

STUDY MATERIAL

NEET

BIOLOGY

Class 11



 **CP PUBLICATION**



BIOLOGY

Study Material for NEET preparation
Prepared by Career Point Kota Experts



CAREER POINT

CONTENTS OF THE PACKAGE AT A GLANCE

BIOLOGY

Class 11

Plant Diversity

- ◆ The living world
- ◆ Biological classification
- ◆ Plant Kingdom

Animal Diversity

- ◆ Animal Kingdom (Non Chordata)
- ◆ Animal Kingdom (Chordata)

Structural Organisation in Plants & Animals

- ◆ Morphology of Flowering Plants
- ◆ Anatomy Of flowering plants
- ◆ Animal Tissue
- ◆ Cockroach
- ◆ Frog

Cell : Structure & Function

- ◆ Cell : the unit of life
- ◆ Cell Cycle and cell division
- ◆ Biomolecules

Plant Physiology

- ◆ Photosynthesis
- ◆ Respiration in Plants
- ◆ Plant Growth & Developments

Human Physiology

- ◆ Breathing and exchange of gases
- ◆ Body fluids and circulation
- ◆ Excretory products and their elimination
- ◆ Locomotion and movements
- ◆ Neural control and coordination
- ◆ Chemical Coordination & Regulation

Features of The Product

This study material is especially designed for NEET aspirants. The entire study material is arranged in such a way so that the learning process progresses gradually from the basic to advanced stages. This easy-to-grasp material enables students to apply the fundamentals they have learned and boost their confidence to tackle the problems asked in the NEET and other medical competitive examinations.

Key Features of the Chapter

Theory & Concepts

Theory provides all the basic concepts in clear and precise manner. It comprises all the related and required diagrams, tables, graphs, real life examples, info graphics, conceptual questions that makes it more comprehensive. It also highlights tips and tricks, facts, notes, misconceptions, key points, and problem solving tactics.

THE LIVING WORLD

Chapter Contents

- Introduction
- What is Living
- Diversity in the living World
- Taxonomy
- Identification
- Nomenclature
- Classification
- Taxonomic Categories

Introduction

- ☞ Living organisms show some unique and distinctive characteristics which help us in recognising and differentiating them from other non-living things.
- ☞ The characteristics which we observe commonly in all living beings are growth, reproduction and sensitivity. There are some other features which are not seen from outside but we know that they are taking place inside the body like metabolic reactions, self-replication, self-organisation, etc.
- ☞ The living organisms also have capability to interact and evolve, which can be observed and studied in them.
- ☞ The ecological conflict and cooperation among members of a population and among populations of a community or even the molecular traffic inside a cell make us deeply reflect on – what indeed is life ?

What is Living ?

Growth

- ☞ Growth is a fundamental characteristic of all living organisms. It is regarded as an **intrinsic** property of living organisms through which they can increase both mass and number of cells, in their body.
- ☞ All living organisms whether unicellular or multicellular, grow by cell divisions. Though, the pattern and duration of growth is distinct in different organisms. Like in plants, growth can occur throughout their life span whereas animals have only a limited period of growth in their life span.
- ☞ In unicellular organisms like bacteria and *Amoeba*, growth occurs by cell division and such cell division also leads to the growth of their population. Although, by such processes of cell division, reproduction of the individual also occurs.
- ☞ Hence, growth and reproduction are **mutually inclusive events** in unicelled organisms. In higher animals and plants, growth and reproduction are linked but are **mutually exclusive events**. However, cell division not only occurs in living organisms at time of growth and reproduction but also during maintenance to replace lost cells due to some injury, etc. from the body.
- ☞ One can say that, to maintain original size, shape and structure of a body, new cells are formed by division in various living beings. Hence, growth involves both increase in mass and number of cells which takes place inside the body of living organisms and is irreversible.
- ☞ On the other hand, non-living system can also be seen growing, like snow mountains grow by addition of snow on them, crystals increase in size by the addition of molecules on its surface, sand-dunes increase by frequent transport of more material from its native bed by natural agents like river, etc. But such growth in non-living objects happens externally by addition of some material from any outside source. So, we can say in non-living objects, growth is extrinsic as compared to intrinsic growth in living organisms. Therefore, non-living objects can increase their mass by accumulation of material on surface by any external agency which can be reversed.

Practice Exercises

Exercise Level -1 : It contains single objective correct (SCQ) type concept building questions.

EXERCISE-1

- Q.1** Which of the following shows reversible growth?
(1) Snow mountain (2) Bacteria
(3) *Euglena* (4) *Spirogyra*
- Q.2** Growth in living organisms occurs by
(1) Division of cells
(2) Increase in mass of the living structure
(3) Accumulation of material by external agency
(4) Both (1) & (2)
- Q.3** *Amoeba* reproduces by
(1) Regeneration (2) Fragmentation
(3) Fission (4) Budding
- Q.4** Which of the following pairs is correctly matched ?
(i) Fungi - Regeneration
(ii) Mosses - Fragmentation
(ii) *Planaria* - Budding
(1) Only (i) (2) Both (i) & (iii)
(3) Only (ii) (4) Only (iii)
- Q.5** Metabolic reaction involves
(1) Synthesis of biomolecules only
(2) Breakdown of some biomolecules only
(3) All physical changes which occur in objects around us
(4) All chemical reactions which occur inside an organism
- Q.6** When green plants capture sunlight and utilize it to synthesize glucose, the reactions involved during this process are said to be
(1) Catabolic reactions
(2) Anabolic reactions
(3) Decomposition reactions
(4) Chain reactions
- Q.7** Sensitivity is the
(1) Ability to grow
(2) Ability to reproduce
(3) Ability to detect changes in the environment
(4) Ability to capture sunlight
- Q.8** Which is not a feature of all living organisms ?
(1) Metabolism (2) Cellular organisation
(3) Self-consciousness (4) Consciousness
- Q.9** Identification is the process of
(1) Naming living organism
(2) Recognising the characteristic features of an organism
(3) Categorising living organism
(4) Discovering new species of plants and animals
- Q.10** International Code of Zoological Nomenclature set rules for scientific naming of
(1) Plants (2) Fungi
(3) Animals (4) Virus
- Q.11** Naming system accepted universally, is known as
(1) Vernacular names
(2) Zoological nomenclature
(3) Binomial nomenclature
(4) Botanical nomenclature
- Q.12** Scientific names are generally taken from
(1) Sanskrit language (2) Latin language
(3) Hindi language (4) Greek language
- Q.13** Classification of organisms is required because
(1) It makes the study of organisms easier and simpler
(2) It enables us to study geographical distribution of some organisms
(3) It makes the study of organisms complex
(4) It leads to ambiguity in study of various organisms
- Q.14** The word 'taxon' signifies
(1) Scientific name of an organism
(2) Developmental process of an organism
(3) Taxonomic group of any rank
(4) Ecological importance of an organism
- Q.15** How many obligate categories are there in taxonomic hierarchy?
(1) Five (2) Six
(3) Seven (4) Four
- Q.16** Lowest category of taxonomic hierarchy is
(1) Taxon (2) Rank
(3) Species (4) Genus
- Q.17** Pick the incorrect statement about species.
(1) Each species has some distinct morphological features than other species
(2) The group of organisms in a particular species freely interbreed among themselves
(3) The second part of biological name consists of specific name
(4) Each species may have one or more genus
- Q.18** The specific epithet in *Solanum tuberosum* and *Canis familiaris* respectively is
(1) *Tuberosum* and *Canis*
(2) *Solanum* and *familiaris*
(3) *Tuberosum* and *familiaris*
(4) *Solanum* and *Canis*
- Q.19** All related species are kept under
(1) One common genus
(2) Different genus due to different evolutionary courses
(3) Various groups according to the similarities and differences
(4) Different higher taxa on basis of morphological differences

Exercise Level -2: It contains single objective type good quality questions on all the concepts of the chapter in mixed manner.

EXERCISE-2

- Q.1** Which of the following is a class?
 (1) Mammalia (2) Sapindales
 (3) Primata (4) Poales
- Q.2** _____ is the assemblage of families which exhibit a few similar characters.
 (1) Class (2) Genus
 (3) Species (4) Order
- Q.3** Three different genera *Solanum*, *Petunia* and *Datura* are placed in the family.
 (1) Poaceae (2) Anacardiaceae
 (3) Homnidae (4) Solanaceae
- Q.4** Identify the generic name from the given scientific names.
Panthera leo, *Canis familiaris*, *Rosa indica*
 (1) *Leo*, *Canis*, *indica*
 (2) *Panthera*, *Canis*, *Rosa*
 (3) *Leo*, *familiaris*, *indica*
 (4) *Panthera*, *Rosa familiaris*
- Q.5** *Solanum* includes species like
 (1) *nigrum* and *melongena* (2) *leo* and *pardus*
 (3) *tigris* and *sapiens* (4) *indica* and *familiaris*
- Q.6** Which of the following is **incorrect** w.r.t. species ?
 (1) A group of individual organisms with fundamental similarities
 (2) Two different species breed together to produce fertile offsprings
 (3) Human beings belong to the species *sapiens*
 (4) *Panthera* has many specific epithet as *tigris*, *leo* and *pardus*
- Q.7** What do A, B and C represent in the given scientific name respectively?

<i>Mangifera</i>	<i>indica</i>	<i>Linn</i>
C	B	A

 (1) Generic name, specific name and author's name
 (2) Specific name, generic name and author's name
 (3) Author's name, specific name and generic
 (4) Generic name, author's name and specific name
- Q.8** Which of the following is incorrect regarding scientific names?
 (1) These are also known as common names
 (2) These ensure that each organism has only one name
 (3) These have two components – the generic name and specific epithet
 (4) These are universally accepted names
- Q.9** Which one of the following criteria is/are essential and form the basis of modern taxonomic studies?
 (1) Ecological information of organisms
 (2) Development process
 (3) External and internal structure
 (4) All of these
- Q.10** Which of the following is not a result of cell division?
 (1) Growth (2) Repair
 (3) Metabolism (4) Reproduction
- Q.11** Mark the **incorrect** pair.
 (1) *Hydra* - Budding
 (2) Flatworm - Regeneration
 (3) *Amoeba* - Fragmentation
 (4) Yeast - Budding
- Q.12** Which of the following is **incorrect** for reproduction?
 (1) Unicellular organisms reproduce by cell-division
 (2) Reproduction is a characteristic of all living organisms
 (3) In unicellular organisms, reproduction and growth are linked together
 (4) Non-living objects are incapable of reproducing
- Q.13** Mark the **incorrect** statement w.r.t. metabolism.
 (1) Microbes exhibit the metabolism
 (2) It is the property of all living forms
 (3) The metabolic reactions can be demonstrated *in vitro*
 (4) It is not a defining feature of life forms
- Q.14** Non-living objects exhibit/show
 (1) Property of self-replication
 (2) Evolution
 (3) Self-regulating interactive systems
 (4) Reversible growth
- Q.15** Which statement is false about the growth shown by non-living objects?
 (1) The growth occurs from outside
 (2) The growth is reversible
 (3) The growth is due to the accumulation of material on the surface
 (4) The growth is intrinsic
- Q.16** Taxonomy deals with
 (1) Development of zoological parks
 (2) Study of kinds and diversity of microorganisms only
 (3) Evolutionary relationships between organisms
 (4) Classification of diverse organisms in different taxa
- Q.17** Which of the following features are not shown by scientific names of various organism?
 (1) They consists of two components
 (2) They have Latin origin
 (3) They always have "linn" abbreviation at the end of second component
 (4) They are printed in italics
- Q.18** The correct sequence of taxonomic study of a newly discovered organism is
 (1) First classification then identification, nomenclature and characterisation
 (2) First identification then classifying organism and then characterisation and nomenclature
 (3) First nomenclature then characterisation, identification and classification
 (4) First characterisation then identification and nomenclature and then classification

Exercise Level -3 : It contains previous years NEET exam questions from 2005 to upto to present year.

EXERCISE-3

- Q.1** A group of plants or animals with similar traits of any rank is [AIPMT-1992]
(1) species (2) genus
(3) order (4) taxon
- Q.2** Practical purpose of taxonomy or classification – [CBSE PM/PD-1999]
(1) Facilitate the identification of unknown species
(2) Explain the origin of organisms
(3) To know the evolutionary history
(4) Identification of medicinal plants
- Q.3** Which arrangement is in correct ascending order - [CBSE PM/PD-1999]
(1) Species < genus < order < family
(2) Genus < species < family < order
(3) Order < family < Genus < species
(4) Species < genus < family < order
- Q.4** Which of the following is less general in characters as compared to genus ? [AIPMT-2001]
(1) Species (2) Division
(3) Class (4) Family
- Q.5** Species are considered as : [AIPMT-2003]
(1) real units of classification devised by taxonomists
(2) real basic units of classification
(3) the lowest units of classification
(4) artificial concept of human mind which cannot be defined in absolute terms
- Q.6** The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for ? [AIPMT-2007]
(1) Interaction with the environment and progressive evolution
(2) Reproduction
(3) Growth and movement
(4) Responsiveness to touch
- Q.7** ICBN stands for [AIPMT-2007]
(1) International Code of Botanical Nomenclature
(2) International congress of Biological Names
(3) Indian code of Botanical Nomenclature
(4) Indian congress of Biological Names
- Q.8** Which one of the following aspects is an exclusive characteristic of living things ? [AIPMT -2011]
(1) Isolated metabolic reactions occur in vitro
(2) Increase in mass from inside only
(3) Perception of events happening in the environment and their memory
(4) Increase in mass by accumulation of material both on surface as well as internally
- Q.9** Which one of the following animals is correctly matched with its particular named taxonomic category? [AIPMT-2011]
(1) Cuttlefish – Mollusca, a class
(2) Humans – Primata, the family
(3) Housefly – *Musca*, an order
(4) Tiger – *tigris*, the species
- Q.10** Which one of the following organisms is **scientifically correctly named, correctly printed** according to the International Rules of Nomenclature and **correctly described** ? [AIMPT - 2012]
(1) *Plasmodium falciparum* – a protozoan pathogen causing the most serious type of malaria
(2) *Felis tigris* – The Indian tiger, well protected in Gir forests.
(3) *E.Coli* – Full name *Entamoeba coli*, a commonly occurring bacterium in human intestine
(4) *Musca domestica* – The common house lizards, a reptile
- Q.11** The common characteristics between tomato and potato will be maximum at the level of their [NEET-2013]
(1) Family (2) Order
(3) Division (4) Genus
- Q.12** Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature ? [NEET-1 2016]
(1) The first word in a biological name represents the genus name, and the second is a specific epithet
(2) The names are written in Latin and are italicised
(3) When written by hand, the names are to be underlined
(4) Biological names can be written in any language
- Q.13** Match **Column-I** with **Column-II** for housefly classification and select the correct option using the codes given below : [NEET-2 2016]
- | Column-I | Column-II |
|-----------------|------------------|
| a. Family | (i) Diptera |
| b. Order | (ii) Arthropoda |
| c. Class | (iii) Muscidae |
| d. Phylum | (iv) Insecta |
- Codes :**
- | | a | b | c | d |
|-----------|-------|------|-------|---|
| (1) (iii) | (i) | (iv) | (ii) | |
| (2) (iii) | (ii) | (iv) | (i) | |
| (3) (iv) | (iii) | (ii) | (i) | |
| (4) (iv) | (ii) | (i) | (iii) | |
- Q.14** Which one of the following animals correctly matched with its particular taxonomic category ? [NEET-2017]
(1) Tiger – *tigris*, species
(2) *Cuttlefish* – *mollusca*, class
(3) *Humans* – *primate*, family
(4) *Housefly* – *Musca*, order

Answer key

Above mentioned all exercises provided with answer key

ANSWER KEY

EXERCISE-1

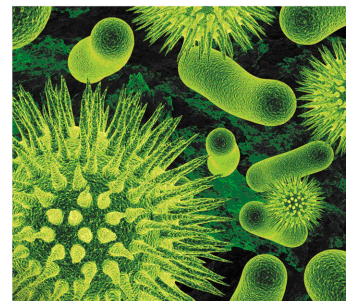
Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	4	3	3	4	2	3	3	2	3	3	2	1	3	3	3	4	3	1	4
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	1	3	4	2	4	2	4	3	4	4	2	3	2	4	2	3	4	2	2
Ques.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	3	3	1	2	4	2	4	3	3	1	3	3	4	3	4	2	1	4	3	1
Ques.	61	62	63	64	65	66	67	68												
Ans.	2	1	1	1	4	2	1	4												

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NEET

CHEMISTRY

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CONTENTS OF THE PACKAGE AT A GLANCE

CHEMISTRY

Class 11

Physical Chemistry (I)

- ◆ Atomic Structure
- ◆ Basic Concepts of Chemistry
- ◆ Redox & Volumetric Analysis
- ◆ Chemical Energetics
- ◆ Chemical Equilibrium
- ◆ Acid Base & Ionic Equilibrium

Inorganic Chemistry (I)

- ◆ Periodic Table
- ◆ Chemical Bonding

Organic Chemistry (I)

- ◆ Classification & Nomenclature
- ◆ Isomerism
- ◆ GOC
- ◆ Hydrocarbon
- ◆ Aromatic Hydrocarbons

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ATOMIC STRUCTURE

KEY CONCEPT

1. Introduction

- The word atom was first introduced by Ostwald (1803 - 1807) in scientific world.
- According to him matter is ultimately made up of extremely small indivisible particles called atoms.
- It takes part in chemical reactions.
- Atom is neither created nor destroyed

2. Dalton's Atomic Theory

Dalton proposed the atomic theory on the basis of the law of conservation of mass and law of definite proportions. He also proposed the law of multiple proportion as a logical consequence of this theory. The salient features of this theory are

- Each element is composed by extremely small particles called atoms.
- Atoms of a particular element are all alike but differ with the atoms of other elements.
- Atom of each element is an ultimate particle, and has a characteristic mass but is structure less.
- Atom is indestructible i.e. it can neither be destroyed nor created by simple chemical reactions.
- Atom of an element takes part in chemical reaction to form molecule.
- In a given compound, the relative number and kind of atom are same.
- Atoms of different elements combine in fixed ratio of small whole numbers to form compound atoms (now called molecules).

2.1 Merits and Demerits of Dalton's theory :

2.1.1 Merits :

- Dalton's theory explains the law of conservation of mass and some other laws of chemical combination.
- Atoms of elements take part in chemical reaction is true till today.

2.1.2 Demerits :

- There is no mention of atomic weights of elements.
- He could not explain that why do atoms of same element combined with each other.
- The law of definite proportion fails if different isotopes are used.

3. Fundamental Particles

3.1 Properties of electron

- Electron was discovered by Sir J.J. Thomson
- The charge on the electron is 1.6×10^{-19} coulomb/gm (Millikan)
- The molar mass of electron is 5.48×10^{-4} gm/mole
- The mass of electron in motion is expressed as

$$m' = \frac{m}{\left(1 - \frac{v^2}{c^2}\right)^{1/2}}$$

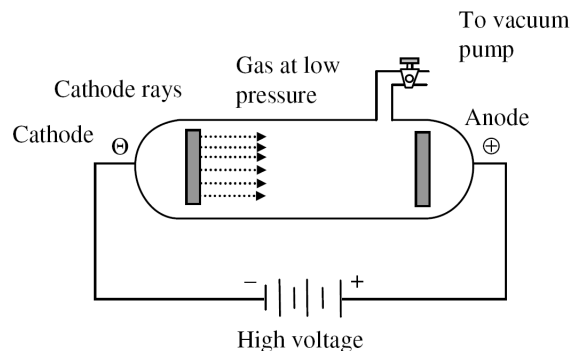
where m' = mass of the electron in motion

m = rest mass, v = velocity of the electron

c = velocity of light

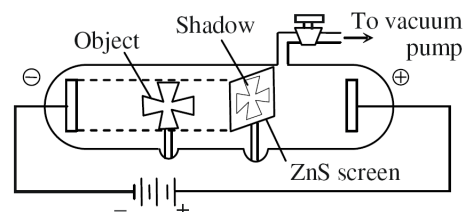
- In 1897, J.J. Thomson determined the e/m value (charge/mass) of the electron by studying the deflections of cathode rays in electric and magnetic fields. The value of e/m has been found to be -1.7588×10^8 coulomb
- The first precise measurement of the charge on the electron was made by Robert A. Millikan, in 1909 by oil drop experiment. Its value was found to be -1.6022×10^{-19} coulomb.
- The mass of electron can be calculated from the value of e/m and the value of e which is 9.1096×10^{-31} Kg.

3.1.1 Cathode rays



- The electron was discovered as a result of the studies of the passage of electricity through gases at extremely low pressures known as discharge tube experiments.
- When a high voltage of the order of 10,000 volts or more was impressed across the electrodes, some sort of invisible rays moved from the negative electrode to the positive electrodes these rays are called as cathode rays
- Cathode rays have the following properties.**
- Path of travelling is straight from the cathode with a very high velocity

As it produces shadow of an object placed in its path



In Chapter Examples

To clarify the application of theory & concept accurately & correctly, there is number of solved in-chapter questions following each topic. It proves practically very effective to understand and correct application of related theory.

Examples based on Fundamental Particles

- Ex.1** For cathode rays' the value of e/m -
 (A) Is independent of the nature of the cathode and the gas filled in the discharge tube
 (B) Is constant
 (C) Is -1.7588×10^8 coulombs/g
 (D) All of the above are correct **Ans.(D)**
- Sol.** Cathode rays consists of electrons which are fundamental particles of matter.

- Ex.2** Which has highest e/m ratio -
 (A) He^{2+} (B) H^+
 (C) He^{1+} (D) H **Ans.(B)**

Sol. Mass of H^+ is minimum

- Ex.3** Arrange the following particles in increasing order of values of e/m ratio : Electron (e), proton (p), neutron (n) and α -particle (α) -

- (A) n, p, e, α (B) n, α , p, e
 (C) n, p, α , e (D) e, p, n, α **Ans.(B)**

Sol.

	Electron	Proton	Neutron	α -particle
e	1 unit	1 unit	zero	2 units
m	1/1837 unit	1 unit	1 unit	4-units
e/m	1837	1	zero	1/2

Solved Examples

To understand the concept application, in end of the each chapter there is sufficient number of solved examples.

SOLVED EXAMPLE

- Ex.1** Complete the following table -

Atom/ion	Atomic Number (Z)	Mass No.	Protons	Neutrons	Electrons
Al^{3+}	13	(A)	(p)	(n)	(e)
Cu	29	63	12	14	
Mg^{2+}		24			
Sr		88	38		

- Sol.**
- (i) Atomic number (Z) = 13 = Number of protons
 Number of electrons = $13 - 3 = 10$
 Mass number = $n + p = 14 + 13 = 27$
- (ii) Atomic number = Number of protons
 = Number of electrons = **29**
 Mass number = $n + p = 63$
 since $p = 29$
 $\therefore n = 63 - p = 63 - 29 = 34$
- (iii) Number of protons = $Z = 12$ & Number of electrons = $12 - 2 = 10$
 Mass number = $n + p = 24$
 $\therefore n = 24 - p = 24 - 12 = 12$
- (iv) Number of electrons = Number of protons = $Z = 38$
 Mass number = $n + p = 88$
 $\therefore n = 88 - p = 88 - 38 = 50$

- Ex.2** An oil drop has 6.39×10^{-19} C charge. Find out the number of electrons in this drop -

Sol. Charge on oil drop = 6.39×10^{-19} C
 Now we know that
 1.602×10^{-19} C is the charge on one electron
 $\therefore 6.39 \times 10^{-19}$ C will be charge on

$$= \frac{6.39 \times 10^{-19}}{1.602 \times 10^{-19}} = 4 \text{ electrons}$$

- Sol.** He^+ is a hydrogen like species i.e. the electron is ionised from first orbit.

$$\therefore \text{Ionization energy of } \text{He}^+ = \frac{Z^2 E_H}{n^2}$$

$$= \frac{4 \times 13.6}{1^2} = 54.4 \text{ eV}$$

- Ex.5** Which transition of the Hydrogen spectrum would have the same length as the Balmer transition, $n = 4$ to $n = 2$ of He^+ spectrum -

- (A) $n_2 = 2$ to $n_1 = 1$ (B) $n_2 = 3$ to $n_1 = 1$
 (C) $n_2 = 4$ to $n_1 = 2$ (D) $n_2 = 5$ to $n_1 = 3$
(Ans. A)

- Sol.** For He^+ ion, we have

$$\frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$$

$$= R_H [2]^2 \left[\frac{1}{2^2} - \frac{1}{4^2} \right] = \frac{3}{4} R_H \quad \dots(\text{A})$$

Now for H atom

$$\frac{1}{\lambda} = R_H \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$$

...(B)

Equating equs (A) and (B) we have

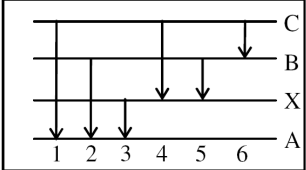
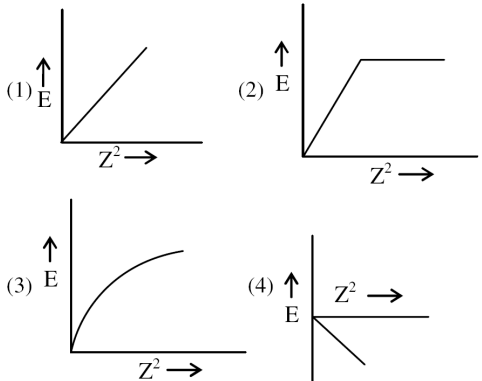
$$\frac{1}{n_1^2} - \frac{1}{n_2^2} = \frac{3}{4}$$

Obviously $n_1 = 1$ and $n_2 = 2$. Hence the transition $n = 2$ to $n = 1$ in hydrogen atom will have the same length as the transition $n = 4$ to $n = 2$ in He^+ species.

Practice Exercises

Exercise Level -1 : It contains TOPIC WISE single objective correct (SCQ) type concept building questions.

EXERCISE # 1

- Q.1** For Li^{+2} , $r_2 : r_5$ will be -
 (1) 9 : 25 (2) 4 : 25 (3) 25 : 4 (4) 25 : 9
- Q.2** The ratio of the radii of two Bohr orbit's of H-atom is 4 : 1 what would be their nomenclature :
 (1) K & L (2) L & K (3) N & L (4) 2 & 3 both
- Q.3** Order of magnitude of density of Uranium nucleus :
 (1) 10^{20} kg/m^3 (2) 10^{17} kg/m^3
 (3) 10^{14} kg/m^3 (4) 10^{11} kg/m^3
- Q.4** The velocity of electron in third excited state of Be^{3+} will be -
 (1) $\frac{3}{4} (2.188 \times 10^8) \text{ ms}^{-1}$ (2) $\frac{3}{4} (2.188 \times 10^6) \text{ ms}^{-1}$
 (3) $(2.188 \times 10^6) \text{ Kms}^{-1}$ (4) $(2.188 \times 10^3) \text{ Kms}^{-1}$
- Q.5** The Bohr orbit radius for the hydrogen atom ($n = 1$) is approximately 0.530 Å. The radius for the first excited state ($n = 2$) will be -
 (1) 0.13 Å (2) 1.06 Å (3) 4.77 Å (4) 2.12 Å
- Q.6** According to Bohr theory, the radius(r) and velocity(v) of an electron vary with the principal quantum number 'n' as -
 (1) r increases, v decreases
 (2) r and v both increases
 (3) r & v both decreases
 (4) r decreases, v increases
- Q.7** The most important short coming in Bohr's model is that it :
 (1) Is unable to explain fine structure of spectral line
 (2) Combined the classical and quantum theories
 (3) Did not consider the motion of nucleus
 (4) Assumed the orbits to be circular
- Q.8** The ratio of radius of first orbit in hydrogen to the radius of first orbit in deuterium will be :
 (1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) 4 : 1
- Q.9** The binding energy of e^- in ground state of hydrogen atom is 13.6 eV. The energies required to eject out an electron from three lowest state of He^+ atom will be - (in eV)
 (1) 13.6, 10.2, 3.4 (2) 13.6, 3.4, 1.5
 (3) 13.6, 27.2, 40.8 (4) 54.4, 13.6, 6
- Q.10** Which one of the following species will give a series of spectral lines similar to that of Mg^{2+} :
 (1) Al^{3+} (2) Na (3) Mg^+ (4) F
- Q.11** An atom has x energy level, then total number of lines in its spectrum are :
- (1) $1 + 2 + 3 \dots \dots \dots (x + 1)$
 (2) $1 + 2 + 3 \dots \dots \dots (x^2)$
 (3) $1 + 2 + 3 \dots \dots \dots (x - 1)$
 (4) $(x + 1) (x + 2) (x + 4)$
- Q.12** The wave number of first line of Balmer series of hydrogen atom is 15200 cm^{-1} . What is the wave number of first line of Balmer series of Li^{2+} ion :
 (1) 15200 cm^{-1} (2) 1368000 cm^{-1}
 (3) 76000 cm^{-1} (4) 136800 cm^{-1}
- Q.13** The figure indicates the energy level diagram for the origin of six spectral lines in emission spectrum (e.g. line no. 5 arises from the transition from level B to X) which of the following spectral lines will not occur in the absorption spectrum :
- 
- (1) 1, 2, 3 (2) 3, 2 (3) 4, 5, 6 (4) 3, 2, 1
- Q.14** The transition of electron in H-atom that will emit maximum energy is :
 (1) $n_3 \rightarrow n_2$ (2) $n_4 \rightarrow n_3$
 (3) $n_5 \rightarrow n_4$ (4) All have some energy
- Q.15** The energy levels for ${}_Z\text{A}^{(+z-1)}$ can be given by :
 (1) E_n for $\text{A}^{(+z-1)} = Z^2 \times E_n$ for H
 (2) E_n for $\text{A}^{(+z-1)} = Z \times E_n$ for H
 (3) E_n for $\text{A}^{(+z-1)} = \frac{1}{Z^2} \times E_n$ for H
 (4) E_n for $\text{A}^{(+z-1)} = \frac{1}{Z} \times E_n$ for H
- Q.16** The graphical representation of energy of e^- and atomic number is :
- 

Exercise Level -2 : It contains single objective type good quality questions on all the concepts of the chapter in mixed manner.

EXERCISE # 2



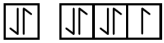





- Q.1** The ratio of minimum frequency of Lyman & Balmer series will be -
 (1) 1.25 (2) 0.25 (3) 5.4 (4) 10
- Q.2** When a hydrogen sample in ground state is bombarded then what potential is required to accelerate electron so that first Paschan line is emitted :
 (1) 2.55 eV (2) 0.65 eV
 (3) 12.09 eV (4) 12.75 eV
- Q.3** In H-atom, electron transits from 6th orbit to 2nd orbit in multi step. Then total spectral lines (without Balmer series) will be :
 (1) 6 (2) 10 (3) 4 (4) 0
- Q.4** Potential energy is -27.2 eV in second orbit of He^+ then calculate, double of total energy in first excited state of Hydrogen atom :
 (1) -13.6 eV (2) -54.4 eV
 (3) -6.8 eV (4) -27.2 eV
- Q.5** A certain electronic transition from an excited state to ground state of the H_2 atom in one or more step gives rise to three lines in the ultra violet region of the spectrum. How many lines does this transition produce in the infrared region of the spectrum :
 (1) 1 (2) 2 (3) 3 (4) 4
- Q.6** The ratio of minimum wavelengths of Lyman & Balmer series will be :
 (1) 1.25 (2) 0.25 (3) 5 (4) 10
- Q.7** Given that in the H-atom the transition energy for $n = 1$ to $n = 2$ Rydberg state is 10.2 eV. The energy for the same transition on Be^{3+} is -
 (1) 20.4 eV (2) 163.2 eV
 (3) 30.6 eV (4) 40.8 eV
- Q.8** Find out ratio of following for photon
 $(v_{\max})_{\text{Lyman}} : (v_{\max})_{\text{Brakett}}$ -
 (1) 1 : 16 (2) 16 : 1 (3) 1 : 4 (4) 4 : 1
- Q.9** If the ionization energy of hydrogen is 313.8 K cal mole, then the energy of electron in 2nd state will be -
 (1) -113.2 K cal./ mole (2) -78.45 K cal./ mole
 (3) -313.8 K cal./ mole (4) -35 K cal./ mole
- Q.10** A certain electronic transition from an excited state to the ground state of the H_2 atom in one or more steps gives rise to four lines in the ultra violet region of the spectrum, how many lines does this transition produce in the infrared region of the spectrum -
 (1) 1 (2) 2 (3) 3 (4) 4
- Q.11** Angular momentum in 2nd Bohr orbit of H-atom is x . Then find out angular momentum in 1^{st} excited state of Li^{+2} -
 (1) $3x$ (2) $9x$ (3) $\frac{x}{2}$ (4) x
- Q.12** If the potential energy (PE) of hydrogen electron is -3.02 eV then in which of the following excited level is electron present :
 (1) 1^{st} (2) 2^{nd} (3) 3^{rd} (4) 4^{th}
- Q.13** Supposing the I.P. of hydrogen atom is 960 eV. Find out the value of principal quantum number having the energy equal to -60 eV :
 (1) $n = 2$ (2) $n = 3$ (3) $n = 4$ (4) $n = 5$
- Q.14** The ionisation energy for excited hydrogen atom in eV will be -
 (1) 13.6 (2) Less than 13.6
 (3) Greater than 13.6 (4) 3.4 or less
- Q.15** If the ionisation potential of an atom is 20 eV, its first excitation potential will be -
 (1) 5 eV (2) 10 eV (3) 15 eV (4) 20 eV
- Q.16** A single electron orbits a stationary nucleus of charge $+Ze$, where Z is a constant. It requires 47.2 eV to excite electron from second Bohr orbit to third Bohr orbit, find the value of Z :
 (1) 1 (2) 3 (3) 5 (4) 4
- Q.17** A photon of energy 12.75 eV is completely absorbed by a hydrogen atom initially in ground state. The principle quantum number of the excited state is :
 (1) 1 (2) 3 (3) 4 (4) ∞
- Q.18** An hydrogen atom (ionisation energy 13.6 eV) jumps from third excited state to first excited state The energy of photon emitted in the process is :
 (1) 1.89 eV (2) 2.55 eV
 (3) 12.09 eV (4) 12.75 eV
- Q.19** For H atom, the energy required for the removal of electron from various sub-shells is given at under:
- $3s \quad 3s \quad 3d$
 $E_1 \quad n = \infty$
 E_2
 E_3
- The order of the energies would be :
 (1) $E_1 > E_2 > E_3$ (2) $E_3 > E_2 > E_1$
 (3) $E_1 = E_2 = E_3$ (4) None of these
- Q.20** If a photon of energy 14 eV. is incident on an H-atom, what is true :
 (1) Atom will be ionised and electron will have a kinetic energy of 14 eV
 (2) Atom will be ionised and electron will have a kinetic energy of 0.4 eV
 (3) Photon passes through atom without interacting with it
 (4) More than one electrons will make transitions

Exercise Level -3 : It contains previous years NEET exam questions from 2005 to upto to present year.

EXERCISE # 3

- Q.1** Neutron is a fundamental particle which have :
[AIPMT-90]
(1) + 1 unit charge and 1 unit mass
(2) No charge and 1 unit mass
(3) Have no charge and mass
(4) Have - 1 unit charge and 1 unit mass
- Q.2** Na^+ is Isoelectronic with - [AIPMT-91]
(1) Li^+ (2) Mg^{+2} (3) Ca^{+2} (4) Ba^{+2}
- Q.3** Number of unpaired electron in $1s^2, 2s^2, 2p^4$
[AIPMT-91]
(1) 4 (2) 2 (3) 0 (4) 1
- Q.4** Principal quantum number represents :
[AIPMT-91]
(1) Shape of orbital
(2) Distance between nucleus and electron
(3) No. of electron in one shell
(4) Number of orbitals in one shell
- Q.5** Unpaired electron present in Cr^{+3} [AIPMT-92]
(1) 3 (2) 1 (3) 2 (4) 5
- Q.6** Which of the following pair is isoelectronic :
[AIPMT-92]
(1) Ca, Ar (2) Mg, Na^+ (3) Ag, Sn (4) Ar, Cl^-
- Q.7** Which of following set of quantum numbers (n, l, m, s) is not correct : [AIPMT-93]
(1) 3, 1, 0, -1/2 (2) 3, 2, 1, +1/2
(3) 3, 1, 2, -1/2 (4) 3, 2, 0, +1/2
- Q.8** If Hydrogen atom is excited by giving 8.4 eV energy, then number of emitted spectrum lines will be - [AIPMT-93]
(1) None (2) Two (3) Three (4) Four
- Q.9** No. of unpaired electron present in an inert gas is : [AIPMT-96]
(1) 5 (2) 3 (3) 0 (4) 2
- Q.10** Which of the following is incorrect for n = 5 and m = 3 : [AIPMT-96]
(1) $\ell = 4$ (2) $\ell = 3$
(3) $\ell = 0, 1, 2, 3$ (4) $s = +1/2$
- Q.11** An element M has 25 protons. The number of electrons in its M^{+2} cation will be : [AIPMT-97]
(1) 25 (2) 24 (3) 23 (4) 22
- Q.12** The energy of H-atom in nth orbit is E_n then energy in nth orbit of singly ionised helium atom will be : [AIPMT-2001]
(1) $4E_n$ (2) $E_n/4$ (3) $2E_n$ (4) $E_n/2$
- Q.13** Maximum frequency of emission is obtained for the transition : [AIPMT-2000]
(1) $n = 2$ to $n = 1$ (2) $n = 6$ to $n = 2$
(3) $n = 1$ to $n = 2$ (4) $n = 2$ to $n = 6$
- Q.14** When an electron transit from $n = 4$ to $n = 2$, then emitted line in spectrum will be : [AIPMT-2000]
(1) First line of Lyman series
(2) Second line of Balmer series
(3) First line of Paschen series
(4) Second line of Paschen series
- Q.15** Ionisation energy of second orbit of Li^{+2} eV [AIPMT-2000]
(1) 122.4 eV (2) 40.8 eV
(3) 30.6 eV (4) 13.6 eV
- Q.16** If change in energy : [AIPMT-2000]
 $(\Delta E) = 3 \times 10^{-8} \text{J}$, $h = 6.64 \times 10^{-34} \text{J-s}$ and $c = 3 \times 10^8 \text{m/s}$, then wavelength of the line is
(1) $6.64 \times 10^3 \text{\AA}$ (2) $6.64 \times 10^5 \text{\AA}$
(3) $6.64 \times 10^{-8} \text{\AA}$ (4) $6.64 \times 10^{18} \text{\AA}$
- Q.17** The following quantum no. are possible for how many orbitals $n = 3, \ell = 2, m = +2$ [AIPMT-2001]
(1) 1 (2) 2 (3) 3 (4) 4
- Q.18** The de-Broglie wavelength associated with a particle of mass 10^{-6}kg moving with a velocity of 10ms^{-1} , is - [AIIMS-2001]
(1) $6.63 \times 10^{-22} \text{m}$ (2) $6.63 \times 10^{-29} \text{m}$
(3) $6.63 \times 10^{-31} \text{m}$ (4) $6.63 \times 10^{-34} \text{m}$
- Q.19** Which of the following set of quantum numbers is permissible : [AIIMS-2001]
(1) $n = 3, \ell = 2 ; m = 2$ and $s = +\frac{1}{2}$
(2) $n = 3, \ell = 4 ; m = 0$ and $s = -\frac{1}{2}$
(3) $n = 4, \ell = 0 ; m = 2$ and $s = +\frac{1}{2}$
(4) $n = 4, \ell = 4 ; m = 3$ and $s = +\frac{1}{2}$
- Q.20** Which of the following set of quantum numbers is not valid. [AIIMS-2001]
(1) $n = 1, \ell = 2$ (2) $n = 3, m = 2$
(3) $n = 3, \ell = 0$ (4) $n = 4, \ell = 2$
- Q.21** Which of the following is iso - electronic : [AIPMT-2002]
(1) CO_2, NO_2 (2) $\text{NO}_2^-, \text{CO}_2$
(3) CN^-, CO (4) SO_2, CO_2

EXERCISE # 4

- Q.1** Which orbital diagram does not obey aufbau principle : [IIT-88]
- (1)  (2) 
- (3)  (4) 
- Q.2** Find out the nucleus which are isoneutronic : [IIT-91]
- (1) ${}^{14}_6\text{C}$, ${}^{15}_7\text{N}$, ${}^{17}_9\text{F}$ (2) ${}^{12}_6\text{C}$, ${}^{14}_7\text{N}$, ${}^{19}_9\text{F}$
- (3) ${}^{14}_6\text{C}$, ${}^{14}_7\text{N}$, ${}^{17}_9\text{F}$ (4) ${}^{14}_6\text{C}$, ${}^{14}_7\text{N}$, ${}^{19}_9\text{F}$
- Q.3** Species which are isoelectronic to one another are - [IIT-92]
- (a) CN^- (b) OH^-
- (c) CH_3^+ (d) N_2
- (e) CO
- Correct Ans :
 (1) a, b, c (2) a, c, d
 (3) a,d,e (4) b, c, d
- Q.4** Wave number of 1st line of Balmer series is 15200 cm^{-1} for H-atom, then wave number of 1st line of Balmer series for Li^{+2} is : [IIT-92]
- (1) 15200 cm^{-1} (2) 60800 cm^{-1}
- (3) 76000 cm^{-1} (4) 136800 cm^{-1}
- Q.5** The radius of a shell for H-atom is 4.761 \AA . The value of n is : [IIT-92]
- (1) 3 (2) 9 (3) 5 (4) 4
- Q.6** Quantum number which can not be calculated by schrodinger wave equation is : [IIT-92]
- (1) n (2) ℓ (3) m (4) s
- Q.7** The standard reference of atomic mass is - [IIT-93]
- (1) ${}^1_1\text{H}$ (2) ${}^{12}_6\text{C}$ (3) ${}^{12}_6\text{C}$ (4) ${}^{16}_8\text{O}$
- Q.8** Which configuration does not obey pauli's exclusion principle : [IIT-93]
- (1)  (2) 
- (3)  (4) 
- Q.9** The nitrogen atom has 7 proton, so the nitride ion will have : [IIT-94]
- (1) $7e^-$ and + 7p (2) $7e^-$ and + 4p
- (3) $10e^-$ and + 7p (4) $10e^-$ and + 4p
- Q.10** Lightest fundamental particle is : [IIT-95]
- (1) Neutron (2) Electron
- (3) Proton (4) None of these
- Q.11** In 2s orbital, electrons orbital angular momentum is : [IIT-96]
- (1) $+\frac{1}{2}\frac{h}{2\pi}$ (2) 0
- (3) $\frac{h}{2\pi}$ (4) $\sqrt{2}\frac{h}{2\pi}$
- Q.12** The number of nodal planes in a p_x orbital is - [IIT Screening-2000]
- (1) One (2) Two
- (3) Three (4) Zero
- Q.13** The electronic configuration of an element is $1s^2, 2s^2, 2p^6, 3s^2, 3p^0, 3d^5, 4s^1$. This represents its : [IIT Screening-2000]
- (1) Excited state (2) Ground state
- (3) Cationic form (4) Anionic form
- Q.14** Nodal plane is found in which orbital. [AIIEEE-2002]
- (1) $n = 2, \ell = 0$ (2) $n = 3, \ell = 0$
- (3) $n = 2, \ell = 1$ (4) $n = 1, \ell = 0$
- Q.15** In a hydrogen atom. If energy of an electron in ground state 13.6 eV , then energy in the 2^{nd} excited state is : [AIIEEE-2002]
- (1) -1.51 eV (2) -3.4 eV
- (3) -6.04 eV (4) -13.6 eV
- Q.16** Uncertainty in position of a 0.25 g particle is 10^{-5} m . Then uncertainty in its velocity will be : [AIIEEE-2002]
- ($h = 6.6 \times 10^{-34}\text{ Js}$) :
- (1) 1.2×10^{34} (2) 2.1×10^{-26}
- (3) 1.6×10^{-20} (4) 1.7×10^{-9}
- Q.17** What is the de-Broglis wavelength associated with the hydrogen electron in its third orbit : [AIIEEE-2002]
- (1) $9.96 \times 10^{-10}\text{ cm}$ (2) $9.96 \times 10^{-8}\text{ cm}$
- (3) $9.96 \times 10^4\text{ cm}$ (4) $9.96 \times 10^8\text{ cm}$
- Q.18** Which of the following are isoelectronic : [IIT Screening-2003]
- $\text{NO}_3^-, \text{CO}_3^{2-}, \text{ClO}_3^-, \text{SO}_3$
- (1) $\text{NO}_3^-, \text{CO}_3^{2-}$ (2) $\text{SO}_3, \text{NO}_3^-$
- (3) $\text{ClO}_3^-, \text{CO}_3^{2-}$ (4) $\text{CO}_3^{2-}, \text{SO}_3$
- Q.19** The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{l(l+1)} \cdot \frac{h}{2\pi}$. This momentum for an s-electron will be given by - [AIIEEE 2003]
- (1) $\frac{h}{2\pi}$ (2) $\sqrt{2} \cdot \frac{h}{2\pi}$ (3) $+\frac{1}{2} \cdot \frac{h}{2\pi}$ (4) zero

Answer key

Above mentioned all exercises provided with answer key

ANSWER KEY

EXERCISE # 1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	4	2	4	4	1	2	1	4	1	3	4	3	1	1	4	4	2	4	4
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	1	3	1	1	2	3	4	1	4	1	4	2	4	1	4	2	1	2	4
Q.No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	4	2	2	1	1	1	2	2	3	3	4	3	4	1	2	3	1	2	1
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	1	2	3	1	3	3	3	1	3	4	3	3	3	1	4	1	4	3	2	2
Q.No.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	1	2	3	3	1	4	1	3	3	4	4	3	3	1	1	1	2	3	1	1
Q.No.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	4	3	3	1	2	4	2	2	3	4	2	1	4	1	1	2	3	4	2	3
Q.No.	121	122	123	124	125	126	127	128	129	130										
Ans.	4	3	3	4	2	2	4	2	4	1										

Revision Plan

We emphasize that every student should prepare his/her own revision plan. For this purpose there is Revision Plan Section in each chapter which student should prepare while going through the study material. This will be useful at the time of final revision before final exam for quick & effective revision.

Revision Plan

Prepare Your Revision plan today!

After attempting Exercise Sheet, please fill below table as per the instruction given.

- Write Question Number (QN) which you are unable to solve at your own in **column A**.
- After discussing the Questions written in **column A** with faculty, strike off them in the manner so that you can see at the time question number during Revision, to solve such questions again.
- Write down the Question Number you feel are important or good in the **column B**.

EXERCISE	COLUMN A	COLUMN B
	Questions unable to solve in first attempt	Good or Important questions
Exercise-1		
Exercise-2		
Exercise-3		
Exercise-4		

Revision Strategy:

Whenever you wish to revision this chapter, follow the following steps-

- Step-1:** Review your theory notes.
- Step-2:** Solve Questions of column A
- Step-3:** Solve Questions of Column B
- Step-4:** Solve questions from other Question Bank, Problem book etc.

Online Solutions

Self explanatory and detailed solution of all exercises mentioned above are available on Career Point website www.careerpoint.ac.in

ATOMIC STRUCTURE

EXERCISE-1

Answer Key & Solution

Question Number	Solution
1	Click Here
2	Click Here
3	Click Here
4	Click Here
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Question Number	Solution
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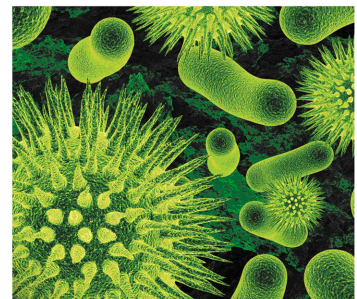
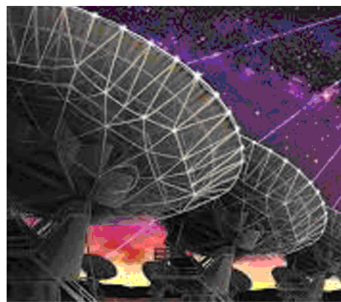
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Mechanics (Part-I)

- ◆ Basic Mathematics
- ◆ Unit & Dimension & Errors
- ◆ Vector
- ◆ Motion in one Dimension
- ◆ Projectile Motion
- ◆ Circular Motion
- ◆ Newton's Laws of Motion
& Friction

Mechanics (Part-II)

- ◆ Work, Power, Energy
- ◆ Laws of Conservation
- ◆ Rotational Motion
- ◆ Simple Harmonic Motion
- ◆ Gravitation

Heat & Wave

- ◆ Properties of Matter (Surface Tension)
- ◆ Properties of Matter (Elasticity)
- ◆ Properties of Matter (Viscosity)
- ◆ Fluid Mechanics
- ◆ Calorimetry
- ◆ Kinetic Theory of Gases
- ◆ Thermodynamics
- ◆ Mode of Heat Transfer
- ◆ Thermal Expansion
- ◆ Wave Motion

Features of The Product

This study material is especially designed for NEET aspirants. The entire study material is arranged in such a way so that the learning process progresses gradually from the basic to advanced stages. This easy-to-grasp material enables students to apply the fundamentals they have learned and boost their confidence to tackle the problems asked in the NEET and other medical competitive examinations.

Key Features of the Chapter

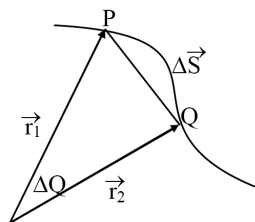
Theory & Concepts

Theory provides all the basic concepts in clear and precise manner. It comprises all the related and required diagrams, tables, graphs, real life examples, info graphics, conceptual questions that makes it more comprehensive. It also highlights tips and tricks, facts, notes, misconceptions, key points, and problem solving tactics.

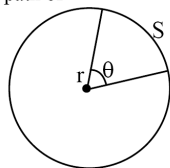
ROTATIONAL MOTION

KEY CONCEPT

1. Angular Displacement



- When a particle moves in a curved path, the angle subtended by its position vector about a fixed point is known as angular displacement.
- Unit** : radian
- Dimension** : $M^0L^0T^0$
- It is a vector quantity whose direction is given by right hand screw rule.
- If θ be the angular displacement of a particle moving in a circular path of



radius r and S be the length of arc, $S = r\theta$

Note :- $360^\circ = 2\pi$ radian

Ex.1 If a particle complete one and half revolution along the circumference of a circle then its angular displacement is-

- (1) 0 (2) π (3) 2π (4) 3π

Sol.(4)

2.1 Equation of Linear Motion and Rotational Motion :

Linear Motion	Rotational Motion
(a) If acceleration is 0, $v = \text{constant}$ and $s = vt$.	(a) If acceleration is 0, $\omega = \text{constant}$ and $\theta = \omega t$.
(b) If acceleration $a = \text{constant}$,	(b) If acceleration $a = \text{constant}$ then
(i) $s = \frac{(u + v)}{2} t$	(i) $\theta = \frac{(\omega_1 + \omega_2)}{2} t$
(ii) $a = \frac{v - u}{t}$	(ii) $\alpha = \frac{\omega_2 - \omega_1}{t}$
(iii) $v = u + at$	(iii) $\omega_2 = \omega_1 + \frac{1}{2} \alpha t$
(iv) $s = ut + (1/2) at^2$	(iv) $\theta = \omega_1 t + \frac{1}{2} \alpha t^2$
(v) $v^2 = u^2 + 2as$	(v) $\omega_2^2 = \omega_1^2 + 2 \alpha \theta$
(vi) $S_{nth} = u + \frac{1}{2} a (2n-1)$	(vi) $\omega_{nth} = \omega_1 + (2n-1) \frac{\alpha}{2}$

2. Angular Velocity

- The angular displacement per unit time is defined as angular velocity. If, a particle moves from P to Q in time Δt , $\omega = \frac{\Delta\theta}{\Delta t}$ where $\Delta\theta$ is the angular displacement during the time interval Δt .

$$\text{If } \omega = \lim_{\Delta t \rightarrow 0} \frac{\Delta\theta}{\Delta t} = \frac{d\theta}{dt} = \text{Instantaneous angular velocity}$$

$$\bar{\omega} = \frac{\theta_2 - \theta_1}{t_2 - t_1} = \frac{\Delta\theta}{\Delta t} = \text{average angular velocity}$$

- Unit** : Radian /sec
- Dimension** : $[M^0L^0T^{-1}]$ which is same as that of frequency.
- It is a vector quantity, whose direction is normal to the rotational plane & its direction is given by right hand screw rule.
- If ω be the angular velocity, v be the linear velocity & r be the radius of path, we have the following relation.

$$\vec{v} = \vec{\omega} \times \vec{r}$$
 or $v = r\omega$.
- If f be the frequency, $\omega = 2\pi f$
 If T be the time period, $\omega = \frac{2\pi}{T}$
- The angular velocity of a rotating rigid body can be either positive or negative, depending on whether body is rotating in the direction of increasing θ (anticlockwise) or of decreasing θ (clockwise).
- The magnitude of an angular velocity is called the angular speed which is also represented by ω ,

In Chapter Examples

To clarify the application of theory & concept accurately & correctly, there is number of solved in-chapter questions following each topic. It proves practically very effective to understand and correct application of related theory.

Ex.8 If the radius of solid sphere is 35 cm. The ratio of radius of gyration, when the axis is along a diameter to that when the axis is along a tangent will be-

(1) $\sqrt{\frac{10}{35}}$ (2) $\sqrt{\frac{35}{10}}$ (3) $\frac{7}{1}$ (4) $\frac{1}{7}$

Sol.(1) Along the diameter, $I_g = (2/5) mR^2$ or $K_g^2 = (2/5) R^2$

$$\text{or } K_g = R \sqrt{\frac{2}{5}} = 35 \sqrt{\frac{2}{5}}$$

$$\text{Along tangent, } I = I_g + mR^2$$

$$\therefore mK^2 = mK_g^2 + mR^2 \text{ or } K^2 = K_g^2 + R^2$$

$$= (2/5) R^2 + R^2 = (7/5) R^2$$

$$K = R \sqrt{\frac{7}{5}} = 35 \sqrt{\frac{7}{5}} \text{ . Now } \frac{K_g}{K} = \sqrt{\frac{10}{35}}$$

Ex.9 The diameter of flywheel increases by 1%. The percentage increase in moment of inertia about axis of symmetry will be-

(1) 1% (2) 2% (3) 3% (4) 4%

Sol.(2) The moment of inertia of flywheel is given by, $I = MR^2$

Taking log,

$$\log I = \log M + 2 \log R$$

$$\text{Differentiating, } \frac{dI}{I} = 0 + 2 \frac{dR}{R}$$

$$\therefore \% \text{ change in moment of inertia} = \frac{dI}{I} \times 100$$

$$= 2 \times 1\% = 2\%$$

Ex.10 The moment of inertia of sphere is 20 kg-m² about the diameter. The moment of inertia about any tangent will be-

(1) 70 kg-m² (2) 35 kg-m²
(3) 50 kg-m² (4) 20 kg-m²

Sol.(1) According to the theorem of parallel axes, the have

$$I = I_G + Ma^2$$

$$= \frac{2}{5} MR^2 + MR^2 \text{ (}\therefore a = R\text{)} = \frac{7}{5} MR^2$$

$$\text{Given that } \frac{2}{5} MR^2 = 20$$

$$\text{or } MR^2 = \frac{20 \times 5}{2} = 50,$$

$$\therefore I = \frac{7}{5} \times 50 = 70 \text{ kg-m}^2$$

Ex.11 If the moment of inertia of a disc about an axis tangentially and parallel to its surface be I, what will be the moment of inertia about the axis tangential but perpendicular to the surface-

(1) $\frac{6}{5} I$ (2) $\frac{3}{4} I$ (3) $\frac{3}{2} I$ (4) $\frac{5}{4} I$

Sol.(1) According to the theorem of parallel axes, the moment of inertia of the disc about an axis tangentially and parallel to the surface is given by

$$I = I_{\text{parallel}} = \frac{MR^2}{4} + MR^2$$

$$= \frac{5}{4} MR^2$$

The moment of inertia of the disc about an axis tangential but perpendicular to the surface is given by

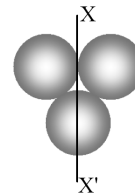
$$I' = I_{\text{perpendicular}} = \frac{MR^2}{2} + MR^2 = \frac{3}{2} MR^2$$

$$= \frac{6}{5} \left[\frac{5}{4} MR^2 \right] = \frac{6}{5} I$$

QUESTIONS FOR PRACTICE

Q.1 Adjoining diagram has three disc, in which each has mass M and radius R.

What is MI about axis XX' [Ans. $\frac{11}{4} MR^2$]



Points To Remember

This part contain important Theories, concepts, formulas of chapter at one place in short manner, So that student can revise all these in short time.

POINTS TO REMEMBER

- A rigid body is said to be in general motion, if it has both the translational and rotational motions.
- Moment of force about the axis of rotation is called torque.
- Torque = Force x perpendicular distance of point of application of force from the axis of rotation.

$$\tau = r \cdot F \text{ or } \vec{\tau} = \vec{r} \times \vec{F} \text{ or } \tau = rF \sin\theta$$

where θ is the angle between \vec{r} and \vec{F} .

- Torque may be clockwise or anticlockwise. Anticlockwise torque is taken as positive.
- Power of Torque $P = \tau \times \omega$ where $\omega = \frac{d\theta}{dt}$

Solved Examples

To understand the concept application, in end of the each chapter there is sufficient number of solved examples.

SOLVED EXAMPLE

- Ex.1** The radius of a wheel of a car is 0.4 meter. The car is accelerated from rest by an angular acceleration of 1.5 rad/sec^2 for 20 seconds. Distance covered by wheel and linear velocity will respectively be -
 (1) 120 m, 12 m/s (2) 12 m, 12 m/s
 (3) 1.2 m, 12 m/s (4) 120 m, 1.2 m/s

Sol.(1) Initially the wheel is at rest ($\omega = 0$). The angular displacement of the wheel in t sec is

$$\theta = t + \frac{1}{2} \alpha t^2$$

$$= 0 + \frac{1}{2} (1.5 \text{ rad/sec}^2) (20 \text{ sec})^2 = 300 \text{ radian}$$

Radius of the wheel, $r = 0.4$ meter. Therefore, the linear displacement of the wheel is -

$$s = r\theta$$

$$= 0.4 \text{ meter} \times 300 \text{ rad} = 120 \text{ meter}$$

This is the distance covered by the wheel.

Angular velocity of the wheel after t sec is

$$\omega = \omega_0 + \alpha t$$

$$= 0 + (1.5 \text{ rad/sec}^2) (20 \text{ sec})$$

$$= 30 \text{ rad/sec}$$

Therefore, the linear velocity of the wheel is $v = r\omega$

$$= 0.4 \text{ meter} \times 30 \text{ rad/sec}$$

$$= 12 \text{ meter/sec}$$

- Ex.2** A wheel of mass 6 kg is rotating at 300 rpm. Its angular velocity will be

- (1) 31.4 rad/sec (2) 3.14 rad/sec
 (3) 0.314 rad/sec (4) 0.03 rad/sec

Sol.(1) Here, $\omega = \frac{2\pi n}{t} = \frac{2 \times 3.14 \times 300}{60} = 31.4 \text{ rad/sec}$

- Ex.3** The shaft of an electric motor starts from rest and on the application of a torque, it gains an angular acceleration given by $\alpha = 3t - t^2$, during the first 2 seconds after it starts after which $\alpha = 0$. The angular velocity after 6 seconds will be-

- (1) 10/3 rad/sec (2) 20/3 rad/sec
 (3) 5/3 rad/sec (4) 1/3 rad/sec

Sol.(1) Given, $\alpha = 3t - t^2 \Rightarrow \alpha = 3t - t^2$ or
 $\therefore d\omega = (3t - t^2) dt \Rightarrow \omega = (3t - t^2) dt$

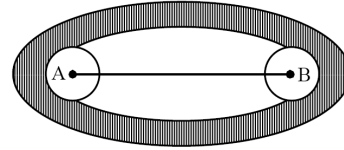
$$\Rightarrow \omega = \left(\frac{3t^2}{2} - \frac{t^3}{3} \right) + C \quad [t = 0, \omega = 0 \therefore C = 0]$$

$$\Rightarrow \omega = \frac{3t^2}{2} - \frac{t^3}{3} \text{ Putting } t = 2$$

$$= 6 - \frac{8}{3} = \frac{10}{3} \text{ rad/sec}$$

Since there is no angular acceleration after 2 sec the angular velocity after 6 sec remains the same i.e. $10/3 \text{ rad/sec}$.

- Ex.4** A wheel 'A' has a radius 20 cm coupled by belt to wheel B of radius 30 cm as shown in fig. Wheel A increases its angular speed from rest at a uniform rate of 3.14 rad/sec^2 . The time for wheel B to reach a rotational speed of 100 rev/min assuming that belt does not slip, will be-



(1) 5 sec (2) 10 sec (3) 2.5 sec (4) 20 sec
Sol.(1) As the belt does not slip, velocity of A = velocity B

$$\text{i.e. } v_A = v_B \text{ or } r_A \omega_A = r_B \omega_B$$

$$\text{Given, } r_A = 20 \text{ cm, } r_B = 30 \text{ cm}$$

$$\text{and } \omega_B = 2\pi \times 100/60 \text{ rad/sec}$$

$$\text{So, } 20 \omega_A = 30 \times 2\pi \times 100/60 = 100\pi$$

$$\text{or } \omega_A = 5\pi \text{ rad/sec}$$

We know that, $\omega = \omega_0 + \alpha t$ or

$$t = \frac{\omega}{\alpha} \text{ (as } \omega_0 = 0)$$

$$\therefore t = \frac{5\pi}{3.14} = 5 \text{ sec}$$

- Ex.5** A mass of 2 kg is rotating on a circular path of radius 0.8 m with angular velocity of 44 rad/s. If the radius of the path becomes 1.0 m, what will be the value of angular velocity?

- (1) 2.816 rad/sec (2) 3.832 rad/sec
 (3) 5.899 rad/sec (4) 28.16 rad/sec

Sol.(4) Let I_1 and ω_1 be the initial moment of inertia and angular velocity of the mass about the axis of rotation and I_2 and ω_2 the corresponding quantities after the radius of the path is changed. By conservation of angular momentum, we have

$$I_1 \omega_1 = I_2 \omega_2$$

$$\text{Here } I_1 = 2 \times (0.8)^2 = 1.28 \text{ kg-m}^2,$$

$$\omega_1 = 44 \text{ rad/s } I_2 = 2 \times (1.0)^2 = 2 \text{ kg-m}^2, \omega_2 = ?$$

$$1.28 \times 44 = 2 \times \omega_2$$

$$\text{or } \omega_2 = \frac{1.28 \times 44}{2} = 28.16 \text{ rad/s}$$

- Ex.6** A weightless horizontal rod is free to rotate about an axis OO'. Two masses, each of 1 kg, are placed at A and A' such that $O'A = O'A' = 0.20$ meter. Now a torque of 2.0 Newton-meter is applied on the system which rotates about OO'. If the masses are displaced to B and B' such that $O'B = O'B' = 0.50$ meter, then decrement in angular acceleration will be -

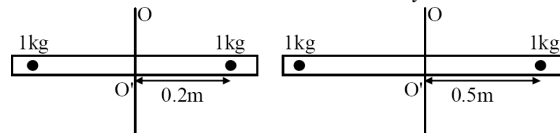
- (1) 21 rad/sec² (2) 42 rad/sec²
 (3) 12 rad/sec² (4) 24 rad/sec²

Sol.(1) In the first case, the moment of inertia of each mass about OO'

$$= \text{mass} \times (\text{distance from O})^2$$

$$= 1 \text{ kg} \times (0.20 \text{ m})^2 = 0.04 \text{ kg-m}^2$$

\therefore Moment of inertia of the whole system about OO'



Practice Exercises

Exercise Level -1 : It contains TOPIC WISE single objective correct (SCQ) type concept building questions.

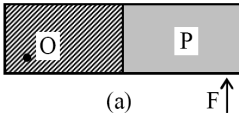
EXERCISE # 1

- Q.1** A wheel starts rotating from rest and attains an angular velocity of 60 rad/sec in 5 seconds. The total angular displacement in radians will be-
(1) 60 (2) 80 (3) 100 (4) 150
- Q.2** A body rotates at 300 rotations per minute. The value in radian of the angle described in 1 sec is-
(1) 5 (2) 5π (3) 10 (4) 10π
- Q.3** A chain couples and rotates two wheels in a bicycle. The radii of bigger and smaller wheels in a bicycle. The radii of bigger and smaller wheels are 0.5m and 0.1, respectively. The bigger wheel rotates at the rate of 200 rotations per minute, then the rate of rotation of smaller wheel will be -
(1) 1000 rpm (2) 50/3 rpm (3) 200 rpm (4) 40 rpm
- Q.4** If the position vector of a particle is $\hat{r} = (3\hat{i} + 4\hat{j})$ metre and its angular velocity is $\vec{\omega} = (\hat{j} + 2\hat{k})$ rad/sec then its linear velocity is (in m/s) -
(1) $-(8\hat{i} - 6\hat{j} + 3\hat{k})$ (2) $(3\hat{i} + 6\hat{j} + 8\hat{k})$
(3) $-(3\hat{i} + 6\hat{j} + 6\hat{k})$ (4) $(6\hat{i} + 8\hat{j} + 3\hat{k})$
- Q.5** A car is moving with a speed of 72 Km/hour. The diameter of its wheels is 50cm. If its wheels come to rest after 20 rotations as a result of application of brakes, then the angular retardation produced in the car will be -
(1) 25.5 Radians/sec² (2) 0.25 Radians/sec²
(3) 2.55 Radians/sec² (4) 0
- Q.6** A particle, situated in an object, moves with angular acceleration of 6 rad/sec² and with $2\sqrt{2}$ rad/sec angular velocity. If the radius of the circular path is 1m, its total acceleration in m/sec² will be -
(1) 1 (2) 100 (3) 10 (4) $\sqrt{10}$
- Q.7** A particle starts from rest under the effect of an angular acceleration of 5 rad/sec². The value of angular displacement in 2 seconds in radian will be ?
(1) 10 (2) 20 (3) 20π (4) 50
- Q.8** When a body rotates about an axis the quantity which remains same for all its particles, is
(1) linear velocity (2) angular velocity
(3) linear acceleration (4) angular momentum
- Q.9** A wheel of an engine executes 4800 revolutions per minute. Its angular velocity (in rad/sec) would be -
(1) 4800π (2) 2400π (3) 160π (4) 80π
- Q.10** A fan is rotating with a frequency 50Hz, its angular speed would be -
(1) 50π rad/sec (2) 200π rad/sec
(3) 100π rad/sec (4) $\left(\frac{100}{\pi}\right)$ rad/sec
- Q.11** A particle moves by 1 cm in 1 sec in a path of radius 10cm. Its angular speed would be-
(1) 10^0 /sec (2) 10 rad/sec
(3) 0.1 rad/sec (4) 1 rad/sec
- Q.12** Two particles of masses m_1 and m_2 complete one revolution of respective radii r_1 and r_2 in same time. The ratio of their angular speeds would be
(1) $m_1 r_1^2 : m_2 r_2^2$ (2) $r_1 : r_2$
(3) $r_2 : r_1$ (4) 1 : 1
- Q.13** When a mass rotates about any axis, the direction of the angular velocity will be -
(1) towards radius
(2) towards the tangent to the orbit
(3) at an angle of 45° to the plane of rotation
(4) along the direction of axis of rotation
- Q.14** If a rigid body a point rotates 60° in 6 minutes the angular velocity of the body is -
(1) 1/6 rad/s (2) 3.14/18 rad/s
(3) $3.14/180 \times 6$ rad/s (4) None of these
- Q.15** A particle, moving along a circular path has equal magnitudes of linear and angular acceleration. The diameter of the path is (in metre) -
(1) 1 (2) π (3) 2 (4) 2π
- Q.16** The moment of inertia of a body depends upon -
(1) mass only
(2) angular velocity only
(3) distribution of particles only
(4) mass and distribution of mass about the axis
- Q.17** On account of melting of ice at the north pole the moment of inertia of spinning earth -
(1) increases (2) decreases
(3) remains unchanged (4) depends on the time
- Q.18** Two spheres of same mass and radius are in contact with each other. If the moment of inertia of a sphere about its diameter is I, then the moment of inertia of both the spheres about the tangent at their common point would be -
(1) 3I (2) 7I (3) 4I (4) 5I
- Q.19** Moment of inertia of a cylindrical shell of mass M, radius R and length L about its geometrical axis would be -
(1) MR^2 (2) $\frac{1}{2}MR^2$
(3) $M\left(\frac{R^2}{4} + \frac{L^2}{12}\right)$ (4) $\frac{ML^2}{12}$
- Q.20** The moment of inertia of a sphere of radius R about an axis passing through its centre is proportional to -
(1) R^2 (2) R^3 (3) R^4 (4) R^5
- Q.21** The moment of inertia of a body does not depend on -
(1) its mass (2) angular velocity
(3) distribution of its particles
(4) its axis of rotation
- Q.22** The moment of inertia of NaCl molecule with bond length r about an axis perpendicular to the bond and passing through the centre of mass is

Exercise Level -2 : It contains single objective type good quality questions on all the concepts of the chapter in mixed manner.

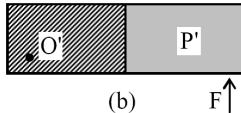
EXERCISE # 2

- Q.1** The dimensional formula of angular momentum is equal to that of the -
 (1) Force \times Time (2) Power \times Time
 (3) Work \times Time (4) Momentum \times Time
- Q.2** If the earth loses its atmosphere suddenly, then the duration of day will -
 (1) increase (2) decrease
 (3) remain unchanged (4) nothing can be definitely said
- Q.3** The rotational kinetic energy of a body is E. In the absence of external torque, if mass of the body is halved and radius of gyration doubled, then its rotational kinetic energy will be-
 (1) 0.5 E (2) 0.25 E (3) E (4) 2E
- Q.4** A ring is rolling without slipping. Its energy of translation is E. Its total kinetic energy will be-
 (1) E (2) 2E (3) 3E (4) 4E
- Q.5** A disc rolls down a plane of length L and inclined at angle θ , without slipping. Its velocity on reaching the bottom will be-
 (1) $\sqrt{\frac{4gL \sin \theta}{3}}$ (2) $\sqrt{\frac{2gL \sin \theta}{3}}$
 (3) $\sqrt{\frac{10gL \sin \theta}{7}}$ (4) $\sqrt{4gL \sin \theta}$
- Q.6** A spherical shell and a solid cylinder of same radius rolls down an inclined plane. The ratio of t_1 and t_2 is-
 (1) 15 : 14 (2) $\sqrt{10} : 3$ (3) 2 : 3 (4) 3 : 5
- Q.7** A ring takes time t_1 and t_2 for sliding down and rolling down an inclined plane of length L respectively for reaching the bottom. The ratio of t_1 and t_2 is-
 (1) $\sqrt{2} : 1$ (2) $1 : \sqrt{2}$ (3) 1 : 2 (4) 2 : 1
- Q.8** In the figure (a) half of the meter scale is made of wood while the other half of steel. The wooden part is pivoted at O. A force F is applied at the end of steel part. In figure (b) the steel part is pivoted at O' and the same force is applied at the wooden end-
- wood Steel



(a) $F \uparrow$

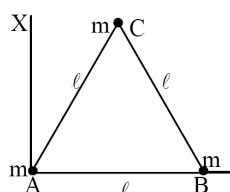
Steel wood



(b) $F \uparrow$
- (1) more angular acceleration will be produced in(a)
 (2) more angular acceleration will be produced in(b)
 (3) same angular acceleration will be produced in both conditions
 (4) information is incomplete
- Q.9** The moment of inertia of a disc of radius 0.5m about its geometric axis is $2\text{kg}\cdot\text{m}^2$. If a string is tied to its circumference and a force of 10 Newton is applied, the value of torque with respect to this axis will be-
 (1) 2.5 N-m (2) 5 N-m (3) 10 N-m (4) 20 N-m
- Q.10** In the above question 9, if the disc executes rotatory motion, its angular acceleration will be-
 (1) 2.5 rad/sec² (2) 5 rad/sec²
 (3) 10 rad/sec² (4) 20 rad/sec²
- Q.11** In the above question 9, the value of its angular velocity after 2 seconds will be-
 (1) 2.5 rad/sec (2) 5 rad/sec
 (3) 10 rad/sec (4) 20 rad/sec
- Q.12** In the above question 9, the change in angular momentum of disc in first 2 seconds in Nm second will be-
 (1) 2.5 (2) 5 (3) 10 (4) 20
- Q.13** In the above question 9, angular displacement of the disc, in first two second will be in radian-
 (1) 2.5 (2) 5 (3) 10 (4) 20
- Q.14** The maximum and minimum distance of a comet from the sun are $14 \times 10^9\text{m}$ and $7 \times 10^7\text{m}$ respectively. If the maximum velocity of the comet is $6 \times 10^2\text{ km/sec}$, its minimum velocity will be-
 (1) 3 km/sec (2) 4 km/sec (3) 6 km/sec (4) 8 km/sec
- Q.15** A stone is tied to a string and is rotated round the finger and is then released. The string wraps around the finger, then-
 (1) the linear momentum will be conserved
 (2) the linear velocity will continuously increase
 (3) the linear velocity will continuously decrease
 (4) the angular velocity will remain constant
- Q.16** If the earth suddenly stops rotating then rise in its temperature is-
 (1) $\frac{I^2 \omega^2}{5\text{ sJ}}$ (2) $\frac{5\text{ sJ}}{I^2 \omega^2}$ (3) $\frac{5\text{ sJ}}{R^2 \omega^2}$ (4) $\frac{R^2 \omega^2}{5\text{ sJ}}$
- Q.17** A sphere of radius R and of specific heat S is rotating at n revolutions per second along the central axis. It is stopped suddenly. If 50% of its energy is converted into heat, then increase in its temperature will be-
 (1) $\frac{2JR^2 \pi^2 n^2 s}{5}$ (2) $\frac{4R^2 \pi^2 n^2}{5\text{ J s}}$
 (3) $\frac{4R^2 \pi^2 n^2}{5\text{ s}}$ (4) $\frac{2R^2 \pi^2 n^2}{5\text{ J s}}$
- Q.18** A solid sphere is rolling down on inclined plane from rest and a rectangular block of same mass is also slipping down simultaneously from rest on the same plane. Then-
 (1) both of them will reach the bottom simultaneously
 (2) the sphere will reach the bottom first
 (3) the rectangular block will reach the bottom first
 (4) depends on density of material
- Q.19** The M.I. of a thin rod of length ℓ about the perpendicular axis through its centre is I. The M.I. of the square structure made by four such rods about a perpendicular axis to the plane and through the centre will be-
 (1) 4 I (2) 8 I (3) 12 I (4) 16 I

Exercise Level -3 : It contains previous years NEET exam questions from 2005 to upto to present year.

EXERCISE # 3

- Q.1** A thin, uniform, circular ring is rolling down on inclined plane of inclination 30° without slipping its linear acceleration along the inclined plane will be- [AIPMT-92]
 (1) $\frac{g}{2}$ (2) $\frac{g}{3}$ (3) $\frac{g}{4}$ (4) $\frac{2g}{3}$
- Q.2** The speed of homogeneous solid sphere after rolling down on inclined plane of vertical height h from rest without sliding is- [AIPMT-92]
 (1) $\sqrt{\frac{10}{7}gh}$ (2) \sqrt{gh} (3) $\sqrt{\frac{6}{3}gh}$ (4) $\sqrt{\frac{4}{3}gh}$
- Q.3** Two disc one of density 7.2 g/cm^3 and the other of density 8.9 g/cm^3 are of same mass and thickness. Their moments of inertia are in the ratio- [AIPMT-92]
 (1) $\frac{8.9}{7.2}$ (2) $\frac{7.2}{8.9}$
 (3) $(8.9 \times 7.2) : 1$ (4) $1 : (8.9 \times 7.2)$
- Q.4** If a ring, a disc, a solid sphere and a cylinder of same radius rolls down on inclined plane, the first one to reach the bottom will be- [AIPMT-93, RPMT-94]
 (1) disc (2) ring
 (3) solid sphere (4) cylinder
- Q.5** Three point masses, each of mass m , are placed at the corners of an equilateral triangle of side ℓ . Then the moment of inertia of this system about an axis along one side of the triangle is- [AIIMS-95]
 (1) $3 m\ell^2$ (2) $m\ell^2$ (3) $\frac{3}{4}m\ell^2$ (4) $\frac{3}{2}m\ell^2$
- Q.6** The angular momentum of body remains conserve if - [MPPET-2002, AIIMS-2002]
 (1) applied force on body is zero
 (2) applied torque on body is zero
 (3) applied force on body is constant
 (4) applied torque on body is constant
- Q.7** A circular disc is to be made by using iron and aluminium so that it acquired maximum moment of inertia about geometrical axis. It is possible with- [AIPMT-2003]
 (1) aluminium at interior and iron surrounded to it
 (2) iron at interior and aluminium surrounded to it
 (3) using iron and aluminium layers in alternate order
 (4) sheet of iron is used at both external surface and aluminium sheet as internal layer
- Q.8** A solid cylinder of mass M and radius R rolls without slipping down an inclined plane of length L and height h . What is the speed of its centre of mass when the cylinder reaches its bottom- [AIPMT-2003]
 (1) $\sqrt{2gh}$ (2) $\sqrt{\frac{3}{4}gh}$ (3) $\sqrt{\frac{4}{3}gh}$ (4) $\sqrt{4gh}$
- Q.9** A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is K . If radius of the ball be R , then the fraction of total energy associated with its rotational energy will be- [AIPMT-2003]
 (1) $\frac{K^2 + R^2}{R^2}$ (2) $\frac{K^2}{R^2}$
 (3) $\frac{K^2}{K^2 + R^2}$ (4) $\frac{R^2}{K^2 + R^2}$
- Q.10** The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plane of the ring is- [AIPMT-2004]
 (1) $2 : 1$ (2) $\sqrt{5} : \sqrt{6}$ (3) $2 : 3$ (4) $1 : \sqrt{2}$
- Q.11** A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is- [AIPMT-2004]
 (1) ω (2) $\frac{I_1\omega}{I_1 + I_2}$
 (3) $\frac{(I_1 + I_2)\omega}{I_1}$ (4) $\frac{I_2\omega}{I_1 + I_2}$
- Q.12** Three particles, each of mass m are situated at the vertices of an equilateral triangle ABC of side ℓ cm (as shown in the figure). The moment of inertia of the system about a line AX perpendicular to AB and in the plane of ABC, in gram cm^2 units will be- [AIPMT-2004]
- 
- (1) $2 m\ell^2$ (2) $\frac{5}{4}m\ell^2$ (3) $\frac{3}{2}m\ell^2$ (4) $\frac{3}{4}m\ell^2$
- Q.13** A wheel having moment of inertia 2 kg-m^2 about its vertical axis, rotates at the rate of 60 rpm about the axis. The torque which can stop the wheel's rotation in one minute would be- [AIPMT-2004]
 (1) $\frac{\pi}{12} \text{ N-m}$ (2) $\frac{\pi}{15} \text{ N-m}$ (3) $\frac{\pi}{18} \text{ N-m}$ (4) $\frac{2\pi}{15} \text{ N-m}$
- Q.14** In an orbital motion, the angular momentum vector is- [AIIMS-2004]
 (1) along the radius vector
 (2) parallel to the linear momentum
 (3) in the orbital plane
 (4) perpendicular to the orbital plane

EXERCISE # 4

- Q.1** A ring of mass M and radius R is moving in horizontal plane at angular speed ω about self axis. If two equal point masses are placed at the ends of any diameter. Find final angular speed of system - [AIEEE-2002]
 (1) $\frac{M}{2m}\omega$ (2) $\frac{M}{M+2m}\omega$ (3) $\frac{m}{M+2m}\omega$ (4) none
- Q.2** The minimum velocity (in ms^{-1}) with which a car driver must travel on a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is - [AIEEE-2002]
 (1) 60 (2) 30 (3) 15 (4) 25
- Q.3** A solid sphere, a hollow sphere and a ring are released from top of an inclined plane (frictionless) so that they slide down the plane. Then maximum acceleration down the plane is for (no rolling) [AIEEE-2002]
 (1) Solid sphere (2) Hollow-sphere
 (3) Ring (4) All same
- Q.4** Moment of inertia of a circular wire of mass M and radius R about its diameter is - [AIEEE-2002]
 (1) $\frac{MR^2}{2}$ (2) MR^2 (3) $2MR^2$ (4) $\frac{MR^2}{4}$
- Q.5** A circular disc X of radius R is made from an iron plate of thickness t and another disc Y of radius $4R$ is made from an iron plate of thickness $t/4$. Then the relation between the moment of inertia I_X and I_Y is - [AIEEE-2003]
 (1) $I_Y = 16 I_X$ (2) $I_Y = I_X$
 (3) $I_Y = 64 I_X$ (4) $I_Y = 32 I_X$
- Q.6** A particle performing uniform circular motion has angular momentum L . If its angular frequency is doubled and its kinetic energy halved, then the new angular momentum is - [AIEEE-2003]
 (1) $2L$ (2) $4L$ (3) $L/2$ (4) $L/4$
- Q.7** A solid sphere is rotating in free space. If the radius of the sphere is increased keeping mass same which one of the following will not be affected? [AIEEE-2004]
 (1) Moment of inertia (2) Angular momentum
 (3) Angular velocity (4) Rotational kinetic energy
- Q.8** One solid sphere A and another hollow sphere B are of same mass and same outer radii. Their moment of inertia about their diameters are respectively I_A and I_B such that where d_A and d_B are their densities. [AIEEE-2004]
 (1) $I_A = I_B$ (2) $I_A > I_B$ (3) $I_A < I_B$ (4) $\frac{I_A}{I_B} = \frac{d_A}{d_B}$
- Q.9** An annular ring with inner and outer radii R_1 and R_2 is rolling without slipping with a uniform angular speed. The ratio of the forces experienced by the two particles situated on the inner and outer parts of the ring, F_1/F_2 is [AIEEE-2005]
 (1) $\frac{R_2}{R_1}$ (2) $\left(\frac{R_1}{R_2}\right)^2$ (3) 1 (4) $\frac{R_1}{R_2}$
- Q.10** The moment of inertia of uniform semicircular disc of mass M and radius r about a line perpendicular to the plane of the disc through the centre is [AIEEE-2005]
 (1) $\frac{1}{4}Mr^2$ (2) $\frac{2}{5}Mr^2$ (3) Mr^2 (4) $\frac{1}{2}Mr^2$
- Q.11** A thin circular ring of mass m and radius R is rotating about its axis with a constant angular velocity ω . Two objects each of mass M are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with an angular velocity $\omega' =$ [AIEEE 2006]
 (1) $\frac{\omega m}{(m+M)}$ (2) $\frac{\omega m}{(m+2M)}$
 (3) $\frac{\omega(m+2M)}{m}$ (4) $\frac{\omega(m-2M)}{(m+2M)}$
- Q.12** Four point masses, each of value m , are placed at the corners of a square $ABCD$ of side ℓ . The moment of inertia of this system about an axis passing through A and parallel to BD is - [AIEEE 2006]
 (1) $3m\ell^2$ (2) $m\ell^2$ (3) $2m\ell^2$ (4) $\sqrt{3}m\ell^2$
- Q.13** A round uniform body of radius R , mass M and moment of inertia 'I', rolls down (without slipping) an inclined plane making an angle θ with the horizontal. Then its acceleration is [AIEEE 2007]
 (1) $\frac{g \sin \theta}{1+I/MR^2}$ (2) $\frac{g \sin \theta}{1+MR^2/I}$
 (3) $\frac{g \sin \theta}{1-I/MR^2}$ (4) $\frac{g \sin \theta}{1-MR^2/I}$
- Q.14** Angular momentum of the particle rotating with a central force is constant due to [AIEEE 2007]
 (1) Constant Force (2) Constant linear momentum
 (3) Zero Torque (4) Constant Torque
- Q.15** Consider a uniform square plate of side 'a' and mass 'm'. The moment of inertia of this plate about an axis perpendicular to its plane and passing through one of its corners is [AIEEE 2008]
 (1) $\frac{1}{12}ma^2$ (2) $\frac{7}{12}ma^2$ (3) $\frac{2}{3}ma^2$ (4) $\frac{5}{6}ma^2$
- Q.16** The moment of inertia of a thin square plate $ABCD$ (figure) of uniform thickness about an axis passing through the centre O and perpendicular to the plane of the plate is [IIT - 1992]
-
- (1) $I_1 + I_2$ (2) $I_3 + I_4$ (3) $I_1 + I_3$ (4) All of these where I_1, I_2, I_3 and I_4 are respectively the moments of inertia about axes 1, 2, 3 and 4 which are in the plane of the plate.
- Q.17** A thin horizontal circular disc is rotating about a vertical axis passing through its centre. An insect is at rest at a point near the rim of the disc. The insect now moves along a diameter of the disc to reach its other end. During the journey of the insect, the angular speed of the disc: [AIEEE - 2011]
 (1) remains unchanged (2) continuously decreases
 (3) continuously increases (4) first increases and then decreases

Answer key

Above mentioned all exercises provided with answer key

ANSWER KEY

EXERCISE # 1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	4	4	1	1	1	3	1	2	3	3	3	4	4	3	3	4	1	2	1	4
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	3	1	4	4	1	1	2	4	4	1	2	3	2	2	2	2	4	3	
Q.No.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	4	2	4	3	2	1	4	1	1	1	2	2	1	3	4	2	3	3	1
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	2	3	4	2	2	3	1	4	3	4	4	3	3	2	3	2	2	3	3	1
Q.No.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	1	3	2	2	1	3	3	1	4	2	1	1	1	1	4	4	3	2	1	2
Q.No.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118		
Ans.	1	2	2	1	1	4	2	3	1	2	2	1	3	3	3	2	3	4		

Revision Plan

We emphasize that every student should prepare his/her own revision plan. For this purpose there is Revision Plan Section in each chapter which student should prepare while going through the study material. This will be useful at the time of final revision before final exam for quick & effective revision.

Revision Plan

Prepare Your Revision plan today!

After attempting Exercise Sheet, please fill below table as per the instruction given.

- Write Question Number (QN) which you are unable to solve at your own in **column A**.
- After discussing the Questions written in **column A** with faculty, strike off them in the manner so that you can see at the time question number during Revision, to solve such questions again.
- Write down the Question Number you feel are important or good in the **column B**.

EXERCISE	COLUMN A	COLUMN B
	Questions unable to solve in first attempt	Good or Important questions
Exercise-1		
Exercise-2		
Exercise-3		
Exercise-4		

Revision Strategy:

Whenever you wish to revision this chapter, follow the following steps-

- Step-1:** Review your theory notes.
- Step-2:** Solve Questions of column A
- Step-3:** Solve Questions of Column B
- Step-4:** Solve questions from other Question Bank, Problem book etc.

Online Solutions

Self explanatory and detailed solution of all exercises mentioned above are available on Career Point website www.careerpoint.ac.in

ROTATIONAL MOTION

EXERCISE-1

Answer Key & Solution

Question Number	Solution
1	Click Here
2	Click Here
3	Click Here
4	Click Here
5	Click Here
6	Click Here
7	Click Here
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Question Number	Solution
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