

NCERT Exemplar Solutions of Class 11 Biology – Chapter 21: Neural Control and Coordination

VERY SHORT ANSWER QUESTIONS

Question 1

Rearrange the following in the correct order of involvement in electrical impulse movement: Synaptic knob, dendrites, cell body, Axon terminal, Axon

Solution: The correct order of involvement in electrical impulse movement is:

Dendrites → Cell body → Axon → Axon terminal → Synaptic knob

Enhanced Explanation: This sequence represents the path of nerve impulse transmission:

Dendrites receive signals from other neurons

Cell body integrates incoming signals

Axon conducts the action potential away from cell body

Axon terminal is the endpoint of the axon

Synaptic knob releases neurotransmitters at the synapse

Question 2

Comment upon the role of ear in maintaining the balance of the body and posture.

Solution: The inner ear plays a crucial role in maintaining body balance and posture through the vestibular system, which consists of two main parts:

Semicircular canals - Detect rotational movements of the head

Vestibule (utricle and saccule) - Detect linear acceleration and head position relative to gravity

Enhanced Explanation: The vestibular organs contain specialized hair cells and otoliths (calcium carbonate crystals) that respond to head movements. When the head moves, these structures send signals to the brain about body position, allowing for postural adjustments and maintenance of equilibrium.

Question 3

Which cells of the retina enable us to see coloured objects around us?

Solution: The **cone cells** present in the retina enable us to see coloured objects around us.

Enhanced Explanation: Cone cells are photoreceptors responsible for color vision and visual acuity. There are three types of cone cells, each sensitive to different wavelengths:

S-cones (short wavelength) - blue light

M-cones (medium wavelength) - green light

L-cones (long wavelength) - red light The brain interprets different combinations of signals from these cones as various colors.

Question 4

Arrange the following in the order of reception and transmission of a sound wave from the eardrum: Cochlear nerve, external auditory canal, eardrum, stapes, incus, malleus, and cochlea.

Solution: The correct order of reception and transmission of sound waves is: **External auditory canal → Eardrum → Malleus → Incus → Stapes → Cochlea → Cochlear nerve**

Enhanced Explanation: This pathway shows how sound waves are converted from mechanical vibrations to electrical signals:

Sound waves travel through the external auditory canal

Vibrate the eardrum (tympanic membrane)

Transfer through the three ossicles (malleus, incus, stapes)

Amplify and transmit vibrations to the cochlea

Hair cells in cochlea convert to electrical signals

Cochlear nerve carries signals to the brain

Question 5

During resting potential, the axonal membrane is polarized, indicate the movement of +ve and -ve ions leading to polarisation diagrammatically.

Solution: During resting potential, the axonal membrane maintains polarization through:

Ion Distribution:

Outside the membrane: High Na^+ concentration, Low K^+ concentration

Inside the membrane: Low Na^+ concentration, High K^+ concentration, Negatively charged proteins

Ion Movement:

Na^+ - K^+ pump: Actively transports 3 Na^+ out for every 2 K^+ in

K^+ leak channels: Allow K^+ to leak out down its concentration gradient

Na^+ channels: Mostly closed during resting state

Enhanced Explanation: The diagram in the PDF shows the distribution of charges across the membrane, with positive charges accumulated outside and negative charges inside, creating a potential difference of approximately -70mV. This polarization is essential for action potential generation.

Question 6

Name the structures involved in the protection of the brain.

Solution: The brain is protected by several structures:

Skull (cranium) - Hard bony outer protection

Cranial meninges - Three protective membrane layers:

Dura mater (outer layer) - Thick, tough, fibrous membrane

Arachnoid mater (middle layer) - Spider-like membrane structure

Pia mater (inner layer) - Thin, delicate, vascular membrane

Cerebrospinal fluid (CSF) - Fills subarachnoid space, acts as cushion

Enhanced Explanation: These protective layers work together to shield the brain from mechanical trauma, maintain stable chemical environment, and provide cushioning against sudden movements. The CSF also helps in nutrient transport and waste removal.

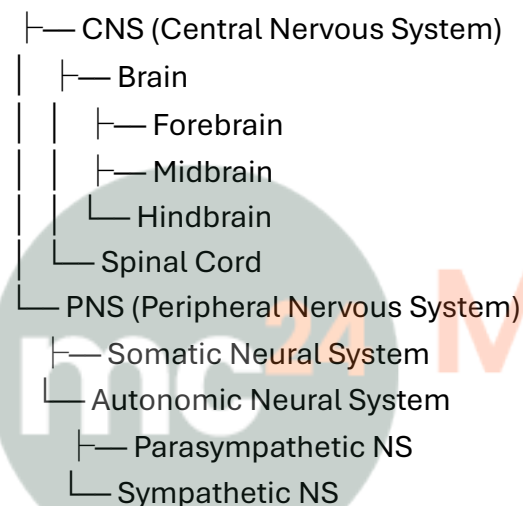
SHORT ANSWER TYPE QUESTIONS

Question 1

The major parts of the human neural system are depicted below. Fill in the empty boxes with appropriate words.

Solution: The human neural system is organized as follows:

Human Neural System



Enhanced Explanation: This hierarchical organization shows how the nervous system is divided into central (CNS) and peripheral (PNS) components, with further subdivisions based on function and anatomical location.

Question 2

What is the difference between electrical transmission and chemical transmission?

Solution:

Aspect	Electrical Transmission	Chemical Transmission
Location	Electrical synapses	Chemical synapses
Speed	Faster	Slower
Mechanism	Direct current flow through gap junctions	Neurotransmitter release and binding
Gap	Very narrow (2-4 nm)	Wider synaptic cleft (20-40 nm)
Direction	Usually bidirectional	Unidirectional

Aspect	Electrical Transmission	Chemical Transmission
Plasticity	Limited	High (can be modified)

Enhanced Explanation: Electrical transmission allows rapid, synchronized responses (like in cardiac muscle), while chemical transmission provides more precise control and signal modulation, allowing for complex neural processing and learning.

Question 3

Neural system and computers share certain common features. Comment in five lines.

Solution: Similarities between neural systems and computers:

Input devices: Computers use mouse/keyboard; neural systems use sensory neurons to receive environmental inputs

Processing unit: CPU in computers processes data; brain in neural systems integrates and processes information

Output devices: Computers have monitors/printers; neural systems use motor neurons and effector organs

Memory storage: Both systems can store and retrieve information for future use

Signal transmission: Both use electrical signals for information transfer and processing

Enhanced Explanation: While both systems process information using electrical signals, the neural system is far more complex, with parallel processing, adaptability, and self-repair capabilities that current computers cannot match.

Question 4

If someone receives a blow on the back of the neck, what would be the effect on the person's CNS?

Solution: A blow to the back of the neck can have serious effects on the CNS:

Immediate Effects:

Potential dislocation of cervical vertebrae (especially C1-C7)

Possible spinal cord injury at the cervical level

Disruption of nerve pathways between brain and body

Consequences:

Mild injury: Temporary numbness, tingling, or pain

Severe injury: Paralysis, loss of sensation, breathing difficulties

Critical injury: Complete spinal cord transection leading to quadriplegia or death

Enhanced Explanation: The cervical region of the spinal cord carries vital nerve pathways controlling breathing, heart function, and limb movement. Damage here can be life-threatening due to disruption of these essential functions.

Question 5

What is the function ascribed to Eustachian tube?

Solution: The Eustachian tube serves several important functions:

Primary Function:

Pressure equalization: Maintains equal air pressure on both sides of the eardrum

Secondary Functions:

Drainage: Allows mucus and fluid to drain from the middle ear to the pharynx

Protection: Helps prevent infection by providing a drainage pathway

Ventilation: Allows air circulation in the middle ear cavity

Enhanced Explanation: The tube connects the middle ear cavity to the nasopharynx and opens during swallowing, yawning, or nose-blowing. This pressure equalization is crucial for proper hearing and prevents eardrum damage during altitude changes.

Question 6

Label the following parts in the given diagram using the arrow: Aqueous chamber, Cornea, Lens, Retina, Vitreous chamber, Blind spot



Solution: The labeled diagram of the human eye shows:

Cornea: Transparent front layer that refracts light

Aqueous chamber: Fluid-filled space between cornea and lens

Lens: Adjustable structure that focuses light on retina

Vitreous chamber: Large gel-filled cavity maintaining eye shape

Retina: Light-sensitive layer containing photoreceptors

Blind spot: Area where optic nerve connects to retina (no photoreceptors)

Enhanced Explanation: Each structure plays a vital role in vision: the cornea and lens focus light, the chambers maintain eye shape and pressure, the retina converts light to electrical signals, and the blind spot is where these signals exit the eye via the optic nerve.