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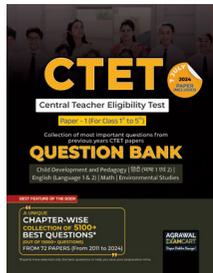
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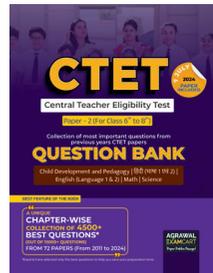
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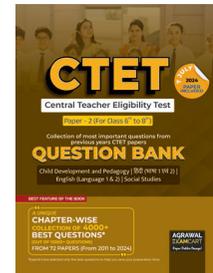
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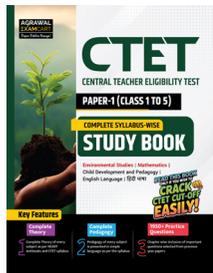
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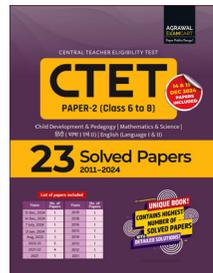
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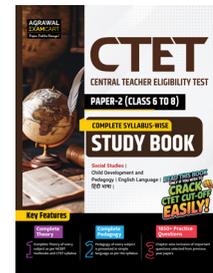
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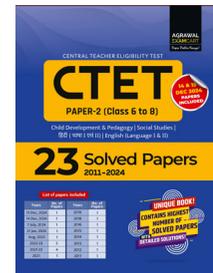
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# Chapter 1

## Concept of Development and Its Relationship with Learning

### 1. Introduction

- Change is the law of nature. Animate or inanimate objects are all subject to change. Animate objects are distinguished from inanimate objects chiefly by their potentiality to maintain the flow and cycle of life. Seeds, after germinating in the soil, grow as saplings and then as specific plants or trees which in turn flower and produce seeds or fruits for further germination. Similar is the case with birds, animals and human beings who can reproduce their own kind by the transmission of specific characteristics of the species through sexual union between the male and the female.
- As far as the human being is concerned, life starts with conception in the mother's womb as a result of the process of fertilisation of the ovum(egg cell) of the mother by the sperm cell of the father. The mother's womb then becomes the site and the meaning for the growth and development of the new life and it is only after nine months that the baby is able to come into the world as a newborn.
- The period spent in the mother's womb is termed as **pre-natal period** and is usually not included in the computation of one's **chronological age**.
- In all animals, including human beings, the prenatal period resembles the time taken by a germinating seed to come out of the soil, which then grows and develops into a full-fledged plant or tree.
- The processes by which a germinating seed or conceived organism is turned into a mature plant or full fledged being are collectively termed **growth and development**.

### 2. Concept of Growth and Development

- **Child's growth and development are complex processes** which are influenced by multiple factors and sources.
- The terms growth and development are often used interchangeably or paired up in a rather similar way, which causes ambiguity over their meaning. It is, therefore, important to understand the difference between these two terms right at the outset.
- **Meaning and Definition of Child Growth :**
  - ❖ Growth basically refers to the **quantitative changes** in body proportion like **change in height, weight, internal organs** etc. In other words, growth means increase in size of not only the overall dimensions of the body in terms of height and weight but also of the parts of the body such as head, arms, trunk, heart and muscles. It changes from the early stage of growth to the later stage. Thus, growth is confined to the **physical changes which are quantifiable**.

- ❖ In simple words we can say that growth refers to physical increase in some quantity over time. It includes changes in terms of height, weight, body proportions and general physical appearance.
- ❖ **In Encyclopedia Britannica**, growth is defined as “an increase in size or the amount of an entity”. It means growth involves all those structural and physiological changes that take place within an individual during the process of maturation. For example, growth of a child means the increase in weight, height and different organs of the child's body.
- ❖ **Hurlock** has defined growth as “**change in size, in proportion, disappearance of old features and acquisition of new ones**”.
- ❖ **According to Crow and Crow**, growth refers to structural and physiological changes.
- **Characteristics of Growth :**
  - ❖ Growth has following distinct characteristics. Growth indicates physical change and increase in size as a result of accretion of tissues similar to the originally present and has three distinct components:-
    - ★ **cell division,**
    - ★ **assimilation, and**
    - ★ **cell expansion.**
  - ❖ Growth can be measured **quantitatively**.
  - ❖ Growth rates vary during different stages of growth.
  - ❖ **Growth rate is rapid during prenatal, neonatal, infancy and adolescence but slows down during childhood.**
  - ❖ Physical growth is minimal during adulthood.
  - ❖ Growth is a function of an organism in which heredity acts as a limiting factor.
  - ❖ **Growth does not continue throughout life**, it stops with the attainment of maturity.
- **Meaning and Definition of Child Development :**
  - ❖ The term development implies the overall changes occurring in both the **quantitative as well as qualitative aspects**. It may be defined as a progressive series of orderly, coherent changes. The term progressive denotes that changes lead forward.
  - ❖ **Development is a continuous process through which physical, emotional and intellectual changes occur.** It is a more wider and comprehensive term than growth. It is also possible without growth.

- ❖ **Development is modifiable** from the moment of conception till death, the individual is continuously changing. Development can be modified by life circumstances to some extent.
- ❖ There is **no break/ discontinuity** in development, in some stages development is fast and in some it is slow.
- ❖ Physical development is sometimes predictable as it follows a similar pattern of development as **Cephalocaudal** and **Proximodistal**.
- ❖ Development is not linear in shape, it is spiral and it can be back and forth throughout life.
- ❖ Developments depended on both **heredity and environment**, according to Woodworth development is a product of heredity and environment.
- ❖ **According to Boring**, “By development, we mean the changes in the shape of the parts of the body and the integration of the various parts into the functional units as growth goes on.”
- ❖ **Baer defined** development as, “behavioural change which requires programming and programming requires time, but not enough of it to call it age.” According to this view, development is the collection of learning experiences, which the child acquires in the process of interaction with the environment.
- ❖ **In Webster's dictionary** development is defined as “the series of changes which an organism undergoes in passing from an embryonic stage to maturity.”
- ❖ **According to Skinner**, development is a continuous and gradual process.
- ❖ **According to Crow and Crow**, development is concerned with growth as well as those changes in behaviour which results from environmental situations.
- ❖ Thus, development is a process of change in growth and capability over time due to function of both maturation and interaction with the environment.

- **Characteristics of Development :**

- ❖ Development is a product of the interaction between the person and the environment. **Development is a continuous and life long process.**
- ❖ Development is **sequential and orderly**. It follows a **predictable pattern**.
- ❖ Development is **multidimensional and multidirectional**.
- ❖ Different **aspects/spheres of development are interrelated and are interdependent**.
- ❖ Development proceeds from **general to specific** and is based on mass differentiation and integration.
- ❖ Development is functional. It implies overall changes in shape, form or structure resulting in improved working and functioning.
- ❖ Development indicates the changes in the quality or character rather than in quantitative aspects.
- ❖ Development implies improvement in functioning and behaviour and hence brings qualitative changes which are difficult to measure.

- ❖ Development is wider and comprehensive, it includes growth and covers all those changes which take place in the organism.
- ❖ **Development of individual children can be predicted somewhat but all children's develop at different rates.**
- ❖ **Development** is said to be a **complex process** in comparison to the process of growth.
- ❖ Generally, growth influences the process of development but not always as is evident from the cases of children who do not gain in terms of height, weight and size but do experience functional improvement or **development in physical, social, emotional and intellectual aspects.**

### 3. Differences Between Growth and Development

- Growth and development can be compared as follows :

➤ Growth refers to physiological changes	➤ Development refers to overall changes in the individual. It involves changes in an orderly and coherent type towards the goal of maturity.
➤ Changes in the quantitative respect is termed as growth.	➤ Development changes in the quality along with quantitative aspect.
➤ Growth does not continue throughout life.	➤ Development continues throughout life.
➤ Growth stops after maturation.	➤ Development is progressive.
➤ Growth occurs due to the multiplication of cells.	➤ Development occurs due to both maturation and interaction with the environment.
➤ Growth is cellular.	➤ Development is organizational.
➤ Growth is one of the part of the developmental process.	➤ Development is a wider and comprehensive term.
➤ Growth may be referred to describe the changes in particular aspects of the body and behavior of the organism.	➤ Development describes the changes in the organism as a whole.
➤ The changes produced by growth are subjects of measurements. They may be quantified and observable in nature.	➤ Development brings qualitative changes which are difficult to measure directly. They are assessed through keen observation of behavior in different situations.
➤ Growth may or may not bring development.	➤ Development is possible without growth.

#### 4. Importance of Growth and Development

- The chief aim of education is to help the students to have desirable changes and new ways of thinking. To bring about this kind of changes it is necessary to know about the growth and development of the children to their age.
- Development is a continuous and non-stop process at all periods and stages of human life. Therefore, we should never give up our efforts to achieve perfection in terms of development in the different dimensions of our personality.
- The Principles related to growth and development suggest a pattern or trend for the advancement of children on the developmental path.
- Principles like proceeding from general to specific responses and the principle of integration help us to plan the learning processes and arrange suitable learning experiences to achieve maximum gain in terms of growth and development.

#### 5. Maturation

- Maturation is the process by which we change, grow, and develop throughout life.
- Developmental psychologists look at many different types of maturation throughout the lifespan.
- Maturation is the process of development that occurs as we grow and change.
- There are two main types of maturation:
  - **Physical Maturation :**
    - ❖ Physical maturation occurs when our body grows and changes as we get older.
    - ❖ A child goes through some very distinct physical maturity as they progress through all their development stages.
    - ❖ For example, in the early stages of development, a child depends on reflexes majorly.
    - ❖ Then as children grow they develop their motor skills and coordination. They also grow taller and add more weight.
    - ❖ Their body goes through hormonal changes as they leave adolescence and enter early adulthood.
  - **Cognitive Maturation:**
    - ❖ Cognitive maturation is the process of development in the way we think as we grow.
    - ❖ This refers to the cognitive development of children from birth to adulthood.
    - ❖ It refers to how babies think, learn, interact with their environment etc.
    - ❖ Some important aspects of cognitive development are the processing of information, language development, reasoning skills, development of intellect and memory.
    - ❖ This process of cognitive development begins right in infancy.
    - ❖ An infant uses his/her sensory organs to explore the surroundings.
    - ❖ By three months infants can actually distinguish faces and sounds.

- ❖ And as they go through adolescence and their teenage years, the cognitive development continues.
- ❖ Each stage is earmarked with certain benchmarks that the teachers can focus on to chart the child's cognitive maturity.

#### 6. Learning

- Child development refers to the changes that occur as a child grows and develops in relation to being physically healthy, mentally alert, emotionally sound, socially competent and ready to learn.
- Children learn best when they participate in meaningful activities.
- Learning is defined as “any relatively permanent change in behaviour that occurs as a result of practice and experience”. This definition has three important elements :
  - ❖ Learning is a change in behaviour—better or worse.
  - ❖ It is a change that takes place through practice or experience, but changes due to growth or maturation are not learning.
  - ❖ This change in behaviour must be relatively permanent, and it must last a fairly long time.

#### 7. Maturation vs Learning

- Learning is the gathering of knowledge and skills with the help of study.
- This is with respect to formal learning. Informal learning begins from birth, the learning that comes from observation and experiences.
- Maturation, on the other hand, is an act of maturity.
- It refers to physical and mental development. So the ability to act, react and behave responsibly comes from maturity.
- So while learning comes from experiences and practice, maturity comes from individual growth without any external stimuli.
- In fact, we can say that maturation is essential for learning skills. Attaining maturity enables learning new skills.
- This is one important factor that teachers must keep in mind.
- Because if learning precedes maturity, it can be a wasted effort. So learning must begin when the child is mature enough for that particular lesson.
- Growth, Development, Learning and Maturation are very important concepts in understanding the behaviour, learning style, and maturity level and development pattern of children during different stages of life. As Health, Nutrition, emotional well-being and Education are the major issues that are to be studied for understanding the progress of the child, one needs to understand the interdisciplinary basis of child development.

#### 8. Aspects/Dimensions of Child Development

- The various aspects/dimensions of development that take place in the life of human beings are :

- **Physical Development or Motor Development**
  - ❖ Physical growth and development related to the development of the body and its parts. Changes in the body size, brain development, body proportions, development of sensory capacities, functioning of various body systems are all part of physical development.
  - ❖ It is essential to know how children develop physically as physical development influences children's behaviour both directly and indirectly.
  - ❖ Physical development refers to the changes in size, structure and proportions, functioning of the body system and motor capacities etc.
  - ❖ Motor development refers to the development of control over body movement. **Motor development can be classified under two categories:**
    - ★ **Gross Motor Development:**
      - As children grow from infancy into middle childhood, they gain more and better control over their muscles. In the initial years of the childhood, a child gains control over her gross or large muscles, which enable her to control gross movements, involving large areas of the body *e.g.*, **running, jumping, ball skills such as throwing, catching and kicking, going up and down stairs, riding a bike, climbing a ladder, reaching to get something off of a shelf etc.**
      - Gross motor skills include **lifting one's head, rolling over, sitting up, balancing, crawling and walking.** Gross motor development usually follows a pattern.
      - Generally large muscles develop before smaller ones, thus, gross motor development is the foundation for developing skills in other areas such as fine motor skills. Development also generally moves from top to bottom.
    - ★ **Fine Motor Development:**
      - Fine motor skills include the ability to manipulate small objects, transfer objects from **hand to hand, and various hand-eye coordination tasks.**
      - Fine motor skills may involve the use of very precise motor movement in order to achieve an especially delicate task.
      - Some examples of fine motor skills are **using the thumb and forefinger to pick up small objects, cutting, colouring, Dialling the phone, turning door knobs, keys and locks, putting a plug into socket, tying shoelaces, brushing teeth, writing, scribbling or threading beads.**
      - Fine motor development refers to the development of skills involving the smaller muscle groups.
  - ❖ The development of motor skills is determined both by maturation and learning opportunities.
- **Cognitive Development :**
  - ❖ Cognitive development refers to the growth and changes in the mental capacities, thinking, ways of making sense of the world and the like. It involves many abilities such as **attention, perception, memory, thinking, problem solving and intelligence.**
  - ❖ Childhood is the stage of **rapid intellectual development.**
  - ❖ Children develop various concepts about things, people and ideas. His power of **reasoning, thinking, observation, concentration, perception, imagination** etc. are developed to a reasonable extent.
- **Social Development:**
  - ❖ It refers to the ability of the child to establish relationships with persons in his/her environment. As the child grows, relationships with peers and visitors in the family, parents and family members are established. The behaviour of the human infant is not social at birth.
  - ❖ Gradually as a result of social interaction and education efforts, one begins to imbibe social qualities and learn social behaviour.
  - ❖ Social development begins with the infant's first contact with the mother and other members of a family. As one grows in age the scope of interaction with other people increases.
  - ❖ The child at adolescence age begins to acquire social maturity and at the end of adolescence the child becomes socially mature.
  - ❖ However, social development continues throughout one's life as long as one gets opportunities for social interaction.
- **Emotional Development:**
  - ❖ The word emotion is derived from the Latin word '**Emovere**' which means to excite or agitate, which is actually a disturbed state of mind. When our feelings become intense and excited, they become emotions. Emotions are of two types that is **pleasant emotions** like – **joy, happiness** and **unpleasant emotions** like – **anger, fear and jealousy.**
  - ❖ We have imbibed with a number of emotions but the situation is quite different when one begins his life on this earth. There are only two emotions *i.e.* distress and delight present up to 6 months of age in infants. Later the rate of emotional development gets increased to the extent that up to 2 to 3 years, almost all emotions are distinguishable by the beginning of childhood.
  - ❖ In the **infancy** the **emotional behaviour** is expressed through motor responses like **crying, yelling, throwing, pushing** etc. In the **childhood**, the child learns to express his emotional behaviour through reasonable means and proper way.
  - ❖ Emotional development is a uniquely integrative and psychologically constructive feature of psychological growth in infancy and childhood.
  - ❖ The major types of **emotions** include **fear, sadness, anger, surprise, excitement, guilt, shame, disgust, interest and happiness.**
- **Moral Development :**
  - ❖ By morality we mean conformity to the moral code of the social group. The term comes from the Latin word "**mores**" meaning **manners, customs or folkways.** To

act in a moral way means to act in conformity to group standards of conduct. Morality also includes a sense of right or wrong behaviour which has to do with the conscience of the individual.

- ❖ Moral behaviour is learnt. Moral standards vary from group to group depending upon what has been accepted by the group as a socially approved behaviour. True morality comes from within the individual. It is internal in nature and not imposed by external authority.
- ❖ Moral development focused on the emergence, change, and understanding of morality from infancy through adulthood.

- **Language Development :**

- ❖ Language is the ability that separates humans from animals. Language is a means of communication. It helps us to express our thoughts and feelings in words.
- ❖ It includes different forms of communication such as verbal, non-verbal, listening, speaking, writing, sign language, expressions and gestures.
- ❖ Language development starts with sounds and gestures, then words and sentences.
- ❖ Children learn to engage in social behaviour with the help of language. Development influences cognitive, social and emotional development. Reading books and sharing stories is good for language development.
- ❖ **Linguist Noam Chomsky (1959)** first talked about the limitations of the reinforcement theory. He proposed that every human being is born with a mental structure to acquire language. He called it a “**Language Acquisition Device**” (**LAD**). This language acquisition device helps the child to process the linguistic data from their environment and generate the grammar rules by themselves.
- ❖ That is, when children hear people talking, listen to stories, read to them, listen to a radio or to the TV or movies; everything they hear is a ‘**language input**’.
- ❖ This is selectively processed in the **LAD (Language Acquisition Device)** and children automatically induce grammatical rules for themselves.

## 9. Stages of Development

- All children progress in a definite order through these stages and they all follow similar basic patterns. These stages along with the corresponding ages of the child have been identified by developmental psychologists as follows:

Stage	Time frame
prenatal	<b>before birth</b>
infancy	<b>Birth to 2 year</b>
Childhood	Early Childhood : <b>2-6 years</b> Late Childhood : <b>6-12 years</b>
adolescence	<b>12-20 years</b>
young adulthood	<b>20-30 years</b>
adulthood	<b>30-50 years</b>
mature adult	<b>50-65 years</b>
ageing adult	<b>65+</b>

## 10. Prenatal Stage (before birth)

- Prenatal stage is also known as antenatal which literally means occurring, existing, performed or used before birth. Development happens quickly during the prenatal period, which is the time between conception and birth.
- Prenatal development is the process by which a body develops inside the **mother’s womb**.
- It takes about **38 weeks** to complete, in which a single cell becomes a full term baby.
- **Characteristics of Prenatal Stage :**

Prenatal stage of development is divided into three sub-stages:

### The Germinal Stage :

- ❖ Germinal stage is the stage in which a baby develops from a single cell after conception into an embryo and later a fetus. Germinal stage is the period of gestation from fertilisation or conception to implantation of the embryo in the uterus.
- ❖ Conception is the beginning of the germinal stage of prenatal development.
- ❖ Around seven days after conception, the ball of cells starts to become embedded in the walls of the uterus. This process is called implantation and takes a week to complete. If implantation fails, as is quite common, the pregnancy terminates.
- ❖ The germinal stage occurs during the first two weeks of development after conception (or the second to fourth week of pregnancy). The **zygote** moves along the fallopian tubes towards the uterus. At the same time zygote is rapidly dividing in the process called cleavage. As the zygote divides and reaches the uterus, it forms a blastocyst, or a ball of cells.
- ❖ The **blastocyst** cells keep dividing and eventually form a hollow cavity in the centre called blastocoel.
- ❖ The blastocoel looks like a basketball with a hollow inside and a thick coating of cells on the outside. The hollow shape will be important for creating the layers of the body later on.
- ❖ When the blastocyst attaches to the uterus wall, cells in the uterus begin to grow around the blastocyst forming the amniotic cavity or closed sac. Similarly, the uterus will grow around the blastocyst to help it mature.
- ❖ The germinal period ends when the blastocyst is fully implanted into the uterine tissue. It is also known as the **period of ovum**.

### The Embryonic Stage :

- ❖ The **embryonic period** lasts from implantation until about **8 weeks from conception** (or the 10th week of pregnancy).
- ❖ The embryonic stage of gestation is the period after implantation, during which all the major organs and structures within the growing mammals are formed.

- ❖ The blastocyst that is implanted in the uterus continues to divide rapidly after implantation. Through a process called differentiation, cells begin to take different functions. Some cells will form placenta and others will make up the baby. Placenta has two important functions:
  - \* Passing oxygen and nutrients from mother's blood into the embryo or foetus.
  - \* Remove waste materials from embryos or foetuses.
- ❖ After the formation of the placenta, the process of gastrulation starts.
- ❖ Gastrulation is a critical stage where the three different layers of the embryo form. Each layer is destined to become a different set of tissues and organs. The three layers are:
  - \* The outer **ECTODERM**, the middle **MESODERM** and the innermost **ENDODERM**.
- ❖ Each layer will differentiate into different structures. During gastrulation, cells at the top of the blastocyst migrate towards a central line called the primitive streak. This creates a cavity called the archenteron that will form the digestive tract. The area at which the archenteron opens is called the blastopore.
- ❖ The outer ectoderm will form many other tissues such as skin and hair as well as most of the nervous system tissues including the brain.
- ❖ The mesoderm will form tissues inside the body such as lungs, bones and muscles-including the heart.
- ❖ The endoderm will form tissues such as digestive tract and bladder as well as other internal organs.
- ❖ The four stages of embryonic development are the **morula stage, the blastula stage, the gastrula stage and the neurula stage**.
- ❖ In the embryonic stage, all the major organs form and the embryo becomes very fragile. The biggest dangers are teratogens which are agents such as viruses, drugs, and radiation that can cause deformities in the embryo or foetus.
- ❖ At the end of the embryonic period, the embryo is about an inch long.

#### **The Foetal Period :**

- ❖ After the **8th week**, the baby is called a foetus. This stage takes place from the end of the embryonic period until the time of birth (or the 10th to 40th week of pregnancy).
- ❖ The rate of growth reaches its peak during the early foetal period and then declines.
- ❖ During the **3rd month** the baby's arms, hands, fingers, feet and toes are formed. Baby can open and close the fist. Fingernails and toenails are also developed. Circulatory and urinary systems are working and the liver produces bile.
- ❖ During the **4th month** eyelids, eyebrows, eyelashes, nails and hair are formed. The nervous system is starting to function.

- ❖ During the **5th month** the mother begins to feel the baby move. Except for the differentiation of such parts as hair, nails, external sex organs, development in the foetal period is characterised primarily by further genesis of existing structures, changes in body proportions and increases in functions.
- ❖ In addition to **quantitative change**, there are some interesting **qualitative changes**.
- ❖ Kicking appears to decrease and squirming to increase as the foetus approaches birth and head movements show a particularly striking increase in the third trimester.
- ❖ Reflexes, automatic and apparently innate responses develop over an extended period and tend to appear as they become important for survival.
- ❖ All the reflexes that are important for life in the uterus appear by about the fifth month and "**advance preparation**" begins during the last trimester for those functions that will be vital during infants postnatal existence (**swallowing, urinating, muscular movements of gastrointestinal tract**).
- ❖ Other reflexive responses such as pupillary reflex do not appear to be present even in the seven month old premature infant.

### **11. Infancy(Birth-2 years)**

- Infancy is the shortest period of human growth and development. It is the period of growth and development commencing from birth **0** and ends when the infant reaches the age of **2 years**. This period has a tremendous importance in the development of the child. Child can't sit, stand, walk, and feed at his own will.
- It is a **sensitive period for acquiring language**. The child cares about his own happiness. That is why this stage is also called the self-centered state.
- Child's behaviour appears to be determined by **stimulus-response (sensor-S, motor-R)** arrangements.
- He is completely dependent upon the parents and following development takes place in this stage :
  - ❖ **Physical Development:** Physical development means the progressive development of the various parts of the body and their capacity to function. It implies an orderly series of change in size, body proportion, nervous system and changes in internal organs.
    - \* **Size and Weight:** Average length of a newborn child is 19 inches and varies from **17-20 inches**. At birth a normal child weighs about **7 pounds** and during this period the child develops his sensory muscular skills.
    - \* **Change in Proportions:** At birth a child's body is unattractive. Different parts of the body like the hand and trunk begin to take proportionate size. The head that seems enormous at birth seems small now as legs and arms increase in length.

- ★ **Bones and Muscles:** There is rapid growth in bones and muscles. The bones of neonate are flexible. They start hardening in the first year.
- ★ **Teeth:** Teeth are absent at birth. The first tooth appears at the age of six months. By the end of the first year, the baby has five to six teeth and by the end of second year the baby has **16 teeth**.
- ★ **Heart beat:** During the first month of infancy, the child's heart beats up to **140 times/min.** but in the first **6 months** it slows down to around **100 times/min.**
- ❖ **Motor Development Skills in Infancy:** Motor development refers to the development of control over body movement. We know that a child in the beginning is unable to sit, by the age of **5 to 6** months she/he sits with the help of some support and finally can sit without any support. The child's capacity to sit, stand, walk, hold an object, eat, write, climb stairs and run etc. are included in motor development. The motor development can be classified under two categories :
  - ★ **Gross Motor Development:** As children grow from infancy into middle childhood, they gain more and better control over their muscles. In the initial years of the childhood, a child gains control over her gross or large muscles, which enable her to control gross movements, involving large areas of the body eg- walking, running, jumping etc. Gross motor skills include lifting one's head, rolling over, sitting up, balancing, crawling and walking. Gross motor development usually follows a pattern. Generally large muscles develop before smaller ones, thus, gross motor development is the foundation for developing skills in other areas such as fine motor skills. Development also generally moves from top to bottom.
  - ★ **Fine Motor Development:** Fine motor skills include the ability to manipulate small objects, transfer objects from hand to hand, and various hand-eye coordination tasks. Fine motor skills may involve the use of very precise motor movement in order to achieve an especially delicate task. Some examples of fine motor skills are using the thumb and forefinger to pick up small objects, cutting, colouring, writing or threading beads. Fine motor development refers to the development of skills involving the smaller muscle groups.
- ❖ **Role of Parents and Teachers in Providing Opportunities for Physical Motor Development :**
  - ★ **Play:** The role of parents and teachers in providing opportunities for physical motor development is very important. The value of play for physical and motor development needs no special emphasis. Vigorous active play helps the child in gaining muscular control. Physical development and acquisition of motor skills depend upon maturation of the parts of the body and opportunities available to the child to practise these skills. Parents and teachers can provide special opportunities for play and physical movement activities to the children for physical motor development. These include the following categories :
    - **Locomotor Movement:** Movement of the body from place to place is involved in locomotor movement. Physical abilities such as crawling, walking, hopping, jumping, and running, leaping, galloping and skipping are examples of locomotor movement. This type of movement helps develop gross motor skills.
    - **Non-loco Motor Movement:** Movement of the body while staying in one place is involved in non-loco motor movement. Physical abilities such as pushing, pulling, twisting, and turning, wiggling, sitting and rising are examples of non-loco motor movement. This type of movement helps develop balance and coordination skills.
    - **Manipulative Movement:** Movement that involves controlled use of hands and feet is reflected in manipulative movement. Physical abilities such as opening and closing hands, waving, throwing and catching are examples of manipulative movement. This type of movement helps develop fine- motor skills and hand eye coordination.
- ❖ **Mental/intellectual/Cognitive Development:** By intellectual development we mean development of language interests, imagination, understanding reasoning, thinking, and concept perception. Some of the characteristics of intellectual development of this stage are.
  - ★ **Development of Language:** The child at birth can only cry as an expression of emotion—pleasure or pain. In the first year he may utter a few words like Aa, baa, Paa etc. In the 2nd year he learns to speak very short sentences then language development becomes rapid.
  - ★ **Curious Questions:** During infancy the power of reasoning and judgement are sharp. A child makes questions as what is it? Why is it so? Who has done it? He shows great curiosity in knowing more and more about his environment.
  - ★ **Quick learning:** During infancy the child learns most things quickly. Speed of learning is the fastest.
  - ★ **Span of attention:** Initially his span of attention is low. Gradually it increases. Development of the perception of size, colour and shape starts at this stage.
- ❖ **Social Development:** Infants depend on others for the satisfaction of his/ her needs. A child is not social at birth; he is self-centred. Social Development takes place at a slow pace. The child shows signs of selfishness.
  - ★ **Shyness:** a child does not want to mix with outsiders.
- ❖ **Emotional Development:** The emotions of the child are not specific at birth. They occur in diffused states. As the child grows and reaches the age of 2, **anger, joy, fear** develops.

- ❖ **Language Development:** Linguistic development begins long before humans are mentally developed enough to speak. Between birth and approximately 25 weeks, infants develop the basic skills for the production of speech, first making only basic biological noises such as crying, breathing, coughing and other similar noises. Coing and more advanced types of vocal play are engaged as the infant develops. At about 25-50 weeks, an infant can and does form a relatively complex phonetic construct in what is commonly known as “babbling”. At about one year, give or take a few months, the infant can produce, albeit to a limited extent, actual language. The process by which infants gain the use of language depends almost entirely upon interaction with parents and caregivers. Around the end of first year, children speak their first word, but the progress thereafter is not rapid, probably due to the toddler’s preoccupation with new found skills.
- ❖ **Emotional Development:** According to Jersild, emotion is a state of being moved, stirred up and aroused in some way. Between 7 and 9 months, infants are likely to exhibit anxiety when confronted by a stranger. Towards the end of first year, they are likely to manifest anxiety if they are separated from their mother. According to psychoanalysts, the sex life of an infant is quite rich. According to Freud, the early infancy is the stage of autoeroticism or self-love. It is the stage at which the child’s emotions begin to be organised in a sentiment around his own self. Narcissism is the name given to love of oneself. According to Erikson, two tendencies namely trust vs. mistrust and autonomy vs. shame or doubt develop during infancy.

## 12. Childhood (2-12 year)

- It is the 2nd stage of growth and development psychologists have divided this stage into 2 categories :
  - ❖ **Early Childhood (2-6):** It starts from 2-6 years of age and is called problem age and toy age by parents. The educationists and psychologists prefer to call this stage by several names like **Preschool age, Questioning age, Imitative age and Creative age.**
  - ❖ **Late Childhood (6-12):** It extends from 6-12 years it is called as elementary school age by educators and **gang age or play age** by psychologists. It begins when the child enters the school and during childhood many Physical, Mental, emotional and social changes take place. The Environment of the child widens during this period. During this time the growth rate is slow but not steady. It brings many changes in a child’s life. This is a critical time for a child to develop confidence in all areas of life, such as through friends, schoolwork and sports. In this stage, a child develops concrete thinking and can indulge in cooperative play. According to Jean Piaget’s cognitive development theory, a child who is in childhood can reason logically and do conservation tasks.

❖ Following are the development patterns of the childhood :

- ★ **Physical Growth and Development:** The physical growth of early childhood is very rapid but in late childhood the physical growth is slow, steady and uniform. There is marked increase in muscular coordination of the child. The child gains control over the body and is able to walk freely during this period. The child also learns speaking skills in his mother tongue. The milk teeth start falling and permanent teeth take the place of temporary teeth. Girls increase more in height and weight in this stage. There is change in the overall appearance of the child.
- ★ **Social Development:** Home is the primary social institution of the child. Child learns how to behave with his family members. He learns the way of conversation. Child develops friendly behaviour as he comes in contact with other children. Therefore a child’s cooperative behaviour develops as he participates in play and group activities. The child learns sympathy for fellow feelings. The child shows more loyalty to his gang. Children learn various forms of social behaviour. The child widens his social relations. The child becomes a member of a gang. The child prefers group games to individual games. He develops an extrovert outlook and begins to expand his social relations. Early childhood is often called the ‘**Toy age**’. This period is also known as ‘**Preschool**’ period. After this stage, children are ready to go to formal school.
- ★ **Cognitive/Intellectual development during childhood:** During this period new experiences are acquired and applied. Following are the characteristics of intellectual development. During childhood language development a child develops his speech. His vocabulary is enriched and language skills develop rapidly such as reporting, questioning, thinking etc. The curiosity of asking questions increases.
  - **Development of Concepts:** Child develops the concepts of time, length and distance fully.
  - **Development of Interest:** Interest of the child expands. He likes books, travel, fairy tales and mystery etc.
  - **Development of Power of thinking:** Power of observation, reasoning, remembering, recalling attention and thinking develops.
  - **Curious Questions:** The child tries to put curious questions to his elders and parents and tries to get answers from them. These questions are more definite than he used to ask during his infancy.
- ★ **Emotional Development:** In the beginning of this period, the child shows off his emotions. The child cries and throws himself on the ground if his wishes are not fulfilled. He also fights with children of his age. Fear

is also common at this stage. Bursts of aggressiveness, anger, jealousy and negativism are the characteristics of the childhood age. As the child grows he changes the manner of expression of emotions. The emotions get stabilised and the child learns to control his emotions. He develops the techniques of controlling and suppressing emotions. He gets angry but ages not hit out, he gets frightened but tries to look brave, he is still jealous but does not cry etc.

- \* **Development Tasks of Childhood:** Learning physical skills is necessary for ordinary games. Building a wholesome attitude towards oneself as a growing organism. Learning to get along with age mates. Development skills in regarding, writing and calculating.
- \* **Language Development in Early Childhood:** Early childhood stage is also called the “**Chatterbox age**”, because at this stage children talk a lot with ease and ask many questions to satisfy their curiosity. Children’s ability to process, to understand and to produce information language develops in an amazing way. Their pre-speech form of communication which they found useful during babyhood gets stronger during early childhood, young children experience a language explosion during this phase. By the **age of 6**, their vocabulary may expand dramatically to anywhere from **8000 to 14,000 words**. Their crying and babbling is greatly curtailed, they gain more confidence and use words to express feelings and cope. Children become increasingly skilled at remembering and practising the words used around them. They also use gestures and modify the use of words based on other people’s reactions. At this stage, listening skills and comprehension skills increased significantly which helps children to communicate with others. They can understand most of what is said and follow directions with at least two or three steps. They notice and respond to sounds in the environment such as someone calling them, car horn, dog barking, alarm clock etc. Along with listening skills, improvement in speaking skills also takes place in this particular stage. It is time when rapid developments are made in learning to speak and communicate. Children can speak simple to complex sentences of four or more words. They are more vulnerable to learn more words and their meanings. They can talk easily without repeating words, sing rhymes, and speak clearly enough that any strangers can understand.
- \* **Language Development in Late Childhood:** Children’s language skills improve adequately during late childhood. They continue to refine their language skills in several domains. Their understanding of word meaning or semantic development continues throughout this period. Children become considerably aware about their language as a tool for being accepted by

their peers. Therefore speech is consciously improved from immature unacceptable ways of communication to mature and acceptable ways of communication. Grammatical understanding and pronunciation expands, taking interest in telling jokes or narrating events or riddles. Children become better at maintaining and contributing to a conversation by asking questions and adding information to the sentence. Children develop social etiquette of language and parents and teachers are the main contributors of this speech improvement by encouraging and correlating them. Children become more effective communicators, use more complex grammatical constructions, and are more aware of their role as a communicator within variable contexts. Multimedia source (T.V. Internet) serve as models for speech. There is a remarkable improvement in vocabulary as names of colours, numbers, money concepts, time concepts, environmental concepts, are included. They also develop some secret codes used by their gang as a communication pattern.

- \* **Emotional Development:** A tremendous amount of emotional development takes place during early childhood. The emotions are very intense during this phase because it is a time of disequilibrium when children are not able to control and manage their emotions. They tend to have rapid mood swings and their feelings also tend to be quite short lived. They can recognize other people’s emotions through physical clues only, such as tears and sadness. Children show some common emotions in early childhood stages such as; Joy, anger, fear, affection, curiosity, jealous etc. Children express their anger through temper tantrums that are identified by creaming, stamping, crying, kicking, jumping up and down or striking. They are able to simply manage their emotions with the support of elders by choosing some other activity to avoid frustration and anger. **Emotion of fear** finds its expression in the **early childhood stage**. Children may be afraid of the things which they are not familiar with or which they do not know about. Children express emotion of jealousy when they feel their parents attention is shifting toward someone else in the family, especially a new sibling. They can freely express their jealousy by screaming or by reverting to infantile behaviour to seek attention of their family members. They become more curious about anything new that is related to their own bodies or the bodies of others and ask so many questions (Sometimes children become envious of something they don’t have, they express their envy in different ways). Children express joy and happiness in different situations like their favourite food, sudden or unexpected noise, playing pranks or getting other new toys, completing different tasks etc. They express their joy by smiling, laughing, clapping, dancing, jumping etc. Another pleasure giving emotions is also derived

in the early childhood stage that is affection. Children can express their love and affection towards the people whom they love. They want to live with such people or objects which give them pleasure. They express their love and affection by kissing, hugging and patting. They also express their sadness or grief by crying and by losing interest in their daily activities if they lose something that is close or important to them.

### 13. Adolescence (12-20 years)

- Adolescence is the most important period of human life. The term adolescence is derived from the Latin word “**adolescere**” which means **growing towards maturity between childhood and adulthood**. It emerges from childhood and merges into adulthood. This period starts at the age of **12 or 13 for girls and 13 or 14 for boys**. It continues up to **19**. So it is also called revolutionary change. During this period of development, great physical and mental changes occur.
- **The World Health Organization (WHO)**, defines adolescents as those people between 10 and 19 years of age.
- **According to Erikson**, adolescence is known as an Identity crisis, in this stage teenagers actively search for identity.
- According to Jean Piaget, adolescence is “the age of great ideas and the beginning of theories as well as the time of simple adaptation of life”.
- **According to Dorothy Rogers**, Adolescence is a “process, rather than a period, a process of achieving the attitudes and beliefs needed for effective participation in the society”.
- **According to Stanley Hall**, it is a period of great stress and strain, storm and strife. The changes during puberty are dramatic in adolescence. Within a few years, the school-going child is transformed into a full-grown adult.
  - ❖ These changes can be classified as :
    - ★ Hormonal changes
    - ★ Changes in body size and proportions
    - ★ Muscle fat makeup and other internal changes
    - ★ Sexual maturation
    - ★ These psychological changes appear in the areas of emotional, social, cognitive and moral development.
  - ❖ **Physical Development:** Adolescents’ height increases rapidly. Weight also increases due to an increase in bones and muscles. Generally, boys are heavier and taller than girls.
    - ★ **Change in Bodily Proportions:** Different parts of the body grow at different rates and reach their final size shoulders broaden late in adolescence.
    - ★ **Facial Features:** Also boys and girls develop the characteristic features of their respective sexes. Rapid development of bones and muscles, the muscles of girls remain softer while those of boys become hard and firm.
- ★ **Change in Voice:** There is a distinct change in voice among boys and girls. The voice of the boys deepens and becomes harsher. The girl’s voice acquires shrillness and becomes sweet.
- ★ **Digestive System:-** During adolescence organs of the digestive system undergo qualitative changes. As a result of this change adolescence has a desire to eat more.
- ★ **Increase in Pulse Rate:** Like other organs of the body, the heart increases in size and weight. The rate of growth is higher in boys than girls. The pulse rate increases on both sides.
- ❖ **Cognitive/Intellectual Development During the Adolescent Stage:**
  - ★ **Development of Intelligence:** Adolescence is the period of maximum growth and intellectual development. Intelligence reaches its climax during this period. Intellectual powers, life logical thinking, abstract reasoning and concentration are almost developed up to the end of this period.
  - ★ **Increase in Span of Attention:** During the adolescent period, the span of attention increases. The adolescent can attend one thing for a longer period. The power of concentration and memory is increased.
  - ★ **Development of Imagination:** Adolescents possess excessive imagination. Writers, artists, poets, philosophers, doctors and engineers were born in this period. He thinks in terms of his future. He builds castles in the air widening of interest. The interests of young adolescents are numerous and varied. The most important categories of their interest include recreational, social, personal interests, vocational interests and religious interests.
  - ★ **Hero Worship:** This is very prominent in this period an adolescent begins to worship his ideal man or woman and tries to model himself on him or her. Hero for an adolescent may be a film star, a political leader, a poet, a scientist, a writer or a teacher. Adolescents try to follow their hero.
- ❖ **Social Development During the Adolescent Stage :**
  - ★ **Social Consciousness:** It is developed in adolescents at a fast speed. They wanted to be praised by their parents, teachers and friends. They know their status in society. **They want social approval of various modes of behaviour.**
  - ★ **Group Loyalty:** Adolescent boys and girls in their groups discuss their problems freely. They become very loyal to their group. They learn the qualities of sympathy, obedience etc.
  - ★ **Social Service:** In the adolescent stage, ideals of social service and altruism are formal and cherished. Social Service in public gatherings, fairs and festivals become a passion for the adolescent. He doesn’t mind personal inconvenience in doing such a service.
- ❖ **Emotional Development During the Adolescent Stage:**
  - ★ It is a period of heightened emotion and is characterised

by a high degree of instability. His emotions are very intense. Sometimes adolescents are happy and sometimes sad. They may develop fear, an inferiority complex, shyness, depression etc.

- ★ Adolescents are too conscious about sex. He wants freedom of expression and self-determination due to bodily change.
- ★ The most important emotional patterns of an adolescent include **love, anger, jealousy, fear, worry** etc. Love is a prominent feeling in this period.
- ★ The emotions of adolescents are not under control. **Outbursts of temper are often noticed during this period.**
- ★ **Stanley Hall says it is a period of great stress and strain, storm and strife.** Adolescents remain tense during this stage. He doesn't tolerate the over-strictness of parents and teachers.

## 14. Stages of Adolescence

- In this way from the above-stated definition, it is clear that adolescence is the stage of strict changes, which is an intermediate stage between childhood and adulthood *i.e.* it starts from the last of the children and ends at the early stage of the young stage. Intellectual divide adolescence into two stages for the sequence-wise study, which are as follows:
  - ❖ Early Adolescence: **13 to 16** years of age
  - ❖ Post Adolescence: **17 to 21** years of age

### Adolescence: A period of change

- ❖ **Physical Changes in Adolescents:**
- ❖ **Boys Physical Changes in an Adolescent:** There are different changes in boys which are listed below:
  - ★ Growth spurt occurs
  - ★ Shoulders broaden
  - ★ Muscles develop
  - ★ Skin becomes oily
  - ★ Voice deepens
  - ★ Growth of moustaches and beard
  - ★ Growth of underarm, chest and genital hair
  - ★ Penis and testes enlarge
  - ★ Sperm production begins in the testes and ejaculation occurs
- ❖ **Physical Changes in Adolescent Girls:** There are different changes in girls which are listed below:
  - ★ Growth spurt occurs
  - ★ Breasts develop
  - ★ Skin becomes oily
  - ★ Hips widen
  - ★ Waistline narrows

- ★ Growth of underarm and genital hair
- ★ External genitals enlarge
- ★ The uterus and ovaries enlarge
- ★ Ovulation occurs and menstruation begins.

- **Sexual Changes in the Boys:**

- ❖ During adolescence, the adolescents become sexually active. So it is very important to know the sexual changes.

The sexual changes in boys are as follows:

- ★ Penis, testes and scrotum enlarge.
- ★ Pubic, axillary and bodily hair appears.
- ★ The voice of the young boy breaks and attains a deeper tone.
- ★ The body itself becomes more distinctly muscular.
- ★ Sexual urge begins.
- ★ Sperm production begins in the testes and ejaculation occurs.
- ❖ At about this time, the young man begins to experience a distinct sexual urge or drive.
- ❖ The sexual forces awakened in him make him suddenly conscious of the strong sensual pleasure that can be associated with his genitals.
- ❖ This may give rise to pleasure, confusion and guilt feelings.
- ❖ There is an increased sexual excitability, which leads to touching of the genitals and their stimulation (masturbation).
- ❖ This is particularly true of the male because his sexual urges and drives are more distinctly genital.
- ❖ He also becomes more conscious of and attracted to the other gender and may fantasise about them or imagine being in love with one of them.
- ❖ Nocturnal emissions or wet dreams may begin and become a source of anxiety.
- **Sexual Changes in the Girls:**
- ❖ The sexual changes in girls are as follows:
  - ★ **Menarche, the appearance of the first menstruation is a dramatic event in the life of a female. The menstrual cycle, initially, may be irregular but becomes regular over a period of time.**
  - ★ Budding of the breasts takes place, which becomes progressively bigger and fuller.
  - ★ Axillary and pubic hairs start appearing.
  - ★ The hips become wider and the body shape changes.
  - ★ Sexual urge begins.
- ❖ In the adolescent female, the sexual urges are more diffused and more associated with emotion and daydreams of romantic situations. They, initially, may be shy in seeking

friendship with the other gender but may soon look forward and want to be friends with boys rather than girls.

- ❖ Many young women also may have erotic dreams and may find pleasure in stimulating their own genitals.

- **Emotional and Social Changes During Adolescence:**

- ❖ These are the changes which are not observable as physical but definitely the behaviour of adolescents changes due to emotional and social changes happening in their bodies and mind. These changes are as follows:

- ★ Emotional instability
- ★ Preoccupied with body image
- ★ Frequent mood changes
- ★ Curiosity and experimentation
- ★ Self-exploration and evaluation
- ★ Concerns and worries about the body changes
- ★ Conflicts with family/elders over control
- ★ Development of abstract thinking but confusion at times
- ★ Attraction towards opposite sex
- ★ Daydreaming and fantasising
- ★ Relationships tend to be oriented from parents to peers.

- ❖ The changes in body, mind and relationships transform an adolescent mentally and emotionally.

- ❖ The shape of the body, especially that of the girls, changes.

- ❖ These newer events leave adolescents bewildered, confused, scared and sometimes guilty.

- ❖ They start experiencing romantic feelings, sexual arousal, anger or mood swings.

- ❖ They may feel attracted to the opposite sex, “**fall in love**”, hate someone intensely and want to talk to persons of the other gender.

**Characteristics of Adolescence :**

- Adolescence is a difficult journey of self-exploration and interaction with the world.

- It is characterised by contradictions, fantasies, surprises and uncertainties while posing immense possibilities and threats.

- The self-description given below by one of the adolescents will help us understand various characteristics of this beautiful period.

- Adolescence is an important stage of human life. As Staley Hall stated by making it clearer - “**Adolescence is a new birth for the higher and more completely human traits**”.

- **Growth spurt**

- ❖ Adolescents mature at **varying rates of speed and are highly disturbed** by body changes.

- ❖ They are physically vulnerable because of poor health habits or risky experimentation with drugs and sex.

- **Physical Appearance Decides Self-image :**

- ❖ The rapid physical growth leaves teenagers often feeling awkward, self-conscious, uncoordinated, embarrassed and even confused.

- ❖ They frequently attempt to hide or constantly complain about whatever part of their body makes them most uncomfortable.

- ❖ Teasing and bullying further make their life miserable.

- **Self-discovery :**

- ❖ The adolescent is in the process of discovering self and it fluctuates across situations and times.

- ❖ In the quoted description by the girl above she remarks she could not understand how she can switch so fast! I mean, how can I be cheerful one minute and anxious the next, and then be sarcastic? The multiple roles played by adolescents in different relationship contexts are contradictory.

- ❖ The adolescent finds herself moody and understanding, ugly and attractive, introverted and fun-loving.

- **The Desire for Independence and to Prove their Identity :**

- ❖ Adolescents have a great desire for independence and want to be treated like adults. Anxiously searching for identity, adolescents attach great importance to status symbols, as reflected by their possessions and clothing.

- ❖ Rebellion seems to be inevitable, so they can be different from their parents and defy them.

- **Egocentrism :**

- ❖ This is the heightened self-consciousness of adolescents, which is reflected in their belief that others are as interested in them as they are themselves.

- ❖ They have attention-seeking behaviour- the attempt to be noticed, visible and “**onstage**” and consider themselves unique.

- ❖ This, according to some writers, is responsible for drug use, suicides and failure to use contraceptives during sex.

- **Emotionally Unstable :**

- ❖ Their emotions outpace their rational thinking, they are so intertwined that adolescents have difficulty distinguishing between feeling and thinking.

- ❖ They experience mood swings often with peaks of intensity and unpredictability and are self-conscious.

- ❖ Hormones put them on a vulnerable emotional roller coaster ride overflowing with exaggerated and uncontrollable feelings.

- ❖ This causes conflicts and stress.

- **Curiosity and Experimentation :**

- ❖ Adolescents are curious, innovative, exploring and experimenting.

- ❖ Fascinated by “adult” behaviours; they are motivated to try out forbidden activities like rash driving, sex and experiments with drugs.

- **Peer Influence Outweighs Parental Affection :**
  - ❖ Adolescents need frequent validation by others and they desperately seek peer affiliation and acceptance.
  - ❖ They are fiercely loyal to peer group values and peers' opinions become most influential and guide the flow of their life.
- **Changing the Focus of Relationships :**
  - ❖ Parents no longer are the major focus of the teenagers' world.
  - ❖ Adolescents shift from same-sex best-friend relationships to having close interactions and increasing interest in both sexes.
  - ❖ They are often aggressive and argumentative.
- **Idealism and Confrontation with Religion, Traditions and Moral Value :**
  - ❖ Adolescents are **idealistic, and abstract** and have a strong sense of fairness.
  - ❖ They criticise, challenge and confront moral values and ask frequent, ambiguous questions about the meaning of life.
- **Absence of Long-term Thinking About Life and the World**
  - ❖ The absence of abstract thinking makes the present most precious and the self – the most important.
  - ❖ The future seems far away and immediate gratification becomes more important.
- **Desire to be Considered as an Asset Rather than a Problem :**
  - ❖ The moral and spiritual development leads the adolescent to find a bigger role for himself while questioning the behaviour of elders.

## 15. Challenges of Adolescence

The period of adolescence usually is an eventful one. However, it poses various challenges for adolescents and society.

- Let us understand these challenges.
- **Challenges Related to Physical Development :**
  - ❖ Physical changes are an essential part of adolescence. While these changes are part of a normal process of maturation, it is a challenging process for the individual especially when these changes are early or late compared to their peers. The process of physical maturation often creates problems for adolescents.
  - ❖ The changes in height, weight and development of secondary sexual characteristics happen at different ages and variable rates. These pose a dilemma of normality.
  - ❖ Bullying by peers and comparison with peers who are developing at a different rate makes them anxious about their appearance. The adolescent may be stressed and there may be a lowering of self-esteem.
  - ❖ Taking poor nutrition may cause poor growth in height and anaemia is a common problem in adolescents. This may have bad effects on health and even in future generations in the form of low birth weight babies.
  - ❖ The adolescents and their parents may not be aware of the variability in the developmental changes. The adolescents

may take harmful drugs like steroids for increasing their height and muscles and suffer from their bad effects.

- **Challenges Related to Cognitive Development :**
  - ❖ The adolescents develop a capacity for abstract thinking, discover how to think about relationship issues, discern new ways of processing information and learn to think creatively and critically.
  - ❖ The adolescents move from concrete thinking to dealing with ideas, concepts and abstract theories. They become passionately interested in abstract concepts and notions and are able to discern what is real from what is ideal. They understand information and act on that understanding to solve problems passing through phases of success and failure.
  - ❖ Egocentricity or self-interest is the hallmark of adolescents. They may have the idea that everyone is watching them as though they were on stage and tend to draw other's attention by their particular behaviour. They feel unique and think that no one is capable of understanding them and their feelings. This has important implications for counsellors.
  - ❖ The ability to think creatively on one hand helps adolescents to make innovations, getting away from difficult situations and, on the other hand invites troubles due to innovative and potentially risky experiments like rash driving, unsafe sex, taking alcohol and drugs etc.
- **Challenges Related to Psychosexual Development :**
  - ❖ The adolescent is no longer a child. He is a new person emerging into an adult. This process of understanding self and seeking meaning and direction leads to identity formation. The adolescent constructs concepts of self within the context of relations with others, yet he is also seeking to establish an independent entity. This journey of self-discovery is both stressful and anxiety-provoking for them.
  - ❖ The formation of personal identity and integration with society gives rise to conflicts. Emotional reactivity and instability makes it difficult for adolescents to control their behavioural responses, which at times may be inappropriately extreme viz., excitement, anger, sadness, depression and embarrassment. This often gives rise to feelings of ridicule, humiliation and embarrassment and adolescents feel disgusted and ashamed of themselves.
  - ❖ The adolescents who belong to underprivileged and minority groups have difficulty in establishing personal identity. The prejudice leads to emotions such as anger and outrage may be directed towards the majority of society.
  - ❖ Exploration of personal sexuality and sexual identity lead them into serious relationships, heart breaks and resulting stress.
  - ❖ Sexual hormones during puberty trigger an increase in sexual arousal, desire and urge in both males and females. These are managed through fantasy and masturbation but often lead to sexual experimentation with their friends.
  - ❖ Unsafe sex may lead to unwanted pregnancies, sexually transmitted diseases and HIV/AIDS.

- **Challenges Related to Social Development :**

- ❖ Adolescents need to find their place in society and gain a sense of fitting in it. This is a process of socialisation involving an adolescent's integration with society. This process of socialisation enhances the sense of personal identity, and the development of personal identity helps the adolescent to deal with society's expectations and standards and norms. This challenges the adolescent to make changes in social behaviour.
- ❖ Society's expectations pose a challenge for adolescents and are valuable in helping them to progress along the path to adulthood. The fulfilment of these expectations helps to develop a positive sense of self.
- ❖ Adolescents who are overwhelmed by society's expectations may revert to anti-social behaviour ranging from low-level delinquency to serious crimes.
- ❖ Parental expectations to perform and conform to their standards are abnormally high or unrealistic. They may generate negative feelings, communication gaps and anti-social behaviour.
- ❖ Adolescent expectations in relationships with peers, parents and society are often not fulfilled and cause conflicts.
- ❖ Moving away from dependence on parents and family and having close relationships with friends is a major social change. Parental control leads to conflicts and communication gaps. Peers determine the flow of an adolescent's life and develop their personality too. However, negative peer pressure leads to high-risk behaviours.

- **Moral and Spiritual Challenges :**

- ❖ The processes of social development and the formation of a personal identity go hand in hand with moral and spiritual development. The adolescent finds it difficult to choose between self-sacrifice and social conformity. The process of identity formation, peer pressure, desire to form relationships and exploration of their sexuality pose difficult challenges.
- ❖ The motives for doing well or avoiding wrong depend on the approval of elders and society in general. The lack of clear direction confuses adolescents.
- ❖ Decision-making is difficult based on moral teaching and therefore adolescents often come into confrontation with law and order.
- ❖ Formation of personal identity goes hand in hand in adolescents with finding meaning in their lives. They look within themselves to examine thoughts and feelings and to reason about them. This leads them to seek answers to questions of a spiritual nature. Those adolescents who are struggling with identity formation and are striving to find their place in society, may come into conflicts with the social norms and need direction, understanding and empathy.

- Thus, adolescence by its nature of change, poses innumerable challenges both for adolescents as well as society.

- Awareness generation, and providing correct and scientific information may help to face these challenges up to a great extent.
- An understanding of the world of adolescents will help the adolescents to pass through this turbulent phase of life and will also help them to make a positive and constructive contribution to make a healthy and harmonious social environment.

## 16. Adulthood (20-65+ years)

- For better understanding, adulthood can be divided into three stages. These are:
  - ❖ **Young adulthood (20-50 years)**
  - ❖ **Mature adulthood or the Middle years (50-65 years)**
  - ❖ **Ageing adulthood (65+ years)**
- Strength and energy characterise this time of life from the middle twenties when most bodily functions are fully developed, until about the age of 50. Thereafter there is a gradual decline in energy level.

## 17. Factors Affecting Growth and Development

The factors affecting growth and development are as follows:

- **Heredity**

- ❖ Heredity or genetics is found to influence the development of a child's intellectual potential, height, weight and general physical appearance.
- ❖ The genetic makeup inherited from parents seems to be tied to the maturation of the body and the brain which influences growth and developmental milestones.
- ❖ To an extent, susceptibility to certain diseases (such as colour blindness, Down's Syndrome, asthma, and diabetes) also depends on heredity.
- ❖ In addition to that, certain personality characteristics such as temperament may also be affected by genetic factors.

- **Environmental Factors**

- ❖ **Nutrition, Health and Hygiene Needs of a Child and the Mother :** The foundations for growth and healthy development are laid from the mother's womb. A foetus gets nourishment from the mother's diet. It is very important that during pregnancy, the mother takes a balanced diet which is rich in all necessary nutrients. Moreover, antibodies produced by the mother to combat infectious diseases are transmitted to the foetus, usually producing immunity at birth and for some months thereafter.
- ❖ **Age of the Mother:** Reproductive organs of mothers who are less than seventeen years of age are not fully mature and the hormones required for reproduction are not at the optimum level. Among young teenagers, pregnancy tends to inhibit the mother's as well as the child's growth. Young mothers are at high risk of complications during pregnancy. Likewise, after the age of 35, hormonal activity gradually

decreases and may lead to complications. Women over the age of 40 runs a risk of having children with chromosomal abnormality.

- ❖ **Exposure to X-rays:** Repeated exposures to radiation may have harmful effects on the physical and mental development of the child.
- ❖ **Drugs:** Many drugs are suspected including some antibiotics, hormones and steroids.
- ❖ **Drinking and Smoking:** The symptoms of this condition include retarded prenatal and postnatal growth, premature birth, mental retardation, physical malformations, sleep disturbances and congenital heart disease. Lowers the resistance to illness and retardation of growth.
- ❖ **Environmental Pollution:** The high levels of lead exposure are consistently linked to slightly poor mental development during the first two years. It may also lead to a variety of physical defects.

- **Endocrine Glands**

- ❖ Endocrine glands are ductless glands that secrete hormones which are carried to particular organs or tissues through the bloodstream. These glands control growth, development and reproduction.
- ❖ **Endocrine glands** secrete hormones in **response to external and internal stimuli**.
- ❖ The **Pituitary gland** also known as the **master gland** is located at the base of the brain and controls the functioning of all endocrine glands and regulates growth.
- ❖ The **Thyroid gland** located in the neck controls the **rate of metabolism**.
- ❖ The **Parathyroid gland** regulates **calcium balance** in the body.
- ❖ The **Adrenal gland** is responsible for the **action of the body in an emergency**.
- ❖ The **Pancreas** are a digestive system gland that maintains the sugar levels in the blood. The pancreas is an abdominal organ possessing both endocrine and exocrine functions. It produces a variety of hormones that mostly pertain to regulating blood sugar levels. As an exocrine gland, it secretes pancreatic fluid that contains bicarbonate and digestive enzymes.
- ❖ **Testes and ovaries** are responsible for the growth and development of reproductive cells in males and females respectively.

- **Exocrine Glands**

- ❖ The glands that secrete their product into a duct. For example:- **salivary glands** secrete the **saliva** into the **salivary duct**.
- ❖ **Salivary glands** produce **saliva (spit)** and empty it into your mouth through ducts, or small openings. They lubricate your mouth and throat, aid in swallowing and

digestion, and help shield your teeth from cavity-causing bacteria.

- ❖ **Sweat glands** and **sebaceous glands** produce **sweat and sebum**, respectively. Each of these fluids has a role to play in maintaining homeostasis. Sweat cools the body surface when it gets overheated and helps excrete small amounts of metabolic waste.
- ❖ The **lacrimal gland** is located within the orbit above the lateral end of the eye. It continually releases fluid which cleanses and protects the eye's surface as it lubricates and moistens it. These lacrimal secretions are commonly known as tears.
- ❖ The **mammary gland** is a highly evolved and specialized organ present in pairs, one on each side of the anterior chest wall. The organ's primary function is to secrete milk. Though it is present in both sexes, it is well-developed in females and rudimentary in males.
- ❖ **Digestive glands** secrete **digestive juices**, which contain **enzymes for the digestion of food**. The digestive system also contains associated glands such as the pancreas, liver etc., which release their secretions in the alimentary canal to facilitate digestion.

- **Other Contextual Factors**

- ❖ **Socio-economic Background:** Lack of opportunities and exposure, especially in, lead to a lag in certain aspects of development.
- ❖ **Living Conditions, Illness and Accidents:** If living conditions are poor, children may suffer from a variety of diseases leaving them with stunted growth and development. like water-borne diseases like diarrhoea, typhoid and many other ailments of the stomach. Respiratory and gastrointestinal diseases.
- ❖ **Family Structure :** Shrinking family size clubbed with the busy schedules of the parents due to their work commitments often leave the children being socialized by different forms of media and technology. Children's engagement with modern-day gadgets such as phones, laptops, tablets and televisions may impact their overall growth and development.
- ❖ **Enabling and Stimulating Environment:** The development of children will be positive in a home where they are encouraged to play and interact freely with parents and caregivers. Parents should avoid comparing the siblings, as this can create resentment and jealousy.
- ❖ **Peer Group:** The peer group helps children to learn and behave in a socially acceptable manner.
- ❖ **Gender and Culture:** Differences in behaviour shown by boys and girls emerge because of parental and societal expectations. Often, it is seen that boys are encouraged to fight back and not to cry "**like a girl**" while crying is accepted in girls when they are attacked. This is harmful as it creates gender stereotypes, and parents and teachers should ensure that no such behaviour is encouraged through action and words.

❖ **School:** It is the place where a child learns things that are essential for a social life. It is an **environmental factor** which impacts **learning**. The ego-centric culture of “I” is gradually transformed into the collective noun “we”.

Hence, school is said to be an important socialising medium. School rules make the child understand the limitations of freedom, actions and speech or usage of words (Language Development).

## Important Questions

1. Childhood is :  
 (A) a social construct.  
 (B) a physio-logical construct.  
 (C) a stage characterizing the period from birth till the child begins going to school.  
 (D) a period of development in which only quantitative changes takes place.
2. Which of the following is a sensitive period for acquiring language ?  
 (A) Pre-natal  
 (B) Early childhood  
 (C) Adolescence  
 (D) Adulthood
3. Development of children proceeds from ..... to .....  
 (A) abstract: concrete.  
 (B) general; specific.  
 (C) toe; head  
 (D) extremities; centre.
4. The period from 2 years to 6 years is referred to as :  
 (A) Infancy  
 (B) Early childhood  
 (C) Middle childhood  
 (D) Adolescence
5. Which of the following is an environmental factor which impact learning ?  
 (A) Attitude  
 (B) Motivation  
 (C) Personality traits  
 (D) School
6. Choose the correct statement about development:  
 (A) Development is unidirectional and unidimensional.  
 (B) Development is modifiable.  
 (C) Development is totally genetically programmed.  
 (D) Individuals achieve developmental milestones at the same age and pace.
7. Development of children is a result of :  
 (A) only heredity.  
 (B) only environment.  
 (C) schooling and education.  
 (D) interaction between heredity and environment.
8. Development is :  
 (A) unidimensional.  
 (B) uni-directional.  
 (C) modifiable.  
 (D) totally genetically pre-programmed.
9. Which of the following statement is correct ?  
 (A) Development is not sequential.  
 (B) Development is disorderly.  
 (C) Development is a continuous process.  
 (D) Development milestones are not influenced by the cultural context.
10. Which of the following is an example of use of fine motor skills ?  
 (A) Running      (B) Walking  
 (C) Scribbling    (D) Jumping
11. Contemporary perspectives in child development view:  
 (A) Child as a biological category.  
 (B) Child as a physiological entity.  
 (C) Childhood as dividant into eight distinct stages.  
 (D) Childhood as culture-specific and socially constructed.
12. Thought becomes abstract and idealistic during the period of :  
 (A) Infancy  
 (B) Early childhood  
 (C) Middle childhood  
 (D) Adolescence
13. Which period of development comprises each of the following characteristics: establishment of independence, development of identity abstract thinking ?  
 (A) Middle childhood  
 (B) Late childhood  
 (C) Adolescence  
 (D) Early adulthood
14. During the period of childhood, development :  
 (A) consists only of quantitative changes  
 (B) is disorderly and disjointed  
 (C) is slow and cannot be measured  
 (D) is multi-layered and complex
15. Development starts from :  
 (A) post-childhood stage  
 (B) pre-natal stage  
 (C) the stage of infancy  
 (D) pre-childhood stage

## Answer Key

1. (A)    3. (B)    4. (B)    5. (B)    6. (D)  
 7. (B)    8. (D)    9. (C)    10. (C)    11. (C)  
 12. (D)    13. (C)    14. (D)    15. (B)



# अध्याय 1

## अपठित गद्यांश

### महत्वपूर्ण अभ्यास प्रश्न

#### निर्देश (प्रश्न संख्या 1 से 9 तक)

निम्नलिखित गद्यांश को पढ़कर पूछे गए प्रश्नों के सबसे उपयुक्त उत्तर वाले विकल्प चुनिए—

भौगोलिक दृष्टि से भारत विविधताओं का देश है, तथा सांस्कृतिक रूप से एक इकाई के रूप में इसका अस्तित्व प्राचीनकाल से बना हुआ है। इस विशाल देश में उत्तर का पर्वतीय भू-भाग है, जिसकी सीमा पूर्व में ब्रह्मपुत्र और पश्चिम में सिन्धु नदियों तक विस्तृत है। इसके साथ ही गंगा, यमुना, सतलुज की उपजाऊ कृषिभूमि, विंध्य और दक्षिण के वनों से आच्छादित पठारी भू-भाग, पश्चिम में थार का रेगिस्तान, दक्षिण का तटीय प्रदेश तथा पूर्व में असम और मेघालय का अतिवृष्टि का सुरम्य क्षेत्र सम्मिलित है। इस भौगोलिक विभिन्नता के अतिरिक्त इस देश में आर्थिक और सामाजिक भिन्नता भी पर्याप्त रूप से विद्यमान है। वस्तुतः इन भिन्नताओं के कारण भारत में अनेक सांस्कृतिक उपधाराएँ विकसित होकर पल्लवित और पुष्पित हुई हैं। संस्कृति की सकारात्मकता देश के लोगों की निपुणता, नेतृत्व, संयम उत्कंठा पर निर्भर करती है। जिस जनसमुदाय में अपने देश की समस्याओं को सुलझाने की प्रबल इच्छा हो, उस देश की संस्कृति सृजनात्मक अवश्य होगी।

- गद्यांश के अनुसार संस्कृति की सकारात्मकता देशवासियों के किन गुणों पर निर्भर करती है?  
(A) आज्ञाकारिता (B) निपुणता  
(C) सौजन्यता (D) सदृश्यता
- भारत के पश्चिम का भू-भाग कैसा है ?  
(A) तटीय (B) उपजाऊ  
(C) रेतीला (D) अतिवृष्टि वाला
- 'भौगोलिक दृष्टि से भारत विविधताओं का देश है।' भौगोलिक विविधता से तात्पर्य है—  
(A) परिधान की विविधता  
(B) धर्म की विविधता  
(C) भाषा की विविधता  
(D) जलवायु की विविधता
- उत्तर दिशा के पर्वतीय भू-भाग की सीमा कहाँ से कहाँ तक विस्तृत है ?  
(A) पूर्व में ब्रह्मपुत्र और पश्चिम में सिन्धु नदी तक  
(B) मेघालय के अतिवृष्टि वाले क्षेत्र तक  
(C) सतलुज की उपजाऊ भूमि तक  
(D) थार के रेतीले और पठारी भू-भाग तक
- गद्यांश में किस प्रकार की विभिन्नता की बात नहीं की गयी है?

- (A) आर्थिक (B) सामाजिक  
(C) बौद्धिक (D) भौगोलिक

- भारत में अनेक सांस्कृतिक उपधाराएँ विकसित होने का क्या कारण है?  
(A) इसके भू-भाग की विशालता।  
(B) इसमें पाई जाने वाली विविधता  
(C) देशवासियों की निपुणता।  
(D) जनसमुदाय की सृजनात्मकता
- 'मेघालय' शब्द का संधि विच्छेद है—  
(A) मेघा + आलय (B) मेघाल + य  
(C) मेघ + आलय (D) मेघ + अलय
- 'पल्लवित और पुष्पित हुई हैं,' रेखांकित से तात्पर्य है—  
(A) समृद्ध (B) बलिष्ठ  
(D) विकृत (C) पैदा
- 'सांस्कृतिक' शब्द में प्रत्यय है—  
(A) इक (B) क  
(C) तिक (D) का

#### निर्देश (प्रश्न संख्या 10 से 18 तक)

निम्नलिखित गद्यांश को पढ़कर पूछे गये प्रश्नों के सबसे उपयुक्त उत्तर वाले विकल्प को चुनिए।

धूल के कारण प्रदूषण, प्रदूषण का एक अप्रत्याशित कारण भी है। आज के वर्तमान समय में मनुष्य के द्वारा प्रकृति के कार्यों में हस्तक्षेप किया जा रहा है। जिसके कारण वातावरण में आँधी के द्वारा फेंकी जाने वाली धूल बढ़ती जा रही है। खनन, सड़क निर्माण, भवन-निर्माण जैसे कार्य भी इसके लिए उत्तरदायी हैं। हम भारत में थार मरुस्थल में उठने वाले धूल के तूफानों से परिचित हैं जो कि दिल्ली तक के दूरस्थ क्षेत्रों को प्रभावित करते हैं। यह विश्वास किया जाता है कि यह भूमि के प्राकृतिक रूप में मनुष्य द्वारा किये जा रहे परिवर्तन जैसे कि चारागाहों को ज्यादा से ज्यादा मवेशियों के द्वारा चराकर नष्ट करने से हो रहा है।

वातावरण में धूल इकट्टी करने में गंधक, सल्फर डाइ-आक्साइड और हाइड्रोजन सल्फाइड जैसी गैसों भी सहायक होती हैं जो कि कारखानों की चिमनियों से लगातार निकल रही हैं। ये गैसों वनस्पतियों और अन्य जैविक तत्वों के सड़ने से भी पैदा होती हैं। भले ही ये गैसों कुछ ही घंटों में बिखर जाती हैं, लेकिन उतने ही समय में अमोनिया क्रिया करके सल्फर डाइ-आक्साइड गैस अमोनियम सल्फाइड के सूक्ष्म कण पैदा करने में

समर्थ हो जाती है। ये कण वातावरण में काफी लंबे समय तक तैरते रहते हैं। इस प्रकार हम देखते हैं कि मनुष्य प्रकृति के मामले में हस्तक्षेप करके एक धूसरित भविष्य के निर्माण में सहायक हो रहा है।

- 'अप्रत्याशित' का संधि विच्छेद होगा—  
(A) अप्रत्यय + आशित (C) अप्रति + आशित  
(B) अ + प्रत्याशित (D) अप्रत्या + आशित
- 'खनन' का तात्पर्य है—  
(A) खान (B) खोदना  
(C) खाना (D) खिलाना
- धूल बढ़ने के अप्रत्याशित कारणों में शामिल नहीं है—  
(A) आँधी और तूफान  
(B) खुदाई और निर्माण कार्य  
(C) मरुस्थलों से गुजरने वाले तूफान  
(D) चारागाहों की संख्या में वृद्धि
- गंधक और सल्फर डाइ आक्साइड की क्या भूमिका बताई गई है?  
(A) कारखानों में प्रदूषण  
(B) धूल नष्ट करना  
(C) धूल एकत्रित करना  
(D) ऑक्सीजन से प्रतिक्रिया करना
- 'जैविक' शब्द में मूल शब्द और प्रत्यय क्या है?  
(A) जैव + इक (B) जै + विक  
(C) जीव + क (D) जीव + इक
- 'धूल के कण वातावरण में लंबे समय तक तैरते हैं।' उपर्युक्त वाक्य का प्रकार है—  
(A) सरल (B) संयुक्त  
(C) मिश्र (D) जटिल
- 'तैरते रहते हैं'—पद क्रिया के किस भेद के अंतर्गत आएगा?  
(A) अकर्मक (B) सकर्मक  
(C) द्विकर्मक (D) प्रेरणार्थक
- गद्यांश से उद्धृत निम्नलिखित वाक्य को चार भागों में बाँटा गया है। इनमें से एक भाग में अशुद्धि है। उसे पहचानिए।  
(A) आज के वर्तमान समय में  
(B) मनुष्य के द्वारा  
(C) प्रकृति के कार्यों में  
(D) हस्तक्षेप किया जा रहा है।

18. किसके कण वातावरण में काफी समय तक तैरते रहे हैं?

- (A) अमोनिया  
(B) अमोनिया सल्फाइड  
(C) सल्फाइड  
(D) सल्फर डाइ-आक्साइड

**निर्देश (प्रश्न संख्या 19 से 27 तक)**

निम्नलिखित गद्यांश को पढ़कर पूछे गए प्रश्नों के सबसे उपयुक्त उत्तर वाले विकल्प चुनिए।

मातृभाषा का विद्यालयी पाठ्यचर्या में महत्वपूर्ण स्थान है। यह विद्यालय में पढ़ाया जाने वाला एक विषय मात्र नहीं, अन्य विषयों को सीखने का माध्यम भी है। भाषा के माध्यम से जो मूलभूत कौशल अर्जित किए जाते हैं, वे अन्य विषय क्षेत्रों की संकल्पनाओं को समझने सीखने में भी सहायता करते हैं। अक्सर देखा गया है कि जिस बालक में मातृभाषा की पकड़ जितनी अधिक होती है, वह उतनी सरलता और शीघ्रता से अन्य विषयों का ज्ञानार्जन कर लेता है। इस दृष्टि से यह उपयुक्त है कि जिस भाषा में बालक बोलता, सोचता और कल्पना करता है वही भाषा उसकी शिक्षा का माध्यम भी हो ताकि अध्ययन किए जाने वाले विषयों को सही ढंग से समझने, उन पर स्वतंत्र रूप से चिंतन करने तथा उन्हें स्पष्ट और प्रभावी रूप से अभिव्यक्त करने में आसानी हो। इसी कारण सभी शिक्षाविदों ने इस बात पर बल दिया है कि शिक्षा का माध्यम मातृभाषा ही होना चाहिए। परन्तु अक्सर देखने में आता है कि विद्यालयों में मातृभाषा के अध्ययन-अध्यापन पर अपेक्षित बल नहीं दिया जाता। अध्यापकों की सारी शक्ति विज्ञान, गणित, सामाजिक विज्ञान आदि विषयों के शिक्षण पर केन्द्रित रहती है। भाषा पर पूर्ण अधिकार न होने के कारण बालकों में इन विषयों की सूझ-बूझ भी अधूरी ही रह जाती है। इसके लिए आवश्यक है कि मातृभाषा के अध्ययन-अध्यापन को शिक्षा का केन्द्र बिन्दु मानकर चला जाए ताकि बालकों में भाषा कौशलों का विकास हो सके तथा उनकी अभिव्यक्ति में स्पष्टता, ज्ञान में गंभीरता, कल्पना-शक्ति में मौलिकता और अंतःवृत्तियों में सजगता आए।

19. विद्यालयी पाठ्यचर्या में मातृभाषा का विशेष महत्व माना गया है, क्योंकि वह—

- (A) बच्चों को सर्वाधिक प्रिय होती है  
(B) एक विषय की तरह पढ़ाई जाती है  
(C) मातृभूमि से प्रेम करना सिखाती है  
(D) अन्य विषयों को सीखने का माध्यम होती है

20. अन्य विषयों की संकल्पनाओं को समझने के कौशल अर्जित किए जा सकते हैं—

- (A) किसी भाषा के माध्यम से  
(B) मातृभाषा में कुशल होने से  
(C) प्रशिक्षण प्राप्त करने से  
(D) वैज्ञानिक दृष्टि अपनाने से

21. 'सूझ-बूझ' शब्द है—

- (A) समास रहित शब्द  
(B) पूरक शब्द  
(C) समानार्थी शब्द  
(D) युग्म शब्द

22. मातृभाषा के स्थान पर विज्ञान, गणित आदि के शिक्षण पर अधिक बल देने के परिणामस्वरूप—

- (A) बालकों की सूझ-बूझ अधूरी रह जाती है  
(B) परीक्षा परिणामों में सुधार दिखाई पड़ता है  
(C) बच्चों के ज्ञान में वृद्धि होती है  
(D) बच्चे जागरूक नागरिक बनते हैं

23. मातृभाषा को शिक्षा का केंद्र बिंदु मानकर चलने के लाभों के बारे में निम्नलिखित abc कथनों पर विचार कीजिए और सही विकल्प चुनिए—

- (a) अभिव्यक्ति में स्पष्टता और ज्ञान में गंभीरता आती है  
(b) कल्पनाशक्ति में सजगता और अंतःवृत्तियों में मौलिकता दिखाई देती है  
(c) भाषा कौशलों का विकास होता है।  
(A) केवल a (B) a तथा b  
(C) b तथा c (D) a तथा c

24. अनुच्छेद में सर्वाधिक बल किस बात पर दिया गया है?

- (A) शिक्षण में पाठ्यचर्या के महत्व पर  
(B) मातृभाषा को शिक्षा का माध्यम बनाने पर  
(C) विज्ञान-गणित आदि के महत्व पर  
(D) कल्पनाशक्ति और सजगता पर

25. अनुच्छेद के अनुसार 'ज्ञानार्जन' शब्द का विग्रह होगा—

- (A) ज्ञान से अर्जन  
(B) ज्ञान का अर्जन  
(C) ज्ञान में अर्जन  
(D) ज्ञान के लिए अर्जन

26. 'गंभीरता' शब्द के पद-परिचय में कौन-सा कथन अनुपयुक्त है?

- (A) भाववाचक संज्ञा (B) स्त्रीलिंग  
(C) गुणवाचक (D) एकवचन

27. 'मातृभाषा विद्यालय में पढ़ाया जाने वाला एक विषय मात्र ही नहीं है।'

उपर्युक्त वाक्य का अर्थ के अनुसार भेद होगा—

- (A) विधानार्थक वाक्य  
(B) सरलार्थक वाक्य  
(C) निषेधार्थक वाक्य  
(D) आज्ञार्थक वाक्य

**निर्देश (प्रश्न संख्या 28 से 34 तक)**

निम्नलिखित गद्यांश को ध्यानपूर्वक पढ़िए तथा पूछे गए प्रश्नों का उत्तर दीजिए।

जनता के पास लोकतंत्र में चुनाव ही वह अस्त्र हुआ करता है जिसके द्वारा वह शासक दल और विरोधी-दल

दोनों पर अंकुश और नियंत्रण लगाए रख सकती है, पर अपने इस अचूक अस्त्र के प्रयोग के लिए लोकतंत्रीय व्यवस्था वाले देशों में जनता का सभी प्रकार से जागरूक तथा सावधान होना बहुत आवश्यक हुआ करता है। सामाजिक, राजनैतिक आदि सभी पहलुओं से जागरूक जनता ही चुनाव के माध्यम से देश या प्रांतों के प्रशासन में ऐसे व्यक्तियों को भेज सकती है जो वास्तव में निहित स्वार्थों से ऊपर उठकर जनसेवा के कार्यों में रुचि रखने वाले हों, त्याग और बलिदान की भावना से भरकर जनता और राष्ट्रहित को ही सर्वोच्च मानने वाले हों और उनमें ऐसा सब कर सकने की शक्ति और क्षमता भी पूर्ण रूप से विद्यमान हो। इस जागरूकता और सावधानी के अभाव में चुनावों का नाटक और लोकतंत्र खिलवाड़ बनकर रह जाया करते हैं।

28. जनप्रतिनिधि को क्या नहीं होना चाहिए—

- (A) जनसेवक  
(B) राष्ट्रहित को सर्वोच्च मानने वाला  
(C) स्वार्थी  
(D) निःस्वार्थी

29. चुनाव का अचूक प्रयोग कौन कर सकता है?

- (A) अंधभक्त जनता (B) जागरूक जनता  
(C) सोयी हुई जनता (D) परेशान जनता

30. किसके माध्यम से शासक दल और विरोधी दल पर नियंत्रण लगाया जा सकता है?

- (A) चुनाव (B) बहिष्कार  
(C) समर्थन (D) प्रोत्साहन

31. चुनाव नाटक कब बन जाते हैं?

- (A) जब जनता व्यक्ति के कार्य व क्षमता से प्रभावित होकर अपना वोट दे  
(B) जब जनता जागरूक तथा सावधान हो  
(C) जब जनता जागरूक तथा सावधान न हो  
(D) जब जनता अपने वोट का सही प्रयोग करे

32. 'अंकुश' शब्द का विलोम है—

- (A) निरंकुश (B) लवकुश  
(C) नियंत्रण (D) रोकथाम

33. जनप्रतिनिधियों में कौन-सा भाव नहीं होना चाहिए?

- (A) जनसेवा का भाव  
(B) त्याग का भाव  
(C) बलिदान का भाव  
(D) स्वार्थ का भाव

34. सामाजिक शब्द में कौन-सा प्रत्यय है?

- (A) इत (B) इक  
(C) ईक (D) जिक

**निर्देश (प्रश्न संख्या 35 से 43 तक)**

नीचे दिए गए गद्यांश को पढ़कर सबसे उचित विकल्प का चयन कीजिए।

समाज में पाठशालाओं, स्कूलों अथवा शिक्षा की दूसरी दुकानों की कोई कमी नहीं है। छोटे-से-छोटे बच्चे को माँ-बाप स्कूल भेजने की जल्दी करते हैं। दो-ढाई साल के बच्चे को भी स्कूल में बिठाकर आ-जाने का आग्रह भी हर घर में बना हुआ है।

इसके विपरीत हर घर की दूसरी सच्चाई यह भी है कि कोई भी माँ-बाप बालकों के बारे में, बालकों की सही शिक्षा के बारे में और साथ ही सच्चा एवं अच्छा माता-पिता अथवा अभिभावक होने का शिक्षण कहीं से भी प्राप्त नहीं करता। माता-पिता बनने से पहले किसी भी नौजवान जोड़े को यह नहीं सिखाया जाता है कि माँ-बाप बनने का अर्थ क्या है? इससे पहले किसी भी जोड़े को यह भी नहीं सिखाया जाता कि अच्छे और सच्चे दाम्पत्य की शुरुआत कैसे की जानी चाहिए? पति-पत्नी होने का अर्थ क्या है? यह भी कोई नहीं बताता। परिणाम साफ है कि जीवन शुरू होने से पहले ही घर टूटने-बिखरने लगते हैं। घर बसाने की शाला न आज तक कहीं खुली है और न खुलती दिखती है। समाज और सत्ता दोनों या तो इस संकट के प्रति सजग नहीं हैं या फिर इसे अनदेखा कर रहे हैं।

35. 'भी' शब्द है—

- (A) क्रिया  
(B) क्रियाविशेषण  
(C) संबंधवाचक  
(D) निपात

36. 'इसके विपरीत हर घर की दूसरी सच्चाई यह भी है कि ..... वाक्य के रेखांकित अंश का समानार्थी शब्द है।

- (A) सूचित (B) वास्तविक  
(C) वास्तविकता (D) सद्बचन

37. घर के टूटने-बिखरने का मुख्य कारण क्या है?

- (A) बच्चों के बारे में न जानना  
(B) माता-पिता बनने का अर्थ न जानना  
(C) दाम्पत्य का अर्थ न जानना  
(D) घर बसाने की जल्दी करना

38. हर घर में किस चीज़ का आग्रह बना हुआ है?

- (A) बच्चों को स्कूल न भेजने का  
(B) बहुत छोटे बच्चे को स्कूल में पढ़ाने का  
(C) बहुत छोटे बच्चे को दुकान भेजने का  
(D) बहुत छोटे बच्चे को स्कूल में बिठाकर आने का

39. लेखक के लिए किसका शिक्षण प्राप्त करना जरूरी है?

- (A) पति-पत्नी बनने का  
(B) बच्चों को किसी भी प्रकार की शिक्षा देने का  
(C) अच्छे माता-पिता बनने का  
(D) छोटे-छोटे बच्चों को उच्च विद्यालयों में प्रवेश दिलाने का

40. माता-पिता को बच्चों की सही शिक्षा के बारे में जानना क्यों जरूरी है?

- (A) बच्चों को ज्ञानवान् बनाया जा सके  
(B) ताकि बच्चों को उच्च डिग्रियाँ प्राप्त करवाई जा सकें  
(C) ताकि बच्चे स्वयं प्रवेश लेने योग्य बन सकें  
(D) जिससे बेहतर समाज का निर्माण किया जा सके

41. समाज और सत्ता किसके प्रति सजग नहीं है?

- (A) अभिभावकों के द्वारा शिक्षा प्राप्त न करने के प्रति  
(B) ज्ञानवान समाज न बन पाने के घोर संकट के प्रति  
(C) घर बसाने की शिक्षा देने वाली शाला खोलने के प्रति  
(D) माता-पिता द्वारा बच्चों को पालन-पोषण न करने के प्रति

42. लेखक के अनुसार सबसे पहले क्या जानना जरूरी है?

- (A) दाम्पत्य की शुरुआत कैसे की जानी चाहिए  
(B) बच्चों के बारे में  
(C) बच्चों की शिक्षा के बारे में  
(D) माता-पिता के शिक्षा-स्तर को

43. 'माता-पिता' शब्द-युग्म है।

- (A) सार्थक-निरर्थक शब्द-युग्म  
(B) सार्थक शब्द-युग्म  
(C) निरर्थक शब्द-युग्म  
(D) पुनरुक्त शब्द-युग्म

निर्देश (प्रश्न संख्या 44 से 50 तक)

नीचे दिए गए गद्यांश को पढ़कर सबसे उचित विकल्प का चयन कीजिए।

शिक्षा केवल तभी बच्चों के आत्मिक जीवन का एक अंश बनती है, जबकि ज्ञान सक्रिय कार्यों के साथ अभिन्न रूप से जुड़ा हो। बच्चों से यह आशा नहीं की जा सकती कि पहाड़े या समकोण चतुर्भुज का क्षेत्रफल निकालने के नियम आप से आप उन्हें आकर्षित करेंगे। जब बच्चा यह देखता है कि ज्ञान सृजन के या श्रम के लक्ष्यों की प्राप्ति का साधन है, तभी वह ज्ञान पाने की इच्छा उनके मन में जागती है। मैं यह चेष्टा करता था कि छोटी उम्र में ही शारीरिक श्रम में बच्चों को अपनी होशियारी और कुशाग्र बुद्धि का परिचय देने का अवसर मिले। स्कूल का एक सर्वाधिक महत्वपूर्ण कार्यभार है—बच्चों को ज्ञान का प्रयोग करना सिखाना। छोटी कक्षाओं में यह खतरा सबसे ज्यादा होता है कि ज्ञान निरर्थक बोझ बनकर रह जाएगा, क्योंकि इस उम्र में बौद्धिक श्रम नई-नई बातें सीखने से ही संबंधित होता है।

44. लेखक के अनुसार शिक्षा का अर्थ है

- (A) ज्ञान का प्रयोग करना  
(B) श्रम करना  
(C) विषय पर अधिकार प्राप्त करना  
(D) ज्ञान प्राप्त करना

45. ज्ञान-प्राप्ति की इच्छा कब जगती है?

- (A) जब हम यह देखें कि ज्ञान हमारे भौतिक जीवन के लक्ष्यों की प्राप्ति का साधन है  
(B) जब हम यह देखें कि ज्ञान-वान मनुष्य ही श्रम का अधिकारी है  
(C) जब हम यह देखें कि ज्ञान के द्वारा हम समस्त सुखों का लाभ उठा सकते हैं  
(D) जब हम यह देखें कि ज्ञान के द्वारा सृजनात्मक कार्य किए जा सकते हैं

46. लेखक के अनुसार :

- (A) शारीरिक श्रम में तेज बुद्धि की आवश्यकता नहीं होती  
(B) शारीरिक श्रम में समझदारी और तेज बुद्धि की भी आवश्यकता होती है  
(C) शारीरिक श्रम बच्चों को होशियार बनाता है  
(D) शारीरिक श्रम ही एकमात्र महत्वपूर्ण तत्त्व है

47. गद्यांश के अनुसार ज्ञान कब निरर्थक बोझ बन जाता है?

- (A) जब उसे कक्षाओं तक सीमित कर दिया जाए  
(B) जब उसे शारीरिक श्रम से न जोड़ा जाए  
(C) जब उसका सक्रिय प्रयोग न किया जाए  
(D) जब उस पर पूर्णतः अधिकार न किया जाए

48. 'इच्छा' शब्द में 'इक' प्रत्यय जोड़ने से बनने वाला नया शब्द है

- (A) ऐच्छिक (B) इच्छिक  
(C) ईच्छिक (D) एच्छिक

49. 'कार्य' का बहुवचन रूप है—

- (A) कार्ये (B) कार्य  
(C) कार्यक्रमाँ (D) कार्याँ

50. 'बौद्धिक' शब्द में मूल शब्द है

- (A) बुद्ध (B) बौद्ध  
(C) बौद्धि (D) बुद्धि

निर्देश (प्रश्न संख्या 51 से 57 तक)

नीचे दिये गये गद्यांश को पढ़कर सबसे उचित विकल्प का चयन कीजिए:

बाल-मस्तिष्क की प्रकृति की यह माँग होती है कि बच्चे का बौद्धिक विकास विचारों के स्रोत के पास हो। दूसरे शब्दों में, यह ठोस, वास्तविक बिंबों के बीच और सर्वप्रथम प्रकृति की गोद में हो, जहाँ बच्चा ठोस बिंब को देखे, सुने और फिर उसका विचार इस बिंब के बारे में प्राप्त सूचना के 'संसाधन' के काम में लगे। जब बच्चे को प्रकृति से दूर रखा जाता है, जब बच्चा पढ़ाई के

पहले दिन से ही केवल शब्द के रूप में सारा ज्ञान और बोध पाता है, उसके मस्तिष्क की कोशिकाएँ जल्दी ही थक जाती हैं और अध्यापक द्वारा प्रस्तुत काम को निभा नहीं पाती। और इन कोशिकाओं को तो अभी विकसित, सशक्त, सुदृढ़ होना है। यहीं पर उस बात का कारण छिपा है, जो प्राथमिक कक्षाओं में अक्सर देखने में आती हैं— बच्चा चुपचाप बैठा अध्यापक की आँखों में आँखें डाले देखता है, मानों बड़े ध्यान से सुन रहा हो, लेकिन वास्तव में वह एक शब्द भी नहीं समझ पाता, क्योंकि बच्चे को नियमों पर सोच-विचार करना पड़ता है, और ये सब अमूर्त सामान्यीकृत बातें होती हैं।

51. "..... वास्तव में वह एक शब्द भी नहीं समझ पाता" इसका संभावित कारण क्या है?
- (A) बच्चों के पास कोई सजीव बिंब नहीं होता  
(B) बच्चे मंदबुद्धि होते हैं  
(C) बच्चों के पास बहुत सीमित अनुभव होते हैं  
(D) शिक्षक बच्चों की बात नहीं सुनते
52. बच्चों को प्रकृति के निकट रखने की बात क्यों की गई है?
- (A) प्रकृति में शुद्ध ऑक्सीजन मिलती है  
(B) प्रकृति का हरा-भरा वातावरण बच्चों को आकर्षित करता है  
(C) बच्चे अपनी इंद्रियों के माध्यम से बिंब बनाते हैं  
(D) बच्चे को सबसे ज्यादा विचार प्राकृतिक वातावरण में ही आते हैं
53. केवल शब्दों के रूप में सारा ज्ञान देना :
- (A) बाल-मस्तिष्क को प्रखर बनाता है  
(B) बाल-मस्तिष्क की प्रकृति के विरुद्ध है  
(C) बाल-मस्तिष्क की कोशिकाओं को विकसित करता है  
(D) बाल-मस्तिष्क की प्रकृति के अनुकूल है
54. इस गद्यांश के आधार पर आप अपनी कक्षा में क्या करेंगे?
- (A) बच्चों को मैदान, वन-बाग की सैर कराएँगे।  
(B) बच्चों पर सीखने का बोझ नहीं डालेंगे  
(C) बच्चों के मस्तिष्क को प्रखर बनाने के लिए कठोर परिश्रम करेंगे और बच्चों से करवाएँगे  
(D) ऐसे अनुकूल वातावरण का निर्माण करेंगे, जहाँ बच्चों को इंद्रिय अनुभव के अवसर मिल सकें
55. "यहीं पर उस बात का कारण छिपा है, जो प्राथमिक ..... आती है।" वाक्य में किस बात की तरफ इशारा दिया गया है?
- (A) बच्चे का कक्षा में सदैव डर के कारण चुपचाप बैठना  
(B) अध्यापक का सदैव बोलना  
(C) बच्चे द्वारा अध्यापक की बातों को न समझ पाना  
(D) बच्चे द्वारा निरन्तर सोच-विचार करना
56. किस शब्द में 'इक' प्रत्यय का प्रयोग नहीं किया जा सकता?

- (A) प्रकृति (B) ज्ञान  
(C) वास्तव (D) बुद्धि

57. "जब बच्चे को प्रकृति से दूर रखा जाता है '...' वाक्य के रेखांकित अंश में कौन-सा कारक है?"
- (A) कर्ता कारक (B) सम्प्रदान कारक  
(C) कर्म कारक (D) अपादान कारक

#### निर्देश (प्रश्न संख्या 58 से 62 तक)

दिये गये गद्यांश को पढ़कर निम्नलिखित प्रश्नों के विकल्प छाँटिए:

आदिम आर्य घुमकड़ ही थे। यहाँ से वहाँ वे घूमते ही रहते थे। घूमते भटकते ही वे भारत पहुँचे थे। यदि घुमकड़ का बाना उन्होंने न धारण किया होता, यदि वे एक स्थान पर ही रहते, तो आज भारत में उनके वंशज न होते। भगवान बुद्ध घुमकड़ थे। भगवान महावीर घुमकड़ थे। वर्षाऋतु के कुछ महीनों को छोड़कर एक स्थान में रहना बुद्ध के वंश का नहीं था। 35 वर्ष की आयु में उन्होंने बुद्धत्व प्राप्त किया। 35 वर्ष से 80 वर्ष की आयु तक जब उनकी मृत्यु हुई, 45 वर्ष तक वे निरन्तर घूमते ही रहे। अपने आप को समाज सेवा और धर्म प्रचार में लगाये रहे। अपने शिष्यों से उन्होंने कहा था, "चरथ भिक्खवे" चारिक" हे भिक्षुओं! घुमकड़ करो यद्यपि बुद्ध कभी भारत के बाहर नहीं गये, किन्तु उनके शिष्यों ने उनके वचनों को सिर आँखों पर लिया और पूर्व में जापान, उत्तर में मंगोलिया पश्चिम में मकदूनियाँ और दक्षिण में बाली द्वीप तक धावा मारा। श्रवण महावीर ने स्वच्छन्द विचरण के लिए अपने वस्त्रों तक को त्याग दिया। दिशाओं को उन्होंने अपना अम्बर बना लिया, वैशाली में जन्म लिया, पावा में शरीर त्याग किया। जीवनपर्यन्त घूमते रहे। मानव के कल्याण के लिए मानवों के राह प्रदर्शन के लिये और शंकराचार्य, बारह वर्ष की अवस्था में संन्यास लेकर कभी केरल, कभी मिथिला, कभी कश्मीर और कभी बद्रिकाश्रम में घूमते रहे। कन्याकुमारी से लेकर हिमालय तक समस्त भारत को अपना कर्मक्षेत्र समझा। सांस्कृतिक एकता के लिए, समन्वय के लिए, श्रुति धर्म की रक्षा के लिए शंकराचार्य के प्रयत्नों से ही वैदिक धर्म का उत्थान हो सका।

58. घुमकड़ शब्द में कौन-सा प्रत्यय है?

- (A) अड़ (B) ड़  
(C) अकड़ (D) कड़

59. महावीर स्वामी का जन्म कहाँ हुआ था?

- (A) कुशीनगर (B) वैशाली  
(C) पावापुरी (D) पारसौली

60. स्वच्छन्द में कौन-सी सन्धि है?

- (A) गुण (B) दीर्घ  
(C) विसर्ग (D) व्यंजन

61. महात्मा बुद्ध ने जब बुद्धत्व प्राप्त किया तब उनकी अवस्था कितनी थी?

- (A) 45 वर्ष (B) 35 वर्ष  
(C) 12 वर्ष (D) 80 वर्ष

62. "श्रुति धर्म" का क्या अर्थ है?

- (A) मुस्लिम धर्म (B) बौद्ध धर्म  
(C) जैन धर्म (D) वैदिक धर्म

63. निम्नलिखित गद्यांश को पढ़कर प्रश्न का उत्तर दीजिए।

आज विज्ञान मनुष्यों के हाथों में अद्भुत और अतुल्य शक्ति दे रहा है, इसका उपयोग एक व्यक्ति और समूह के उत्कर्ष और दूसरे व्यक्ति और समूह के गिराने में होता ही रहेगा। इसलिए हमें उस भावना को जागृत रखना है और उसे जागृत रखने के लिए कुछ ऐसे साधनों को भी हाथ में रखना होगा, जो उस अहिंसात्मक त्याग भावना को प्रोत्साहित करें और भोग भावना को दबाए रखें। नैतिक अंकुश के बिना शक्ति मानव के लिए हितकर नहीं होती।

उपर्युक्त पंक्ति में कौन मनुष्य के हाथों में अद्भुत और अतुल्य शक्ति दे रहा है?

- (A) विज्ञान (B) साहित्य  
(C) वाणिज्य (D) कला

#### निर्देश (प्रश्न संख्या 64 से 68 तक)

निम्नलिखित गद्यांश के आधार पर प्रश्नों के उत्तर दीजिए—

'शिक्षा' बहुत व्यापक शब्द है। उसमें सीखने योग्य अनेक विषयों का समावेश हो सकता है। पढ़ना-लिखना भी उसी के अंतर्गत है। इस देश की वर्तमान शिक्षा-प्रणाली अच्छी नहीं। इस कारण यदि कोई स्त्रियों को पढ़ाना अनर्थकारी समझे तो उसे उस प्रणाली का संशोधन करना या कराना चाहिए, खुद पढ़ने-लिखने को दोष न देना चाहिए। लड़कों ही की शिक्षा-प्रणाली कौन-सी बड़ी अच्छी है। प्रणाली बुरी होने के कारण क्या किसी ने यह राय दी है कि सारे स्कूल और कॉलेज बंद कर दिया जाएँ? आप खुशी से लड़कियों और स्त्रियों की शिक्षा की प्रणाली का संशोधन कीजिए। उन्हें क्या पढ़ना चाहिए, कितना पढ़ना चाहिए, किस तरह की शिक्षा देनी चाहिए और कहाँ पर देनी चाहिए घर में या स्कूल में - इन सब बातों पर बहस कीजिए, जी में आये सो कीजिए; पर परमेश्वर के लिए यह न कहिए कि स्वयं पढ़ने-लिखने में कोई दोष है-यह अनर्थकर है, वह अभिमान का उत्पादक है, वह गृह-सुख का नाश करने वाला है। ऐसा कहना सोलहों आने मिथ्या है।

64. 'अनर्थकारी' शब्द का क्या अभिप्राय है ?

- (A) विपरीत अर्थ करने वाला  
(B) अमौद्रिक अर्थ वाला  
(C) विशिष्ट अर्थ करने वाला  
(D) अनिष्ट करने वाला

65. इनमें कौन-सा शब्द पुल्लिङ्ग के रूप में प्रयुक्त होता है ?

- (A) शिक्षा (B) अच्छी  
(C) बहस (D) अभिमान

66. इनमें कौन-सा युग्म सही विकल्प है ?  
 (A) गौ – गौँ (B) गृह – गृहें  
 (C) स्कूल – स्कूलें (D) अनेक – अनेकों
67. 'अध्यापक कक्षा में पढ़ा रहा होगा' वाक्य में कौन-सा काल है ?  
 (A) सामान्य भविष्यत् काल  
 (B) संभाव्य भविष्यत् काल  
 (C) सामान्य भूत काल  
 (D) आसन्न भूत काल
68. 'प्रणाली' शब्द का सही अर्थ है—  
 (A) परंपरा (B) राय  
 (C) पद्धति (D) विधान

**निर्देश (प्रश्न संख्या 69 से 73 तक)**

एक एक गद्यांश दिया गया है। गद्यांश को ध्यानपूर्वक पढ़ें तथा प्रत्येक प्रश्न के चार विकल्पों में से सही विकल्प चुनें।

विवेकशीलता का अर्थ है सही और गलत की पहचान कर पाना और फिर सही के समर्थन में गलत का विरोध करना। यही है वह पक्षधरता जो मनुष्य को जागरूक बनाती है। हमारी त्रासदी यह है कि दृष्टा भाव से जीने को हम एक दार्शनिक और आध्यात्मिक अर्थ देकर अनायास अपना बचाव कर लेते हैं। दृष्टा भाव से जीने का कुछ भी ऊँचा अर्थ होता हो, सही के पक्ष में खड़े होने को आवश्यकता और महत्ता उससे कम नहीं होती। आज सवाल मनुष्यता के अस्तित्व का है, मनुष्यता अर्थात् वह भावना जो मानवीय आदर्शों से हमें जोड़ती है, जो यह अहसास कराती है कि मनुष्य होने के नाते

हमारा यह कर्तव्य बनता है कि हम उचित के पक्ष में खड़े हों। अपने भीतर वह साहस पैदा करें जो अनुचित के विरुद्ध खड़े होने की प्रेरणा बनाता है। 'कोउ नृप होहि हमहि का हानी' वाला मंथरा-दर्शन कुल मिलाकर हमें सजीव मनुष्य से निर्जीव वस्तु में ही परिणत करता है। अपने आप को निर्जीव वस्तु के रूप में देखना मनुष्य के लिए असंभव की हद तक मुश्किल है। लेकिन जब हमें यह भूल जाते हैं कि सही-गलत की पहचान करके सही के साथ खड़े होना हमारी मनुष्यता का प्रमाण है, तो हमारे सजीव और सजग होने का अर्थ ही क्या रह जाता है? सवाल मनुष्योचित सजगता को जीवित रखने का है। कहीं भी, किसी भी तरह से यदि कुछ गलत हो रहा है तो इस सजगता का तकाजा है कि हम अपना विरोध दर्ज कराएँ—स्वयं अपनी दृष्टि में मनुष्य बने रहने के लिए। यही है तटस्थता की विरुद्धता का दर्शन और यही हमारे मनुष्य होने का प्रमाण भी है।

69. गद्यांश में पक्षधरता से क्या आशय है ?  
 (A) सही के समर्थन से  
 (B) गलत के विरोध से  
 (C) सही-गलत में पहचान न कर पाना  
 (D) सही के समर्थन में गलत का विरोध
70. 'दृष्टा भाव' का प्रयोग लोग अधिकतर किसलिए करते हैं ?  
 (A) आत्म-रक्षा के लिए  
 (B) अपनी कायरता छिपाने के लिए  
 (C) स्वयं को तटस्थ दिखाने के लिए  
 (D) किसी पचड़े में न पड़ने के लिए

71. लेखक को मंथरा-दर्शन क्यों अच्छा नहीं लगता ?  
 (A) स्वार्थ प्रेरित (B) कायरतापूर्ण  
 (C) संवेदनहीन (D) निर्जीव बनाता है
72. यहाँ 'तकाजा' शब्द का अर्थ है—  
 (A) शिकायत (B) माँग  
 (C) ऋण (D) देनदार
73. लेखक को तटस्थता की विरुद्धता के दर्शन की आवश्यकता क्यों महसूस हुई ?  
 (A) समय की माँग  
 (B) अनेक वादों के प्रचार से बचने के लिए  
 (C) मानवता के संरक्षण के लिए  
 (D) अपने अस्तित्व की रक्षा के लिए

**उत्तरमाला**

1. (B) 2. (C) 3. (D) 4. (A) 5. (C)  
 6. (B) 7. (C) 8. (A) 9. (A) 10. (C)  
 11. (B) 12. (D) 13. (C) 14. (D) 15. (A)  
 16. (A) 17. (A) 18. (B) 19. (C) 20. (B)  
 21. (D) 22. (A) 23. (D) 24. (B) 25. (B)  
 26. (C) 27. (A) 28. (C) 29. (B) 30. (A)  
 31. (C) 32. (A) 33. (D) 34. (B) 35. (D)  
 36. (C) 37. (C) 38. (D) 39. (C) 40. (D)  
 41. (C) 42. (A) 43. (B) 44. (A) 45. (D)  
 46. (B) 47. (C) 48. (A) 49. (B) 50. (D)  
 51. (A) 52. (C) 53. (B) 54. (D) 55. (B)  
 56. (B) 57. (C) 58. (C) 59. (B) 60. (D)  
 61. (B) 62. (D) 63. (A) 64. (D) 65. (D)  
 66. (A) 67. (B) 68. (C) 69. (D) 70. (C)  
 71. (D) 72. (B) 73. (C)

□□



By 2050, India's total water demand will increase by 32 percent from now. Industrial and domestic sectors will account for 85 percent of the additional demand. Over-exploitation of ground-water, failure to recharge aquifers and reduction in catchment capacities due to uncontrolled urbanisation are all causes of the precarious tilt in the water balance.

If the present rate of groundwater persists, India will have only 22 percent of the present daily per capita water available in 2050, possibly forcing the country to import its water.

Optimists believe that India's people some 1.7 billion by 2050, will have integrated water efficient practices into their daily lives. If the ambitious water sustainability goals set by global industries and governments are testament we dare say that the world has begun to recognize water as a resource after all.

While beverages giants are focussed on returning water to the communities where they manufacture their drinks, food processing players are engaging with farmers and upstream actors to minimise water usage across the supply claim and textile houses are evangelising the concept of sustainable fashion. Companies have realised the risks emanating from the possibility of a water-scarce future. This has triggered companies to re-engineer processes, implement water optimizing, technologies, establish water audit standards, and use a collaborative approach to deal with the water crisis.

10. The problem of acute water scarcity in future cannot be dealt with by companies through :
- (A) implementing water optimizing technologies  
(B) discovering a viable substitute for water.  
(C) re-engineering processes  
(D) establishing water audit standards.
11. Which one of the following words is most similar in meaning to the word 'threatening' as used in the passage ?
- (A) menacing (B) coercing  
(C) persisting (D) frightening
12. Which one of the following words is most opposite to the meaning of the word 'increase' as used in the passage ?
- (A) perceive (B) achieve  
(C) relieve (D) decrease
13. Identify the clause in the underlined part of the following sentence :
- He breathed his last in the village where he was born.
- (A) Adjective clause  
(B) Adverb clause  
(C) Principal clause  
(D) Noun clause

14. What part of speech is the underlined word in the following sentence ?  
I do not know why he is so curious about it.
- (A) Noun clause  
(B) Principal clause  
(C) Adverb clause  
(D) Adjective clause
15. We will face a severe water-scarcity problem in future mostly because :
- (A) water is not a renewable source.  
(B) by 2050, demand for water will increase considerably.  
(C) we do not use water responsibly.  
(D) ground-water level water is steadily decreasing.
16. Which of the following will NOT lead to a severe water imbalance ?
- (A) over-exploitation of water.  
(B) failure to recharge aquifers.  
(C) uncontrolled urbanisation.  
(D) flawless water infrastructure.
17. Persistent ground water depletion will NOT necessitate :
- (A) shutting down of industries  
(B) adoption of smart water management technologies  
(C) using water judiciously  
(D) import of water
18. Optimists cannot pin their hope for better water management on :
- (A) reducing demand for water by using new technologies.  
(B) discovering new ways of augmenting water supply  
(C) treating sea water for domestic and industrial sectors  
(D) integrating water efficient practices into daily use.

**Direction (Q. No. 19 to 27)**

Read the passage given below and answer the questions that follow, by selecting the correct/ most appropriate options :

1. Each drop represents a little bit of creation and of life itself. When the monsoon brings to northern India the first rains of summer, the parched earth opens its pores and quenches its thirst with a hiss of ecstasy. After baking in the sun for the last few months, the land looks cracked, dusty and tired. Now, almost overnight, new grass springs up, there is renewal everywhere, and the damp earth releases a fragrance sweeter than any devised by man.
2. Water brings joy to earth, grass, leaf-bud, blossom, insect, bird, animal and the pounding heart of man. Small children run out of their homes to romp naked in

the rain. Buffaloes, which have spent the summer listlessly around lakes gone dry, now plunge into a heaven of muddy water. Soon the lakes and rivers will overflow with the monsoon's generosity. Trekking in the Himalayan foothills, I recently walked for kilometres without encountering habitation. I was just scolding myself for not having brought along a water-bottle, when I came across a patch of green on a rock face. I parted a curtain of tender maiden hair fern and discovered a tiny spring issuing from the rock-nectar for the thirsty traveller.

3. I stayed there for hours, watching the water descend, drop by drop, into a tiny casement in the rocks. Each drop reflected creation. That same spring, I later discovered, joined other springs to form a swift, tumbling stream, which went cascading down the hill into other streams until, in the plains, it became part of the river. And that river flowed into another mightier river that kilometres later emptied into the ocean. Be like water, taught Laotzu, philosopher and founder of Taoism. Soft and limpid, it finds its way through, over or under any obstacle. It does not quarrel; it simply moves on.
19. Which part of the following sentence contains an error ?
- He knew that he will  
(a) (b)  
go back on his promise  
(c) (d)  
(A) (d) (B) (a)  
(C) (b) (D) (c)
20. Which of the following statements is not true ?
- (A) The damp earth releases a sweet fragrance.  
(B) There is renewal everywhere.  
(C) New grasses spring up.  
(D) The sweltering heat comes to an end.
21. The earth does not look ..... before the onset of the monsoon.
- (A) tired (B) cracked  
(C) brown (D) dusty
22. Children respond to the first rains of summer by :
- (A) singing songs.  
(B) giving shouts of joy.  
(C) floating paper boats in water  
(D) running and playing in the rain
23. The tiny spring issuing from the rock is hidden by :

- (A) tall grass
- (B) thick moss
- (C) maiden hair fern
- (D) bushes and creepers

24. To become part of a river, a tiny drop has to :
- (A) merge its identity.
  - (B) have lot of strength.
  - (C) depend on external forces.
  - (D) suffer a lot
25. Which of the following words is most similar in meaning to the word 'pounding' as used in para 2 of the passage ?
- (A) sinking            (B) shaking
  - (C) benumbing        (D) palpitating
26. Which one of the following words is most opposite in meaning to the word 'descend' (para 3) as used in the passage ?
- (A) zoom                (B) flow
  - (C) ascend             (D) hover
27. Which part of speech is the underlined word in the following sentence ?  
Almost overnight new grass spring up.
- (A) Adverb            (B) Preposition
  - (C) Pronoun           (D) Adjective

**Direction (Q. No. 28 to 36)**

Read the passage given below and answer the questions that follow :

The future of water will be a gamble-resting entirely on the way we decide to play the game here. Either we continue to use water irresponsibly, threatening the very existence of this planet, or we adopt sustainable and smart water management practices to build a water secure future.

By 2050, India's total water demand will increase by 32 percent from now. Industrial and domestic sectors will account for 85 percent of the additional demand. Over-exploitation of ground-water, failure to recharge aquifers and reduction in catchment capacities due to uncontrolled urbanisation are all causes of the precarious tilt in the water balance.

If the present rate of groundwater persists, India will have only 22 percent of the present daily per capita water available in 2050, possibly forcing the country to import its water.

Optimists believe that India's people some 1.7 billion by 2050, will have integrated water efficient practices into their daily lives. If the ambitious water sustainability goals set by global industries and governments are testament we dare say that the world has begun to recognize water as a resource after all.

While beverages giants are focussed on returning water to the communities where they manufacture their drinks, food processing

players are engaging with farmers and upstream actors to minimise water usage across the supply chain and textile houses are evangelising the concept of sustainable fashion. Companies have realised the risks emanating from the possibility of a water-scarce future. This has triggered companies to re-engineer processes, implement water optimizing technologies, establish water audit standards, and use a collaborative approach to deal with the water crisis.

28. The problem of acute water scarcity in future cannot be dealt with by companies through :
- (A) implementing water optimizing technologies
  - (B) discovering a viable substitute for water.
  - (C) re-engineering processes
  - (D) establishing water audit standards.
29. Which one of the following words is most similar in meaning to the word 'threatening' as used in the passage ?
- (A) menacing        (B) coercing
  - (C) persisting        (D) frightening
30. Which one of the following words is most opposite to the meaning of the word 'increase' as used in the passage ?
- (A) perceive        (B) achieve
  - (C) relieve            (D) decrease
31. Identify the clause in the underlined part of the following sentence :  
He breathed his last in the village where he was born.
- (A) Adjective clause
  - (B) Adverb clause
  - (C) Principal clause
  - (D) Noun clause
32. What part of speech is the underlined word in the following sentence ?  
I do not know why he is so curious about it.
- (A) Noun clause
  - (B) Principal clause
  - (C) Adverb clause
  - (D) Adjective clause
33. We will face a severe water-scarcity problem in future mostly because :
- (A) water is not a renewable source.
  - (B) by 2050, demand for water will increase considerably.
  - (C) we do not use water responsibly.
  - (D) ground-water level water is steadily decreasing.
34. Which of the following will NOT lead to a severe water imbalance ?
- (A) over-exploitation of water.

- (B) failure to recharge aquifers.
- (C) uncontrolled urbanisation.
- (D) flawless water infrastructure.

35. Persistent ground water depletion will NOT necessitate :
- (A) shutting down of industries
  - (B) adoption of smart water management technologies
  - (C) using water judiciously
  - (D) import of water
36. Optimists cannot pin their hope for better water management on :
- (A) reducing demand for water by using new technologies.
  - (B) discovering new ways of augmenting water supply
  - (C) treating sea water for domestic and industrial sectors
  - (D) integrating water efficient practices into daily use.

**Direction (Q. No. 37 to 43)**

Read the passage given below and answer the questions that follow by choosing correct/most appropriate option :

1. There is consistent, strong evidence to prove that the SARS CoV-2 virus, behind the COVID-19 pandemic, is predominantly transmitted through air, according to a new assessment published on Friday in The Lancet journal. The analysis by six experts from the UK, the US and Canada says public health measures to fail to treat the virus as predominantly the airborne route leaves the people unprotected and allows the virus to spread. Although some studies in the past have suggested that COVID-19 may spread through air, overall scientific literature on the subject has been inconclusive. In July last year, over 200 scientists from 32 nations wrote to WHO, saying there is evidence that the Corona virus is airborne, and even smaller particles can infect people. "The evidence supporting airborne transmission is overwhelming, and evidence supporting large droplet transmission is almost non-existent", said Jose-Luis Jimenez, from the University of Colorado Boulder in the US. "It is urgent that the World Health Organization and other public health agencies adapt their description of transmission to the scientific evidence so that the focus of mitigation is put on reducing airborne transmission," Jimenez said. Studies have confirmed these events cannot be adequately explained by close contact or touching shared surfaces or objects, the researchers said in their assessment.

2. They noted the transmission rates of SARS-CoV-2 are much higher indoors than outdoors, and transmission is greatly reduced by indoor ventilation. The term cited previous studies estimating that silent- asymptomatic or pre-symptomatic transmission of SARS-CoV-2 from people who are not coughing or sneezing accounts for at least 40 percent of all transmission.
37. Which of the following statements is not true about the transmission of SARS-CoV-2?
- (A) It is transmitted through air.  
 (B) Transmission rates of the disease are much higher indoors than outdoors.  
 (C) It is not transmitted via close contact or touching shared surfaces or objects.  
 (D) It could be transmitted through asymptomatic patients to a healthy person.
38. According to experts from the UK, the US and Canada the SARS-CoV-2 virus.
- (A) spreads through human contact.  
 (B) affects the elderly the most.  
 (C) proves fatal to people with weak immune system  
 (D) the airborne route leaves people unprotected.
39. What, according to Jimenez, should WHO and other public health organisations do to effectively deal with the problem?
- (A) To find a scientific cure for permanent extinction of the virus.  
 (B) To find scientific ways to reduce the airborne transmission  
 (C) Issue guidelines regarding Covid-19 protocol and make them mandatory for all.  
 (D) To adapt their description of transmission to scientific evidence to reduce airborne transmission.
40. Choose the correct option to fill in the blank in the following sentence :  
 ..... was the first to establish the fact that Covid-19 pandemic prominently spreads through air.
- (A) World Health Organisation  
 (B) Jose-Luis Jimenez  
 (C) Research studies  
 (D) Lancet Journal
41. Which of the following words has the same meaning as the word, 'overwhelming' as used in paragraph 1 of the passage?
- (A) strong (B) transparent  
 (C) clear (D) close

42. Which of the following words is opposite in meaning to the word, 'consistent' as used in para 1 of the passage?
- (A) excellent (B) dependable  
 (C) marvellous (D) astonishing
43. Which part of the following sentences contains an error?
- He asked him why was he reluctant  
 a b  
to accept such a good offer  
 c d
- (A) (a) (B) (d)  
 (C) (b) (D) (c)

**Direction (Q. No. 44 to 50)**

Read the passage given below and answer the questions by choosing the correct/most appropriate options.

Over the last few years, e-commerce has become an indispensable part of the global retail framework. Like many other industries, the retail landscape has undergone a substantial transformation following the advent of the Internet, and thanks to the ongoing digitalization of modern life, consumers from virtually every country now profit from the perks of online transactions. As Internet access and adoption are rapidly increasing around the globe, the number of digital buyers worldwide keeps climbing every year. According to the latest calculations, e-commerce growth will accelerate even further in the future.

Internet users can choose from various online platforms to browse, compare, and purchase the items or services they need.

While some websites specifically target B2B (business-to business) clients, individual consumers are also presented with a vast number of digital possibilities. As of 2020, online market places account for the largest share of online purchase worldwide. Leading the global ranking of online retail websites in terms of traffic is Amazon. In terms of gross merchandise value (GMV), Amazon ranks third behind Chinese competitors Taobao and Tmall. Both platforms are operated by the Alibaba Group, the leading online commerce provider in Asia. One of the most visible trends in the world of e-commerce is the unprecedented usage of mobile devices. As the adoption of mobile devices is progressing at a rapid pace, especially in regions that lack other digital infrastructure, mobile integration will continue to shape the shopping experience of the future. M commerce is particularly popular across Asia, with South Korea generating up to 65 per cent of their total online transaction volume via mobile traffic.

44. Read the following statements :
- (a) E-commerce growth has reached its saturation point.

- (b) Consumers from a few countries stand to gain from the perks of online transactions.
- (A) (a) is true and (b) is false.  
 (B) (b) is true and (a) is false.  
 (C) Both (a) and (b) are false.  
 (D) Both (a) and (b) are true.
45. Which of the following is not true according to the passage?
- (A) The traditional modes of doing business have become a matter of the past.  
 (B) Amazon leads the global ranking of online retail websites in terms of traffic.  
 (C) The arrival of computer has revolutionised the methods of doing business.  
 (D) The number of digital buyers keeps climbing every two years.
46. The retail landscape has undergone a substantial change because :
- (A) every consumer in the world is using the digital mode.  
 (B) most consumers are techno savvy.  
 (C) governments all over the world are trying to popularise e-commerce.  
 (D) the arrival of computer has revolutionised the methods of doing business.
47. What accounts for the increasing popularity of mobile devices in certain regions of the world?
- (A) Ease of use  
 (B) Lack of other digital infrastructure  
 (C) Low cost of mobile devices  
 (D) Incentives by mobile phone manufacturers.
48. Which of the following is not supported by evidence in the passage?
- (A) Amazon ranks third in terms of gross merchandise.  
 (B) Taobao is operated by Amazon.  
 (C) Tmall is trying hard to compete with Amazon.  
 (D) Alibaba group is the leading commerce provider in both Europe and Asia.
49. Which of the following words is nearest in meaning to the word 'advent' as used in the passage ?
- (A) departure (B) arrival  
 (C) postponement (D) engagement
50. Which part of speech is the underlined word in the following sentence?  
 Internet users can choose from various online platforms.

- (A) Pronoun (B) Conjunction  
(C) Preposition (D) Noun

**Direction (Q. No. 51 to 58)**

Read the passage given below and answer the question that follow selecting the correct/most appropriate options.

Loss of Learning During the Pandemic (extract)

School closure due to the COVID-19 pandemic has led to complete disconnect from education for the vast majority of children or inadequate alternatives like community based classes or poor alternatives in the form of online education, including mobile phone-based learning. One complete academic year has elapsed in this manner, with almost no or little curricular learning in the current class. But this is only one kind of loss of learning. Equally alarming is the widespread phenomenon of ‘forgetting’ by students of learning from the previous class— this is regression in their curricular learning. This includes losing foundational abilities such as reading with understanding and performing addition and multiplication, which they had learnt earlier and become proficient in, and which are the basis of further learning. These foundational abilities are such that their absence will impact not only learning of more complex abilities but also conceptual understanding across subjects. Thus, this overall loss of learning-loss (regression or forgetting) of what children had learnt in the previous class as well as what they did not get an opportunity to learn in the present class—is going to lead to acumulative loss over the years, impacting not only the academic performance of children in their school years but also their adult lives. To ensure that this does not happen, multiple strategies must be adopted with rigorous implementation to compensate for this overall loss of learning when schools reopen.

This study, undertaken in January 2021, reveals the extent and nature of the ‘forgetting/ regression’ kind of learning loss (*i.e.* what was learnt earlier but has been now lost) among children in public schools across primary classes because of school closure during the COVID-19 pandemic. The study covered 16067 children in 1137 public schools in 44 districts across 5 states. It focused on the assessment of four specific abilities each in language and mathematics, across classes 2-6. These four specific abilities for each grade were chosen because these are among the abilities for all subsequent learning—across subjects—and so the loss of any one of these would have very serious consequence on all further learning.

An assessment of the learning levels of children when schools closed as well of their

current status were necessary to understand any such regression. The former was best done through teachers who have been deeply engaged with their learners, and thus had a reliable assessment of children’s abilities, when schools closed in March 2020. Therefore, this baseline assessment of children’s learning levels, *i.e.* where they were assessed on specific abilities in language and mathematics when school closed, was done based on a comprehensive analysis by the relevant teachers, aided by appropriate assessment tools. All abilities associated with the previous class were not assessed; a few abilities critical for further learning were carefully identified and assessed. These are referred to as specific abilities in the document. ‘End-line’ was the assessment of the same children’s proficiency on these very same abilities in January 2021, which was done by administering oral and written tests.

51. Pick the correct option to justify :

**Assertion (A) :** School closure due to the COVID-19 pandemic has led to complete disconnect from education.

**Reasoning (R) :** Vast majority of the children are being taught through community-based classes, inadequate online or phone-based classes.

- (A) A is true and R is false  
(B) A is false and R is true  
(C) Both A and R are true and R is the correct explanation for A  
(D) Both A and R are true and R is not the correct explanation of A

52. Given below are 4 real life situation pertaining to school education. Which of the following option is correct :

- (a) COVID-19 Pandemic has led to complete school closure.  
(b) One complete academic year has been totally Lost.  
(c) Little or almost no curricular learning has taken place.  
(d) Widespread “forgetting” of learning from previous class.

(A) (a) & (b) (B) (c) & (d)

(C) (a) & (c) (D) (b) & (d)

53. Pick the option which best gives the meaning of the word ‘pandemic’ as used in the passage.

- (A) widespread disease.  
(B) a chronic disease.  
(C) a disease confined to one region.  
(D) a disease that has spread all over the world.

54. Study the following statements :

- (a) School closure had led to forgetting by students of what they had learnt in the previous year.

(b) Lack of foundational abilities will impact further learning.

(A) (a) is right and (b) is wrong.

(B) (b) is right and (a) is wrong.

(C) Both (a) and (b) are right.

(D) Both (a) and (b) are wrong.

55. Pick the correct option to justify/show how loss of learning can be remedied.

**Assertion (A) :** It can be ensured that learning loss does not happen.

**Reason (R) :** However, rigorous implementation of multiple strategies have to be used for maintain curricular achievement.

(A) A is true but R is false

(B) Both A and R are false but R is the correct explanation of A

(C) Both A and R are true and R is the correct explanation of A

(D) A is false but R is true

56. Pick the right option to show how a baseline tool can be made to make a comprehensive assessment.

(a) Assess all grade level competencies included in curriculum.

(b) Assess skills/abilities that lead to future complex learning in language and maths.

(c) Assess all advanced concepts and skills in all subjects.

(d) Assess core language skills and foundational maths operations and numericals.

(A) (a) & (b)

(B) (a) & (c)

(C) (b) & (d)

(D) (c) & (b)

57. Pick the option which is opposite in meaning to the word “proficiency” used in the passage.

(A) advanced abilities

(B) inadequacy

(C) competence

(D) incompetence

58. ‘in the form of ....

The underline word is a :

(A) Noun (B) Pronoun

(C) Adjective (D) Adverb

**Direction (Q. No. 59 to 66)**

Read the passage given below and answer the questions that follow by selecting the correct/most appropriate options :

As science progresses, superstitions ought to grow less. On the whole, that is true. However, it is surprising how superstitions linger on. If we are tempted to look down on savage tribes for holding such ideas, we should remember that even today, among most civilised nations,

a great many equally stupid superstitions exist and are believed in by a great many people.

Some people will not sit down thirteen at a table; or will not like to start anything important on a Friday; or refuse to walk under a ladder. Many people buy charms and talismans because they think they will bring them luck. Even in civilised nations today, many laws are made on the basis of principles which are just as much unproved. For instance, it is often held as a principle that white people are by nature superior to people of other colours. The ancient Greeks believed that they were superior to the people of Northern and Western Europe. The only way to see if there is anything in such a principle is to make scientific studies of a number of white and black and brown people under different conditions of life and find out just what they can and cannot achieve.

If it is, however, true that the increase of scientific knowledge does reduce superstition and also baseless guessing and useless arguments and practices. Civilised people do not argue and get angry about what water is composed of. The composition of water is known, and there is no argument about it.

59. Who believe in superstitions ?  
 (A) Only some civilised nations.

- (B) Only some tribals.  
 (C) All tribals and some civilized nations.  
 (D) All civilised nations.

60. Study the following statements.  
 (a) Ancient Greeks were superior to other European nations.  
 (b) Science helps us fight superstitions.  
 (A) (a) is wrong and (b) is right.  
 (B) Both (a) and (b) are right.  
 (C) Both (a) and (b) are wrong.  
 (D) (a) is right and (b) is wrong.

61. Which part of speech is the underlined word in the following sentence ?  
 On the whole that is true.  
 (A) Pronoun (B) Conjunction  
 (C) Preposition (D) Determiner

62. Identify the part of speech of the underlined word in the following sentence.  
 It is often held that as a principle.  
 (A) Adverb (B) Adjective  
 (C) Preposition (D) Pronoun

63. Fill in the blank in the following sentence.  
 .....is opposite in meaning to the word, 'superior'.

- (A) Prior (B) Inferior  
 (C) Lower (D) Higher

64. The statement which best sums up the passage is :  
 (A) Irrational beliefs decline with the advancement of science.  
 (B) Civilized nations are no less superstitions than the savage tribes.  
 (C) We are very different from the savage nations in our beliefs.  
 (D) Superstitions disappear with the advancement of science.
65. We should not despise the savage tribes because :  
 (A) they indulge in useless arguments.  
 (B) they have stopped being superstitious.  
 (C) we are no less superstitions than they are.  
 (D) they do not believe in science.
66. Which of the following has a scientific basis for it ?  
 (A) Number thirteen is inauspicious.  
 (B) Talismans and charms always bring luck.  
 (C) Fridays are as good as other days.  
 (D) We should not walk under a ladder.

## (B) : Poetry

### Direction (Q. No. 67 to 72)

Read the poem given below and answer the questions that follow by choosing the correct/most appropriate options :

Behold her, single in the field,  
 Yon solitary Highland Lass!  
 Reaping and singing by herself;  
 Stop here, or gently pass!  
 Alone she cuts and binds the grain,  
 And sings a melancholy strain;  
 O listen! For the Vale profound  
 Is overflowing with the sound.  
 No Nightingale did ever chaunt  
 More welcome notes to weary bands  
 Of travellers in some shady haunt,  
 Among Arabian sands:  
 A voice so thrilling ne'er was heard  
 In spring-time from the Cuckoo-bird,  
 Breaking the silence of the seas  
 Among the farthest Hebrides.  
 Will no one tell me what she sings?—  
 Perhaps the plaintive numbers flow  
 For old, unhappy, far-off things,  
 And battles long ago :  
 Or is it some more humble lay,  
 Familiar matter of to-day?  
 Some natural sorrow, loss or pain,  
 That has been, and may be again?

67. The poem suggests that  
 (A) The song the girl is singing is meant for others.  
 (B) The poet is greatly moved by the song.  
 (C) The song that the girl is singing is one of ecstasy.  
 (D) The theme of the song concerns familiar matters of today.

68. The song is addressed to  
 (A) the travellers who pass by her.  
 (B) herself.  
 (C) the vale around her.  
 (D) the poet.

69. The phrase 'a melancholy strain' means  
 (A) a playful song  
 (B) a lilting song  
 (C) a sad song  
 (D) a mysterious song

70. The tone of the poem is :  
 (A) cheerful (B) passionate  
 (C) loud (D) sad

71. Which figure of speech is used in 'Among Arabian sands.'  
 (A) Metaphor (B) Metonymy  
 (C) Personification (D) Alliteration

72. Which figure of speech has been used in the lines :  
 "Breaking the silence of the seas  
 Among the farthest it Hebrides"  
 (A) Metaphor (B) Simile  
 (C) Personification (D) Assonance

### Direction (Q. No. 73 to 78)

Read the poem given below and answer the questions that follow by choosing the best/appropriate options :

The crucified planet Earth  
 Should it find a voice  
 and a sense of irony,  
 might now well say  
 of our abuse of it,  
 "Forgive them Father,  
 They know not what they do"  
 The irony would be that we know what  
 we are doing.  
 When the last living thing  
 has died on account of us,  
 how poetical it would be  
 If Earth could say,  
 in a voice floating up  
 perhaps  
 from the floor  
 of the Grand Canyon  
 "It is done"  
 People did not like it here.

73. Who is the speaker of the line, "Forgive them, Father, they know not what they do" in the above poem?  
 (A) The Earth (B) People  
 (C) The heavens (D) The planets
74. Identify and name the figure of speech used in 'Crucified Earth'?  
 (A) Personification (B) Conceit  
 (C) Allegory (D) Paradox
75. A sense of destructive fear pervades the poem. What prompts the poet to signal this note on apocalypse?  
 (A) People did not like being on Earth.  
 (B) Earth itself no longer welcomes humans.  
 (C) God did not grant them forgiveness.  
 (D) Man has recklessly ruined and exploited nature.
76. Which of the following is not true according to the extract?  
 (A) We do not know what we are doing.  
 (B) We are destroying what sustains us.  
 (C) We are waiting for a saviour.  
 (D) We are too naïve to understand the implications of our actions.
77. "People did not like it here" is an example of :  
 (A) hyperbole (B) sarcasm  
 (C) paradox (D) metonymy
78. According to the poet, if the Earth is given a chance for any utterance, what would it say to God?  
 (A) Stop the extinction of mankind.  
 (B) Forgive the wrongful deeds of men.  
 (C) Fix responsibility for the mindless destruction of the Earth.  
 (D) Give people the strength to resist temptation.

**Direction (Q. No. 79 to 84)**

Read the poem given below and answer the questions by choosing the correct/most appropriate options :

Boats sail on the rivers,  
 And ships sail on the seas;  
 But clouds that sail across the sky  
 Are prettier than these.  
 There are bridges on the rivers,  
 As pretty as you please;  
 But the bow that bridges heaven,  
 And overtops the tree,  
 And builds a road from earth to sky,  
 Is prettier far than these.

79. The main idea in the poem, 'Rainbow' is that :  
 (A) rainbow are extremely beautiful.

- (B) man-made things have a beauty of their own.  
 (C) God-made things are more beautiful than man-made things.  
 (D) both rainbows and ships are a source of joy.

80. The prominent literary device used by the poet in this poem is :  
 (A) repetition (B) assonance  
 (C) synecdoche (D) metonymy
81. In the second half of the poem, the poet compares a bridge to :  
 (A) heaven (B) a rainbow  
 (C) a river (D) a road
82. The literary device used in the lines "And ships sail on the sea" is :  
 (A) alliteration (B) metaphor  
 (C) simile (D) hyperbole
83. Which of the following underscores the symbolic significance of the rainbow?  
 (A) The rainbow is more beautiful than boats and ships.  
 (B) It has a transitory existence.  
 (C) Its beauty has a bewitching effect on man.  
 (D) It links the earth with heaven.
84. The poet thinks of the rainbow  
 (A) as a kind of road to happiness  
 (B) as a kind of road to heaven  
 (C) as a kind of road to salvation  
 (D) as a kind of road to the sky

**Direction (Q. No. 85 to 90)**

Read the poem given below and answer the questions/complete the statements that follow by choosing the appropriate options from the given ones.

My mistress bent that brow of hers;  
 Those deep dark eyes where pride demurs  
 When pity would be softening though,  
 Fixed me a breathing while or twos  
 With life or death in the balance right!  
 The blood replenished me again;  
 My last thought was at least not vain :  
 I and my mistress, side by side  
 Shall be together, breathe and ride,  
 So, one day more am I deified,  
 Who knows next but the world may end to-night?

85. Study the following statements :  
 (a) The lover's fate hangs in balance  
 (b) The beloved is easily persuaded  
 (c) Her pride stands in the way of her lover's success  
 (d) There is a conflict between pride and pity

- (A) (a) and (b) are both correct  
 (B) (b) and (c) are both correct  
 (C) (c) and (d) are both correct  
 (D) (a) and (b) are both wrong

86. Study the following statements :  
 (A) The poet is a dejected lover  
 (B) He loses heart very soon  
 (C) He knows that ultimately he will win her love  
 (D) His request is a matter of life and death for him
87. What was the poet's last thought?  
 (A) his request for a ride together  
 (B) that his beloved would accept his love  
 (C) that she would raise her beautiful brow  
 (D) that his breathing would start again
88. 'Am I deified' the figure of speech used in the expressions is :  
 (A) Simile (B) Metaphor  
 (C) Personification (D) Imagery
89. 'with life and death in the balance' the figure of speech in the expression is :  
 (A) Simile (B) Metaphor  
 (C) Hyperbole (D) Personification
90. Study the following statements :  
 (a) At the end the lover feels that he is in Heaven.  
 (b) At least his one request has been granted.  
 (A) (a) is right and (b) is wrong  
 (B) (b) is right and (a) is wrong  
 (C) Both (a) and (b) are right  
 (D) Both (a) and (b) are wrong

**Direction (Q. No. 91 to 96)**

Read the following stanza and answer the questions/complete the statements by choosing the best options from the ones that follow :

Strange fits of passion have I known  
 And I will dare to tell.  
 But in the lover's ear alone.  
 What once to me be fell  
 When she I loved looked every day  
 Fresh as a rose in June  
 I to her cottage beat my way  
 Beneath an evening moon.  
 Upon the moon I fixed my eye.  
 All over the wide lea.  
 With quickening pace  
 My horse drew nigh.  
 Those path so dear to me.

91. 'Strange fits of passion' means  
 (A) strange fantasies  
 (B) strange fears that plague the mind

- (C) strange anecdotes  
(D) strange dreams
92. 'evening moon' here symbolises :  
(A) night time (B) romanticism  
(C) fear of death (D) bright future
93. 'Lea' (line 11) means :  
(A) waste land (B) open grass land  
(C) fertile land (D) desert area
94. Which figure of speech is used by the poet in the line 'Fresh as a rose in June'?  
(A) Metaphor (B) Hyperbole  
(C) Simile (D) Onomatopoeia
95. 'With quickening pace'  
The underlined word is a/an.....  
(A) Noun (B) Verb  
(C) Adjective (D) Adverb
96. What is the structure of the poem?  
(A) Sonnet (B) Blank verse  
(C) Free verse (D) Lyric

**Direction (Q. No. 97 to 102)**

Read the poem given below and answer the questions that follow by selecting the correct/most appropriate options :

I think that I shall never see  
A poem lovely as a tree.  
A tree whose hungry mouth is prest  
Against the earth's sweet flowing breast;  
A tree that looks at God all day,  
And lifts her leafy arms to pray;  
A tree that may in Summer wear  
A nest of robins in her hairs;

- Upon whose bosom snow has lain;  
Who intimately lives with rain.  
Poems are made by fools like me,  
But only God can make a tree.
97. Identify and name the figure of speech used in 'Poems are made by fools like me'.  
(A) Hyperbole  
(B) Metaphor  
(C) Personification  
(D) Simile
98. The word, 'mouth' in line 3 refers to the ..... of the tree.  
(A) roots (B) crown  
(C) branches (D) trunk
99. The tree passes its mouth against the sweet earth's flowing breast to  
(A) express its love for it.  
(B) express its gratitude to it.  
(C) draw sustenance from it.  
(D) draw inspiration from it.
100. The tree prays to God by  
(A) providing shade to travellers.  
(B) swinging its branches.  
(C) lifting her arms.  
(D) producing fruit and flowers.
101. Which of the following statements is not true in the context of the poem ?  
(A) It lives closely with rain  
(B) The tree welcomes the snow on its bosom.  
(C) The tree symbolizes strength and stability

- (D) The tree allows birds to build their nests in it.
102. Name the figure of speech used in lines 3 and 4.  
(A) Alliteration (B) Simile  
(C) Personification (D) Metonymy

**Answer Key**

**(A) : Prose**

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

**(B) : Poetry**

67. (B) 68. (B) 69. (C) 70. (D) 71. (D)  
72. (C) 73. (A) 74. (A) 75. (D) 76. (C)  
77. (D) 78. (B) 79. (C) 80. (A) 81. (B)  
82. (A) 83. (D) 84. (B) 85. (C) 86. (D)  
87. (A) 88. (B) 89. (C) 90. (C) 91. (B)  
92. (A) 93. (B) 94. (C) 95. (C) 96. (D)  
97. (D) 98. (A) 99. (C) 100. (C) 101. (C)  
102. (C)



# Chapter 1

## Number System

### 1. IMPORTANT TERMINOLOGY

**1.1 Digits**—0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are defined as digits in Mathematics. We can create many numbers by using these digits. For example : 10, 123, 456, 789 etc.

**1.2 Number System** : There are mainly two types defined in the number system. These are :

**I. Decimal Number System** : It contains 0 to 9 digits. That's why it is called *decimal number system*. In this system, the numbers is read and written in two ways : Indian number system and International number system.

**In the Indian number system or Hindi-Arabic system**, the numbers are read and written as per their place values. These numbers are read as per the following table.

Periods	Crores		Lakhs		Thousands		Ones		
Value	10,00,00,000 (Ten Crores)	1,00,00,000 (Crore)	10,00,000 (Ten Lakhs)	1,00,000 (Lakh)	10,000 (Ten Thousands)	1,000 (Thousand)	100 (Hundred)	10 (Ten)	1 (One)
	$10^8$	$10^7$	$10^6$	$10^5$	$10^4$	$10^3$	$10^2$	$10^1$	$10^0$

**Example** : Number 51,45,42,786 can be read as Fifty-one Crores Forty-five Lakhs Forty-two Thousands Seven Hundred and Eighty-six. It is also called number name.

#### Unit Conversions :

- 1 tens = 10 units
- 1 Hundred = 10 tens = 100 units
- 1 Thousand = 10 Hundreds = 100 tens = 1000 units
- 1 Lakh = 10 Thousands = 100 Hundreds = 1000 tens
- 1 Crore = 10 Lakhs = 100 Thousands = 1000 Hundreds

**In International number system**, the numbers are read and written as per the following table.

Periods	Millions			Thousands			Ones		
Value	100,000,000 (Hundred Millions)	10,000,000 (Ten Millions)	10,00,000 (Millions)	100,000 (Hundred Thousand)	10,000 (Ten Thousand)	1,000 (Thousand)	100 (Hundred)	10 (Ten)	1 (One)
	$10^8$	$10^7$	$10^6$	$10^5$	$10^4$	$10^3$	$10^2$	$10^1$	$10^0$

**Example** : Number 14,542,786 can be read as Fourteen Millions Five Hundred Forty-two Thousand Seven Hundred Eighty-six.

**II. Roman Number System** : In this system, numbers are represented by Latin alphabets. The Roman numerals used in, are based on seven symbols or letters.

Roman System	I	V	X	L	C	D	M
Hindu Arabic System	1	5	10	50	100	500	1000

**Example** : 25 can be written as XXV and 101 as CI.

#### Note

- A letter repeats its value that many times (XXX = 30, CC = 200 etc.). A letter can only be repeated three times.
- If one or more letters are placed after another letter of greater value, add that amount.  
For example,  
VII = 7 (5 + 1 + 1); LXI = 61 (50 + 10 + 1); MCC = 1200 (1000 + 100 + 100)
- If a letter is placed before another letter of greater value, subtract that amount.  
For example,  
IV = 4 (5 - 1); XIV = 14 (10 + 5 - 1); CM = 900 (1000 - 100)
- Only subtract powers of ten (I, X, or C, but not V or L).
- Only subtract one number from another.
- Do not subtract a number from one that is more than 10 times greater (that is, you can subtract 1 from 10 [IX] but not 1 from 20—there is no such number as IXX.)
- A bar placed on top of a letter or string of letters increases the numeral's value by 1,000 times.  
For example, XII = 12 whether  $\overline{\text{XII}}$  = 12000.

### 2. DIGITS OF NUMBER

- **Units** : Digit 0 to 9 are called Unit digits. The smallest and the largest number of 1-digit are 0 and 9 respectively.
- **Tens** : The numbers from 10 to 99 are called ten numbers. The smallest and the largest number of 2-digits are 10 and 99 respectively.
- **Hundreds** : The numbers from 100 to 999 are called hundred numbers. The smallest and the largest number of 3-digits are 100 and 999 respectively.
- **Thousands** : The numbers from 1,000 to 9,999 are called thousand numbers. The smallest and the largest number of 4-digits are 1000 and 9999 respectively.

- **Ten thousands** : The numbers from 10,000 to 99,999 are called ten thousand numbers. The smallest and the largest number of 5-digits are 10,000 and 99,999 respectively.
- **Lakhs** : The numbers from 1,00,000 to 9,99,999 are called lakh numbers. The smallest and the largest number of 6-digits are 1,00,000 and 9,99,999 respectively.
- **Ten Lakhs** : The numbers from 10,00,000 to 99,99,999 are called ten lakh numbers. The smallest and the largest number of 7-digits are 10,00,000 and 99,99,999 respectively.
- **Crores** : The numbers from 1,00,00,000 to 9,99,99,999 are called crore numbers. The smallest and the largest number of 8-digits are 1,00,00,000 and 9,99,99,999 respectively.

### 3. VALUE OF DIGITS

- **Place Value**—Place value helps us determine the value of numbers. Our (base-10) number system contains numerals or digits only from 0 to 9, but we often need to use numbers greater than 9. We show numbers greater than 9 by using place value. Place value refers to the value of each digit in a number.

**Example** : In a number 489765, place value of 7 will be  $7 \times 100$  units, *i.e.*, 700. Similarly, the place value of 8 will be  $8 \times 10,000 = 80,000$ .

- **Face Value** : The actual value of a digit in a number is the digit itself. The place value of the digit is ignored in the number.

**Example** : In a number 59,438, the face value of 4 is 4, face value of 9 is 9 etc.

#### Note

If  $x$  and  $y$  be the tens digit and unit digit respectively, then the 2-digit number formed by these digits will be  $10x + y$ .

### 4. COMPARISON OF NUMBERS

- **When both numbers have unequal number of digits**

The number having more digits is greater. It means  
..... 5-digit number > 4-digit number > 3-digit number .....

**Example** : Find out which is greater 5429683 or 65245893?

**Solution** : Since, the first number 5429683 is of 7-digit number whether the second number 65245893 is of 8-digit. Therefore, the second number is greater than the first number.

- **When both numbers have equal number of digits**

In case of the equal number of digits, we have to check the place value of the left-most digit of both numbers. If the digits of both numbers are also equal, then we move to its next digit placed on the right side and repeat the process until we get the desired result.

**Example** : Arrange the following numbers in ascending order.

5403100, 5460860, 5458087, 5420378

**Solution** : At first, we check the place value of the leftmost digit of each number. Then repeat the same process until we get the answer. Here, in each number, two leftmost digits are equal. After that, we check ten thousand place values and then arrange the digits in ascending order. Hence, we get

$$5403100 < 5420378 < 5458087 < 5460860$$

### 5. CLASSIFICATION OF NUMBERS

There are several types of numbers exist in the number system for different purposes. These numbers are classified into different groups according to their properties. These are :

- **Natural Numbers**—Counting numbers starting from 1, 2, 3..., etc. are called natural numbers. It is represented by capital letter **N**. Its set is shown as

$$N = \{1, 2, 3, 4, 5, \dots\}$$

- **Whole Numbers**—All natural numbers along with 0 is known as whole numbers. It is represented by capital letter **W**. Its set is shown as

$$W = \{0, 1, 2, 3, 4, \dots\}$$

- **Even and Odd Numbers**—A number is even if it is a multiple of two, and is odd otherwise. Even numbers are denoted by capital letter **E** and odd numbers are denoted by capital letter **O**.

$$E = \{2, 4, 6, 8, \dots\} \text{ and } O = \{1, 3, 5, 7, \dots\}$$

- **Integers**—Positive and negative counting numbers, as well as zero are called integers. Integers are denoted by capital letter **Z**.

$$Z = \{\dots -3, -2, -1, 0, 1, 2, 3, \dots\}$$

- **Prime Numbers**—An integer with exactly two positive divisors : itself and 1, is called prime number. For example : 2, 3, 5, 7, 11, 13...etc. are few prime numbers. 2 is the smallest prime number.

- **Composite Numbers**—All those numbers greater than 1 that are not prime are called composite numbers. For example : 4, 6, 8, 9, 10 etc. are few composite numbers.

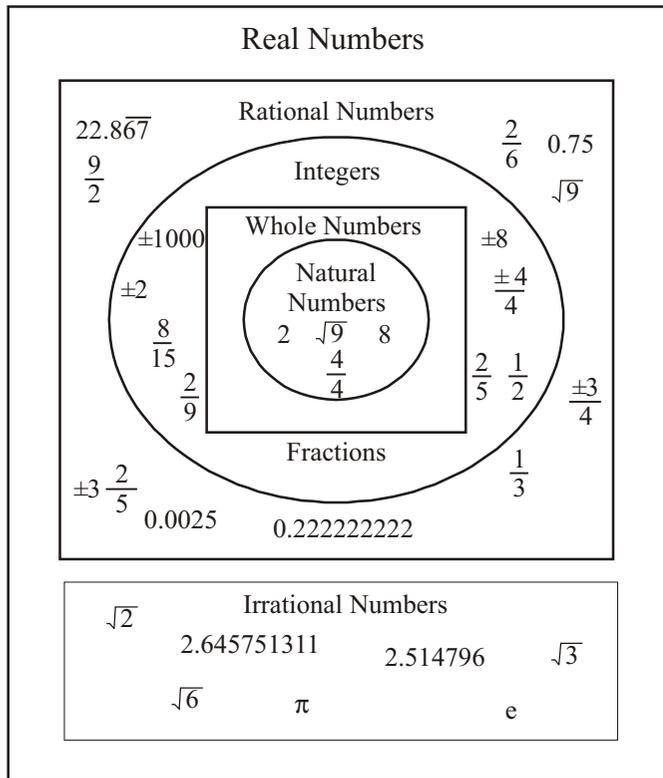
- **Rational Numbers**—Numbers that can be expressed as a ratio of an integer to a non-zero integer. Rational numbers are denoted by capital letter **Q**. All integers are rational, but the converse is not true.

$$Q = \left\{ \dots \frac{2}{3}, -1, 0, \frac{1}{4}, \dots \right\}$$

- **Irrational Numbers**—All the real numbers that are not rational are called irrational numbers. Irrational numbers are denoted by **I**.

$$I = \left\{ \dots \frac{2}{3}, \sqrt{2}, \sqrt{3}, \dots \right\}$$

- **Real Numbers**—They can be positive, negative or zero. All rational numbers are real, but the converse is not true.



## 6. DIVISIBILITY RULE

- Divisibility by 2 :**  
 If the unit digit of a number is any of 0, 2, 4, 6, 8, then the given number is divisible by 2.  
**Example :** 84, 786, 282, 1008, 5000....., etc. are divisible by 2.
- Divisibility by 3 :**  
 A number is divisible by 3, if the sum of all digits of the number is divisible by 3.  
**Example :** 786, here  $7 + 8 + 6 = 21$  (completely divisible by 3)  
 So, the number 786 will be divisible by 3.
- Divisibility by 4 :**  
 A number is divisible by 4, if the last two-digits of the number is divisible by 4.  
**Example :** 3464, here 64 is the last two-digit number which is divisible by 4.  
 So, the number 3464 will be divisible by 4.
- Divisibility by 5 :**  
 A number is divisible by 5, if the unit digit of the number is either 0 or 5.  
**Example :** 3125, 2010, 2015, 6580....., etc. are divisible by 5.
- Divisibility by 6 :**  
 A number is divisible by 6, if the number is divisible by the numbers 2 and 3.

**Example :** Test whether number 8202 is divisible by 6.

**Solution :** (i) the unit digit of the number is 2 which is divisible by 2.

(ii) the sum of digits of the number =  $8 + 2 + 0 + 2 = 12$  (divisible by 3)

Since, it is clear from (i) and (ii) that the number 8202 is divisible by both 2 and 3. So, the number will be divisible by 6.

- Divisibility by 7 :**

Take the last digit of the given number and double it. Subtract this number from the rest of the digits in the original number. If this new number is either 0 or if it is a number that is divisible by 7, then the given number is also divisible by 7.

**Example :** Test whether number 2492 is divisible by 7.

**Solution :** Here, the unit digit of the number = 2

$249 - 2 \times 2 = 245$  (divisible by 7). So, the number will be divisible by 7.

- Divisibility by 8 :**

A number is divisible by 8, if the last three-digits of the number is divisible by 8.

**Example :** Test whether number 6288 is divisible by 8.

**Solution :** Here, in the given number, 288 is the last three-digit number which is completely divisible by 8.

So, the number 6288 will be divisible by 8.

- Divisibility by 9 :**

A number is divisible by 9, if the sum of its digits is divisible by 9.

**Example :** Test whether number 7074 is divisible by 9.

**Solution :** Sum of all digits of the number =  $7 + 0 + 7 + 4 = 18$  (divisible by 9).

So, the number 7074 will be divisible by 9.

- Divisibility by 11 :**

A number is divisible by 11, if difference between the sum of digits at odd places and the sum of digits at even places, is divisible by 11.

**Example :** Test whether number 86460 is divisible by 11.

**Solution :** Sum of the all digits at even places in the number =  $6 + 6 = 12$

Sum of the all digits at odd places in the number =  $8 + 4 + 0 = 12$

Their difference =  $12 - 12 = 0$ . So, the number 86460 will be divisible by 11.

## 7. DIVISION ALGORITHM

The number which we divide is called the dividend. The number by which we divide is called the divisor. The result obtained is called the quotient. The number left over is called the remainder. Some formula are given below for Division based questions.

- Dividend = Divisor  $\times$  Quotient + Remainder

- Divisor =  $\frac{\text{Dividend} - \text{Remainder}}{\text{Quotient}}$

- Quotient =  $\frac{\text{Dividend} - \text{Remainder}}{\text{Divisor}}$

**Example :** In a question, the divisor is 4 times the quotient and 2 times the remainder. If the remainder is 20, then find the value of dividend.

**Solution :** According to Question,

$$\text{Divisor} = 2 \times \text{Remainder} = 2 \times 20 = 40 \quad \dots(1)$$

$$\text{And, Divisor} = 4 \times \text{Quotient} \\ \Rightarrow 4 \times \text{Quotient} = 40 \quad [\text{from eq.(1)}]$$

$$\Rightarrow \text{Quotient} = 40/4 = 10$$

$$\therefore \text{Dividend} = 40 \times 10 + 20 = 400 + 20 \\ = 420$$

## 8. WHOLE NUMBERS

We start counting from the number 1. Hence 1 is the first natural number and the next natural number is 2 which is obtained by adding 1 to the first number. Hence, numbers are represented in two ways according to their orderliness :

- Predecessor** —The natural number immediately preceding a natural number is its predecessor.

**Example :** Predecessor number of 65 = 65 – 1 = 64

Predecessor number of 127 = 127 – 1 = 126

- Successor** —The natural number immediately next to any natural number is its successor.

**Example :** Successor number of 785 = 785 + 1 = 786

Successor number of 109 = 109 + 1 = 110

### Important Questions

1. If  $4003250 = 4 \times 10^x + 3 \times 10^y + 2 \times 10^z + 5 \times 10^w$  then  $x + y + z + w$  is equal to :

- (A) 16 (B) 14  
(C) 12 (D) 10

2. A four digit number  $4ba5$  is divisible by 55, then, the value of  $(a - b)$  is :

- (A) 3 (B) 2  
(C) 1 (D) 0

3. If A, B and C are digits and

$$\begin{array}{r} 3 \text{ A B} \\ + \text{ A B 1} \\ \hline \text{C 1 8} \end{array}$$

then, value of C is :

- (A) 6 (B) 7  
(C) 8 (D) 9

4. What is the difference between the greatest and smallest three digit numbers that can be formed using the digits 0,2, 5 and 6 without repetitions?

- (A) 446 (B) 537  
(C) 447 (D) 400

5. Which of the following numbers is **not** divisible by 11 ?

- (A) 222222 (B) 333333  
(C) 10111013 (D) 10011013

6. If A, B and C are digits and

$$\begin{array}{r} \text{AB} \\ \times 3 \\ \hline \text{CAB} \end{array}$$

then values of A and C are :

- (A) A = 2, C = 1 (B) A = 3, C = 1  
(C) A = 4, C = 1 (D) A = 5, C = 1

7. A, B and C stand for different digits such that B is not a prime number. If  $AB \times 5 = C \text{ A B}$ , then  $A + C =$

- (A) 7 (B) 5  
(C) 3 (D) 2

8. Identify the statement which is **NOT** true,  
(A) Between any two rational numbers, there are infinitely many rational numbers.

- (B) Between a positive rational number and a negative rational number, there is always a whole number.

- (C) Every non-zero rational number has a multiplicative inverse.

- (D) There exist a pair of rational numbers such that there is only one rational number between them.

9. Which of the following numbers is divisible by 6 ?

- (A) 53636 (B) 46356  
(C) 46358 (D) 43538

10. If the 8-digit number  $179x \text{ 091}y$ , is divisible by 88, then what is the value of  $(x - y)$  ?

- (A) 3 (B) 4  
(C) 1 (D) 2

11. If  $52272 = p^2 \times q^3 \times r^4$ , where p, q and r are prime numbers, then the value of  $(2p + q - r)$  is :

- (A) 22 (B) 23  
(C) 29 (D) 21

12. We call a number perfect if it is the sum of all its positive divisors, except itself. For example, 28 is a perfect number because  $28 = 1 + 2 + 4 + 7 + 14$ . Which of the following numbers is a perfect number ?

- (A) 13 (B) 10  
(C) 9 (D) 6

13.  $2^{10} - 1$  is divisible by :

- (A) 3 (B) 4  
(C) 10 (D) 2

14. If  $\overline{148101a095}$  is a multiple of 11, where a is a digit, the value of a is :

- (A) 0 (B) 4  
(C) 1 (D) 2

15. Find the value of A and B in

$$\begin{array}{r} \text{BA} \\ \times \text{B 3} \\ \hline \text{5 7 A} \end{array}$$

(A) A = 5 and B = 2  
(B) A = 5 and B = 5  
(C) A = 2 and B = 2  
(D) A = 2 and B = 5

16. If  $[1X2Y6Z]$  is a number divisible by 9, then the least value of  $X + Y + Z$  is :

- (A) 0 (B) 1  
(C) 6 (D) 9

17. You are given the multiplication of two numbers as below :

$$\begin{array}{r} 5 \text{ A } 3 \\ \times \text{ B } 2 \\ \hline 1 \text{ C } 4 \ 6 \\ + 2 \ \text{D } 9 \ 2 \times \\ \hline \text{E } 1 \ \text{F } \text{G } 6 \end{array}$$

The values of the letters A, B, C, D, E, F and G are :

- (A) A = 2, B = 4, C = 0, D = 0, E = 2, F = 9, G = 6

- (B) A = 7, B = 4, C = 1, D = 0, E = 2, F = 0, G = 6

- (C) A = 2, B = 4, C = 1, D = 0, E = 2, F = 0, G = 6

- (D) A = 7, B = 4, C = 0, D = 9, E = 2, F = 9, G = 6

18. Find the values of A, B, C in the following:

$$\begin{array}{r} 9) 4AB ( 5C \\ \underline{-45} \\ 3B \\ \underline{-36} \\ 0 \end{array}$$

Then what is the value of ?

- (A) 10 (B) 14  
(C) 16 (D) 18
19. Find the value of A, B, C and D in the following addition :

$$\begin{array}{r} 3 A B 6 \\ + D 1 7 C \\ \hline 7 4 3 0 \end{array}$$

- (A) A = 2, B = 5, C = 4 and D = 4  
(B) A = 5, B = 4, C = 3 and D = 3  
(C) A = 4, B = 3, C = 5 and D = 4  
(D) A = 3, B = 4, C = 5 and D = 6
20. Find the value of A, B and C in the following subtraction :

$$\begin{array}{r} 4 3 A \\ - B C 9 \\ \hline 2 4 7 \end{array}$$

- (A) A = 6, B = 1, C = 7  
(B) A = 6, B = 1, C = 8  
(C) A = 5, B = 6, C = 3  
(D) A = 4, B = 3, C = 4

21. In a division question, the denominator is 10 times its quotient and 5 times the remainder. Accordingly, if the remainder is 46, what will be the dividend ?

- (A) 4236 (B) 4306  
(C) 4336 (D) 5336

22. Which statement among the following is not true ?

- (A) Every natural number is an integer.  
(B) Every natural number is a real number.  
(C) Every real number is a rational number.  
(D) Every integer is a rational number.

23. Find the sum of all those prime numbers that are not larger than 17.

- (A) 59 (B) 58  
(C) 41 (D) 42

24. The product of a non zero rational number and its reciprocal is \_\_\_\_\_.

- (A) 1  
(B) 0  
(C) rational number itself  
(D) reciprocal of rational number

25. Which one of the following rational number is additive identity for rational numbers ?

- (A) 0 (B) 1  
(C) 2 (D) 3

26. A negative integer and a positive integer whose difference is + 2, are :

- (A) - 1, 3 (B) - 2, 4  
(C) - 1, 1 (D) - 4, 6

27. For some natural number  $m$ , the product  $m(m+2)(m+4)$  will always divide :

- (A) Form 3 (B) Form 5  
(C) Form 7 (D) Form 2

## Solutions

1. (C)  $4003250 = 4 \times 10^6 + 3 \times 10^5 + 2 \times 10^4 + 5 \times 10^3 \dots(i)$

On writing the place value of 4,3,2, and 5  
= 4000000 or  $4 \times 10^6$

Place value of 3  
= 3000 or  $3 \times 10^3$

Place value of 2 = 200 or  $2 \times 10^2$

Place value of 5 = 50 or  $5 \times 10^1$

So 4003250 can be expressed in the following way

$$= 4 \times 10^6 + 3 \times 10^3 + 2 \times 10^2 + 5 \times 10^1 \dots(ii)$$

Comparing eqn (ii) to eqn (i)

$$x = 6$$

$$y = 3$$

$$z = 2$$

$$w = 1$$

$$\therefore x + y + z + w = 6 + 3 + 2 + 1 = 12.$$

2. (C)  $55 = 5 \times 11$  means the numbers is divisible by both 5 and 11  
Divisibility rule of 5  
Last two numbers must be divisible by 5

Putting  $a = 2$

divisibility rule of 11 =  $4b25$

$$4 + 2 - (b + 5) = 0$$

$$6 - (b + 5) = 0$$

$$1 - b = 0$$

$$1 = b$$

$$(a - b) = (2 - 1) = 1$$

3. (C)  $\frac{1}{3} A B = 7$

$$\underline{A B 1}$$

$$\underline{C 1 8}$$

$$B = 7$$

$$A = 4$$

$$C = 8$$

4. (C) From digits 0, 2, 5, 6

Largest number = 652

Smallest numbers = 205

Hence difference = 447

5. (D) Divisibility rule of 11 - If the sum of the digits in even places of the given number and the difference between digits in odd places should be divisible by 0 or 11.

From option (A), 222222

sum of digits in even places

$$= 2 + 2 + 2 = 6$$

Sum of digits in odd places

$$= 2 + 2 + 2 = 6$$

Required difference =  $6 - 6 = 0$

Hence the number is divisible by 11.

Option (B) to 333333

sum of digits in even places

$$= 3 + 3 + 3 = 9$$

sum of digits in odd places

$$= 3 + 3 + 3 = 9$$

Required difference =  $9 - 9 = 0$

Hence the number 333333 is divisible by 11.

From option (C) 10111013  
sum of digits in even places

$$= 0 + 1 + 0 + 3 = 4$$

Sum of digits in odd places =  $1 + 1 + 1 + 1 = 4$

Required difference =  $4 - 4 = 0$

Hence the number 10111013 is divisible by 11.

Option (D) to 10011013

sum of digits in even places

$$= 0 + 1 + 0 + 3 = 4$$

sum of digits in odd places

$$= 1 + 0 + 1 + 1 = 3$$

Required difference =  $4 - 3 = 1$

Hence, the number 10011013 is not divisible by 11.

6. (D)  $\begin{array}{r} \boxed{A} B \\ \times 3 \\ \hline C \boxed{A} B \end{array}$

From option (D),  $A = 5, C = 1$

$$\begin{array}{r} \boxed{5} B \\ \times 3 \\ \hline 1 \boxed{5} B \end{array}$$

Hence option (D) is correct

7. (A)  $\begin{array}{r} A B \\ \times 5 \\ \hline C A B \end{array}$

If B is not prime number then

$$\begin{array}{r} 5 \ 0 \\ \times 5 \\ \hline 2 \ 5 \ 0 \end{array}$$

Hence A = 5, B = 0, C = 2

$$A + C = 5 + 2 = 7$$

8. (D) The statement that there is a rational number in between a pair of two rational numbers is not true. Since there are infinite numbers of rational numbers between them. Hence option (D) is correct.

9. (B) Divisibility by 6 – If a number is divisible by both 2 and 3, then the number is also divisible by 6.

In the number 46356 the last digit is 6 which is divisible by 2 then the number 46356 will be divisible by 2

The sum of the digits of the number 46356 = 4 + 6 + 3 + 5 + 6 = 24 which is divisible by 3 then the number 46356 will be divisible by 3.

If the number 46356 is divisible by both 2 and 3, it will also be divisible by 6.

10. (D) 179x 091y, is divisible by 88 then it will also be divisible by 8 and 11.

to be divisible by 8,

If the last 3 digits are divisible by 8 then the given number is also divisible by 8. Then, y = 2

to be divisible by 11,

If the difference between the sum of the digits at the even places and the sum of the digits at the odd places is divisible by 11, then the given number will also be divisible by 11.

$$\begin{aligned} (7 + x + 9 + y) - (1 + 9 + 0 + 1) \\ = 16 + x + y - 11 \\ = 5 + x + y \\ = 5 + x + 2 \\ = 7 + x \end{aligned}$$

(7 + x) to be divided by 11

$$x = 4$$

$$\text{So } x - y = 4 - 2 = 2$$

11. (B)  $52272 = p^2 \times q^3 \times r^4 \dots (1)$

$$\begin{array}{r|l} 2 & 52272 \\ \hline 2 & 26136 \\ 2 & 13068 \\ 2 & 6534 \\ 3 & 3267 \\ 3 & 1089 \\ 3 & 363 \\ 11 & 121 \\ 11 & 11 \\ & 1 \end{array}$$

$$\therefore 52272 = 2^4 \times 3^3 \times 11^2 \dots (2)$$

From eqn (i) and eqn (ii)

$$p = 11, q = 3, r = 2$$

$$\therefore \text{value of } (2p + q - r)$$

$$= 2 \times 11 + 3 - 2$$

$$= 22 + 1$$

$$= 23$$

12. (D) whole number

$$\text{Example : } 28 = 1 + 2 + 4 + 7 + 14$$

$$\text{Similarly } 6 = 1 + 2 + 3$$

where 1, 2 and 3 are positive factors of 6.

$$\Rightarrow 13 \neq 1 + 13$$

$$\Rightarrow 10 \neq 1 + 2 + 5$$

$$\Rightarrow 9 \neq 1 + 3$$

Hence, 6 is a whole number.

13. (A)  $2^{10} - 1 = 2^{10} - 1^{10}$

when  $n = \text{even}$  then  $(x^n - a^n)$ , is divisible by  $(x + a)$

so,  $2^{10} - 1^{10}$ , will be divisible by  $(2 + 1 = 3)$

14. (B) Given, number  $\overline{148101a095}$

Divisibility rule of 11 : A number is divisible by 11 if the sum of the digits in the odd places and the sum of the digits in the even places difference is a multiple of 11 or zero, then result is divisible by 11.

Taking odd places terms :

$$S_1 = 1 + 8 + 0 + a + 9 = 18 + a$$

Taking even places terms :

$$S_2 = 4 + 1 + 1 + 0 + 5 = 11$$

$$\text{Now, } S_1 - S_2 = 18 + a - 11 = 7 + a$$

To divisible  $(7 + a)$  by 11 possible value of  $a$  is 4.

15. (A)

$$\begin{array}{r} \text{B A} \\ \times \text{B 3} \\ \hline 57\text{A} \end{array}$$

By hit and trial method and according to given options,

$$\begin{array}{r} \text{B 5} \\ \times \text{B 3} \\ \hline 575 \end{array}$$

If B = 2, then

$$\begin{array}{r} 25 \\ \times 23 \\ \hline 75 \\ 50 \times \\ \hline 575 \end{array}$$

Hence, the required value of A = 5 and B = 2.

16. (A) According to the question,

$$\text{Given number} = 1X2Y6Z$$

If it is divisible by 9, then its sum must be divisible by 9.

$$= 1 + X + 2 + Y + 6 + Z$$

$$= 9 + X + Y + Z$$

So, for the least value, X + Y + Z must be 0, so that sum is divisible by 9.

$$\therefore X + Y + Z = 0$$

17. (A) Given,

$$\begin{array}{r} 5 \text{ A } 3 \\ \times \text{B } 2 \\ \hline 1 \text{ C } 4 6 \\ + 2 \text{ D } 9 2 \times \\ \hline \text{E } 1 \text{ F } \text{ G } 6 \end{array}$$

From option (A), put A = 2, B = 4, C = 0, D = 0, E = 2, F = 9, G = 6

$$\begin{array}{r} 5 \text{ 2 } 3 \\ \times 4 \text{ 2} \\ \hline 1 \text{ 0 } 4 \text{ 6} \\ + 2 \text{ 0 } 9 \text{ 2 } \times \\ \hline 2 \text{ 1 } 9 \text{ 6 } 6 \end{array}$$

These values satisfy the multiplication. Hence, option (A) is the correct answer.

18. (D) In the given division method,

$$A - 5 = 3 \Rightarrow A = 8$$

$$B - 6 = 0 \Rightarrow B = 6$$

$$\text{and } 36 = 9C \Rightarrow C = 4$$

$$\therefore A + B + C = 8 + 6 + 4 = 18$$

19. (A)  $6 + C = 10$

$$\Rightarrow C = 4, \text{ and } 1 \text{ is carried over.}$$

Also,  $(1 + B) + 7$  is a number whose units digit is 3.

$$\therefore (1 + B) + 7 = 13$$

$$\Rightarrow B + 8 = 13$$

$$\Rightarrow B = 5$$

and 1 is carried over.

$$\text{Now, } (1 + A) + 1 = 4$$

$$\Rightarrow A + 2 = 4$$

$$\Rightarrow A = 2$$

$$\text{Further, } 3 + D = 7$$

$$\Rightarrow D = 7 - 3 = 4$$

Hence, A = 2, B = 5, C = 4 and D = 4

20. (B)  $16 - 9 = 7$

$$\Rightarrow A = 6, \text{ and } 1 \text{ is borrowed from } 3.$$

$$\text{Now, } 12 - 8 = 4,$$

So, C = 8 and 1 is borrowed from 4.

$$\text{Finally, } 3 - 2 = 1$$

$$\text{So, } B = 1$$

Hence, A = 6, B = 1 and C = 8.

21. (D) According to the question,

$$\text{Divisor} = \text{Quotient} \times 10$$

$$\text{Divisor} = \text{Remainder} \times 5$$

$$\text{Divisor} = 46 \times 5 = 230$$

$$\text{Quotient} = \frac{\text{Divisor}}{10} = \frac{230}{10} = 23$$

$$\begin{aligned}\text{Dividend} &= \text{Divisor} \times \text{Quotient} \\ &\quad + \text{Remainder} \\ &= 230 \times 23 + 46 \\ &= 5290 + 46 = 5336\end{aligned}$$

22. (C) Every real number is a rational number.

23. (B) Prime numbers up to 17  
 $= 2, 3, 5, 7, 11, 13, 17$

$$\begin{aligned}\therefore \text{Required sum} \\ &= 2 + 3 + 5 + 7 + 11 + 13 + 17 \\ &= 58\end{aligned}$$

24. (A) Let, non-zero rational number  $= \frac{m}{n}$

So, its reciprocal will be  $= \frac{n}{m}$

(According to question),

$$\frac{m}{n} \times \frac{n}{m} = 1$$

$\Rightarrow$  option (A) is correct.

25. (A) Zero (0)

26. (C) From option (C)

$$1 - (-1) = 1 + 1 = 2$$

So, option (C) is correct.

27. (A) putting  $m = 1$

$$m(m+2)(m+4) = 1 \times 3 \times 5 = 15$$

is divisible by 3

putting  $m = 2$

$$m(m+2)(m+4) = 2 \times 4 \times 6 = 48$$

is divisible by 3

putting  $m = 3$

$$m(m+2)(m+4) = 3 \times 5 \times 7 = 105,$$

is divisible by 3

Hence,  $m(m+2)(m+4)$ , is divisible by 3

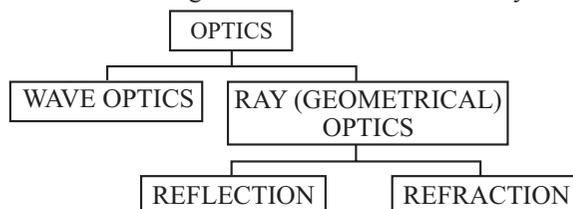
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# Chapter 2

## Light, Sound and Optical Instruments

### 1. Light

- Light is a form of energy which helps us to see our surroundings and it travels in the form of electromagnetic waves. This energy travels from a source in all directions and the direction along which it travels is called a ray of light.



- In 1665, the Danish astronomer Ole Roemer first estimated the speed of light to be about 220,000 km per second.
- In 1849, the first land based estimate was made by Armand Fizeau. Today the speed of light in vacuum is known to be almost exactly 300,000 km per second.
- The speed of light in some media is given below :

Substance	Speed of Light (ms <sup>-1</sup> )	Refractive Index (μ)
Water	$2.25 \times 10^8$	1.33
Glass	$2 \times 10^8$	1.5
Diamond	$1.25 \times 10^8$	2.41
Air	$3 \times 10^8$	1.00

**Note :** The refractive index of a medium is also defined in terms of speed of light in different media.



### Exam Pointers

- The intensity of light can be measured with the help of a Lucimeter.
- The wavelength, frequency and velocity of light changes when a light wave passes from air to glass.
- When light moves from a denser to rarer medium, its speed increases.

### Speed of Light on Different Mediums

Medium	Speed of Light (m/s)
1. Vacuum	$3 \times 10^8$
2. Water	$2.25 \times 10^8$
3. Turpentine Oil	$2.04 \times 10^8$
4. Glass	$2 \times 10^8$
5. Rock Salt	$1.96 \times 10^8$
6. Nylon	$1.96 \times 10^8$

### Principles Related to Light

1. Newton	particle theory of light
2. Huygens	wave theory of light
3. Gremaldi	diffraction theory of light
4. Thomas Young	interference theory of light
5. Foucault	wave theory related to the speed of light of liquids
6. Max Plank	quantum theory of light
7. MaxWell	photo-electromagnetic wave theory
8. Einstein	Electromagnetic wave (photon) theory of light
9. Compton	compton effect of light

### Difference Between Regular Reflection and Diffuse Change

Regular/ Specular Reflection	Diffused Reflection
This reflection occurs from the polished reflecting surface.	This change is caused by a rough surface
If the incident rays are parallel, then in this reflection the reflected rays will also be parallel.	If the incident rays are parallel, then in this reflection the reflected rays will not be parallel to each other.

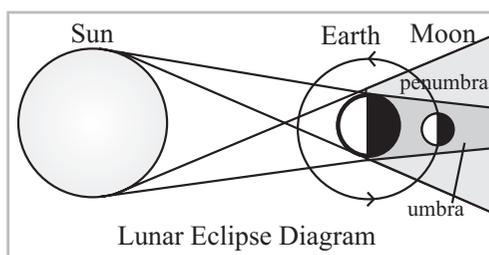
- Luminous Objects:** The objects which can emit their own light are known as Luminous Objects. *Examples*—Sun, Candle and Bulb etc.
- Non-Luminous Objects:** The objects which cannot emit light but can reflect or scatter the light which falls on them are known as Non-Luminous Objects. *Examples*—Chair, Table etc.
- Transparent Objects:** The objects which allow the light to pass through them are known as transparent objects. Exp. Glass.
- Opaque Objects:** The object which do not allow the light to pass through there are known as opaque objects. Exp. Chair.
- Translucent Objects:** The objects which allow small amount of light to pass through then are known as translucent objects. Exp. Filmed Gas.

### 2. Rectilinear Propagation of Light

- The rectilinear propagation of light is such a phenomenon which tells us that the light travels in a straight line. It can change its direction when it is reflected from a surface or its

medium is changed. This phenomenon is used to understand different optical phenomenon.

- If the light comes from an appointed source, then the shadow obtained is a region of total darkness called **Umbra**.
- If the light comes from an extended source then, we find that in the shadow, the umbra is surrounded by a region of partial darkness and this region is known as **Penumbra**.
- The same situation can be seen when the moon comes in between the Earth and the sun (Solar Eclipse). In this case the sun is either partially visible or not visible at all.
- When the Earth comes in between the moon and the sun, the situation is known as the Lunar **Eclipse**. In this case the moon is either partially visible or not visible at all.



### 3. Reflection of Light

- The bouncing of light from the surface of a body is known as reflection.
- A light ray which strikes the surface is called an incident ray.
- The light ray that comes out from the reflecting surface after reflection is called a reflected ray.



#### Exam Pointers

- On reflection, the speed, wavelength and frequency of a light wave does not change. It is so because the light ray returns to the medium from which it had come.
- Although after reflection there is decay in the energy of the light ray.

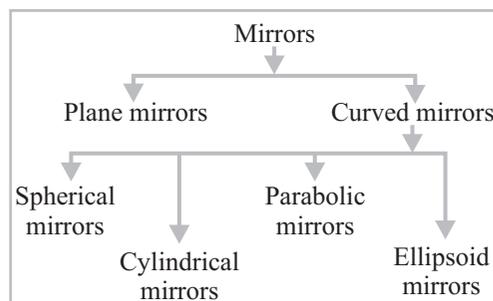


#### Knowledge Facts

- An umbrella with top white and bottom black is most appropriate to avoid sunlight.
- **Albedo**: It is a measure of reflectivity of the surface. It is the fraction of light or radiation that is reflected by a body or surface.

### 4. Mirrors

- A surface which reflects light and creates clear images is called a mirror. The German scientist Justus von Liebig coated the plane surface of a piece of ordinary glass with silver metal and made the first mirror. Such a mirror is called a silvered glass mirror.



#### I. Plane Mirror

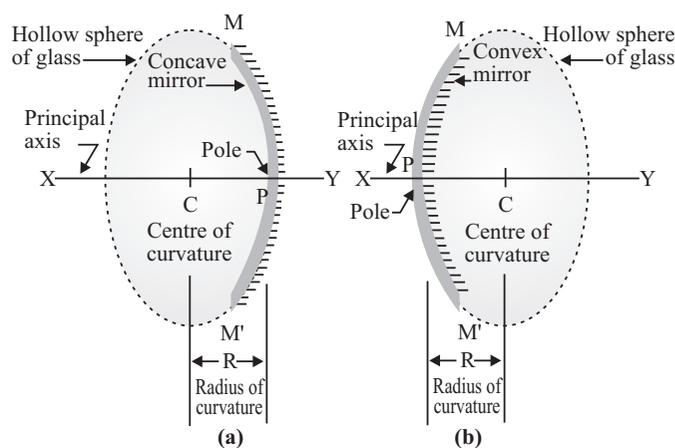
- If the reflecting surface of a mirror is plane then it is called a plane mirror.
- It forms a virtual and erect image. The size of the image formed is always equal to the size of the object.
- Plane mirrors are used in making looking glasses, periscopes (Used in Submarines), Kaleidoscopes.
- For a person to view his entire body in the mirror, the height of the mirror should be at least half of his height.

$$\text{Height of the Mirror} = \text{Height of a Person}/2$$

- **Lateral Inversion**: The word lateral comes from the Latin word “latus” which means side. Lateral inversion means sidewise inversion. It is the apparent inversion of left and right that occurs in a plane mirror. In other words, **Lateral inversion** is the real or apparent reversal of left and right.

#### II. Spherical (Curved) Mirrors

- Spherical mirrors are one form of curved mirrors. If the curved mirror is a part of a sphere, then it is called a ‘spherical mirror’. One side of this mirror is silvered and the reflection of light occurs at the other side.



- ❖ **Focal Length ( $f$ )**: The distance between the pole and the principal focus is called focal length ( $f$ ) of a spherical mirror.

$$\text{Focal length} = \text{Radius of curvature}/2$$

- ❖ Spherical mirrors are of two types—Concave Mirror (Converging Mirror) and Convex Mirror (Diverging Mirror).

(i) **Concave Mirror:** Concave mirror is that spherical mirror in which the reflection of light takes place at the concave or bent-in surface. These mirrors magnify the object placed close to them.

- Ray Diagrams for the formation of Images by a Concave Mirror

- **Uses of Concave Mirror:**

- ❖ **Direct Light to Long Distance:** Used in Torches, search lights and headlights.
- ❖ **Collect Light Efficiently:** They can collect the light from a larger area and focus it into a small spot. Hence, they are used in solar cookers.
- ❖ **Provide Shadow-free Illumination of the Organ:** Head mirrors used by doctors to examine the eye, ear, nose and throat. They are also used in reflecting telescopes.

(ii) **Convex Mirror:** A convex mirror is that spherical mirror in which reflection of light takes place at the convex or bulged-out surface. The image formed by these mirrors is smaller than the object.

- **Uses of Convex Mirror:**

- ❖ Convex mirrors are installed on public roads as traffic safety devices. They are used in acute bends of narrow roads such as hairpin bends in mountain passes where direct view of oncoming vehicles is restricted. It is also used in blind spots in shops.



### Exam Pointers

- Convex mirrors are used to get an extended view of a region. That's why these are used as rear view mirrors in vehicles.
- Convex mirrors will always make an image smaller than the object.
- Convex mirrors are used in reflecting lamps because they spread light in a larger area.
- Nowadays, high intensity sodium lamps are being used on roads for lighting. In these lamps Neon (Ne) gas is used.

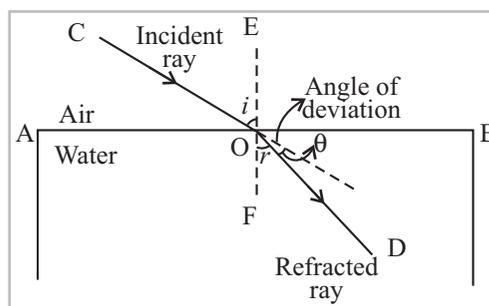


### Knowledge Fact

- If a mirror is rotated through an angle  $q$ , and the incident ray is kept the same, then the reflected ray will turn through an angle of  $2\theta$ .

## 5. Refraction

- Light rays get deviated from their original path while entering from one transparent medium to another medium of different optical density. This deviation (change in direction) in the path of light is known as Refraction.



## 6. Refractive Index

- The amount of refraction of light in a medium is denoted by a term known as refractive index of the medium, which is the ratio of the speed of light in the air to the speed of light in that particular medium. Refractive index depends on the velocity of light in the medium.
- It is also known as the absolute refractive index and it is denoted by the Greek letter ' $\mu$ ' (pronounced as 'mew'). Refractive Index represents the extent to which the ray of light bends.

$$\mu = \frac{\text{Speed of light in air } (c)}{\text{Speed of light in the medium } (v)}$$



### Exam Pointers

- The bottom of a pond/water tank appears to be raised/less deep due to refraction of light.
- A pencil immersed in water appears to be bent due to the refraction of light.
- A lemon kept in water appears to be bigger due to the refraction of light.
- We know that the refractive index of glass is minimum for red colour and maximum for violet colour.
- Higher the refractive index, lower the speed of light.

### I. Total Internal Reflection

- When a ray of light passes from a denser medium to a rarer medium, the refracted ray is bent away from the normal. As the angle of incidence increases, the angle of refraction also increases. At a certain angle of incidence, the angle of refraction becomes  $90^\circ$ . The angle of incidence for which the angle of refraction becomes  $90^\circ$  is called the critical angle C.



### Exam Pointers

- It is clear that Total Internal reflection takes place when a light ray moves from denser medium to rarer medium.
- So TIR can occur when light moves from glass (More Dense) to water (Less Dense) but not when it moves from water (Less Dense) to glass (More Dense).

- The refractive index of water is 1.33 while that of glass is 1.5.
- Total internal reflection is the reason for shine of water droplet.

## II. Total Internal Reflection in Nature

- **Mirage:** On hot summer days, while travelling on a straight hot road or in deserts, we observe the patch of water on the road which keeps moving ahead as we approach it. This is an illusion which takes place at this place. In summer, the air near the ground becomes hotter than the air at higher levels. The refractive index of air increases with its density. Hotter air is less dense, and has a smaller refractive index than cooler air. If the air currents are small, that is, the air is still, the optical density of different layers of air increases with height. As a result, light from an object such as a car, passes through a medium whose refractive index decreases towards the ground. Thus, a ray of light from such an object successively bends away from the normal and undergoes total internal reflection, if the angle of incidence for the air near the ground exceeds the critical angle.
- ❖ **Brilliance in Diamonds:** It occurs mainly due to the total internal reflection of light inside them. The critical angle for diamond – air interface ( $\theta_c = 24.4^\circ$ ) is very small; therefore once light enters a diamond, it is very likely to undergo total internal reflection inside it.



### Knowledge Facts

- Small glass beads fixed on the traffic signals glow brightly when light falls upon them because light is totally reflected when the angle of incidence exceeds a certain critical value and light travelling in a denser medium is reflected from a rarer medium.
- Size of the sun at dusk, the colour of the sun at dawn and the twinkling of the stars are optical illusions.



### Do You Know?

★ Indian-born physicist Narinder Kapany is regarded as the Father of Fibre Optics.

- **Rainbow:** Rainbow is a beautiful natural phenomenon. It is the combined effect of a number of natural processes. Such as dispersion, refraction and total internal reflection of light. It can be seen mainly after a rainfall. Small droplets of water act as small prisms. When light rays from the Sun enter these droplets, it gets refracted and dispersed. Then there is internal reflection as shown in the figure, and after that once again the light gets refracted while coming out of the droplet. All these three processes together produce the rainbow.



### Knowledge Fact

- At 12 noon, the rainbow cannot be seen because rainbow is formed opposite to the sun.

## 7. Lenses

- A lens is an optically transparent medium bounded by two spherical refracting surfaces or one plane and one spherical surface.
- Lens is basically classified into two types: Convex Lens and Concave Lens.
- **Convex or bi-convex Lens:** It is a lens bounded by two spherical surfaces such that it is thicker at the centre than at the edges. A beam of light passing through it, converges to a point. So, a convex lens is also called a converging lens.
- **Concave or bi-concave Lens:** It is a lens bounded by two spherical surfaces such that it is thinner at the centre than at the edges. A parallel beam of light passing through it is diverged or spread out. So, a concave lens is also called a diverging lens.
- **Uses of Convex Lens:**
  - ❖ Convex lenses are used as camera lenses.
  - ❖ Convex Lenses are used in reading glasses.
  - ❖ They are used as magnifying lenses.
  - ❖ They are used in making microscopes, telescopes and slide projectors.
  - ❖ They are used to correct the defect of vision called hypermetropia.
- **Uses of Concave Lens:**
  - ❖ Concave lenses are used as eye lenses of ‘Galilean Telescope’.
  - ❖ They are used in wide angle spy holes in doors.
  - ❖ They are used to correct the defect of vision called ‘myopia’.

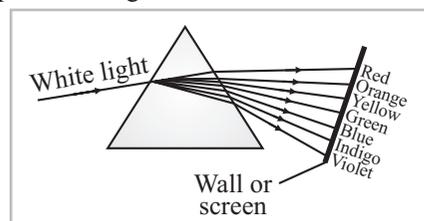


### Exam Pointers

- Lenses are made of crown glass and flint glass.
- Contact lenses were invented by Adolf Gaston Engen.

## 8. Dispersion of Light and Colours

- When a beam of white light or composite light is refracted through any transparent media such as glass or water, it is split into its component colours. This phenomenon is called as ‘dispersion of light’.



- This band of seven colours is termed as spectrum. This spectrum consists of the following colours: Violet, Indigo,

Blue, Green, Yellow, Orange and Red. These colours are represented by the acronym “VIBGYOR”.

- Please note that Sir Issac Newton was the first person to use a glass prism to obtain the Sun's spectrum.
- Angle of refraction is the smallest for red and the highest for violet. Please note that the refractive index of a medium is dependent on the wavelength of the light.
- Violet colour has the shortest wavelength (close to 400 nm) and the red color has the longer wavelength (close to 700 nm).

## 9. Colours

- **Synthesis of colour** is the method of creating colour by mixing various proportions of two (or) three distinct colours of light. These distinct colours are Red, Green and Blue called primary colours. Equal proportions of two primary colours create a secondary color. Magenta, Cyan and yellow are called secondary colours.
  - ❖ Red + Green = Yellow
  - ❖ Red + Blue = Magenta
  - ❖ Green + Blue = Cyan (Aqua Colour)
- Those primary and secondary colours which on mixing produce white colour are known as **Complementary Colours**.
  - ❖ Red + Cyan = White
  - ❖ Red + Magenta = White
  - ❖ Green + Magenta = White
  - ❖ Blue + Yellow = White

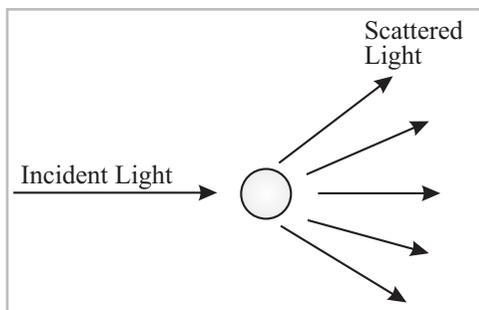


## Exam Pointers

- In a visual display unit, the primary colours are red, green and blue.
- In photography also, primary colours are red, green and blue.

## 10. Scattering of Light

- When sunlight enters the Earth's atmosphere, the atoms and molecules of different gases present in the atmosphere refract the light in all possible directions. This Phenomenon is called 'Scattering of light'. The interacting particle of the medium is called a 'scatterer'.



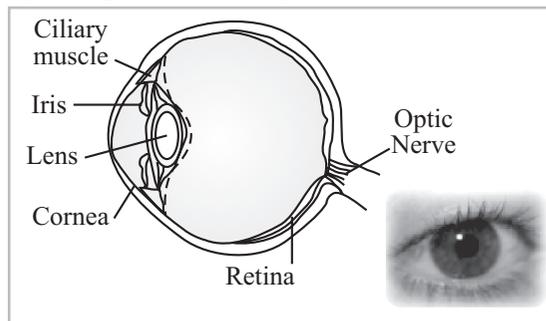
## Do you know?

- In Colloidal solution there is a microscopically small substance that is equally dispersed throughout another material. Example: Milk, Ice cream, muddy water, smoke.

## 11. Human Eye

- The eye has a roughly spherical shape with a diameter of 2.3 cm. It is most sensitive to yellow-green light having the wavelength of 5500 Angstrom or 555 nm. It consists of a tough membrane called sclera, which protects the internal parts of the eye.

Important parts of human eye are:



- ❖ **Cornea:** This is the thin and transparent layer on the front surface of the eyeball as shown in figure 2.15. It is the main refracting surface. When light enters through the cornea, it refracts or bends the light onto the lens.
- ❖ **Iris:** It is the coloured part of the eye. It may be blue, brown or green in colour. Every person has a unique colour, pattern and texture. Iris controls the amount of light entering into the pupil like the camera aperture.
- ❖ **Pupil:** It is the centre part of the Iris. It is the pathway for the light to retina.
- ❖ **Ciliary Muscles:** Eye lens is fixed between the ciliary muscles. It helps to change the focal length of the eye lens according to the position of the object.
- ❖ **Retina:** This is the back surface of the eye. It is the most sensitive part of the human eye, on which real and inverted images of objects are formed. The retina is a delicate membrane (similar to a film in camera) having an enormous number of light-sensitive cells.
- ❖ **Eye Lens:** It is an important part of the human eye. It is convex in nature.
- ❖ **Aqueous Humor:** It is also a fluid found between iris and the eye lens.
- ❖ **Vitreous Humor:** It is a clear gel-like substance that occupies the space behind the lens and in front of the retina at the back of the eye.

## 12. Defects of an Eye

- **Myopia (Short sightedness) :** It occurs due to the lengthening of the eyeball. The affected cannot see farther

objects but can see near objects clearly. To remove this defect, a concave lens is used.

- **Hypermetropia (Long sightedness)** : It occurs due to the shortening of the eyeball. Affected people cannot see nearer objects but can see farther objects clearly. To remove this defect, a convex lens is used.
- **Presbyopia**: It is a combination of myopia and hypermetropia and always happens in old age as the eye loses its power of accommodation. It can be rectified by bifocal lenses.
- **Cataract**: Sometimes, the crystalline lens of people at old age becomes milky and cloudy. This condition is called cataract. This causes partial or complete loss of vision. It is possible to restore vision through a cataract surgery.
- **Astigmatism**: It occurs due to the imperfect structure of the eye lens because of the development of cataract on the lens, ulceration of cornea, injury to the refracting surfaces etc. In it a person is unable to see horizontal and vertical lines clearly simultaneously.
- **Colour Blindness**: It is a genetic disease in which a person is unable to differentiate between colours (mainly green and red). This disease cannot be rectified by any of the lenses. Daltonism (Protanopia) is also a form of colour blindness in which a person cannot distinguish green-blue and red colours.



### Knowledge Fact

- Direct viewing of the sun during a total solar eclipse causes irreversible damage to the eyes. This retinal burn is caused by the UV rays.



### Do You Know?

- ★ A human being has a horizontal field of view of about  $150^\circ$  with one eye and of about  $180^\circ$  with two eyes.
- ★ Some animals, usually prey animals, have their two eyes positioned on opposite sides of their heads to give the widest possible field of view.
- ★ If we shut one eye, then the world looks flat two-dimensional. On keeping both eyes open, the world takes on the third dimension of depth.

## 13. Optical Instruments

### I. Microscope

- This is an optical instrument, which helps us to see tiny (very small) objects. It is classified as **Simple microscope** and **Compound microscope**.

### II. Telescope

- Telescope is an optical instrument to see distant objects.
- The first telescope was invented by Johann Lippershey in 1608.
- Kepler invented Telescope in 1611 which was fundamentally similar to the astronomical telescope.

### III. Kaleidoscope

- This device consists of three plane rectangular mirrors of equal lengths and breadths inclined at an angle of  $60^\circ$  enclosed in a cylinder tube.

### IV. Periscope

- This device consists of two plane mirrors inclined at an angle of  $45^\circ$  such that their reflecting surfaces are oppositely directed.

## 14. Sound

- The to and fro or back and forth motion of an object is termed as vibration (oscillatory motion). When we pluck the string of an instrument, like the sitar, the whole instrument is forced to vibrate, and it is the sound of the vibration of the instrument that we hear.
- Sound is an energy that is produced by the vibration of a body and it produces the sensation of hearing in our ears.
- Since sound is a mechanical wave, it needs a material medium like air, water, steel etc., for its propagation. It cannot travel through a vacuum. That is why we cannot hear sound in space/moon.
- If there is an explosion on the moon, we will not hear its sound on the earth because there is vacuum between the moon and the earth and sound doesn't travel in vacuum.

### Sources of Noise Pollution and Its Effect

Source	Intensity	Effects Felt by Humans
Range of human hearing	$0 (1 \times 10^{-12} \text{ w/m}^2)$	audible
Rustling of leaves	10	Noiseless
Average whisper	20	Noiseless (quiet)
Radio	40	Noiseless (quiet)
Quiet motor vehicles	50	Moderately noisy
Normal conversation	65	Moderately noisy
Traffic on a busy road	70-80	very noisy
Motorbike or Heavy vehicle	90	very noisy
Zet engine (35 m)	105	Inconvenient
Lightning	$120 (1 \text{ w/m}^2)$	Inconvenient
Flying Zet engine	150	Annoying sound
Rocket propellant	180	Annoying sound

- The particles of the medium oscillate about their central or mean positions, in a direction parallel to the propagation of

the wave. Such waves are called **longitudinal waves**. Eg., Sound Wave.

- When particle's oscillations are perpendicular to the direction of propagation of the wave; such waves are called **transverse waves**. Eg., Light wave.
- The difference between light and sound has been given in the following table:

S.No.	Sound	Light
1.	Medium is required for the propagation.	Medium is not required for the propagation.
2.	Sound waves are longitudinal.	Light waves are transverse.
3.	Wavelength ranges from 1.65 cm to 1.65 m.	Wavelength ranges from $4 \times 10^{-7}$ m to $7 \times 10^{-7}$ m.
4.	Sound waves travel in air with a speed of about $340 \text{ m s}^{-1}$ at NTP.	Light waves travel in air with a speed of $3 \times 10^8 \text{ m s}^{-1}$ .

## 15. Propagation of Sound

- Sound travels through a medium (solid, liquid and gases) in all directions.
- Of the three mediums (gas, liquid and solid) sound waves travel the slowest through gases, faster through liquids, and fastest through solids.
- At zero degree celsius, the speed of sound in air is 331 m/s and 344 m/s at 22°C. This shows that the speed of sound increases with increase in temperature.

### Speed of Sound in Different Medium at 25°C.

State	Substance	Speed (ms <sup>-1</sup> )
Solids	Aluminum	6420
	Steel	5960
	Iron	5950
Liquid	Sea Water	1530
	Distilled Water	1498
Gases	Hydrogen	1284
	Oxygen	316

## 16. Characteristics of Sound

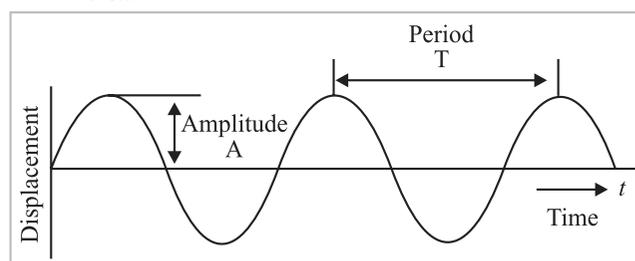
- A sound wave can be described completely by five characteristics namely amplitude, frequency, time period, wavelength and velocity or speed.
  - ❖ **Amplitude:** The maximum displacement of the particles of the medium from their original undisturbed positions, when a wave passes through the medium is called amplitude of the wave.
  - ❖ **Frequency:** The number of vibrations (complete waves or cycles) produced in one second is called frequency of

the wave. It is denoted as  $\nu$  (Greek letter nu). The SI unit of frequency is  $\text{s}^{-1}$  (or) Hertz (Hz).

- ❖ **Time Period:** The time required to produce one complete vibration (wave or cycle) is called the time period of the wave. It is denoted as T. The SI unit of time period is second (s). Frequency and time period are reciprocal to each other.

$$f = 1/T$$

- ❖ **Wavelength:** The minimum distance in which a sound wave repeats itself is called its wavelength. In a sound wave, the distance between the centers of two consecutive compressions or two consecutive rarefactions is also called wavelength. The wavelength is usually denoted as  $\lambda$  (Greek letter lambda). The SI unit of wavelength is metre (m).
  - > Higher the wavelength, smaller the frequency and vice-versa.



## 17. Speed of Sound

- The speed of sound is defined as the distance travelled by a sound wave per unit time as it propagates through an elastic medium.

$$\text{Speed (v)} = \frac{\text{Distance}}{\text{Time}}$$

- If the distance travelled by one wave is taken as one wavelength ( $\lambda$ ), and the time taken for this propagation is one time period (T), then,

$$\text{Speed (v)} = \frac{\text{one wavelength } (\lambda)}{\text{one time period (T)}} \text{ (or) } v = \frac{\lambda}{T}$$

- As,  $\frac{1}{T} = \nu$  the speed (v) of sound is also written as,  $v = \nu \lambda$ . The speed of sound remains almost the same for all frequencies in a given medium under the same physical conditions.

- ❖ The speed of sound in Carbon dioxide is 267 m/s.
  - > The speed of sound in steam is 477.5 m/s.



## Knowledge Facts

- The ascending order of speed of sound is Nitrogen, Water and Steel.
- A worker is working on the rail tracks. A boy holding his ear near the rail track is able to hear the sound of the blow of a workman twice. It is because the speed of sound is greater in steel than air.



## Exam Pointers

- Sound is a way of transferring mechanical energy to which our ears are sensitive.
- In the propagation of sound, the particles of the medium do not move, but only disturbance is transmitted.
- A medium is needed for the transmission of sound. Sound cannot propagate in vacuum.
- Ultrasonic sound is very useful in the fields of industrial medicine etc.
- The reason why different sounds seem different from each other.
  - (i) loudness (ii) pitch (iii) quality.
- The sound energy passing through a unit area in one second is called the intensity of sound.
- Sound is reflected in the same way as light rays and sound also obeys the laws of reflection (for light).

- I. Mach Number:** The ratio of the speed of the source to the speed of sound in air is known as Mach number.
- If the speed of an object is equal to the speed of sound, then the speed of the object will be 1 Mach. If the speed is more than 1 Mach then it is known as Supersonic but in case it is more than 5 Mach then it is **Hypersonic**.
  - The flight of supersonic jets causes depletion in the ozone layer.
- II. Factors Affecting the Speed (velocity) of Sound:** Density of the medium, temperature and relative humidity are those factors which affect the speed of sound.

## 18. Types of Sound

### I. Audible Sound

- Human ear can hear sound of frequency from 20 Hz to 20,000 Hz and these are called **Audible Sound**.
- Please note that the sounds of frequencies less than 20 vibrations per second (20 Hz) and higher than 20,000 vibrations per second (20 kHz) are not audible to human ears.

### II. Infrasonic Sound

- Sound with frequency less than 20 Hz is called **infrasonic sound**. These sounds are produced by bigger sources such as earthquakes, eruptions, ocean waves, elephants, rhinoceros and whales.
- The sound produced by both the pendulum and heart beat is infrasonic sound.
- Radon (Rn) gas is produced when earthquakes take place.
- Seismographs are used to measure earthquakes.
- The magnitude of an earthquake is measured with the help of Richter Scale (Invented by Charles F. Richter in 1935) and Mercalli Scale (Invented by Giuseppe Mercalli in 1886).
- Snake, Dog, Cat, Rabbit etc. can hear infrasonic sound.

### III. Ultrasound

- Sound with frequency greater than 20,000 Hz is called **ultrasonic sound**. Human beings cannot hear infrasonic and ultrasonic sounds.
- Children under 5 years of age and some creatures and insects can hear waves with frequency up to 25 kHz.
- Ultrasonic waves can destroy insects and these are also used in automatic doors.
- Animals, such as bats, dolphins, rats, whales and oil birds, use ultrasound to navigate or communicate.
- **SONAR:** It stands for Sound Navigation and Ranging. It is a device that uses ultrasonic waves to measure the distance, direction and speed of underwater objects. Sonar consists of a transmitter and a detector and is installed at the bottom of boats and ships.
  - ❖ The transmitter produces and transmits ultrasonic waves (50000 Hz frequency). These waves travel through water and after striking the object on the seabed, get reflected back and are sensed by the detector. The detector converts the ultrasonic waves into electrical signals which are appropriately interpreted. The distance of the object that reflected the sound wave can be calculated by knowing the speed of sound in water and the time interval between transmission and reception of the ultrasound.
  - ❖ **Sonography:** Sonography technology uses ultrasonic sound waves to generate images of internal organs of the human body.

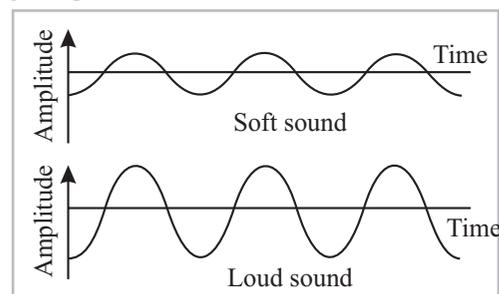


## Do You Know?

- ★ Due to the misuse of sonography technique the incidences of female foeticide.
- ★ Female foeticide is now a cognizable offence under the PNDT Act.

## 19. Distinguishing the Sound

- I. Loudness:** Loudness is a quantity by virtue of which a sound can be distinguished from another one, both having the same frequency. Loudness or softness of sound depends on the amplitude of the wave. Less amplitude means less loudness and high amplitude means more loudness.



- ❖ The loudness of a sound depends on the intensity of the sound wave.

**II. Intensity:** Intensity is defined as the amount of energy crossing per unit area per unit time perpendicular to the direction of propagation of the wave. It depends on five factors: Amplitude of the source, Distance of the observer from the source, Surface area of the source, Density of the medium and Frequency of the source.

- ❖ The unit of intensity of sound is decibel (dB). It has been named in the honour of the Scottish-born scientist Alexander Graham Bell who invented the telephone.



### Knowledge Facts

- Decibel is  $1/10^{\text{th}}$  of a bel, which is a unit of sound intensity.
- The noise level of 100 dB would correspond to the noise from a machine shop.
- Rustling of tree leaves have the sound level of 20 dB.
- The sound level of two persons in conversation is 30 dB.
- According to WHO, the safest sound level for city is 45 dB.
- The optimum sound level for humans is 60 dB.
- The tolerance limit of noise for humans is 85 dB. Beyond it, the sound is called hazardous noise pollution.

**III. Pitch :** Pitch is the characteristics of sound by which we can distinguish whether a sound is shrill or base. High pitch sound is shrill and low pitch sound is flat.

## 20. Reflection of Sound

- The bouncing off of sound after colliding with a large polished and smooth surface is known as reflection of sound. The laws of reflection are:
  - ❖ The angle in which the sound is incident is equal to the angle in which sound is reflected.
  - ❖ Direction of incident sound, direction of the reflected sound and the normal are in the same plane.

## 21. Echo

- It is a reflection of sound that arrives at the listener with a delay after the direct sound. In simpler words, an echo is the repetition of the original sound because of reflection by some surface.
- The delay is directly proportional to the distance of the reflecting surface from the source and the listener.

## 22. Refraction and Diffraction of Sound

### I. Refraction of Sound

- When a sound wave moves from one mechanical medium to the other, it gets deviated from the original path of its incidence. This phenomenon is known as Refraction of sound.
- It happens due to the different speeds of sound in different media.

### II. Diffraction of Sound

- When sound waves originate from a sound source spread in a homogeneous medium, these sound waves get

bent around the edges. This phenomenon is known as diffraction of sound.

## 23. Doppler Effect

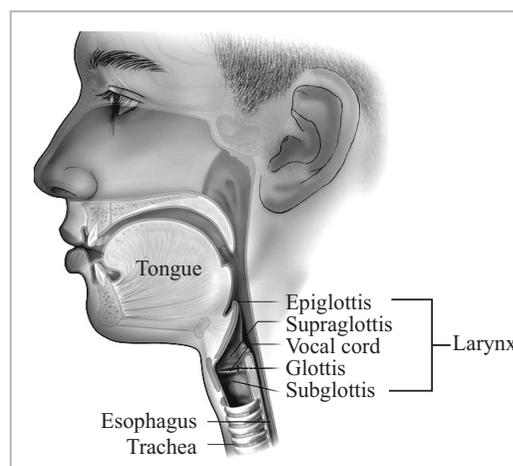
- This relative motion could be due to the listener moving towards or away from a stationary source or the source moving towards or away from a stationary listener. It can be caused as both source and listener moving towards or away from one another or the medium moves when both source and listener are at rest.

### ❖ Applications of Doppler's Effect :

- Used by police to check over speeding.
- Used at airports to guide aircrafts.
- Used to study the heartbeats and blood flow in different parts of body.
- By an astrophysicist to measure the velocities of planets and stars.

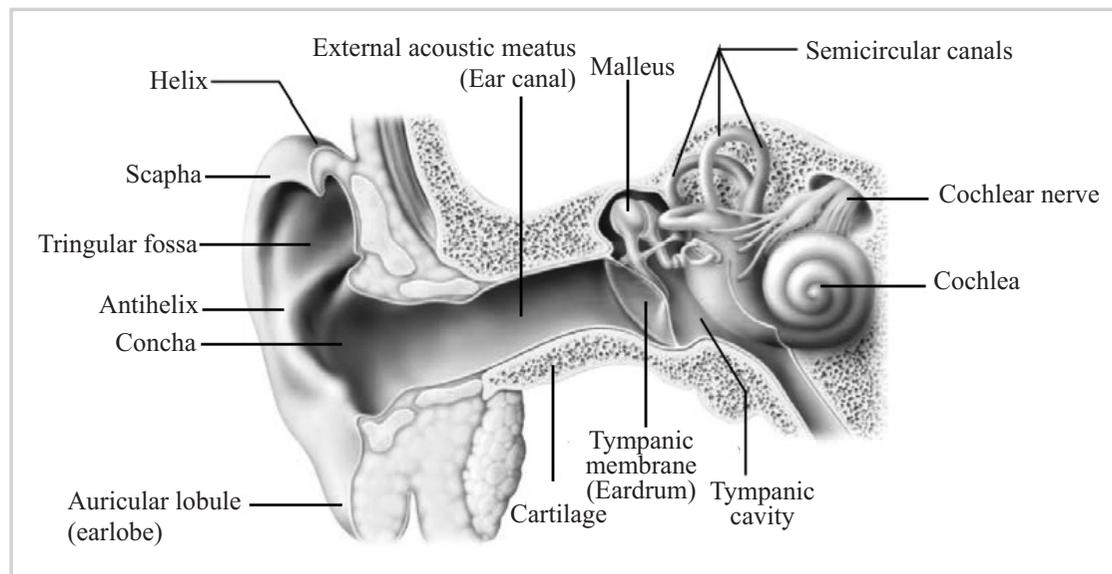
## 24. Sound Produced by Humans

- In human beings, the sound is produced in the voice box, called the larynx, which is present in the throat. It is located at the upper end of the windpipe. The larynx has two ligaments called 'vocal cords', stretched across it. The vocal cords have a narrow slit through which air is blown in and out. When a person speaks, the air from the lungs is pushed up through the trachea to the larynx. When this air passes through the slit, the vocal cords begin to vibrate and produce a sound. Muscles attached to the vocal cords can make the cords tight or loose.



## 25. Mechanism of Human Ear

- The ear is an important organ of the human body. We hear sounds because of our ear. When sound waves fall on the eardrum, it vibrates. These vibrations are converted into electrical signals which travel to the brain through nerves.



## Important Questions

1. The part of human ear which converts sound vibrations into electrical signals is :  
 (A) Cochlea  
 (B) Stirrup  
 (C) Hammer  
 (D) Tympanic membrane
2. What will be direction of the reflected ray when a light ray is incident normal to a surface ?  
 (A) parallel to the surface  
 (B) perpendicular to the surface  
 (C) at an acute angle with the surface  
 (D) at an obtuse angle with the surface
3. An object is placed in front of a convex lens in such a way that its real and magnified image is formed on the other side. If the top half of the convex lens is covered with a black/opaque paper then :  
 (A) the image magnification will be reduced.  
 (B) the top half of the image will vanish.  
 (C) the bottom half of the image will vanish.  
 (D) the sharpness of the image will be reduced.
4. Read the following statements and choose the correct option.  
**Assertion (A):** The speed of sound is more on a hot summer day than on a cold winter day.  
**Reason (R):** The density of hot air is less than the density of cold air.  
 (A) Both A and R are true and R is correct explanation for A.  
 (B) Both A and R are true but R is not the correct explanation for A.  
 (C) A is true and R not true.  
 (D) A is not true and R is true.
5. Sound waves will not be able to travel through which of the following ?  
 (A) Wooden scale (B) Metallic wire  
 (C) Cloth string (D) Vacuum
6. Which of the following statement is true when a ray of light travels from air into oil ?  
 (A) The speed of light decreases and the ray bends towards the normal.  
 (B) The speed of light increases and the ray bends away from the normal.  
 (C) The speed of light increases and the ray bends towards the normal.  
 (D) The speed of light decreases and the ray bends away from the normal.
7. Read the following statements and choose correct option.  
**Assertion (A):** We hear a louder sound when a table is hit hard than when we hit it softly.  
**Reason (R<sub>1</sub>):** Loud sound can travel large distance as it is associated with higher energy.  
**Reason (R<sub>2</sub>):** Loud sound has more frequency than soft sound.  
 (A) Both R<sub>1</sub> and R<sub>2</sub> are correct and R<sub>2</sub> is correct explanation for A.  
 (B) Both R<sub>1</sub> and R<sub>2</sub> are correct and R<sub>1</sub> is correct explanation for A.  
 (C) Only R<sub>1</sub> is true and correct explanation for A.  
 (D) Only R<sub>2</sub> is true and correct explanation for A.
8. Under which of the following conditions will the speed of sound in air be maximum ?  
 (A) In dry air at 0°C  
 (B) In moist air at 0°C  
 (C) In dry air at 40°C  
 (D) In moist air at 40°C
9. Which of the following statements about the image formed by a concave lens always correct ?  
 (A) It is upside down and larger than the object.  
 (B) It is upside down and smaller than the object.  
 (C) It is upright and larger than the object.  
 (D) It is upright and smaller than the object.
10. The factor on which the shadow formation of an object is not dependent is :  
 (A) shape of an object  
 (B) distance of the object from source of light  
 (C) position of the object w.r.t source of light  
 (D) colour of the object
11. Which of the following statements is true regarding sound waves ?  
 (A) Sound waves travel fastest in gases  
 (B) Human beings can hear sound whose frequency is 15000 Hz.  
 (C) Sound waves cannot be reflected  
 (D) The loudness of sound depends on the frequency of sound wave
12. A student wants to change a feeble sound to a loud sound. For this he should increase the :  
 (A) amplitude of sound  
 (B) frequency of sound  
 (C) speed of sound  
 (D) wavelength of sound

13. The image formed by a pin-hole camera is real. Which of the following properties of light provides the best explanation for this phenomenon ?
- (A) Light travels in a straight line  
 (B) Light refracts on moving from one medium to another.  
 (C) Light is made up of several colours.  
 (D) Light is a form of Energy

14. The focal length of a concave mirror is 20 cm. At what distance from the concave mirror could the object placed to produce a virtual image of the object ?
- (A) 10cm                      (B) 20cm  
 (C) 40cm                      (D) 80cm

15. Read the following statements and choose correct option.

**Assertion (A):** A drum produces a low-pitched sound while a piano produces a high-pitched sound.

**Reason (R):** The amplitude of vibrations of the vibrating object determines the

loudness of sound.

- (A) (A) is true and (R) provides the correct explanation for it.  
 (B) Both (A) and (R) true but (R) is not the correct explanation.  
 (C) (A) is true but (R) is false  
 (D) Both (A) and (R) are false
16. Identify the incorrect statement from among the following :
- (A) The motion of light is rectilinear motion  
 (B) The motion of plucked string of a sitar is oscillatory motion.  
 (C) All periodic motions are circular motions.  
 (D) The motion of earth around its axis is periodic motion.

17. Which of the following can be used to create a virtual and magnified image of an object ?
- (A) Convex lens only

- (B) Both convex mirror and convex lens  
 (C) Both concave mirror and convex lens  
 (D) Concave lens only

18. If the frequency of vibrations of a body is decreased and its amplitude is increased, then :
- (A) pitch increases but loudness decreases  
 (B) pitch decreases but loudness increases  
 (C) both pitch and loudness of sound produced will decrease  
 (D) both pitch and loudness of sound produced will increase

### Answer Key

1. (A) 2. (B) 3. (D) 4. (B) 5. (D)  
 6. (A) 7. (C) 8. (D) 9. (D) 10. (D)  
 11. (B) 12. (A) 13. (A) 14. (A) 15. (B)  
 16. (D) 17. (C) 18. (B)

