually suffered from cold and cough. Explain, what prevented rest of those classmates catching cold and cough in spite of their exposure to the infection. 2

Q. 19. Name the positions on earth where the value of 'g' is (i) maximum (ii) minimum? Justify your answer. 2

Q. 20. Define work. Write an expression for work in terms of force and displacement. State SI unit of work done. 2

Q. 21. A boy of mass 50 kg runs up a staircase of 45 steps in 9 s. If the height of each step of the staircase is 15 cm, find the power of the boy. ($g = 10 \text{ m/s}^2$). 2



Short Answer Type Questions-II

(3 Marks Each)

Q. 22. What precautions can you take in your school to reduce the incidence of infectious diseases? 3

Q. 23. (i) Explain what do you understand by Avogadro constant?

(ii) Calculate the number of moles for 56 g of Ne. (Atomic mass Ne = 20 u) 3



Long Answer Type Questions

(5 Marks Each)

Q. 24. (i) Prove that if the earth attracts two bodies placed at the same distance from the centre of earth, with equal force; then their masses will be the same.

(ii) Mathematically express the acceleration due to gravity that is expressed by a free falling object.

(iii) Why is 'G' called a universal constant? 5

OR

Q. 25. (a) What kind of food is advised when we fall sick and why?

(b) Mention any three basic conditions required for good health. 5

OR

Q. 26. (i) If 18 gm of pure water is electrolyzed, 2 gm of hydrogen and 16 gm of oxygen is obtained. Which law of chemical combination is illustrated by this statement?

(ii) State the law of constant proportion. Illustrate with the help of an example.

(iii) Which postulate of Dalton's atomic theory is the result of law of conservation of mass?

(iv) Which point of Dalton's atomic theory came from law of constant proportions? 5

■ ■

Finished Solving the Paper ?

Time to evaluate yourself !

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