

CH# 12

COORDINATION AND CONTROL

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12.1 COORDINATION AND TYPES OF COORDINATION**LONG QUESTIONS**

Q.1 Describe the types of coordination and also discuss components of a coordinated action. (K.B)

Ans:

COORDINATION

“Synchronisation of various activities or actions of body or body organs as a unit is termed as coordination”.

Example:

Working of muscles with different body systems together during body movements is the best example of coordination.

Types of Coordination:

There are **two types** of coordination in organisms:

- (i) **Nervous coordination** brought about by **nervous system**
- (ii) **Chemical coordination** brought about by **endocrine system**

Animals have **both** the nervous and chemical coordination system in their bodies while plants and **other organisms** have only **chemical coordination**.

COMPONENTS OF COORDINATED ACTION

A coordinated action has following **five components**:

Stimulus → Receptor → Coordinator → Effector → Response

Stimuli:

“Any **change** in **external and internal** environment of an organism which can **provoke a response** is called a stimulus”.

Examples:

- **Touch**
- **Light**
- **Heat**
- **Cold**
- **Pressure**
- **Sound waves**
- **Presence of chemicals**
- **Microbial infections**

Type of Stimulus:

There are **two types** of stimulus

- **External Stimulus**
- **Internal Stimulus**

Receptors:

“The **organs, tissues or cells** which are specifically **built to detect** particular type of **stimuli** are called receptors”.

Examples:

- **Sound waves** are detected by **ears**
- **Light** is detected by **eyes**
- **Chemicals in air** are detected by **nose**
- **Touch, heat, cold and pressure** are detected by **skin**
- **Taste** is detected by **tongue**

Coordinators:

“The **organs** that **receive information** from **receptors** and **send messages** to particular **organs** for proper action are called coordinators”.

Nervous Coordination:

In **nervous coordination**, **brain and spinal cord** are coordinators. They **receive information** and send messages through **neurons** in the form of **nerve impulses**.

Chemical Coordination:

In **chemical coordination**, various **endocrine glands** play the role of coordinators. They **receive information** in the form of **various chemicals** and **send messages** by **secreting** particular **hormones** in blood.

Effectors:

“The **parts of body** which **receive messages** from **coordinators** and produce **particular responses** are called effectors”.

Nervous Coordination:

In **nervous coordination**, **neurons** carry messages from coordinators (brain and spinal cord) to muscles and glands, which act as effectors.

Chemical Coordination:

In **chemical coordination**, particular **hormones** carry messages from coordinators (endocrine glands) to particular target tissues, which act as effectors. For some hormones, **nephrons** act as effectors. Similarly, **bones and liver act** as **effectors** for many hormones.

Response:

“The **action performed** by the effectors on **receiving the message** from coordinators is called response”.

Examples:

- Pulling our hand away from something very hot
- The movement of the flower of sunflower towards light

Nervous Coordination:

Nervous coordination produces **immediate** but **short-living responses**.

Chemical Coordination:

Chemical coordination produces **slow** but **long-living responses**.

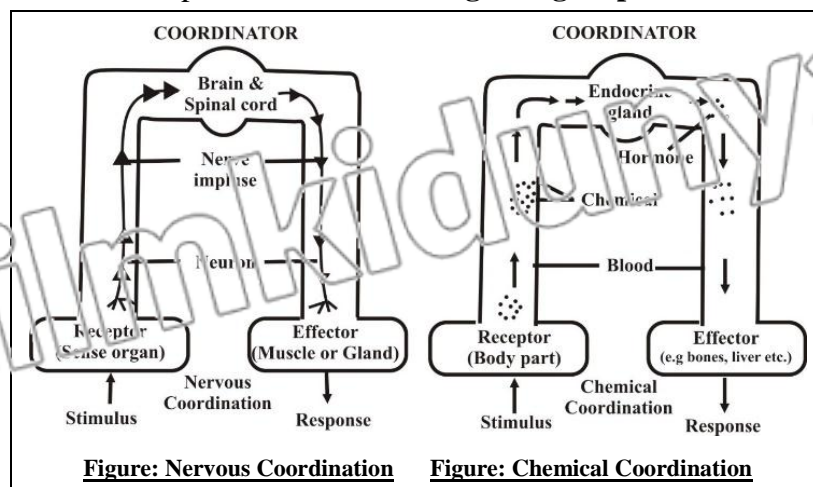


Figure: Nervous Coordination

Figure: Chemical Coordination

12.1 SHORT QUESTIONS

Q.1 Define coordination. (K.B)

(GRW 2017, DGK 2015)

Ans: Page no 57.

Q.2 Define stimuli. (K.B)

Ans: Page no 57.

Q.3 What are two types of coordination in living organisms? (K.B)

(LHR 2013, GRW 2015,17)

Ans: Page no 57.

Q.4 How does coordination take place in unicellular organism? (K.B)

(GRW 2015)

Ans:

COORDINATION IN UNICELLULAR ORGANISM

Chemical co-ordination takes place in unicellular organisms by chemical coordination. The response to stimuli is brought about through chemicals.

Q.5 What is spinal cord? Give its length.

GRW 2017

Ans: Page no 66.

Q.6 Define Stimuli and Response.

LHR 2015

Ans: Page no 57.

Q.7 What is the difference between co-ordination systems in animals and plants? (U.B)

Ans:

CO-ORDINATION SYSTEMS

The major difference between coordination system of animals and plants is:

Animals have both the nervous and chemical coordination systems in their bodies while plants and other organisms have only chemical coordination.

Q.8 Write the five components of the coordinated action? (K.B)

(BWP 2014, DGK 2015)

Ans: Page no 57.

Q.9 Define stimulus. Give examples. (K.B)

(GRW 2014, 2015, LHR 2015, MTN 2015)

Ans: Page no 57.

Q.10 Define receptors. Give examples. (K.B)

(GRW 2015, LHR 2016)

Ans: Page no 57.

Q.11 What are coordinators? Give examples. (K.B)

Ans: Page no 57.

Q.12 What are nervous coordinators? Write its function. (K.B)

Ans: Page no 58.

Q.13 What are chemical coordinators? Write its function? (K.B)

Ans: Page no 58.

Q.14 What are effectors? (K.B)

(GRW 2015, BWP 2015)

Ans: Page no 58.

Q.15 What is response? Give examples? (K.B)

(LHR 2015, GRW 2015)

Ans: Page no 58.

12.1 MULTIPLE CHOICE QUESTIONS

1. **Number of components of coordinated action is: (K.B)**
 (A) 3 (B) 5
 (C) 7 (D) 4
2. **Which process enables the organisms to respond to happenings in the world around them? (U.B)**
 (A) Respiration (B) Coordination
 (C) Excretion (D) Reproduction
3. **In unicellular living organisms the response to stimuli is brought about through (U.B)**
 (A) Impulses (B) chemicals
 (C) neurons (D) electric waves
4. **The movement of sunflower towards light is an example of (U.B)**
 (A) Stimuli (B) response
 (C) coordinator (D) receptor
5. **Which coordination systems do animals have? (K.B)**
 (A) Nervous (B) Chemical
 (C) Nervous and chemical (D) Mutual
6. **Any change in internal or external environment of an organism: (K.B)**
 (A) Response (B) Receptor
 (C) Stimulus (D) Coordinator
7. **Organs specifically built to receive particular type of stimuli: (K.B)**
 (A) Receptors (B) Effectors
 (C) Responses (D) Glands
8. **In some parts of the body neurons many cell bodies combine to make a group:(LHR 2014) (K.B)**
 (A) Nerves (B) Tissues
 (C) Ganglion (D) Muscles
9. **Brain and spinal cord are: (K.B)**
 (A) Receptors (B) Coordinators
 (C) Effectors (D) Responses
10. **All can detect a stimuli corresponding to their organs, except: (U.B)**
 (A) sound waves - Ear (B) Light- eyes
 (C) chemicals- smooth muscles (D) heat/cold – Muscles
11. **Extended processes that conduct the nerve impulse towards cell body are (K.B)**
 (A) Axons (B) dendrites
 (C) nerves (D) nodes of Ranvier
12. **Classification of nerves is based upon the property of (K.B)**
 (A) dendrites (B) Axons
 (C) Ganglions (D) Neuroglial cells

12.2 HUMAN NERVOUS SYSTEM

LONG QUESTIONS

Q.1 Describe human nervous system. (K.B)

Ans: HUMAN NERVOUS SYSTEM

Definition:

“A **system** of animals which is used for **nervous coordination** and **controls** various **activities** of the body is called nervous system”.

There are **two major components** of nervous system which are as follow:

- Central nervous system
- Peripheral nervous system

Central Nervous System:

It comprises of:

- **Brain**
- **Spinal Cord**

Peripheral Nervous System:

It **consists of nerves** that **arise** from **central nervous system** and **spread** in different **parts of body**.

Peripheral nervous system **consists** of two parts

- **Sympathetic**
- **Parasympathetic**

All these **components** are made of **neurons** and **associated cells**.

Q.2 What is neuron? Describe its structure. (K.B)

(GRW 2013, LHR 2015)

OR

Define neuron and describe the structure of a general neuron. (Understanding the Concept Q.3)

Ans:

STRUCTURE OF A NEURON

Definition:

“The **unit** of the **nervous system** is called neuron or nerve cell.”

OR

“Neurons are the **specialized cells** that are able to **conduct nerve impulses** from receptors to coordinators and from coordinators to effectors”.

STRUCTURE OF NEURON

Explanation:

The human nervous system **consists** of **billions of neurons plus supporting** (neuroglial) cells.

Functions:

Neurons are **specialized cells** that are **able** to **conduct nerve impulses** from receptors to coordinators and from coordinators to effectors.

In this way they **communicate** with **each other** and with other types of body cells.

Parts of a Neuron:

A neuron **consists** of the following parts:

- Cell Body
- Dendrites
- Axon
- Schwann Cells
- Myelin Sheath
- Nodes of Ranvier

Cell Body:

The **nucleus** and most of the **cytoplasm** of a neuron is **located** in its **cell body**.

Dendrites:

Different **processes extend out** from **cell body**, these are called **dendrites**. Dendrites **conduct impulses toward cell body**.

Axon:

An axon **arises** from the **cell body** and **conducts impulses away from cell body**.

Schwann Cells:

Schwann cells are **special neuroglial cells located** at **regular intervals** a **long axons**.

Myelin Sheath:

In some neurons, Schwann cells **secrete a fatty layer** called **myelin sheath**, over axons.

Saltatory Nerve Impulse:

Myelin sheath is an **insulator** so the **membrane coated** with this **sheath does not conduct nerve impulse**. In such a neuron, **impulses 'jump'** over the areas of myelin going from **node to node**. Such impulses are called **saltatory ('jumping') impulses**. This **increases the speed** of nerve impulse.

Nodes of Ranvier:

Between the areas of myelin on an axon, there are **non-myelinated points**, called the **nodes of Ranvier**.

Q.3 Write a note on neuron and nerve. (K.B)

Ans: NEURON

Definition:

“Neurons are **specialized cells** that are **able to conduct nerve impulses** from receptors to coordinators and from coordinators to effectors”.

TYPES OF NEURONS

On the **basis of their function**, neurons are of **three types**:

- (i) Sensory Neurons
- (ii) Interneurons
- (iii) Motor Neurons

Sensory Neurons:

- Conduct **sensory information** (nerve impulse) from receptors **towards the CNS**.
- Sensory neurons have **one dendrite** and **one axon**.

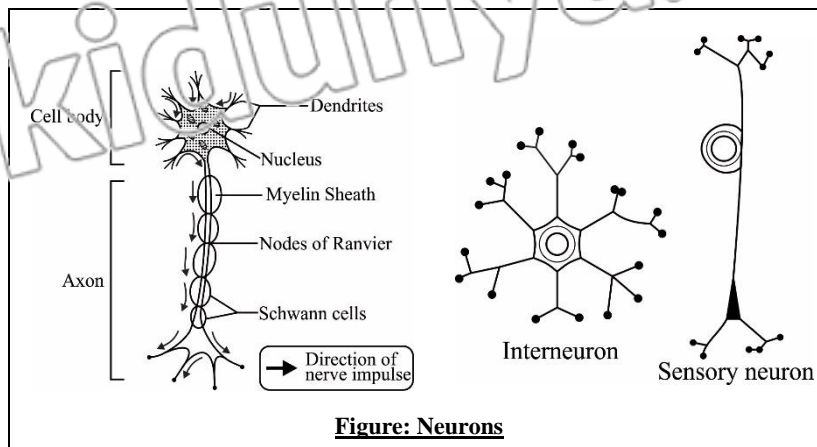


Figure: Neurons

Interneurons:

- From **brain and spinal cord**. They **receive information**, interpret them and **stimulate motor neurons**.
- They have **many dendrites and axons**.

Motor Neurons:

- Carry **information** from **interneurons** to **muscle or glands** (effectors).
- They have **many dendrites** but only **one axon**

Q.4 Describe division of human nervous system. (K.B)

OR

Explain the location and function of these parts of brain; cerebrum, cerebellum, pituitary gland, thalamus, hypothalamus, medulla oblongata. (K.B)

(Understanding the Concept Q.2)

Ans:

DIVISION OF THE NERVOUS SYSTEM

Human nervous system is divided into two parts:

- Central Nervous System
- Peripheral Nervous System

Central Nervous System:

The central nervous system consist of:

- Brain
- Spinal cord

BRAIN

In animals, all **life activities** are under the **control of brain**. The **structure of brain** is **suitable** to perform this function.

Location:

Brain is **situated** inside a **bony cranium** which is the **part of skull**.

Protection:

Inside cranium, brain is **covered** by **three layers** called **meninges**. Meninges **protect brain** and also **provide nutrients** and **oxygen to brain** tissue through their **capillaries**.

Ventricles:

The brain contains **fluid-filled ventricles** that are **continuous** with the **central canal** of spinal cord.

Cerebrospinal Fluid:

Fluid within **ventricles** and **central canal** is called **cerebrospinal fluid (CSF)**.

Divisions of Brain:

There are **three major regions** in the brain of human and other vertebrates. These are:

- Forebrain
- Midbrain
- Hindbrain

Forebrain:

(LHR 2013, 17, BWP 2014)

Forebrain is the **largest area** of brain. It is most **highly developed** in humans. Following are the important parts of this region.

- **Thalamus**
- **Hypothalamus**
- **Cerebrum**

Thalamus:

Thalamus lies just **below cerebrum**.

Functions:

- **Thalamus** serves as a **relay center** between various parts of brain and spinal cord.
- It also **receives** and **modifies sensory impulses** (except from nose) **before** they travel to **cerebrum**.
- **Thalamus** is also involved in **pain perception** and **consciousness** (sleep and awakening).

Hypothalamus:

Hypothalamus lies **above midbrain** and **just below thalamus**.

Size:

In humans, it is **roughly the size of an almond**.

Functions:

- One of the most **important function** of hypothalamus is to link **nervous system** and **endocrine system**.
- It **controls** the **secretions** of **pituitary gland**.
- It also **controls feelings** such as rage, pain, pleasure and sorrow.

Cerebrum:

Cerebrum is the **largest part** of **forebrain**.

Functions:

It controls:

- **Skeletal muscles**
- **Thinking**
- **Intelligence**
- **Emotions**

Divisions of Cerebrum:

Cerebrum is divided into **two cerebral hemispheres**.

Olfactory Bulbs:

The **anterior parts** of cerebral hemispheres are called **olfactory bulbs** which **receive impulses** from **olfactory nerves** and create the **sensation of smell**.

Cerebral Cortex:

(SWL 2014)

The **upper layer** of **cerebral hemispheres** i.e. **cerebral cortex** that **consists of grey matter**.

The grey matter of nervous system consists of **cell bodies** and **non-myelinated axons**.

White Matter:

Beneath this layer is present the **white matter**. The **white matter** of nervous system consists of **myelinated axons**.

Lobes of Cerebral Cortex:

Cerebral cortex has a **large surface area** and is **folded** in order to **fit in skull**. It is **divided** into four lobes:

- **Frontal lobe**
- **Parietal lobe**
- **Occipital lobe**
- **Temporal lobe**

Frontal Lobe:

- **Controls motor functions**
- **Permits conscious control of skeletal muscles**
- **Coordinates movements involved in speech**

Parietal Lobe:

- Contains sensory areas that receive **impulses from skin**

Occipital Lobe:

- **Receives and analyzes visual information**

Temporal Lobe:

- **Concerned with hearing and smell**

Midbrain:

Midbrain lies between **hindbrain and forebrain** and connects the two.

Functions:

- The midbrain **receives sensory information** and sends it to the appropriate part of **forebrain**.
- Midbrain also **controls some auditory reflexes and posture**.

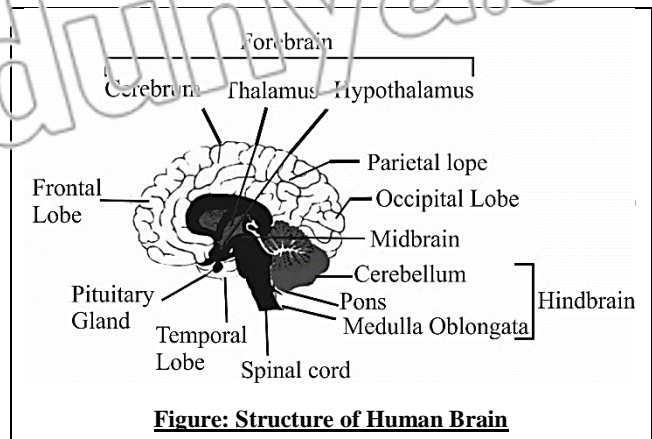


Figure: Structure of Human Brain

Hindbrain:

Hindbrain **consists** of three major parts:

- (i) **Medulla Oblongata**
- (ii) **Cerebellum**
- (iii) **Pons**

Medulla Oblongata:

Medulla oblongata lies on the **top of spinal cord**. **Information that passes between spinal cord and the rest of brain** pass through medulla.

Functions:

It controls:

- **Breathing**
- **Heart rate**
- **Blood pressure**
- **Reflexes such as vomiting, coughing, sneezing**

Cerebellum:

Cerebellum lies **behind medulla oblongata**.

Function:

- It **coordinates muscle movements**.

Pons:

Pons is present on **top of medulla**.

Functions:

- It **assists medulla** in controlling **breathing**.
- It also **serves as a connection** between **cerebellum and spinal cord**.

Q.5 Define spinal cord, describe its structure with diagram. (K.B) (DGK 2014, SWL 2015)

Ans: **SPINAL CORD**

Definition:

“The **spinal cord** is in fact a **tubular bundle of nerves**. It starts from **brain stem** and **extends to lower back**.”

Protection:

- Like brain, **spinal cord** is also covered by **meninges**
- The **vertebral column** surrounds and **protects spinal cord**

STRUCTURE

Outer Region:

The **outer region** of **spinal cord** is made of **white matter** (containing myelinated axons).

Central Region:

The **central region** is **butterfly shaped** that surrounds the **central canal**. It is made of **grey matter** (containing neuron cell bodies).

Spinal Nerves:

31 pairs of **spinal nerves** arise **along spinal cord**. These are "**mixed**" **nerves** because each contains **axons** of both **sensory and motor neurons**.

Roots of Spinal Nerve:

At the point where a **spinal nerve** arises from **spinal cord**, there are **two roots** of spinal nerve. Both roots **unite** and form **one mixed spinal nerve**.

Dorsal Root:

The **dorsal root** contains **sensory axons** and a **ganglion** where **cell bodies** are located.

Ventral Root:

The **ventral root** contains **axons** of **motor neurons**.

Functions:

Spinal cord performs two main functions:

- It serves as a **link** between **body parts and brain**. Spinal cord **transmits nerve impulses** from body parts to brain and from brain to body parts.
- Spinal cord also acts as a **coordinator**. Responsible for some **simple reflexes**.

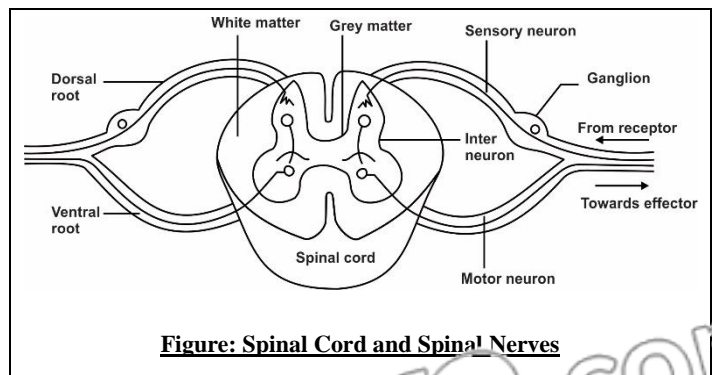


Figure: Spinal Cord and Spinal Nerves

Q.6 Write a note on peripheral nervous system. (K.B)

Ans: **PERIPHERAL NERVOUS SYSTEM**

Composition:

The peripheral nervous system (PNS) is **composed of nerves and ganglia**. **Ganglia** are the **clusters of neuron cell bodies outside** central nervous system.

Cranial Nerves:

The **nerves that arise or lead to brain** are called **cranial nerves**. Humans have **12 pairs** of **cranial nerves**. Some **cranial nerves** are **sensory**, some are **motor** and some are **mixed**.

Spinal Nerves:

The **nerves that arise or lead to spinal cord** are called **spinal nerves**. Humans have **31 pairs** of **spinal nerves**. All spinal nerves are **mixed nerves**.

Pathways:

The cranial and spinal nerves make **two pathways**:

Sensory Pathway:

The **sensory pathway** (conducting impulses from receptors to central nervous system).

Motor Pathway:

The **motor pathway** (conducting impulses from central nervous system to effectors).

Motor pathway makes two systems:

- Somatic Nervous System
- Autonomic Nervous System

Somatic Nervous System:**Composition:**

It includes all of the **motor neurons** that **conduct impulses** from **central nervous system** to **skeletal muscles**.

Function:

- It is **responsible** for the **conscious** and **voluntary actions**.

Autonomic Nervous System:**Composition:**

It consists of **motor neurons** that send impulses to:

- **Cardiac muscles**
- **Smooth muscles**
- **Glands**

Function:

- It is **responsible** for the **activities**, which are **not under conscious control**.

Types of Autonomic Nervous System:

Autonomic nervous system comprises of:

- **Sympathetic Nervous System**
- **Parasympathetic Nervous System**

Sympathetic Nervous System:

Sympathetic nervous system prepares body to deal with **emergency situations**. This is often called the **"fight or flight"** response.

During an emergency situation, this system takes **necessary actions**.

Examples:

- **Dilates pupils**
- **Accelerates heartbeat**
- **Increases breathing rate**
- **Inhibits digestion**

Parasympathetic Nervous System:

When **stress ends**, the **parasympathetic nervous system** takes **action** and **normalizes** all the functions.

- **Causes pupils to contract**
- **Promotes digestion**
- **Slows the rate of heartbeat and breathing rate**

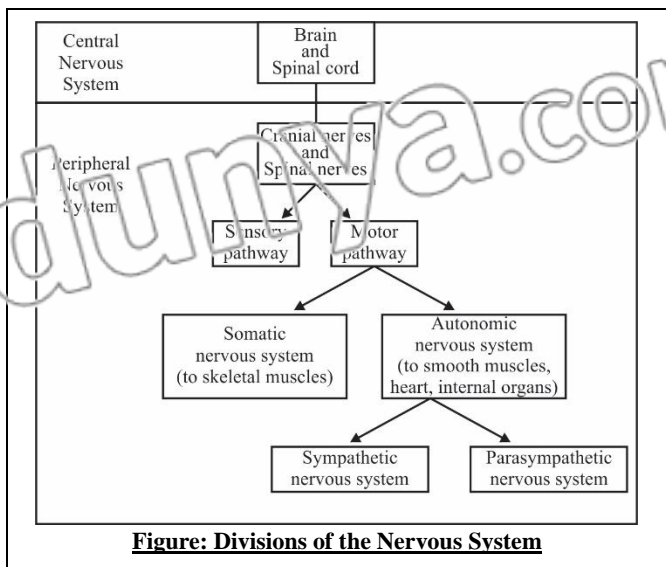


Figure: Divisions of the Nervous System

Q.7 Define reflex action. Explain it with example. (K.B)

(DGK 2015)

Ans: **REFLEX ACTION**

Definition:

“A very quick involuntary response produced by the central nervous system (CNS) is called reflex action”.

Examples:

- Withdrawal of hand after touching a hot object
- Knee jerk
- Pupil reflex

Explanation:

When central nervous system sends impulses to muscles and glands, two types of actions (responses) result.

- (i) The higher centers of brain control the conscious action or voluntary actions.
- (ii) When impulses are not passed to the higher centers of brain, it results in responses which are not under conscious control. Such responses are called involuntary actions. Sometimes, the involuntary response produced by the CNS is very quick. Such a response is called reflex action.

Reflex Arc:

“The pathway followed by the nerve impulses for producing a reflex action, is called reflex arc”.

Example:

The most common example of reflex action is the withdrawal of hand after touching a hot object. In this reflex action, spinal cord acts as coordinator. Heat stimulates temperature and pain receptors in skin. A nerve impulse is generated which is carried by sensory neurons to the interneurons of spinal cord. From interneurons, the impulse is passed to motor neurons, which carry it to the muscles of arm. As a result, the muscles contract to withdraw hand. During it, other interneurons transmit nerve impulses up to brain so that the person becomes aware of pain and what happened.

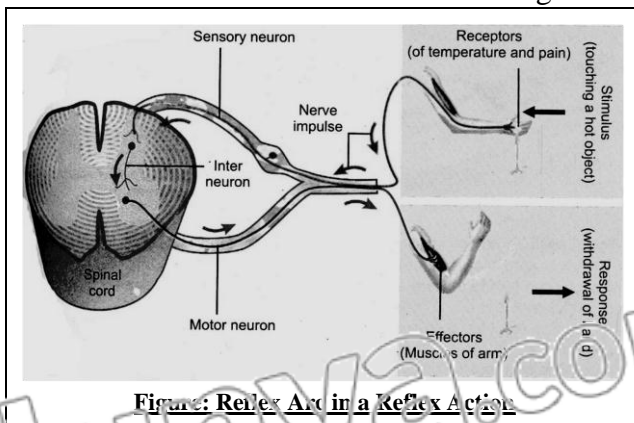


Figure: Reflex Arc in a Reflex Action

12.2 SHORT QUESTIONS

Q.1 What are two major components of nervous system? (K.B)

Ans: Page no 61.

Q.2 Define nerve impulse. (K.B)

(LHR 2017)

Ans: **NERVE IMPULSE**

Definition:

“A wave of electrochemical changes that travels along the length of neuron is called nerve impulse”.

Q.3 Define reflex action and reflex arc.

Ans: Page no 68.

Q.4 What are neurons? (K.B)

OR

Write the types of neurons. (K.B)

Ans: Page no 61.

Q.5 Write the name and functions of lobes of cerebrum (K.B) (LHR 2017)

Ans: Page no 64, 65.

Q.6 What is nerve growth factor? How it repairs brain cells? (K.B)

Ans: NERVE GROWTH FACTOR

Unlike ordinary cells, mature neurons never divide but a protein called “nerve-growth-factor” promotes the regeneration of broken nerve cells. The degenerative brain cells could be repaired, by using embryonic stem cells.

Q.7 What is the difference between sensory and motor neurons? (K.B)(GRW 2016, LAHR 2017)

Ans: DIFFERENTIATION

The difference between sensory and motor neurons is as follows:

Sensory	Motor neurons
<ul style="list-style-type: none"> Sensory neurons conduct sensory information (nerve impulse) from receptors towards the CNS. Sensory neurons have one dendrite and one axon. 	<ul style="list-style-type: none"> Motor neurons carry information from interneurons to muscles or glands (effectors). They have many dendrites but only on axon.

Q.8 Define nerve and write its types. (K.B)

Ans: Page no 62.

Q.9 What are saltatory nerve impulses? (K.B) (LHR 2016)

Ans: Page no 62.

Q.10 What is ganglion? (K.B) (GRW 2016)

Ans: GANGLION

In certain parts of the body, the cell bodies of many neurons form a group enveloped by a membrane, this is called ganglion.

Q.11 What are meninges? Write its functions. (K.B) (GRW 2014, LHR 2016)

Ans: MENINGES

Central nervous system is covered by three layers called meninges.

Functions:

The function of meninges are as follows:

- Protect brain and spinal

Provide nutrients and oxygen to brain tissues through their capillaries

Q.12 What are the functions of thalamus? (A.B)

Ans: Page no 64.

Q.13 What is hippocampus? Write its function. (K.B)

Ans: HIPPOCAMPUS

Hippocampus is a structure that is deep in the cerebrum.

Function:

The function of hippocampus is formation of new memories. People with a damaged hippocampus cannot remember things that occurred after the damage but can remember things that had occurred before damage.

Q.14 What are the functions of hypothalamus? (A.B) (GRW 2013)

Ans: Page no 64.

Q.15 What are the functions of frontal lobe? (A.B) (SWL 2014)

Ans: Page no 65.

Q.16 What is spinal cord? What is its length? (K.B)

Ans: Page no 66.

Q.17 Write down the function of mid brain. (A.B)

Ans: Page no 65.

12.2 MULTIPLE CHOICE QUESTIONS

1. **The central nervous system comprises of: (K.B)** (SWI 2015)
 (A) Brain (B) Spinal cord
 (C) Brain and spinal cord (D) liver
2. **The neurons that conduct impulses from central nervous system to effectors: (K.B)**
 (A) Associative (B) Inter
 (C) Motor (D) Sensory
3. **Supporting cells of neurons are (K.B)**
 (A) Neuroglial cells (B) nerves
 (C) ganglions (D) axons
4. **The largest portion of the forebrain is: (K.B)**
 (A) Thalamus (B) Hypothalamus
 (C) Cerebrum (D) Cerebellum
5. **Which part of neuron conducts nerve impulses away from cell body? (A.B)** (BWL 2015)
 (A) Axon (B) Myelin sheath
 (C) Node of Ranvier (D) Dendrite
6. **In certain parts of the body, the cell bodies of many neurons form a group enveloped by a membrane: (U.B)**
 (A) Brain (B) Nerve
 (C) Spinal cord (D) Ganglion
7. **Is not a part of hindbrain: (K.B)** (BWL 2014)
 (A) Cerebellum (B) Medulla oblongata
 (C) Pons (D) Cerebrum
8. **Part of brain that coordinates muscle movements: (U.B)** (LHR 2015)
 (A) Cerebellum (B) Pons
 (C) Medulla Oblongata (D) Hypothalamus
9. **The three layers covering the brain: (K.B)**
 (A) Choroid (B) Meninges
 (C) Sclera (D) Retina
10. **The largest part of the brain: (K.B)**
 (A) Forebrain (B) Midbrain
 (C) Hindbrain (D) All of these
11. **CSF is filled in (K.B)**
 (A) meninges (B) ventricles
 (C) cranium (D) skull
12. **An almond size structure in fore brain is (K.B)**
 (A) Crebrum (B) cerebium
 (C) hypothalamus (D) thalamus
13. **The part of forebrain that lies just below cerebrum: (K.B)**
 (A) Thalamus (B) Hypothalamus
 (C) Medulla (D) Pons
14. **Lobe concerned with senses of hearing and smell: (K.B)** (LHR 2013)
 (A) Frontal (B) Parietal
 (C) Occipital (D) Temporal
15. **The lobes that receive and analyze visual information: (K.B)**
 (A) Frontal (B) Parietal
 (C) Occipital (D) Temporal

16. The largest part of the forebrain that controls skeletal muscles, thinking, intelligence and emotions: (K.B) (JHR 2013)
 (A) Thalamus (B) Hypothalamus
 (C) Cerebrum (D) Cerebellum
17. The part of brain present on the top of medulla: (K.B)
 (A) Cerebrum (B) Pons
 (C) Cerebellum (D) Thalamus
18. The degenerated brain cell could be repaired by (A.B)
 (A) embryonic stem cells (B) ganglions
 (C) neurons (D) nerves
19. Spinal cord is the continuation of: (K.B)
 (A) Medulla oblongata (B) Thalamus
 (C) Hypothalamus (D) Hippocampus
20. The ventral root contains the axons of which neurons? (U.B)
 (A) Inter (B) associative
 (C) Sensory (D) Motor
21. Spinal cord acts as a: (U.B)
 (A) Receptor (B) Effector
 (C) Coordinator (D) Stimulus
22. The peripheral nervous system consists of pairs of spinal nerves: (K.B)
 (A) 30 (B) 12
 (C) 31 (D) 14
23. The pathway followed by the nerve impulses for producing a reflex action: (K.B)
 (A) Reflex arc (B) Coordinator
 (C) Voluntary action (D) Saltatory

12.3 RECEPTORS IN HUMANS

LONG QUESTIONS

Q.1 Describe the structure of human eye. (K.B) (GRW 2014) (Understanding the Concept Q.4)

Ans: HUMAN EYE

“Eyes are the sensory organs that are associated with the sense of vision”.

Orbit:

Human eyes are located in small portions of skull known as the orbits or eye sockets.

Eyelids:

Eyelids wipe eyes and prevent dehydration. They spread tears on eyes, which contains substances for fighting bacterial infections.

Eyelashes:

Eyelashes prevent fine particles from entering eye.

STRUCTURE OF EYE

The structure of eye can be divided into three main layers:

- Outer Layer
- Middle Layer
- Inner Layer

Outer Layer:

The outer layer of eyeball consists of

- Sclera
- Cornea

(GRW 2015)

Sclera:

Sclera gives eye most of its white colour. It consists of dense connective tissue and protects the inner components of eye and maintains its shape.

Cornea:

In the **front**, sclera forms the **transparent cornea**. Cornea **admits light** to the **interior of eye** and **bends light** rays so that they can be brought to a **focus**.

Middle Layer:**Choroid:**

The **middle layer** is called **choroid**.

The choroid contains **blood vessels** and gives the inner eye a **dark colour**. The dark colour **prevents disruptive reflections** within eye.

Iris:

Behind cornea, choroid **bends** to form a **muscular ring**, called **iris**.

Pupil:

There is **round hole**, called **pupil**, in the **centre of iris**. After striking the cornea, **light passes** through the **pupil**. The **size of pupil** is **adjusted** by the **muscles** of iris. Pupil **constricts** in bright light when the **circular muscles** of iris contract. Similarly, **pupil dilates** in **dim light** when the **radial muscles** of iris **contract**.

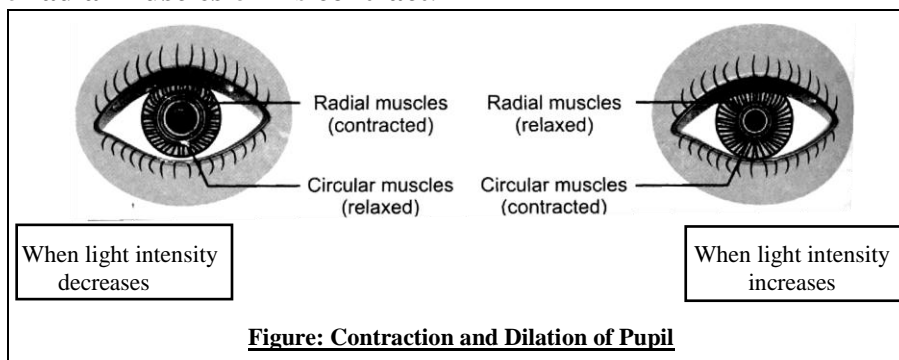


Figure: Contraction and Dilation of Pupil

Lens:

Behind iris, there is a **convex lens**, which **focuses light** on **retina**.

Ciliary Muscles:

Lens is **attached** to **ciliary muscles** of eye via a **ring of suspensory ligament**. To clearly see an object **far away**, **ciliary muscles** are **relaxed** and lens becomes **less convex**. When **ciliary muscles contract**, lens becomes more **convex and round**.

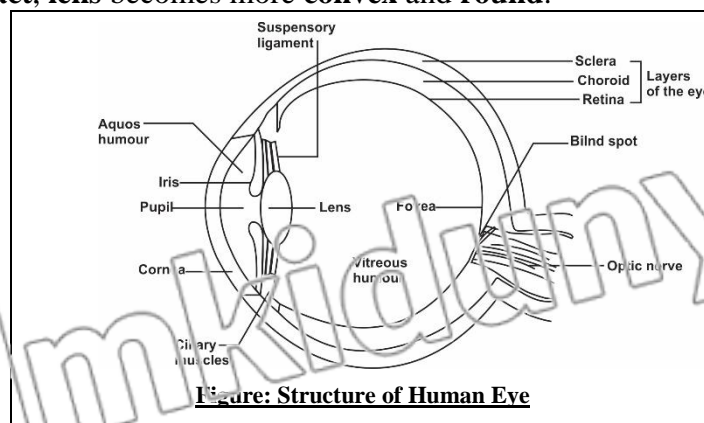


Figure: Structure of Human Eye

Inner Layer:**Retina:**

The **inner layer** is **sensory** and is called as **retina**. It contains the **photosensitive cells** called **rods and cones** and **associated neurons**.

Rods:

Rods are **sensitive to dim light**.

Cones:

The cones are sensitive to **bright light** and so distinguish **different colors**.

Fovea:

Fovea is a **dip in retina**, directly **opposite to lens** and is **densely packed** with cone cells. It is largely responsible for **colour vision** and **sharpness**.

Optic Disc:

Optic disc is a **point on retina** where the **optic nerve** enters retina.

Blind Spot:

There are **no rods and cones** at **optic disc point**, that is why it is referred to as the **blind spot**.

Chambers of Eye:

The **iris** divides the **cavity of eye** into **two chambers**.

Anterior Chamber:

The **anterior chamber** is in front of iris i.e. between cornea and iris. The anterior chamber contains a **clear fluid** known as **aqueous humor**.

Posterior Chamber:

The **posterior chamber** is **between iris and retina**. The posterior chamber contains a **jelly-like fluid** known as **vitreous humor**. It helps maintain the **shape of eye** and suspends the delicate lens.

Q.2 Describe different types of eye disorders. (K.B)

(BWP 2014, SWL 2014, GRW 2016)

OR

What are short sight and long sight problems and how there can be treated? (A.B)

(Understanding the Concept Q.6)

Ans:

DISORDERS OF THE EYE

The **working** of eye is **affected** by the **changes in the shape** of eyeball.

Two disorders of eyes are:

- Myopia
- Hypermetropia

MYOPIA

The image of a **distant object** is formed in **front of retina**. It is also known as **short sight**.

Cause:

The **elongation** of **eyeball** results in myopia.

Effect:

Such persons are **not able** to see **distant objects** clearly.

Treatment:

This problem can be **rectified** by using **concave lens**.

HYPERMETROPIA: LONG SIGHTEDNESS

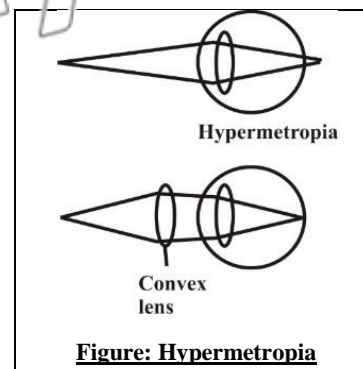
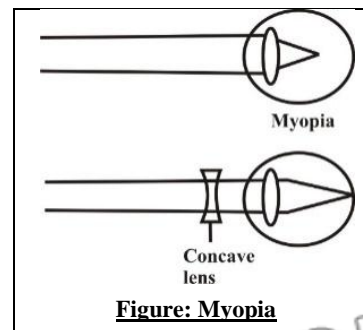
The **image** is formed **behind retina**. It is also known as **long sight**.

Cause and Effect:

It happens when **eyeball shortness**. Such persons are **not able** to see **near objects** clearly.

Treatment:

Convex lens is used to **rectify** this problem.



Q.3 Describe structure of human ear and functions of ear. (K.B)

OR

How would you describe the structure of the external, middle and inner ear of man? (K.B) (Understanding the concept Q.5)

Ans:

STRUCTURE OF HUMAN EAR

Introduction:

Hearing is an important as vision. Our ear helps us in hearing and also to maintain the balance of equilibrium of our body.

Ear has the following three main parts:

- External ear
- Middle ear
- Internal ear

EXTERNAL EAR

External ear consists of **pinna, auditory canal and ear drum** (tympanum).

Pinna:

Pinna is the **broad external part**, made of **cartilage** and covered with **skin**. It **helps** to direct **sound waves** into **auditory canal**.

Auditory Canal:

There are **special glands** in the **walls** of auditory canal, which **produce wax**. The wax and the hairs in auditory canal **protect** ear from **small insects, germs and dust**. In additions to this, they help to **maintain** the **temperature** and **dampness** of auditory canal.

Ear Drum:

Auditory canal **ends in ear drum**. This **thin membrane** separates **external ear** from **middle ear**.

MIDDLE EAR

Middle ear is a **chamber** after external ear.

Ossicles:

Three small bones, called middle ear ossicles, are present in a **chain** in middle ear. These **movable bones** include **malleus, incus and stapes**. **Malleus is attached** with **ear drum**, then comes **incus** and finally **stapes** that is **connected** with a **membrane** called **oval window**.

Oval Window:

Oval window separates middle ear from **inner ear**.

Eustachian Tube:

Middle ear also **communicates** with the **nasal cavity** through **Eustachian tube**. This tube **regulates** the **air pressure** on both sides of eardrum.

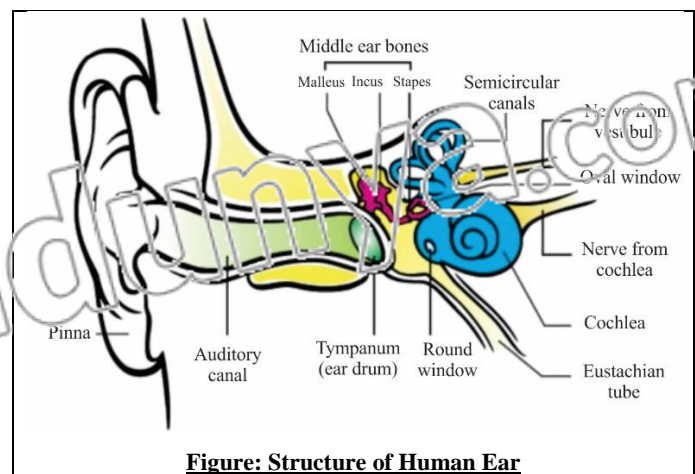


Figure: Structure of Human Ear

INNER EAR

Inner ear consists of **three parts** i.e. **vestibule, semicircular canals and cochlea.**

Vestibule:

Vestibule is **present** in the **center of inner ear.**

Semicircular Canals:

Three canals called **semicircular canals** are **posterior** to the vestibule.

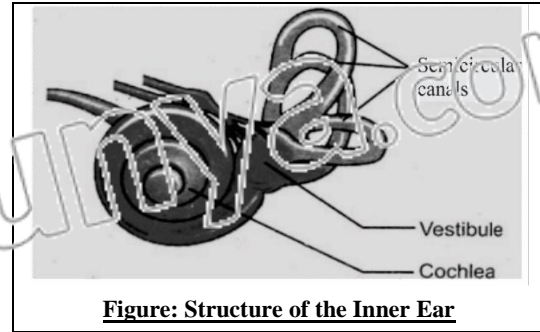


Figure: Structure of the Inner Ear

Cochlea.

The **cochlea** is made of **three ducts** and **wraps** itself into a **coiled tube**. Sound **receptor cells** are present within the **middle duct** of cochlea.

FUNCTIONS OF EAR

There are **two functions** of human ear.

- Hearing
- Balancing of Body

Hearing:

The **pinna** of the external ear focuses and **directs sound waves** into **auditory canal**. The sound waves **strike ear drum** and **produce vibrations** in it. From ear drum, the **vibrations** strike middle ear and **produce** further vibrations in **malleus, incus** and then **stapes**. From **stapes**, the vibrations strike the **oval window** and then reach the **fluid-filled middle duct** of cochlea. The fluid of cochlea is moved and **receptor cells** are **stimulated**. The receptor cells generate a **nerve impulse**, which travels to **brain** and is **interpreted as sound**.

Maintenance the Balance of Body:

Semicircular canals and **vestibule** help to **maintain** the **balance** of body. **Semicircular canals** contain **sensory nerves** which can **detect** any **movement of head**. **Vestibule** can **detect any changes** in the **posture** of body. The **neurons** coming from these two receptors reach **cerebellum** through the **auditory nerve**.

Q.4 **Relate the contribution of Ibn-Al-Haitham and Ali-Ibn-Isa with knowledge about the structure of eye and treatment of various ophthalmic diseases. (Understanding the Concept Q.8)**

Ans:

CONTRIBUTION OF IBN-AL-HAITHAM

Ibn-al-Haitham (965 – 1039 AD) an Arab scientists made scientific contributions to the principles of eye and vision. He is regarded as the father of optics (study of behavior of light). His book of optics' correctly explained and prove the modern theory of vision the discussed the topics of medicine and eye surgery in his book. He made several improvements to eye surgery and accurately described the processes of sight, the structures of eye, image formation in eye and visual system. Ibn al haitham also described the principals of pinhole camera.

CONTRIBUTION OF ALI-IBN-ISA

Ali Ibn Isa (950-1012 AD) was a famous Arab Scientist. He wrote three books on ophthalmology (study of the diseases and surgery of eyes). He describe 30 eyes diseases and prescribed 143 drugs to treat these diseases.

12.3 SHORT QUESTIONS**Q.1 Define receptors. Give examples. (K.B)****Ans:** RECEPTORS**Definition:**

“The organs or parts which are specifically built to detect particular type of stimuli are called sense organs and receptors”.

Main receptors in humans are:

- Eyes
- Ears
- Nose
- Taste Buds

Receptors of Touch, Heat and Cold

Q.2 What is the role of suspensory ligament and ciliary muscle? (K.B)**Ans:** Page no 72.**Q.3 What are rods and cones? (K.B)**

(SWL 2014)

Ans: Page no 72, 73.**Q.4 What is blind spot? (K.B)****Ans:** Page no 73.**Q.5 Define night blindness. (K.B)****Ans:** NIGHT BLINDNESS

Rods contain a pigment called rhodopsin. When light falls on rhodopsin, it breaks for generating a nerve impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Body synthesizes rhodopsin from vitamin A and that is why the deficiency of vitamin A causes poor night vision. This problem is called the night blindness..

Q.6 What is color blindness? (K.B)**Ans:** COLOR BLINDNESS

Cones also contain a pigment, known as iodopsin. There are three main types of cones and each type has a specific iodopsin. Each type of cones recognizes one of three primary colors i.e. blue, green and red. If any type of cone not working well, it becomes difficult to recognize that color. Such person is also not able to distinguish different colors. This disease is called colour blindness and it is a genetic problem.

Q.7 Why owl is not able to see during day times? (U.B)

(LHR 2017)

Ans: OWL CAN'T SEE IN DAY TIMES

Owl is not able to see during day time. The reason for this is the deficiency of cones which receive and sense the bright light. But the presence of more rods gives it greater power of vision during night. All animals that search for prey during night have this characteristic.

Q.8 What is meant by soundless world? (U.B)**Ans:** SOUNDLESS WORLD

Deafness is a state in which hearing is not possible. The defect of ear drum, cochlea, middle ear ossicles, or auditory nerve may cause deafness. Infection in Eustachian tube may spread to middle ear too. Ear drum may be damaged by an infection in auditory canal. Excessive noise, strong blows on cheek, pointed objects entering auditory canal and attack from insects may also affect hearing.

Q.9 How thunderstorm is formed? (A.B)

Ans: THUNDERSTORM

A thunderstorm is characterized by the presence of lightning and a thunder. The lightning is caused by an electrical charge due to the movement of water droplets or electrical charge due to the movement of water droplets or crystals carried by the wind. The sudden increase in pressure and temperature from lightning produces rapid expansion of the air. This expansion of air produces a sound of thunder. The flash of lightning is followed after some seconds by a roar of thunder. This time difference is due to the fact that sound travels than light.

Q.10 Write down the pathway light in human eye? (K.B)

Ans: PATHWAY LIGHT IN HUMAN EYE

Light from objects enters eye and is refracted, when it passes through cornea, aqueous humor, lens and vitreous humor. Lens also focuses light on retina. As a result, the image falls on retina. Rods and cones generate nerve impulses in the optic nerve. These impulses are carried to the brain, which makes the sensation of vision.

Q.11 What is the role of special glands in the wall of auditory canal? (K.B)

Ans: Page no 74.

Q.12 How ears maintain the balance of body? (K.B)

(LHR 2016)

Ans: Page no 75.

Q.13 Have you ever seen the eyes of cat and dog shining in night? Comment on this. (K.B)

Ans: SHINING OF EYES

The eyes of cat and dog shines in night due to presence of tapetum behind the eye which is a layer capable of reflecting light.

Q.14 Why color vision is essential for pilots? (U.B)

Ans: COLOR VISION

Color vision is essential for pilots, so that he/she can recognize aircraft position lights, light-gun signals, airport beacon, approach-slope especially at night. A pilot must have the ability to perceive these colours necessary for the safe performance of his/her duties.

12.3 MULTIPLE CHOICE QUESTIONS

1. **Shape of eye is maintained by (U.B)**

- (A) Sclera (B) cornea
(C) choroid (D) retina

2. **Cornea causes (U.B)**

- (A) duplication (B) reflection
(C) absorption (D) refraction

3. **In how many layers the structure of the eye can be divided? (K.B)**

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

4. **The human eye contains rods about: (K.B)**

(LHR 2013)

- (A) 12.5 millions (B) 7 millions
(C) 12 millions (D) 20 millions

5. **The middle layer of the eye is called: (K.B)**

(LHR 2015, GRW 2016, 17, DGK 2015)

- (A) Sclera (B) Choroid
(C) Cornea (D) Retina

6. **Which are sensitive to dim light? (U.B)**

- (A) Cones (B) Lens
(C) Humours (D) Rods

7. **The point where there are no rods and cones: (K.B)**
 (A) Fovea (B) Optic nerve
 (C) Retina (D) Blind spot
8. **The pigment present in the cones: (K.B)**
 (A) Rhodopsin (B) Iodopsin
 (C) Carotene (D) Xanthophyll
9. **Which vitamin synthesizes rhodopsin? (K.B)**
 (A) A (B) B
 (C) C (D) D
10. **Deficiency of which vitamin causes night blindness? (A.B)**
 (A) K (B) D
 (C) E (D) A
11. **The eyes of cats and dogs shine at night because of the presence of: (U.B)**
 (A) Retina (B) Rods
 (C) Cones (D) Tapetum
12. **Date of birth of Ali Ibn Isa: (K.B)**
 (A) 940 (B) 950
 (C) 960 (D) 970
13. **Date of death of Ibn-al-Haytham: (K.B)**
 (A) 1045 (B) 1049
 (C) 1048 (D) 1039
14. **How many eye diseases were described by Ali Ibn Isa? (K.B)** (LHR 2013)
 (A) 100 (B) 110
 (C) 120 (D) 130
15. **The thin membrane separating external ear from middle ear: (K.B)**
 (A) Oval window (B) Tympanum
 (C) Round window (D) Cochlea
16. **Posterior lobe of pituitary gland secretes. The hormone: (K.B)** (SWL 2015)
 (A) Somatotrophin (B) Thyroxin
 (C) Oxytocin (D) Thyroid
17. **In auditory canal wall, special glands produce: (K.B)** (LHR 2014)
 (A) Wax (B) Blood
 (C) Auditory fluid (D) Nerve impulse
18. **Which one is present in the center of the inner ear? (K.B)**
 (A) Malleus (B) Incus
 (C) Stapes (D) Vestibule
19. **The cochlea is present in: (K.B)** (LHR 2015)
 (A) External ear (B) Middle ear
 (C) Internal ear (D) None of these
20. **Which is not the part of external ear? (K.B)**
 (A) Ossicles (B) Pinna
 (C) Auditory canal (D) Ear drum

12.4 ENDOCRINE SYSTEM

LONG QUESTIONS

Q.1 Write a note on pituitary gland. (K.B) (Understanding the Concept Q.9) (LHR 2016, MTN 2015)

Ans:

PITUITARY GLAND

Shape:

- It is a pea-shaped gland.

Location:

- It is attached to the hypothalamus of brain.

Master Gland:

Many hormones (trophic hormones) of pituitary gland influence the secretions of other endocrine glands.

Direct Action:

Some hormones of this gland act directly on various tissues of body.

Lobes of Pituitary Gland:

There are two lobes of pituitary gland:

- Anterior lobe
- Posterior lobe

Anterior Lobe:

It produces many hormones.

Somatotrophin:

One of its important hormones is somatotrophin. It is also known as growth hormone. It promotes the growth of body.

Dwarfism:

If the production of this hormone is diminished during growing age, the rate of growth decreases. This condition is called dwarfism.

Gigantism:

If this hormone is excessively produced during growing age, it leads to gigantism. The person becomes very tall and overweight.

Acromegaly:

If somatotrophin is excessively produced after growing age, internal organs and body extremities alone grow large. This condition is known as acromegaly. Such persons will have large hands, feet and jawbones.

Thyroid Stimulating Hormone (TSH):

Another important hormone secreted by the anterior lobe of pituitary gland is thyroid stimulating hormone (TSH). It stimulates thyroid gland to secrete its hormones.

Other Hormones:

The remaining hormones of anterior lobe influence reproductive organs and also control adrenal glands.

Posterior Lobe:

The posterior lobe of pituitary gland stores and secretes two hormones.

- Vasopressin (Antidiuretic Hormone)
- Oxytocin

Production:

These hormones are produced by hypothalamus (a part of brain).

Vasopressin:

Vasopressin increases the rate of reabsorption of water from nephrons.

Lesser Water Potential:

When we have **low amount** of **water** in body fluids, **pituitary gland secretes** vasopressin and so **more reabsorption** of water occurs from **nephrons into blood**. In this way, body retains water and **less amount of urine** is produced.

Greater Water Potential:

On the other hand, when body fluids have **more than normal water**, there is a **decline** in the **secretion** of this hormone. If pituitary gland **does not secrete** this hormone in the required amount; **less water** is **reabsorbed** from nephrons and there is **excessive loss of water** through **urine**. This condition is known as **diabetes insipidus**.

Oxytocin:

(MTN 2015)

The hormone, **oxytocin stimulates** the **contraction of uterus** walls in mothers for **child birth**. Moreover, this hormone is necessary for the **ejection of milk from breast**.

Q.2 Write a note on thyroid gland. (K.B) (Understanding the Concept Q.9) (LHR 2016, MTN 2015)

Ans:

THYROID GLAND**Largest Gland:**

This is the **largest endocrine gland** in human body.

Location:

It is present in **neck region**, below **larynx**.

Hormones:

It produces **two hormones**.

- **Thyroxin**
- **Calcitonin**

Thyroxin:

Thyroxin **increases** the **breakdown of food** (oxidation) and **release of energy** in body. It is also responsible for the **growth of body**.

Goiter:

Iodine is required for the **production** of **thyroxin**. If a person **lacks iodine** in diet, thyroid gland **cannot** make its **hormone**. In this condition, thyroid **gland enlarges**. This disorder is called **goiter**.

Hypothyroidism:

Hypothyroidism is caused by the **under-production** of **thyroxin**. It is characterized by **low energy** production in body and **slowing down of heart-beat**.

Hyperthyroidism:

Hyperthyroidism is caused by **over-production** of **thyroxin**. Its symptoms are:

- **Increase in energy production**
- **Increased heart-beat**
- **Frequent sweating**
- **Shivering of hands**

Calcitonin:

The thyroid gland produces another hormone called **calcitonin**. It **decreases** the level of **calcium ions in blood** and promotes the **absorption of calcium** from **blood into bones**.

Q.3 Write a note on parathyroid gland and adrenal gland. (K.B) (Understanding the Concept Q.9)

Ans:

PARATHYROID GLANDS**Number:**

These are **four glands**.

Location:

These are situated on the **posterior side** of **thyroid gland**.

Parathormone:

They produce a hormone known as **parathormone**. It **increases the level of calcium ions** in blood.

Production of Parathormone:

- When there is **increased production** of parathormone, more than **normal calcium salts** are **absorbed** from the **bones** and **added to blood**. Consequently the **bones** become **brittle**.
- If there is **deficiency** in the production of **parathormone**, blood **calcium level falls**. It leads to **tetany**, which affects the **functioning of muscles**.

ADRENAL GLANDS**Number:**

These are **two in number**.

Location:

These are situated **above kidneys**.

Structure:

Each adrenal gland consists of **two parts**:

- The outer part is **cortex**
- The inner part is **medulla**

Adrenal Cortex:

The **adrenal cortex** secretes **many hormones** called **corticosteroids** which **maintain the balance of salts and water** in blood.

Adrenal Medulla:

Adrenal medulla secretes a **hormone** called **epinephrine or adrenaline** in response to **stress**. It prepares our body to overcome **emergency situations**. Therefore, adrenaline is also termed as '**emergency hormone**'.

Q.4 Write a note on pancreas. (K.B)

(Understanding the Concept Q.9) (LHR 2016, GRW 2017)

Ans:

PANCREAS

This organ has **two functions**:

Exocrine Role:

The **major part** of pancreas is a **ducted (exocrine) gland**. This portion **secretes digestive enzymes**, through a duct, into the **small intestine**.

Endocrine Role:

Some portions of **pancreas** serve as **ductless (endocrine) gland**. This portion **contains groups** of endocrine cells referred to as **islets of langerhans**. These islets secrete **two hormones**:

- **Insulin**
- **Glucagon**

Insulin:

Insulin **influences the liver** to take **excess glucose** from **blood** and so the blood glucose concentration **falls**.

Glucagon:

Glucagon **influences the liver** to **release glucose in blood** and so the blood glucose concentration **rises**.

Diabetes Mellitus:

If a person's pancreas does not make **normal quantity of insulin**, the blood glucose concentration **rises** and we say that the person has **diabetes mellitus**.

Symptoms:

Persons with diabetes have:

- Loss of body weight
- Weakening of muscles
- Tiredness

Control:

The disease can be **controlled** by **insulin administration**. Formerly, insulin extracted from animals was used for this purpose. But now human insulin produced from **bacteria** through genetic engineering is available.

Normal Blood Glucose Concentration:

The blood glucose concentration is maintained at the rate of 80 to 120 mg per 100 ml of blood.

Q.5

Ans:

Write a note on gonads. (K.B)

(Understanding the Concept Q.9)

GONADS

The **male and female reproductive organs** are called as **gonads**. The **male reproductive organs** are called **testes** and **female reproductive organs** are called **ovaries**. In addition to producing **gametes**, gonads also **secrete hormones**, called **sex hormones**.

Testes:

The singular of testes is testis. **Testes secrete hormones** e.g. **testosterone**, which is **responsible** for the **development** of **male secondary sex characters** such as:

- Growth of hair on face
- Coarseness of voice

Ovaries:

Ovaries secrete the following hormones:

- Estrogen
- Progesterone

Function:

These both hormones are responsible for the **development** of **female secondary characters** such as the **development of breast** etc.

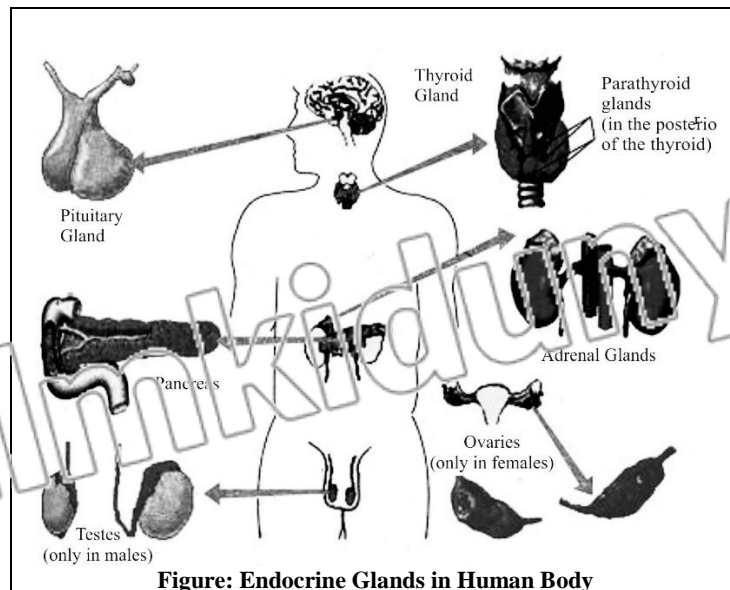
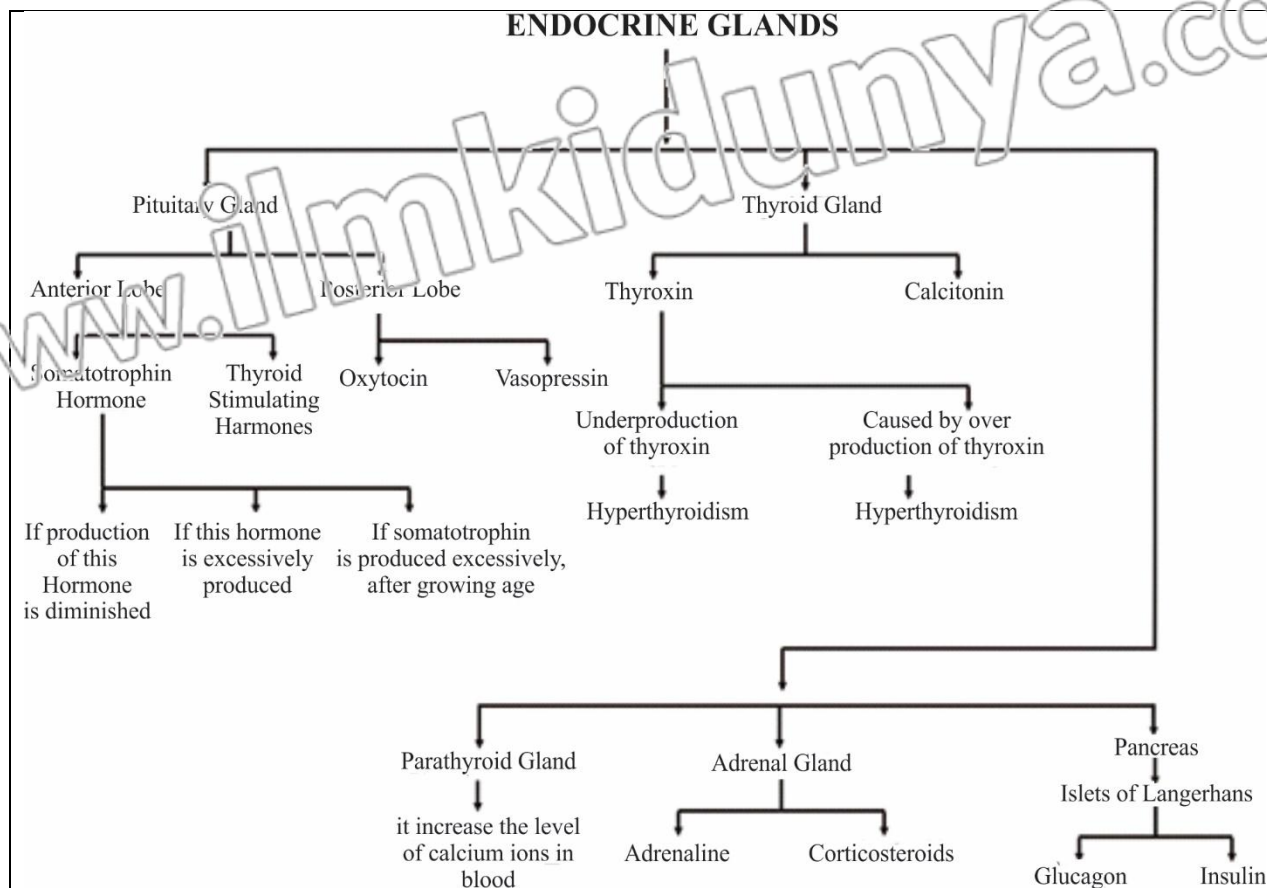


Figure: Endocrine Glands in Human Body

FLOW CHART OF ENDOCRINE GLANDS

Q.6 Describe feedback mechanisms with examples. (U.B)

(GRW 2015)

OR

Describe negative feedback with reference to insulin and glucagon. (A.B)

(Understanding the Concept Q.10)

OR

Describe negative and positive feedback with reference to insulin and glucagon. (A.B)

Ans:

FEEDBACK MECHANISMS

Definition:

“The **regulation** of a **process** by the **output** of the **same process** is called feedback mechanism”

Explanation:

Endocrine glands **do not** secrete their **hormones** at a **constant rate**. The rate **varies** with the needs of the body. Like many other functions in body, the **secretion of hormones** is also **regulated** by **feedback mechanisms**.

TYPES OF FEEDBACK MECHANISMS

Feedback mechanisms are of **two types**:

- Negative Feedback
- Positive Feedback

NEGATIVE FEEDBACK

Definition:

“The feedback in which the **output of a process decreases or inhibits** the process is called **negative feedback**”.

Need of Negative Feedback:

This mechanism works to **return a condition towards its normal value**.

Control of (BGC):

The **blood glucose concentration** (output) **controls** the process i.e. the secretion of insulin and glucagon.

Rise in (BGC):

When the blood glucose concentration **rises**, pancreas **secretes insulin**. It **decreases** the blood glucose concentration. **Decline** in the blood glucose concentration to a **normal set-point inhibits** the secretion of **insulin**.

Fall in (BGC):

When blood glucose concentration **drops below normal**, pancreas **secretes glucagon**. It **raises** the blood glucose concentration. In this case, rise in the blood glucose concentration to a **normal set-point inhibits** the secretion of **glucagon**.

POSITIVE FEEDBACK

Definition:

“The feedback in which the **changes resulting from a process increases the rate of process** is called positive feedback”.

Suckling Action of Infants:

Suckling action of an **infant stimulates** the production of a **hormone in mother**. This hormone works for the **production of milk**. More suckling leads to **more hormone**, which in turn leads to more milk production.

12.4 SHORT QUESTIONS

Q.1 Define hormones. Give examples. (K.B)

Ans:

HORMONE

Definition:

A specific chemical messenger molecule synthesized and secreted by endocrine gland is called a hormone.

Example:

- Somatotrophin
- Thyroxin

Q.2 What is the difference between endocrine and exocrine glands? (K.B)

(LHR 2016)

Ans:

DIFFERENTIATION

The differences between endocrine and exocrine glands are as follows:

Endocrine Glands	Exocrine Glands
Definition	
<ul style="list-style-type: none"> • These glands are ductless and releases their secretions (called hormones) directly into blood stream. 	<ul style="list-style-type: none"> • These glands have ducts for releasing their secretions into the target organs.
Examples	
<ul style="list-style-type: none"> • Pituitary Gland • Thyroid Gland 	<ul style="list-style-type: none"> • Digestive Glands • Skin Glands

Q.3 What are the roles of hormones in animals and unicellular organism? (A.B)

Ans: **ROLES OF HORMONES**

The roles of hormones in animals and unicellular organisms are:

- The step wise process of metamorphosis in many animals is controlled by hormones.
- Life activities such cell division in invertebrates are also regulated by hormones.
- Hormones also control activities like migration in birds.
- Hormones have been identified even in unicellular organism.

Q.4 Why during summer urine output is low? (U.B)

Ans: **URINE OUPUT IN SUMMER**

During summer, urine output is low, Due to increased sweating; the water level of blood is lowered. As a result, pituitary gland releases more anti diuretic hormones (ADH) into blood.

Q.5 Write symptoms of tetany. (U.B)

Ans: **SYMPTOMS OF TETANY**

The symptoms of Tetany are as follows:

- Sharp Flexion of the wrist and ankle joints it is due to decreased blood calcium level.
- Muscles twitching
- Cramps and convulsions

Q.6 Name two hormones which are secreted by posterior lobe of pituitary gland. (K.B)

Ans: Page no 79.

Q.7 What is B.G.C test? (A.B)

Ans: **B.G.C TEST**

The amount of glucose in the blood is measured by this test. It is used to diagnose diabetes. Blood glucose may be measured on a fasting basis (collected after an 8 to 10 hour fast). Randomly (any times) and after a meal.

Blood Glucose After 8-10 Hours Fast	
BGC	Diagnosis
From 70 to 99 mg/100ml	Normal
From 100 to 125 mg/100 ml	Pre-diabetic
126 mg/100 ml and above	Diabetic

Blood Glucose 2 Hours after a 75 gram Glucose Drink	
BGC	Diagnosis
Less than 140 mg/100 ml	Normal
From 140 to 200 mg/100ml	Pre-diabetic
Over 200 mg/100ml	Diabetic

Q.8 Differentiate between dwarfism and gigantism. (K.B)

(LHR 2014)

Ans: **DIFFERENTIATION**

The difference between dwarfism and gigantism is as follows:

Dwarfism	Gigantism
<ul style="list-style-type: none"> • If the production of somatotrophin is diminished during growing age, the rate of growth decreases. The condition is called dwarfism. 	<ul style="list-style-type: none"> • If the somatotrophin is excessively produced during growing age it lead to gigantism (very tall and overweight).

Q.9 Define acromegaly. (K.B)

Ans: Page no 79.

Q.10 Define diabetes insipidus. (K.B)

Ans:

DIABETES INSIPIDUS

Definition:

“If pituitary gland does not secrete the hormone vasopressin in the required amount, less water is reabsorbed from nephrons and there is excessive loss of water through urine.” This condition is known as diabetes insipidus.

Q.11 What is role of calcitonin and parathormone? (A.B)

Ans: Page no 80.

Q.12 What do you mean by emergency hormone? (U.B)

Ans: Page no 81.

Q.13 Differentiate between hypothyroidism and hyperthyroidism. (K.B)

(GRW 2017)

Ans:

DIFFERENTIATION

The differences between hypothyroidism and hyperthyroidism are as follows:

Hypothyroidism	Hyperthyroidism
<ul style="list-style-type: none"> • Hypothyroidism is caused by the under-production of thyroxin. 	<ul style="list-style-type: none"> • Hyperthyroidism is caused by over-production of thyroxin.
<ul style="list-style-type: none"> • It is characterized by low energy production in body and slowing down of heart-beat. 	<ul style="list-style-type: none"> • It is characterized by high energy production and increased heart-beat.

Q.14 What is role of glucagon and insulin hormones? (A.B)

(GRW 2016)

Ans: Page no 81.

Q.15 Define diabetes mellitus. (K.B)

Ans: Page no 81.

Q.16 What are gonads? (K.B)

Ans: Page no 81.

Q.17 What is role of testosterone and estrogen in human reproductive system? (A.B)

Ans: Page no 82.

Q.18 Define feedback mechanism and what are its type? (K.B)

(BWP 2014)

Ans: Page no 82.

Q.19 Name some activities of the body which are required to be regulated by hormones. (U.B)

Ans:

ACTIVITIES

Following are some of the activities of the body which are required to be regulated.

- Growth
- Reproduction
- Maintains of glucose concentration in blood
- Reabsorption of water in kidneys

Q.20 What changes occur in human body during emergency situation? (U.B)

Ans:

EMERGENCY SITUATION

When a person experiences fear, anger or anxiety, the rate and intensity of heartbeat increases, blood pressure increases, blood flow to the limbs increases, blood flow to the alimentary canal and skin is reduced. Such changes prepare the body to face any emergency situation.

12.4 MULTIPLE CHOICE QUESTIONS

1. **Pea shaped gland attached to hypothalamus: (K.B)**
 (A) Thyroid (B) Parathyroid
 (C) Adrenal (D) Pituitary
2. **If the production of somatotrophin is increased during growth, this leads to: (U.B)**
 (A) Dwarfism (B) Acromegaly
 (C) Gigantism (D) Diabetes
3. **Which hormone is secreted in case of emergency situation: (K.B) (LHR 2014)**
 (A) Oxytocin (B) Throxin
 (C) Adrenaline (D) Calcitonin
4. **When the human body has low amount of water then pituitary gland secretes: (K.B)(LHR 2015)**
 (A) Vassopressin (B) Insulin
 (C) TSH (D) Oxytocin
5. **The hormone that stimulates the contraction of uterus walls in mothers for child birth: (K.B)**
 (A) Somatotrophin (B) TSH
 (C) Vasopressin (D) Oxytocin
6. **Thyroxin is produced by which gland? (K.B)**
 (A) Parathyroid (B) Thyroid
 (C) Pituitary (D) Adrenal
7. **Which mineral is required for the production of thyroxin? (A.B)**
 (A) Chlorine (B) Fluorine
 (C) Bromine (D) Iodine
8. **Which is caused by the under production of thyroxin? (K.B)**
 (A) Hypothyroidism (B) Hyperthyroidism
 (C) Acromegaly (D) Dwarfism
9. **The hormone that decreases the level of calcium ions in blood and promotes the absorption of calcium from blood into bones: (A.B)**
 (A) Parathormone (B) Epinephrine
 (C) Calcitonin (D) Thyroxin
10. **Parathyroid gland secretes hormone is called: (K.B) (SWL 2014)**
 (A) Calcitonin is (B) Thyroxin
 (C) Parathormone (D) Epinephrine
11. **Hormones secreted by adrenal cortex: (K.B)**
 (A) Epinephrine (B) Adrenaline
 (C) Corticosteroids (D) Oxytocin
12. **Blood glucose level after 8-10 hours fast for normal: (K.B)**
 (A) From 70 to 99 mg/100ml (B) From 100 to 125mg/100ml
 (C) 126 mg/100ml and above (D) From 10 to 20mg/100ml
13. **Blood glucose level after 8-10 hours fast for diabetic: (K.B)**
 (A) From 70 to 99 mg/100ml (B) From 100 to 125mg/100ml
 (C) 126 mg/100ml and above (D) From 10 to 20mg/100ml
14. **Ovaries secretes _____, which are responsible for the development of female secondary characters such as the development of breast etc. (A.B)**
 (A) Progesterone (B) Testosterone
 (C) Thyroxin (D) None

15. The blood glucose concentration is maintained at the rate of _____ to _____ mg per 100 ml of blood. (A.B)
 (A) 70, 100 mg (B) 80, 120 mg
 (C) 90, 100 mg (D) None
16. If a person's pancreas does not make normal quantity of insulin, the blood glucose concentration rises and we say that the person has: (U.B)
 (A) Diabetes insipidus (B) Diabetes mellitus
 (C) Pre-diabetes (D) None
17. _____ influences the liver to release glucose in blood and so the blood glucose concentration rises. (K.B)
 (A) Insulin (B) Oxytocin
 (C) Thyroxin (D) Glucagon
18. _____ influences the liver to take excess glucose from blood and so blood glucose concentration falls. (K.B)
 (A) Glucagon (B) Insulin
 (C) Parathormone (D) None
19. _____ is caused by over production of thyroxin, its symptoms are increase in energy production, increased heartbeat. (K.B)
 (A) Hypothyroidism (B) Hyperthyroidism
 (C) Gignentism (D) None
20. This is the largest endocrine glands in human body. It is present in neck region, below larynx and produces a hormone _____. (K.B)
 (A) Sometotrophin (B) Oxytocin
 (C) Thyroxin (D) Parathhurmone

12.5 DISORDER OF NERVOUS SYSTEM

LONG QUESTIONS

Q.1 Describe disorders of nervous system. (K.B)

(DGK 2014)

Ans:

NERVOUS DISORDERS

The **disorders** of the **nervous system** are called as nervous disorders.

Types:

There are **two main types** of nervous disorders:

- Vascular disorder
- Functional disorder

Vascular Disorder:

The disorders which are due to any **disturbance in the blood supply** of nervous system are called vascular disorders.

Example

Paralysis

Functional Disorder:

The disorders which are due to any **disturbance in nerve impulse generation and transmission** are called functional disorders.

Example:

- Epilepsy

Q.2 Enlist the symptoms and treatments of paralysis and epilepsy.
(A.B)

(Understanding the Concept 0.12)

OR

Write a note on paralysis and epilepsy. (K.B)

Ans:

PARALYSIS

Definition:

“The complete loss of function by one or more muscle groups is called **paralysis**”.

Causes:

It is most often caused by damage to the **central nervous system** (brain or spinal cord). The damage may be due to.

- **Stroke** (rupture in a blood vessel of brain or spinal cord)
- **Blood clotting in these blood vessels**
- **Poison produced by polio viruses**

Effected Areas:

Patient may have **weak paralysis** throughout his/her body or have **paralysis in one side** of the body. There may also be paralysis in the **lower extremities** or in **all four limbs**.

EPILEPSY

Definition:

“The nervous disorder in which there is **abnormal and excessive discharge of nerve impulses** in brain is called **epilepsy**”.

Seizure:

It causes **unprovoked seizures** in patient. A **seizure** of epilepsy is a **temporary abnormal state of brain marked by convulsions**.

Causes:

- In **younger people**, epilepsy may be due to genetic or **developmental causes**.
- In people over age **40 years**, **brain tumours** are more likely to cause epilepsy.
- **Head trauma** and **central nervous system infections** may cause epilepsy at any age.

Cure:

There is **no known cure** of epilepsy but medicines can **control seizures**. Patients of epilepsy have to take medicines **daily** for the treatment as well as prevention of seizures. These are termed “anticonvulsant” or “**antiepileptic**” drugs.

Precaution during Attack:

During a seizure attack, objects should never be placed in a patient’s mouth as it can result in serious injury. It is possible that the patient will bite his/her own tongue.

12.5 SHORT QUESTIONS

Q.1 What are two types of disorder of nervous system? (K.B)

Ans: Page no 88.

Q.2 What are vascular and functional disorders of nervous system? (K.B)

Ans: Page no 88.

Q.3 Define paralysis. (K.B)

(LHR 2015)

OR

What are causes of paralysis? (U.B)

(LHR 2015)

Ans: Page no 88.

Q.4 What do you mean by epilepsy? (K.B)

OR

What are the causes of epilepsy? (U.B)

Ans: Page no 88.

12.5 MULTIPLE CHOICE QUESTIONS

1. Patients of epilepsy have to take medicine, daily for the treatment as well as prevention of seizures, these medicines are: (K.B)
- (A) Antiviral (B) Antiepileptic
(C) Anti-pyretic (D) Antibiotics
2. _____ is a nervous disorder in which there is abnormal and excessive discharge of nerve impulses in brain. It causes unprovoked Seizure in patient. (K.B)
- (A) Paralysis (B) Dementia
(C) Epilepsy (D) Anemia
3. _____ is the complete loss of function by one or more muscle groups. It is often caused by damage to the central nervous system. (K.B)
- (A) Epilepsy (B) Phobia
(C) Paralysis (D) Dementia
4. _____ are due to any disturbances in the blood supply to nervous system. (K.B)
- (A) Functional disorder (B) Vascular disorder
(C) Cardiac disorder (D) nervous disorder

ANSWER KEY**MULTIPLE CHOICE QUESTIONS****12.1 COORDINATION AND TYPES OF COORDINATION**

1	B	2	B	3	B	4	A	5	C	6	C	7	A
8	C	9	B	10	D	11	B	12	B				

12.2 HUMAN NERVOUS SYSTEM

1	C	2	C	3	A	4	C	5	A	6	B
7	D	8	A	9	B	10	A	11	B	12	C
13	B	14	D	15	C	16	C	17	C	18	A
19	A	20	C	21	C	22	C	23	A		

12.3 RECEPTORS IN HUMAN

1	A	2	C	3	C	4	A	5	B	6	D
7	D	8	B	9	A	10	D	11	D	12	B
13	D	14	B	15	B	16	C	17	A	18	D
19	C	20	A								

12.4 ENDOCRINE SYSTEM

1	A	2	C	3	C	4	A	5	B	6	D
7	D	8	B	9	A	10	B	11	D	12	B
13	D	14	B	15	B	16	C	17	A	18	D
19	B	20	C								

12.5 DISORDER OF NERVOUS SYSTEM

1	B	2	C	3	C	4	B
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REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

- Processes that carry nerve impulses away from the cell body are called: (K.B)
 - Axons
 - Dendrites
 - Synapses
 - Myelin sheath
- The portion of the nervous system that is involuntary in action: (K.B)
 - Somatic nervous system
 - Motor nervous system
 - Autonomic nervous system
 - Sensory nervous system
- Which neurons are present inside the central nervous system? (K.B)
 - Sensory neurons only
 - Motor neurons only
 - Sensory and motor neurons both
 - Interneurons only
- The part of the brain responsible for muscle movement, interpretation of the senses and the memory is the: (K.B)
 - Pons
 - Medulla oblongata
 - Cerebrum
 - Cerebellum
- Apart from hearing, what other major body function is performed by the ear? (A.B)
 - Hormone secretion
 - Body balance
 - Reduction in nerve pressure
 - All of these
- The myelin sheath is formed by, which wrap around the axons of some neurons. (K.B)
 - Nodes of Ranvier
 - Axons
 - Dendrites
 - Schwann cells
- This is not a part of the hindbrain: (K.B)
 - Pons
 - Medulla oblongata
 - Cerebrum
 - Cerebellum
- If you look at an intact human brain, what you see the most is a large, highly convoluted outer surface. This is the: (K.B)
 - Cerebrum
 - Cerebellum
 - Pons
 - Medulla oblongata
- Insulin and glucagon are produced in the: (K.B)
 - Hypothalamus
 - Anterior pituitary
 - Liver
 - Pancreas
- All of these are hormones except: (U.B)
 - Insulin
 - Thyroxin
 - Glucagon
 - Pepsinogen

ANSWERS KEY

1	a	2	c	3	d	4	c	5	b
6	b	7	c	8	a	9	d	10	d

SHORT QUESTIONS

1. Identify the two types of coordination in living organisms. (K.B)

Ans: TWO TYPES OF COORDINATION

There are two types of coordination in living organisms:

- Nervous Coordination brought about by nervous system
- Chemical Coordination brought about by endocrine system

2. Differentiate between the modes of nervous and chemical co-ordinations. (K.B)

Ans: DIFFERENTIATION

The difference between nervous and chemical co-ordinations are as follows:

Nervous Coordination	Chemical Coordination
<ul style="list-style-type: none"> • In nervous coordination, brain and spinal cord are coordinators. They receive information and send messages through neurons in the form of nerve impulses. 	<ul style="list-style-type: none"> • In chemical coordination, various endocrine glands play the role of coordinators. They receive information in the form of various chemicals and send messages by secreting particular hormones in blood.

3. What are the main components of coordination? (K.B)

Ans: MAIN COMPONENTS OF COORDINATION

The following are the components of a coordination:

- Stimulus
- Receptor
- Coordinator
- Effectors
- Response

4. Define reflex action and reflex arc. (K.B)

Ans: REFLEX ACTION

Definition:

“A very quick involuntary response produced by the central nervous system is called reflex action”.

Examples:

- Withdrawal of hand after touching a hot object
- Knee jerk

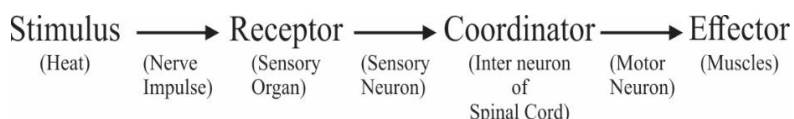
REFLEX ARC

Definition:

“The pathway followed by the nerve impulses for producing a reflex action, is called reflex arc”.

5. Trace the path of a nerve impulse in case of a reflex action. (K.B)

Ans: PATH OF A NERVE IMPULSE IN REFLEX ACTION



6. Describe the pupil reflex in dim and bright light. (K.B)

Ans:

PUPIL REFLEX

Pupil:

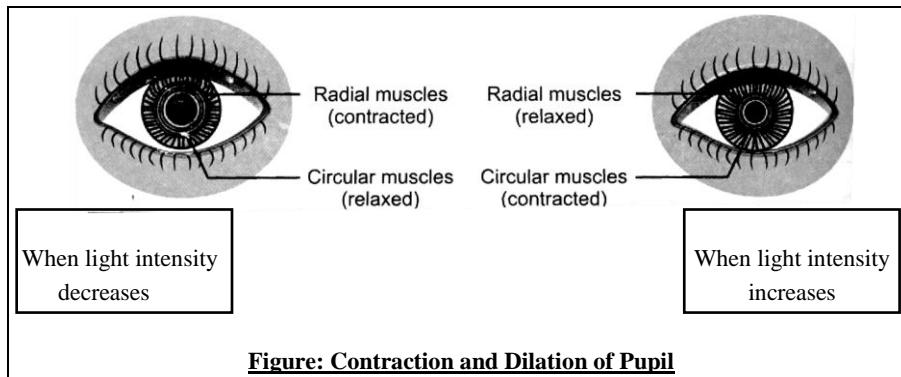
There is round hole, called pupil, in the centre of iris. After striking the cornea, light passes through the pupil. The size of pupil is adjusted by the muscles of iris.

In Bright Light:

Pupil constricts in bright light when the circular muscles of iris contract.

In Dim Light:

Similarly, pupil dilates in dim light when the radial muscles of iris contract.



7. How would you associate the role of vitamin A with vision and effects of its deficiency on retina? (U.B)

Ans:

ROLE OF VITAMIN A IN VISION

Rods contain a pigment called rhodopsin. When light falls on rhodopsin. It breaks for generating a nerves impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Body synthesizes rhodopsin from vitamin A and that is why the deficiency of vitamin A causes poor night vision. The problem is called the night blindness.

8. Define the terms; hormone and endocrine system. (K.B)

Ans:

HORMONE AND ENDOCRINE SYSTEM

Hormone:

A hormone is a specific messenger molecule synthesized and secreted by an endocrine gland.

Example:

- Somatotrophin
- Vasopressin

Endocrine system:

All the endocrine glands (ductless) collectively make a system which is known as endocrine system

Example:

- Pituitary Gland
- Thyroid Gland

UNDERSTANDING THE CONCEPT

1. Explain what can happen if there is no coordination in the activities of organisms. (U.B)

Ans: LACK OF COORDINATION IN ACTIVITIES

If there is no coordination in the activities of organisms cannot perform their activities well.

Example:

When we are writing something, our hands and fingers work in collaboration with our muscles, eyes, thoughts etc. and then very intricate movements result.

Advantage:

Coordination also enables the organism to respond to happenings in the world around it.

2. Explain the location and function of these parts of brain; cerebrum, cerebellum, pituitary gland, thalamus, hypothalamus, medulla oblongata. (A.B)

Ans: See LQ.4 (Topic 12.2)

3. Define neuron and describe the structure of a general neuron. (K.B)

Ans: See LQ.2 (Topic 12.2)

4. Describe the structure of human eye. (K.B)

Ans: See LQ.1 (Topic 12.3)

5. How would you describe the structure of the external, middle and inner ear of man? (K.B)

Ans: See LQ.3 (Topic 12.3)

6. What are short sight and long sight problems and how these can be treated? (A.B)

Ans: See LQ.2 (Topic 12.3)

7. Explain the role of ear in the maintenance of balance. (K.B)

Ans: MAINTENANCE THE BALANCE OF BODY

Semicircular canals and vestibule help to maintain the balance of body. Semicircular canals contain sensory nerves which can detect any movement of head. Vestibule can detect any change in the posture of body. The neurons coming from these two receptors reach cerebellum through the auditory nerve.

8. Relate the contribution of Ibn-al-Haitham and Al-Ibn-Isa with knowledge about the structure of eye and treatment of various ophthalmic diseases. (K.B)

Ans: See LQ.4 (Topic 12.3)

9. Outline the major glands of the endocrine system (pituitary, thyroid, pancreas, adrenal, gonads), with name of their hormones and their functions. (K.B)

Ans: See LQ.1,2,3,4,5 (Topic 12.4)

10. Describe negative feedback with reference to insulin and glucagon. (U.B)

Ans: See LQ.6 (Topic 12.4)

11. Explain how adrenaline may be involved in exercise and emergency conditions. (U.B)

Ans: EMERGENCY CONDITION

Adrenal medulla secretes a hormone called epinephrine or adrenaline in response to stress. It prepares our body to overcome emergency situations. Therefore, adrenaline is also termed as 'emergency hormone'.

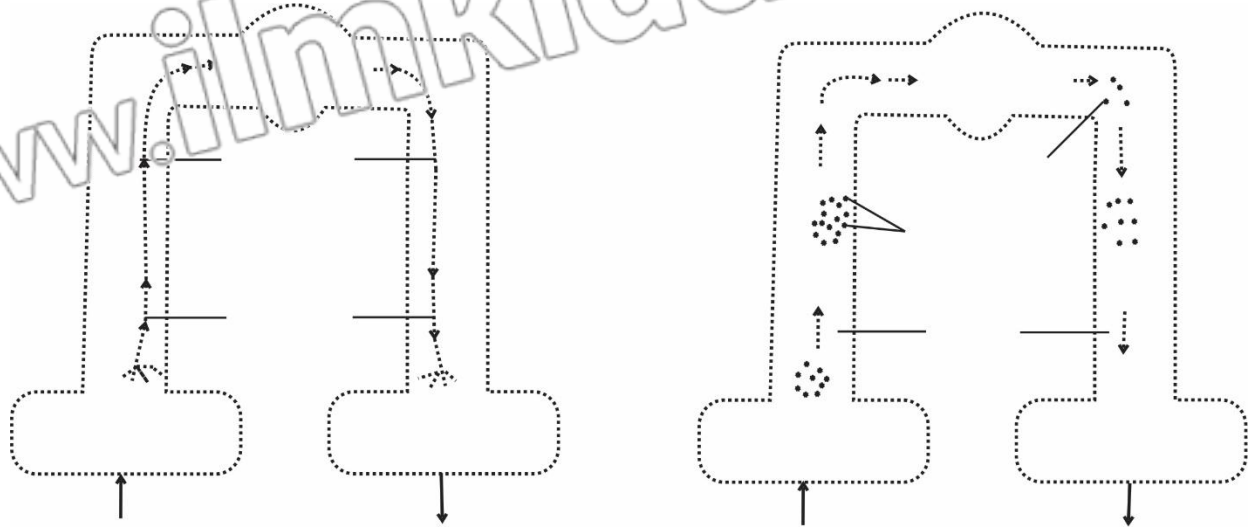
12. Enlist the important symptoms and treatments of paralysis and epilepsy. (K.B)

Ans: See LQ.2 (Topic 12.5)

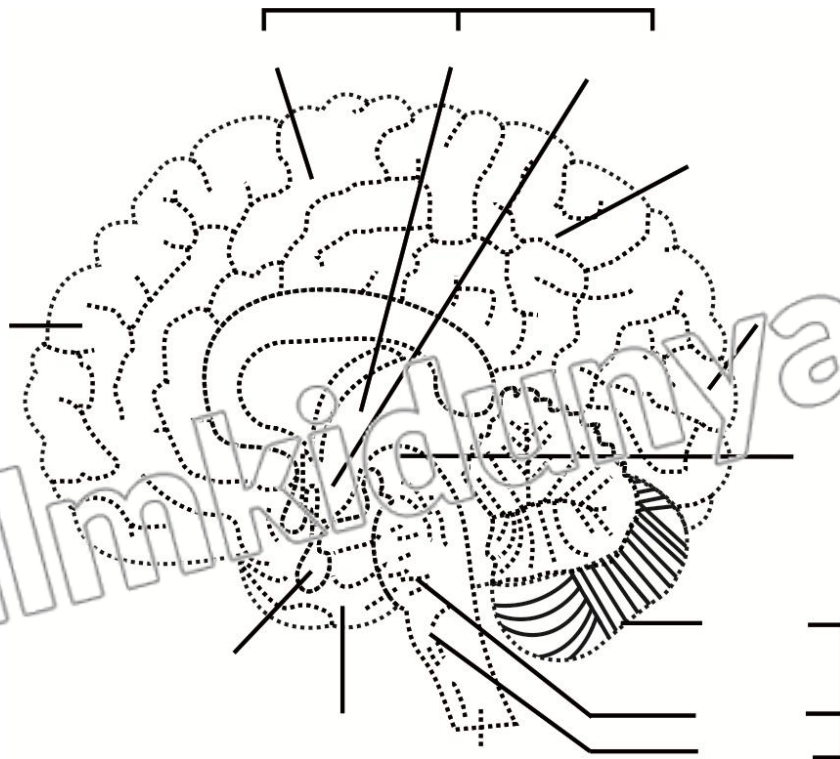
ASSIGNMENT

PRACTICE DIAGRAM & LABEL

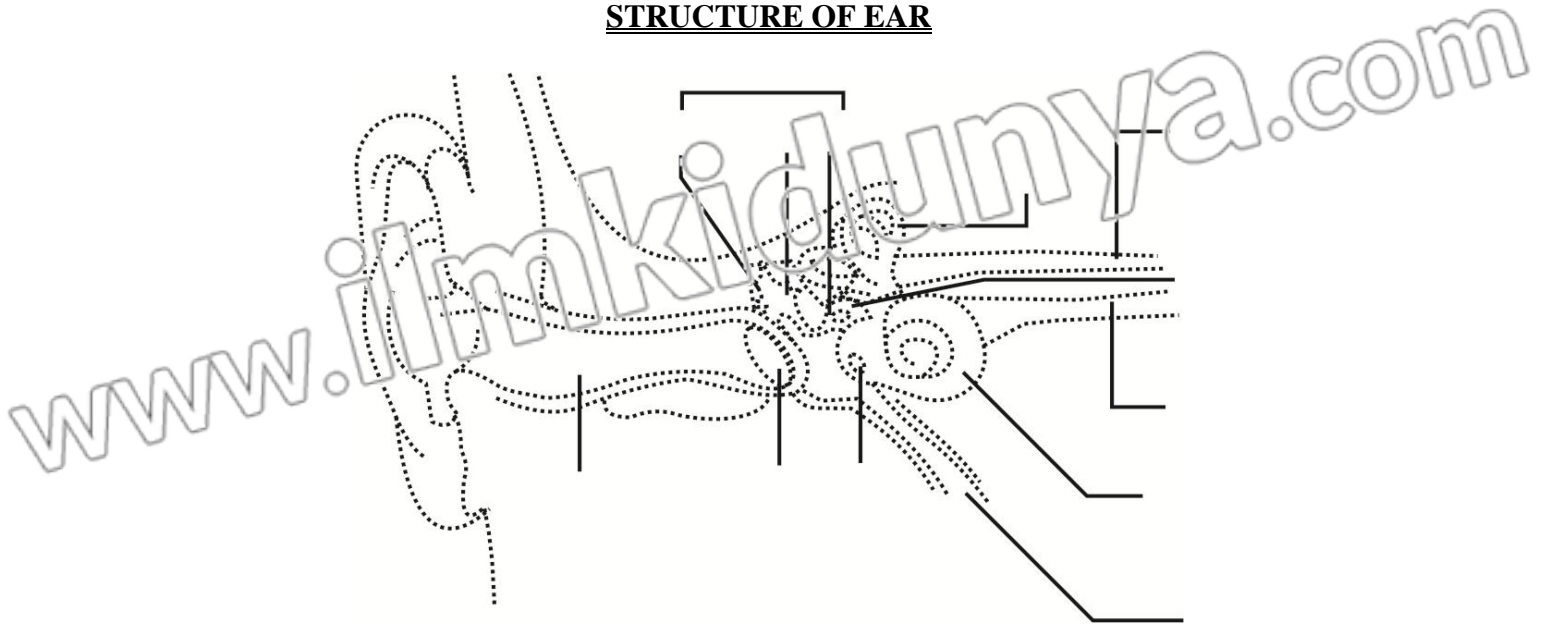
NERVOUS AND CHEMICAL COORDINATION



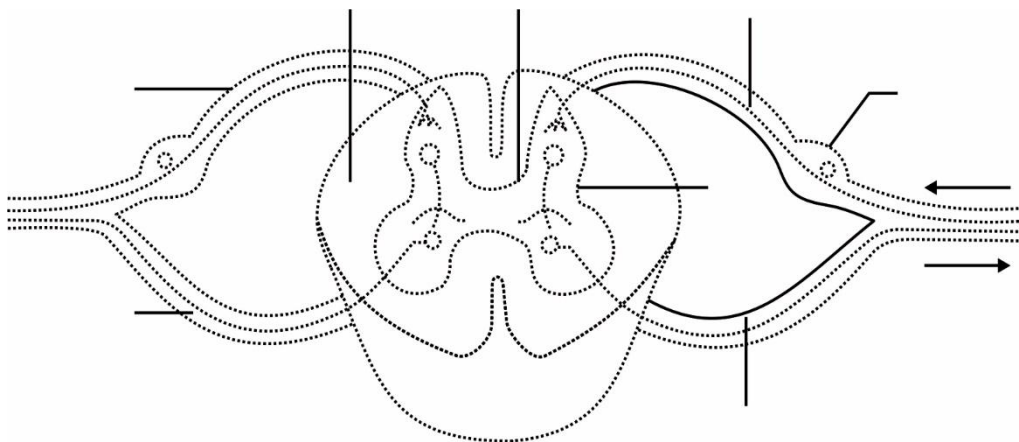
STRUCTURE OF BRAIN



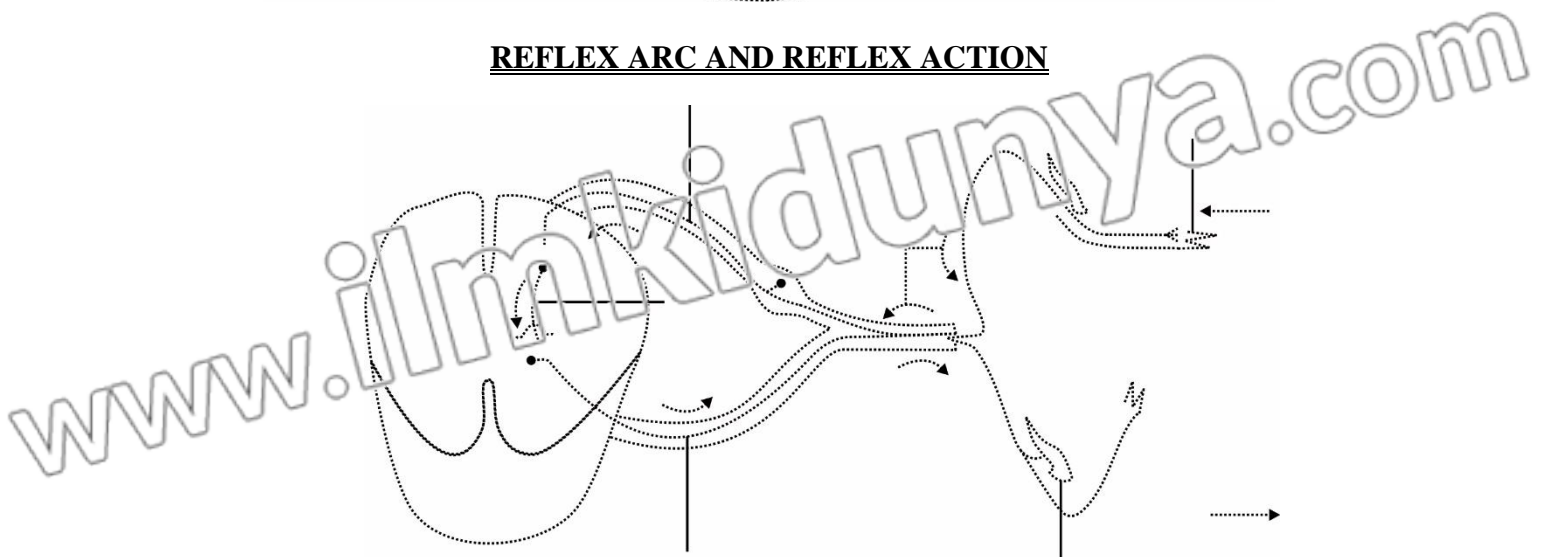
STRUCTURE OF EAR



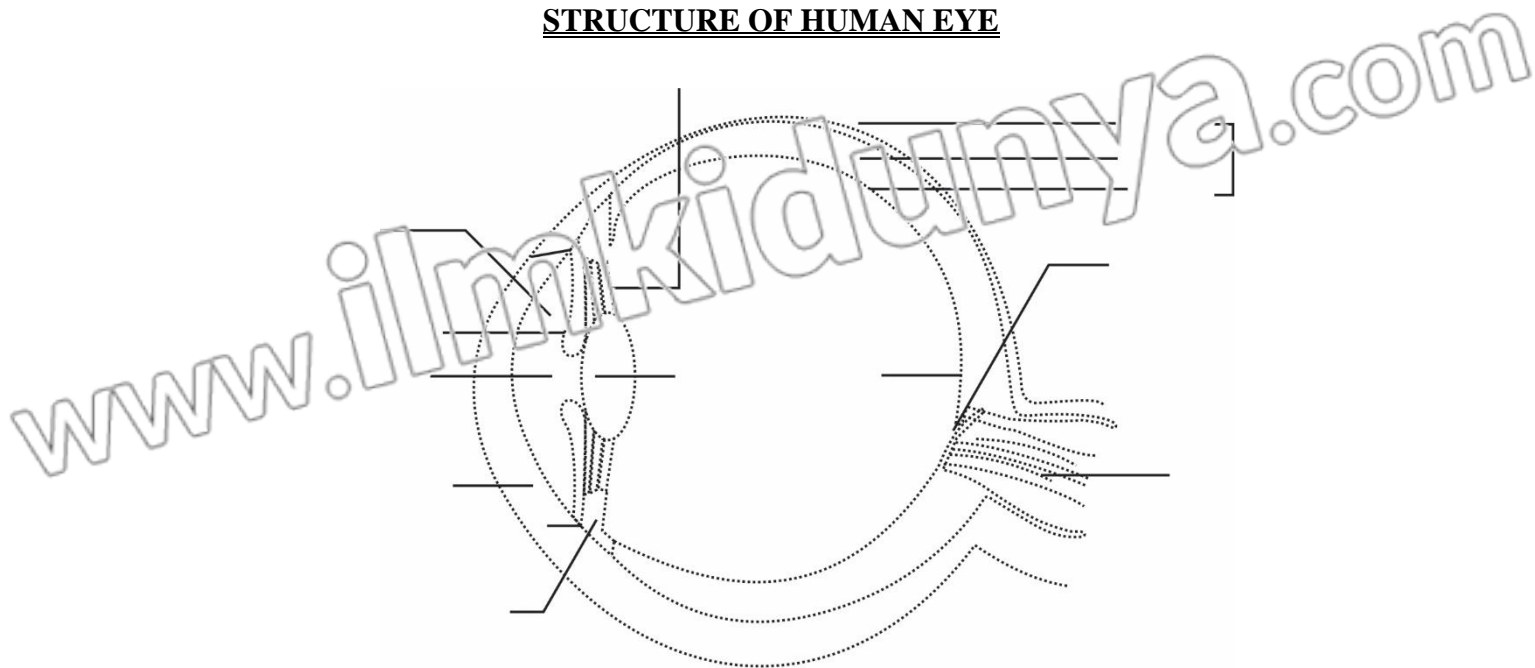
STRUCTURE OF SPINAL CORD



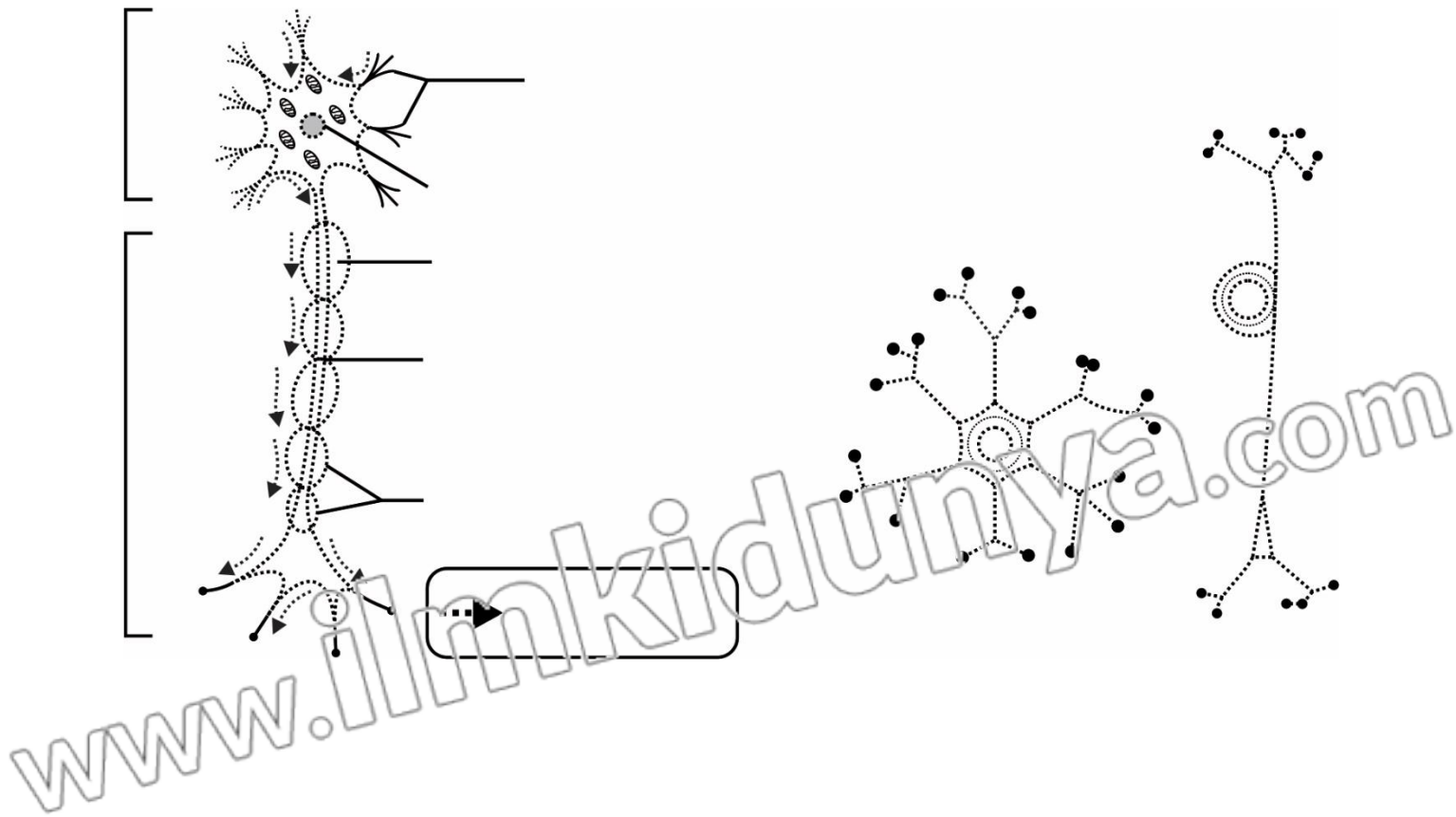
REFLEX ARC AND REFLEX ACTION



STRUCTURE OF HUMAN EYE



NEURONS





CUT HERE

SELF TEST**Time: 40 min****Marks: 25****Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. (6×1=6)****1. Number of steps of co-ordination action is:**

- (A) 3 (B) 5
(C) 7 (D) 4

2. Which part of neuron conducts nerve impulses away from cell body? (BWL 2015)

- (A) Axon (B) Myelin sheath
(C) Node of Ranvier (D) Dendrite

3. The human eye contains rods about:

- (A) 12.5 million (B) 0.7 million
(C) 1.2 million (D) 2 million

4. When the human body has low amount of water then pituitary gland secretes:

- (A) Vassopressin (B) Insulin
(C) TSH (D) Oxytocin

5. _____ are due to any disturbances in the blood supply to nervous system

- (A) Functional disorder (B) Vascular disorder
(C) Cardiac disorder (D) nervous disorder

6. All of these are hormones except:

- (A) Insulin (B) Thyroxin
(C) Glucagon (D) Pepsinogen

Q.2 Give short answers to following questions. (5×2=10)

- (i) What are two types of co-ordination in living organisms?
(ii) Write the five components of the co-ordinate action?
(iii) What is nerve growth factor? How they regenerate brain cells?
(iv) What is the role of special glands in the wall of auditory canal?
(v) What is role of testosterone and estrogen in human reproductive system?

Q.3 Answer the following questions in detail. (5+4=9)

- (a) Write a note on pituitary gland.
(b) Describe the structure of eye.

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of students.