GRADE 12 LIFE SCIENCES NOTES

**NERVOUS SYSTEM**

*The notes below have been compiled according to the official Exam Guidelines for Life Sciences.*

The Nervous System and the Sense Organs will be assessed in Paper 1 end of the year. **40 marks**.

YOU NEED TO KNOW:

1. There are **2 forms of communication** in the body. **Nervous Coordination** and **Chemical Coordination**. These 2 systems help us to respond to any changes in the environment around us. The changes are referred to as **stimuli.**
2. The difference between Nervous Coordination and Endocrine System.

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| --- | --- |
| **NERVOUS COORDINATION**   1. Nerve impulses conduct the message. 2. Impulses transmitted by neurons. 3. Fast response. 4. Specific response in effectors eg muscles and glands. | **ENDOCRINE SYSTEM**   1. Chemicals cause the response. 2. Hormones travel in blood. 3. Slower transmission 4. Number of Target organs stimulated. |

1. **Protection of the Brain and Spinal Cord**: They are protected by 3 membranes called **Meninges.**
2. Examine a **diagram** of the **Brain** in your textbook: Find the location of the Cerebrum, Cerebellum, Corpus callosum, Medulla oblongata, Hypothalamus, Pituitary gland and the Spinal cord.
3. Know the **FUNCTIONS** of each:

**CEREBRUM:** Higher thought processes; Speech; Memory; Interprets sensations from sense organs.

**CEREBELLUM:** Maintains balance; Muscle coordination; Controls muscle tension.

**CORPUS CALLOSUM:** Connects the two hemispheres of the brain, allowing communication between the right and the left brain.

**HYPOTHALAMUS:** Thermostat of the body (Controls body temperature); Seat of emotions such as love. Thirst centre; Centre for appetite.

**PITUITARY GLAND:** Secretes hormones to stimulate endocrine glands to secrete hormones.

**MEDULLA OBLONGATA:** Controls heartbeat; Breathing control centre; Relays impulses between the Spinal cord and the Brain.

**SPINAL CORD:** Reflex Centres are situated here; It serves as a pathway for impulses to and from the brain and the body.

1. **The 3 components of the NERVOUS SYSTEM**

A **The Central Nervous System (CNS)** : Brain and Spinal cord

B **The Peripheral Nervous System:** Nerves that are found **outside the CNS**. This includes 12 pairs of **Cranial Nerves** that originate from the brain and 31 pairs of **Spinal Nerves** that originate from the Spinal Cord. These nerves contain **Sensory Neurons** conducting impulses from receptors **to** the CNS and **Motor Neurons** to conduct impulses **from** the CNS to the effectors (muscles and glands).

C **The Autonomic Nervous System**: This system is **not** under the control of will. It regulates processes that are **automatic** or involuntary. **Examples** are, the control of rate of heartbeat, breathing and digestion. This ensures a stable internal environment. The Autonomic Nervous System is divided into the **Sympathetic** innervation and the opposite, **Parasympathetic** innervations. The Sympathetic system **speeds most processes up**, eg faster heartbeat, faster rate of breathing and dilation of pupil. The parasympathetic system **slows systems** **down** to bring all **back to normal** after the temporary speeding up. The two systems above are said to be **antagonistic**, because they work opposite to one another.

1. **Label** a Nerve Cell **(Neuron)** and know the functions of the different parts of the Neuron: Dendrites; Cell body; Cytoplasm; Nucleus; Axon; Myelin sheath; Synapse.
2. **The role of Receptors:** To detect stimuli and convert them to nerve impulses. Impulses are conducted by the neurons (nerve cells) to and from the CNS
3. **Reflex Action:** This refers to quick automatic response to a stimulus. Impulses are conducted to the spinal cord, NOT the brain. Reflex actions protects the body from possible external harm.

**The Reflex Arc** is the pathway of impulses from the **receptors** to the spinal cord and back to **effectors** (muscles or glands) **during a reflex action.**

**Know** the correct order of events during the reflex arc,

1. Receptors → Sensory Neuron → Dorsal Root of Spinal Nerve → Spinal Cord → Interneuron → Motor Neuron → Ventral Root of Spinal Nerve → Effector.

Describe the **REFLEX ARC** in a diagram, draw and label.

Also be able to **discuss** it in paragraph form. Note, when the question requires candidates to discuss the REFLEX ARC, all marks will be lost if you draw diagrams or use arrows.

1. **Disorders of the Nervous System:** (1) **Alzheimers Disease** is caused by fibres forming in the brain. Patients suffer memory loss and are confused.

(2) **Multiple Sclerosis** is caused by degeneration of the Myelin Sheaths of

Neurons. This leads to loss of control in balance and movement. Muscle weakness and fatigue occur.

**THE EYE**

*The notes on THE EYE have been compiled according to the official Exam Guidelines for Life Sciences, Grade 12.*

1. You need to be able to **label a diagram** of the eye and know the **functions** of the different parts. Examine diagrams pertaining to this chapter in your textbooks.
2. What is the importance of ***Binocular Vision*?** This refers to vision using two eyes situated in front of the head, with overlapping fields of view. This allows a person to have perception of depth.
3. Be able to describe ***accommodation of the eye*** and interpret diagrams on the topic:

When a person views an object less than 6m from the eye…

The Ciliary Muscles contract **√** and

the 2 Ciliary Bodies move closer to the lens. **√**

This causes the tension in the Suspensory Ligaments to become slack. **√**

The lens therefore becomes rounder (more convex) **√** and has greater refractive power. **√**

The light converges on the fovea **√** of the retina where a clear **√** image is formed. Usually [6]

In the event of viewing an object further than 6m, change the above to the opposite.

1. **Pupillary Mechanism:** This refers to what happens in the **iris** of the eye to **change the size of the pupil** when you look into **bright light** OR the opposite, when you move into a dark room.

**In BRIGHT light…**

The Circular Muscles of the iris Contract**√** and the Radial Muscles Relax. **√** These muscles work opposite to one another (antagonistic).

*Pair C for* ***C****ircular with* ***C****ontract and R for* ***R****adial with* ***R****elax.*

This results in the diameter of the pupil getting smaller, the pupil constrics. **√** Less light enters the eye**√** and the fovea is protected from excessive exposure to rays of the sun, preventing damage to the retina. **√ [5]**

If the question asks about the mechanism when you step int an area with **DIM** light, you write the opposite to the above for each point.

1. **Visual Defects**

A **Short-Sightedness:** Light falls in front of the fovea due to (1) Too long eyeball or (2) Cornea is too convex or (3) Lens is too round (convex). The REMEDY is to wear concave lenses

B **Long-Sightedness:** Light falls behind the fovea due to (1) Too short eyeball, or (2) the Cornea is to flat or (3) The lens is too flat. The REMEDY is to wear convex lenses.

C **Astigmatism:** The curvature of the Cornea is irregular. The REMEDY is to have lenses designed for your specific defect.

D **Cataracts:** The lens becomes cloudy and opaque. This reduces the transparency of the lens and the light that reaches the fovea is not sufficient. The REMEDY is to replace the lens with an artificial lens.

**PLEASE EXAMINE DIAGRAMS FROM PREVIOUS QUESTION PAPERS TO BECOME FAMILIAR WITH THE WAY EXAMINERS TEST CANDIDATES ON TOPICS THAT RELATE TO THE EYE.**

**THE EAR**

*The notes on THE EAR have been compiled according to the official Exam Guidelines for Life Sciences, Grade 12.*

1. Examine **diagrams** of the human ear in your text book. You need to know the names of all the **different parts** as well as the **functions** of all.
2. The role of the **organ of Corti** in hearing. Understand how the sense of hearing works.

This includes the **pathway of Sound Waves** through the ear until the stage where the Cerebrum interprets what you hear:

Sound Waves → Pinna → Auditory Canal → Tympanic Membrane → Malleus → Incus → Stapes → Vibrations through Oval Window → Waves in the fluid (Perilymph) of the Vestibular Canal → Pressure is transferred to the Endolymph of the Cochlea Canal → Organ of Corti → The Hair Cells of The Organ of Corti bend → Impulses are Generated → Auditory Nerve → Cerebrum where the sound is interpreted.

1. **Functions of the Structures of the EAR:**

**Pinna** - Directs Sound Waves to the Auditory Canal

**Auditory Canal** - Channels the Sound Waves to the Tympanic Membrane. (Previously known as the eardrum, but do not use this phrase in the exams)

**Tympanic Membrane** - Vibrates as a result of the Sound Waves and converts the Sound Waves to Vibrations.

**Eustachian Tube** - Equalise the Pressure on both sides of the Tympanic Membrane.

**The 3 Ossicles** (Malleus, Incus and Stapes) - These are small bones previously known as the Hammer, Anvil and Stirrup, conduct the Vibrations to the Oval Window of the Inner Ear. The ossicles amplify the sound.

**The Organ of Corti** - Converts Vibrations to Impulses.

**Auditory Nerve** - Conducts impulses to the Cerebrum.

1. **Balance**
2. The **Semi-Circular Canals** contain structures called the **Cristae** with **Hair Cells** that bend in the fluid called endolymph when the head moves. When the **Hair Cells bend**, an impulse is generated. These impulses are sent to the **Cerebellum** via the Vestibular branch of the Auditory Nerve. The Cerebellum sends impulses to the **muscles** to correct the problem.

The **Cristae** in the Semi-Circular Canals are sensitive to any **movement of the head.**

1. **The Sacculus and Utriculus** contain structures called Maculae. The Maculae contain Hair Cells that react to gravitational pull.
2. **Hearing Defects: (a) Middle Ear Infection -** due tobacterial infection pressure builds up in the Middle Ear, very painful. The fluid causing the build-up of pressure, is drained out of the Middle Ear by Grommets which are inserted by a surgeon.

**Hearing Aids** and **Cochlear Implants** amplify the sound.