

Neural Control and Coordination

21.2 Human Neural System

1. In a man, abducens nerve is injured. Which one of the following functions will be affected?
(a) Movement of the eyeball
(b) Movement of the tongue
(c) Swallowing
(d) Movement of the neck (2005)
2. Injury to vagus nerve in humans is not likely to affect
(a) tongue movements
(b) gastrointestinal movements
(c) pancreatic secretion
(d) cardiac movements. (2004)
3. Which cranial nerve has the highest number of branches?
(a) Vagus nerve (b) Trigeminal nerve
(c) Facial nerve (d) None of these (1999)
4. Sympathetic nervous system induces
(a) secretion of digestive juices
(b) heart beat
(c) secretion of saliva
(d) all of these. (1999)
5. The vagus nerve is the cranial nerve numbering
(a) 7 (b) 5
(c) 10 (d) 9. (1997)
6. By which nervous system and of what type, the blood is supplied into visceral organs?
(a) Both SNS and PNS, involuntary
(b) Para-sympathetic nervous system involuntary
(c) Sympathetic nervous system, involuntary
(d) Sympathetic nervous system, voluntary (1996)
7. The sympathetic nerves, in mammals, arise from
(a) sacral nerves
(b) 3rd, 7th, 9th and 10th cranial nerves
(c) thoraco-lumbar nerves
(d) cervical nerves. (1995)
8. Afferent nerve fibres carry impulses from
(a) effector organs to CNS

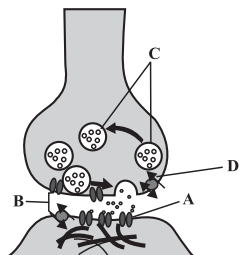
- (b) receptors to CNS
(c) CNS to receptors
(d) CNS to muscles. (1992)

9. Vagus nerve is
(a) X (b) IX
(c) VII (d) V. (1992)
10. One function of parasympathetic nervous system is
(a) contraction of hair muscles
(b) stimulation of sweat glands
(c) acceleration of heart beat
(d) constriction of pupil. (1990)
11. Which of the following cranial nerves can regulate heart beat?
(a) X (b) IX
(c) VIII (d) VII (1989)

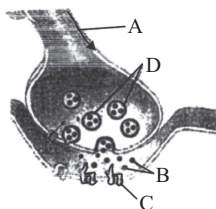
21.3 Neuron as Structural and Functional Unit of Neural System

12. Nissl's bodies are mainly composed of
(a) proteins and lipids
(b) DNA and RNA
(c) nucleic acids and SER
(d) free ribosomes and RER. (NEET 2018)
13. Myelin sheath is produced by
(a) astrocytes and Schwann cells
(b) oligodendrocytes and osteoclasts
(c) osteoclasts and astrocytes
(d) Schwann cells and oligodendrocytes. (NEET 2017)
14. Receptor sites for neurotransmitters are present on
(a) pre-synaptic membrane
(b) tips of axons
(c) post-synaptic membrane
(d) membranes of synaptic vesicles. (NEET 2017)
15. The most abundant intracellular cation is
(a) H⁺ (b) K⁺
(c) Na⁺ (d) Ca⁺⁺. (NEET 2013)

16. A diagram showing axon terminal and synapse is given. Identify correctly at least two of A - D.



- (a) A - Neurotransmitter, B - Synaptic cleft
 (b) C - Neurotransmitter, D - Ca^{++}
 (c) A - Receptor, C - Synaptic vesicles
 (d) B - Synaptic connection, D - K^+ (NEET 2013)
17. The figure shows an axon terminal and synapse. Select the option giving correct identification of labels A-D.



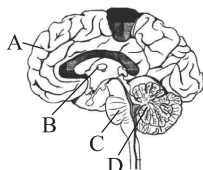
- (a) A-Action potential, C-Neurotransmitter
 (b) B-Neurotransmitter, D- Receptor capsules
 (c) C-Receptor, D-Synaptic vesicles
 (d) A-Axon terminal, B- Serotonin complex (Karnataka NEET 2013)
18. When a neuron is in resting state *i.e.*, not conducting any impulse, the axonal membrane is
- (a) comparatively more permeable to Na^+ ions and nearly impermeable to K^+ ions
 (b) equally permeable to both Na^+ and K^+ ions
 (c) impermeable to both Na^+ and K^+ ions
 (d) comparatively more permeable to K^+ ions and nearly impermeable to Na^+ ions. (2011)
19. Alzheimer's disease in humans is associated with the deficiency of
- (a) glutamic acid (b) acetylcholine
 (c) gamma aminobutyric acid (GABA)
 (d) dopamine. (2009)
20. During the propagation of a nerve impulse, the action potential results from the movement of
- (a) K^+ ions from intracellular fluid to extracellular fluid
 (b) Na^+ ions from extracellular fluid to intracellular fluid
 (c) K^+ ions from extracellular fluid to intracellular fluid
 (d) Na^+ ions from intracellular fluid to extracellular fluid. (2008)

21. During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric charge?
- (a) First positive, then negative and continue to be negative
 (b) First negative, then positive and continue to be positive
 (c) First positive, then negative and again back to positive
 (d) First negative, then positive and again back to negative. (2007)
22. Which one of the following does not act as a neurotransmitter?
- (a) Cortisone (b) Acetylcholine
 (c) Epinephrine (d) Norepinephrine (2006)
23. Parkinson's disease (characterized by tremors and progressive rigidity of limbs) is caused by degeneration of brain neurons that are involved in movement control and make use of neurotransmitter
- (a) acetylcholine (b) norepinephrine
 (c) dopamine (d) GABA. (2005)
24. In the resting state of the neural membrane, diffusion due to concentration gradients, if allowed, would drive
- (a) K^+ into the cell
 (b) K^+ and Na^+ out of the cell
 (c) Na^+ into the cell
 (d) Na^+ out of the cell. (2004)
25. What used to be described as Nissl's granules in a nerve cell are now identified as
- (a) cell metabolites (b) fat granules
 (c) ribosomes (d) mitochondria. (2003)
26. Which of the following statement is correct for node of Ranvier of nerve?
- (a) Neurilemma is discontinuous.
 (b) Myelin sheath is discontinuous.
 (c) Both neurilemma and myelin sheath are discontinuous.
 (d) Covered by myelin sheath. (2002)
27. Depolarization of axolemma during nerve conduction takes place because of
- (a) equal amount of Na^+ and K^+ move out across axolemma
 (b) Na^+ move inside and K^+ move more outside
 (c) more Na^+ outside
 (d) none of these. (2000)
28. The junction between the axon of one neuron and the dendrite of the next is called
- (a) constant bridge (b) junction point
 (c) a joint (d) a synapse. (1999)

29. Which of the following is regarded as a unit of nervous tissue?
 (a) Neurons (b) Myelin sheath
 (c) Axons (d) Dendrites (1999)
30. The Nissl's granules of nerves cell are made up of
 (a) DNA (b) RNA
 (c) ribosome (d) protein. (1997)

21.4 Central Neural System

31. Which part of the brain is responsible for thermoregulation?
 (a) Medulla oblongata (b) Cerebrum
 (c) Hypothalamus (d) Corpus callosum (NEET 2019)
32. Which of the following structures or regions is incorrectly paired with its functions?
 (a) Medulla : Controls respiration and cardiovascular reflexes
 (b) Limbic system : Consists of fibre tracts that interconnect different regions of brain controls movement
 (c) Hypothalamus : Production of releasing hormones and regulation of temperature, hunger and thirst
 (d) Corpus callosum : Band of fibers connecting left and right cerebral hemispheres (NEET 2018)
33. Which of the following regions of the brain is incorrectly paired with its function?
 (a) Corpus callosum - communication between the left and right cerebral cortices
 (b) Cerebrum - calculation and contemplation
 (c) Medulla oblongata - homeostatic control
 (d) Cerebellum - language comprehension (2015 Cancelled)
34. Injury localized to the hypothalamus would most likely disrupt
 (a) short - term memory
 (b) co-ordination during locomotion
 (c) executive functions, such as decision making
 (d) regulation of body temperature. (2014)
35. A sagittal section of human brain is shown here. Identify at least two labels from A-D.



- (a) C-Midbrain, D-Cerebellum
 (b) A-Cerebrum, C-Pons

- (c) B-Corpus callosum, D-Medulla
 (d) A-Cerebral hemispheres, B-Cerebellum (Karnataka NEET 2013)

36. The human hind brain comprises three parts, one of which is
 (a) spinal cord (b) corpus callosum
 (c) cerebellum (d) hypothalamus. (2012)
37. The nerve centres which control the body temperature and the urge for eating are contained in
 (a) hypothalamus (b) pons
 (c) cerebellum (d) thalamus. (2010)
38. Which part of human brain is concerned with the regulation of body temperature?
 (a) Cerebellum (b) Cerebrum
 (c) Hypothalamus (d) Medulla oblongata (2009)
39. Third ventricle of brain is also known as
 (a) metacoel (b) rhinocoel
 (c) paracoel (d) diacoel. (1990)

21.5 Reflex Action and Reflex Arc

40. Destruction of the anterior horn cells of the spinal cord would result in loss of
 (a) commissural impulses
 (b) integrating impulses
 (c) sensory impulses
 (d) voluntary motor impulses. (2015)
41. Which one of the following is the example of the action of the autonomous nervous system?
 (a) Swallowing of food
 (b) Pupillary reflex
 (c) Peristalsis of the intestine
 (d) Knee-jerk response (2005)
42. Ivan Pavlov performed experiments on
 (a) simple reflexes (b) conditioned reflexes
 (c) cardiac reflexes (d) origin of life. (1993)

21.6 Sensory Reception and Processing

43. Match the following columns and select the correct option.

Column-I	Column-II
(A) Organ of Corti	(i) Connects middle ear and pharynx
(B) Cochlea	(ii) Coiled part of the labyrinth
(C) Eustachian tube	(iii) Attached to the oval window
(D) Stapes	(iv) Located on the basilar membrane

- | (A) | (B) | (C) | (D) | |
|-----------|-------|------|-------|-------------|
| (a) (ii) | (iii) | (i) | (iv) | |
| (b) (iii) | (i) | (iv) | (ii) | |
| (c) (iv) | (ii) | (i) | (iii) | |
| (d) (i) | (ii) | (iv) | (iii) | (NEET 2020) |

44. Which of the following statements is correct?

- Cornea consists of dense matrix of collagen and is the most sensitive portion of the eye.
- Cornea is an external, transparent and protective proteinacious covering of the eye-ball.
- Cornea consists of dense connective tissue of elastin and can repair itself.
- Cornea is convex, transparent layer which is highly vascularised. (NEET 2019)

45. Which of the following statements is not correct?

- An action potential in an axon does not move backward because the segment behind is in a refractory phase.
- Depolarisation of hair cells of cochlea results in the opening of the mechanically gated potassium-ion channels.
- Rods are very sensitive and contribute to daylight vision.
- In the knee-jerk reflex, stimulus is the stretching of muscle and response is its contraction. (Odisha NEET 2019)

46. Which of the following receptors are specifically responsible for maintenance of balance of body and posture?

- Basilar membrane and otoliths
- Hair cells and organ of corti
- Tectorial membrane and macula
- Crista ampullaris and macula (Odisha NEET 2019)

47. The transparent lens in the human eye is held in its place by

- ligaments attached to the ciliary body
- ligaments attached to the iris
- smooth muscles attached to the iris
- smooth muscles attached to the ciliary body. (NEET 2018)

48. Good vision depends on adequate intake of carotene rich food.

Select the best option from the following statements.

- Vitamin A derivatives are formed from carotene.
 - The photopigments are embedded in the membrane discs of the inner segment.
 - Retinal is a derivative of vitamin A.
 - Retinal is a light absorbing part of all the visual photopigments.
- (1), (3) and (4)
 - (1) and (3)
 - (2), (3) and (4)
 - (1) and (2)

(NEET 2017)

49. Choose the correct statement.

- Nociceptors respond to changes in pressure.
- Meissner's corpuscles are thermoreceptors.
- Photoreceptors in the human eye are depolarised during darkness and become hyperpolarised in response to the light stimulus.
- Receptors do not produce graded potentials. (NEET-II 2016)

50. Photosensitive compound in human eye is made up of

- opsin and retinol
- transducin and retinene
- guanosine and retinol
- opsin and retinal. (NEET-I 2016)

51. In mammalian eye, the 'fovea' is the center of the visual field, where

- only rods are present
- more rods than cones are found
- high density of cones occur, but has no rods
- the optic nerve leaves the eye. (2015)

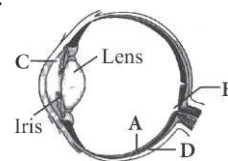
52. A gymnast is able to balance his body upside down even in the total darkness because of

- tectorial membrane
- organ of corti
- cochlea
- vestibular apparatus. (2015 Cancelled)

53. Which one of the following statements is not correct?

- Retinal is the light absorbing portion of visual photopigments.
- In retina the rods have the photopigment rhodopsin while cones have three different photopigments.
- Retinal is a derivative of vitamin C.
- Rhodopsin is the purplish red protein present in rods only. (2014)

54. Parts A, B, C and D of the human eye are shown in the diagram. Select the option which gives correct identification along with its functions characteristics.



- C-Aqueous chamber-Reflects the light which does not pass through the lens.
- D - Choroid - Its anterior part forms ciliary body.
- A - Retina - Contains photoreceptors, i.e., rods and cones.
- B - Blind spot-Has only a few rods and cones. (NEET 2013)

55. Which part of the human ear plays no role in hearing as such but is otherwise very much required?
 (a) Eustachian tube (b) Organ of corti
 (c) Vestibular apparatus (d) Ear ossicles (2012)

56. Select the answer with correct matching of the structure, its location and function.

Structure	Location	Function
(a) Eustachian tube	Anterior part of internal ear	Equalizes air pressure on either sides of tympanic membrane
(b) Cerebellum	Midbrain	Controls respiration and gastric secretions
(c) Hypothalamus	Forebrain	Controls body temperature, urge for eating and drinking
(d) Blind spot	Near the place where optic nerve leaves the eye	Rods and cones are present but inactive here

(Mains 2010)

57. Which one of the following pairs of structures is correctly matched with their corrected description?

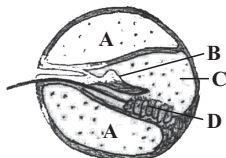
Structures	Description
(a) Tibia and fibula	Both form parts of knee joint
(b) Cartilage and cornea	No blood supply but do require oxygen for respiratory need
(c) Shoulder joint and elbow joint	Ball and socket type of joint
(d) Premolars and molars	20 in all and 3 rooted

(Mains 2010)

58. Cornea transplant in humans is almost never rejected. This is because

- (a) it is composed of enucleated cells
 (b) it is a non-living layer
 (c) its cells are least penetrable by bacteria
 (d) it has no blood supply. (2008)

59. Given below is a diagrammatic cross section of a single loop of human cochlea.



Which one of the following options correctly represents the names of three different parts?

- (a) D : Sensory hair cells, A : Endolymph, B : Tectorial membrane

- (b) A : Perilymph, B : Tectorial membrane, C : Endolymph
 (c) B : Tectorial membrane, C : Perilymph, D : Secretory cells
 (d) C : Endolymph, D : Sensory hair cells, A : Serum (2008)

60. Which one of the following is the correct difference between rod cells and cone cells of our retina?

	Rod cells	Cone cells
(a) Overall function	Vision in poor light	Colour vision and detailed vision in bright light
(b) Distribution	More concentrated in centre of retina	Evenly distributed all over retina
(c) Visual acuity	High	Low
(d) Visual pigment contained	Iodopsin	Rhodopsin

(2008)

61. Bowman's glands are located in the
 (a) anterior pituitary
 (b) female reproductive system of cockroach
 (c) olfactory epithelium of our nose
 (d) proximal end of uriniferous tubules. (2007)

62. Bowman's glands are found in
 (a) juxtamedullary nephrons
 (b) olfactory epithelium
 (c) external auditory canal
 (d) cortical nephrons only. (2006)

63. When we migrate from dark to light, we fail to see for sometime but after a time visibility becomes normal. It is example of
 (a) accommodation (b) adaptation
 (c) mutation (d) photoperiodism. (2001)

64. Which of the following statements is the characteristics of human cornea?
 (a) It is secreted by conjunctiva and glandular layer.
 (b) It is a lacrimal gland which secrete tears.
 (c) Blood circulation is absent in cornea.
 (d) In old age it becomes the cause of cataract. (2001)

65. In the chemistry of vision in mammals, the photosensitive substance is called
 (a) rhodopsin (b) melanin
 (c) sclerotin (d) retinol. (1997)

66. Light rays entering the eye is controlled by
 (a) pupil (b) iris
 (c) cornea (d) lens. (1993)

67. Retina is most sensitive at
 (a) optic disc (b) periphery
 (c) macula lutea (d) fovea centralis. (1993)

- 68.** Function of iris is to
 (a) move lens forward and backward
 (b) refract light rays
 (c) bring about movements of eye lids
 (d) alter the size of pupil. (1993)
- 69.** Iris is part of
 (a) sclerotic
- (b) choroid
 (c) choroid and retina
 (d) sclerotic and choroid. (1993)
- 70.** Sensitive pigmented layer of eye is
 (a) cornea (b) retina
 (c) sclerotic (d) iris. (1989)

ANSWER KEY

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

Hints & Explanations

1. (a) : Abducens is the sixth cranial nerve which innervates the external rectus muscle of the eye ball. It is responsible for turning the eye outwards. Movement of the tongue is controlled by the hypoglossal nerve. Neck movements is controlled by the facial nerve. Swallowing is controlled by glossopharyngeal nerves.

2. (a) : Vagus nerve arises from the side of medulla oblongata. It innervates the larynx, trachea, oesophagus, stomach, lungs, heart and intestines. It is a mixed nerve. It controls the visceral sensations and visceral movements, *i.e.*, heart beat, respiratory movements, peristalsis, sound production, etc. Movement of the tongue is controlled by hypoglossal nerve as it innervates the muscles of the tongue.

3. (b) : Trigeminal nerve is the largest 5th cranial nerve. It has 3 branches : Ophthalmic, Maxillary and Mandibular.

4. (b) : Sympathetic nervous system is a component of autonomic nervous system consisting of a pair of sympathetic trunks, preganglionic sympathetic fibres, postganglionic sympathetic fibres and collateral ganglia. It quickens rate and force of heart beat while it inhibits secretion of saliva and gastric juice.

5. (c) : Vagus nerve is the tenth cranial nerve. It arises from the side of medulla oblongata. It innervates the larynx, trachea, oesophagus, stomach, lungs, heart and

intestines. It is a mixed nerve. It controls the visceral sensations and visceral movements, *i.e.*, heart beat, respiratory movements, peristalsis, sound production, etc.

6. (a) : The blood is supplied into visceral organs by both SNS (sympathetic nervous system) and PNS (parasympathetic nervous system) involuntarily. The sympathetic fibres increase the rate and force of heart beat, constrict most blood vessels and raise the arterial blood pressure. The parasympathetic fibres decrease the rate and force of heart beat, dilate many blood vessels and lower the arterial blood pressure.

7. (c) : Sympathetic nervous system forms a part of autonomic nervous system that consists of nerves which connect the visceral receptors and effectors with the central nervous system through the cranial and spinal nerves. Sympathetic nerves arise from thoraco-lumbar nerves.

8. (b) : Afferent nerve fibres carry impulses from the receptors to the central nervous system. Efferent nerve fibres conduct nerve impulses from the central nervous system to the effector organs such as muscles and glands.

9. (a)

10. (d) : The action of the parasympathetic nervous system is opposite to that of the sympathetic nervous system. If the sympathetic nervous system accelerates an

action, the parasympathetic nervous system slows it. The parasympathetic fibres constrict the pupil, decrease the rate and force of heart beat, dilate many blood vessels, lower the arterial blood pressure, quicken the peristaltic movements and contract the urinary bladder.

11. (a) : Refer to answer 5.

12. (d) : Nissl's bodies, also known as Nissl's granules are irregular masses of rough endoplasmic reticulum (RER) with numerous as well as free ribosomes and polysomes, found in cell body or cyton of a neuron. These probably synthesise proteins for the nerve cell.

13. (d) : Schwann cells and oligodendrocytes form myelin sheath around the axon. Myelin sheath serves as an insulating layer, preventing loss of energy of the nerve impulse during its passage along the fibre.

14. (c) : Neurotransmitter is a chemical substance responsible for transmission of nerve impulse across synapse. It is released by synaptic vesicle into the synaptic cleft. Neurotransmitter binds with protein receptor molecule present on post synaptic membrane causing its depolarisation and generation of action potential.

15. (b) : K^+ ions predominate in the intracellular fluid whereas Na^+ ions predominate in extracellular fluid.

16. (c) 17. (c)

18. (d) : When a neuron is not conducting any impulse, i.e., resting, the axonal membrane is comparatively more permeable to potassium ions (K^+) and nearly impermeable to sodium ions (Na^+).

19. (b) : Alzheimer's disease is a neurological disease characterized by progressive loss of intellectual ability. The disease, which is named after German physician Alois Alzheimer (1864-1915), is associated with general shrinkage of the brain tissue, with deposits of β -amyloid protein and abnormal filaments composed of tau protein in the brain, and changes in the neurotransmitter systems within the brain that include a loss in the activity of cholinergic neurons (neurons releasing acetylcholine). Some inherited forms are associated with a genetic locus on chromosome 21.

20. (b) : Action potential is the change in electrical potential that occurs across a plasma membrane during the passage of a nerve impulse. As an impulse travels in a wave-like manner along the axon of a nerve, it causes a localized and transient switch in electric potential across the membrane from -60 mV (millivolts; the resting potential) to $+45$ mV. It is due to the fact that the sodium channels open and the potassium channels remain closed. As a result, sodium channels permit the influx of Na^+ by diffusion from extracellular fluid to intracellular fluid.

21. (d) : The signal that travels along the length of a nerve fibre and is the means by which information is transmitted through the nervous system is called nerve impulse. During resting phase, inside of the plasma membrane is negatively charged (polarized, -70 mV, resting potential). As the stimulus reaches it becomes positively charged ($+45$ mV, action potential). This condition is known as depolarization of nerve fibres. As impulse passes away, it regains its original ionic distribution and becomes repolarized.

22. (a) : Neurotransmitters are chemicals that are used to relay, amplify and modulate electrical signals between a neuron and another cell. Substances that act as neurotransmitters can be categorized into three major groups: (i) amino acids (primarily glutamic acid, GABA, aspartic acid and glycine), (ii) peptides (vasopressin, somatostatin, neurotensin, etc.), and (iii) monoamines (norepinephrine, dopamine and serotonin) plus acetylcholine. Cortisone is a glucocorticoid steroid hormone, produced by the adrenal glands and has anti-inflammatory and immune-system suppressing properties.

23. (c) : Parkinson's disease is caused by degeneration of neurons in substantia nigra tract which are essentially dopaminergic. This striatum controls muscle tones and coordinates movements. An imbalance is caused by deficiency of dopamine (an inhibitory neurotransmitter) *vis-a-vis*.

24. (c) : In the resting nerve fibre, in the external medium (tissue fluid), sodium ions (Na^+) predominate, whereas within the fibre (intracellular fluid) potassium ions (K^+) predominate. Due to different concentrations of ions on the two sides of the membrane, sodium ions tend to passively diffuse into the nerve fibre and potassium ions tend to diffuse out of the nerve fibre down their electrochemical gradients. The membrane of a resting nerve fibre is, however, more permeable to potassium than to sodium. Because of this selective permeability of the membrane, potassium leaves the nerve fibre faster than sodium enters it. This makes the membrane of the resting nerve fibre polarized, extracellular fluid outside it being electropositive (positively charged) with respect to the cell contents inside it.

25. (c) : Cell body of a nerve cell contains basophilic granules called Nissl's granules. These granules appear to be cisternae of rough endoplasmic reticulum with numerous attached and free ribosomes. They probably synthesise proteins for the cell.

26. (b) : At the level of node of Ranvier the myelin sheath is discontinuous but not the neurilemma lining.

Actually myelin sheath is an integral part of Schwann cell – which form a continuous neurilemmal covering. Each Schwann cell wrap-around the neurite to form concentric layers of plasma membrane. But at the level of junction between two Schwann cells myelin cannot be formed and thus a gap appears.

27. (b) : Depolarization of a nerve cell membrane occurs during the passage of an action potential along the axon where the nerve is transmitting an impulse. During depolarization, the activation gates of Na^+ channels open and the K^+ channels remain closed. Na^+ rush into the axon. Entry of sodium ions leads to depolarization (reversal of polarity) of the nerve membrane, so that the nerve fibre contents become electropositive with respect to the extracellular fluid.

28. (d) : Synapse is the close proximity of the axon of one neuron and the dendrite or cyton of another neuron with a gap of just about 200 Å in between. A nerve impulse is transmitted across the synapse by the release from the presynaptic membrane of neurotransmitter, which diffuses across the synaptic cleft to the post synaptic membrane. This triggers the propagation of the impulse from the dendrite along the length of the post synaptic neuron.

29. (a) : Neurons or nerve cells are the structural and functional unit of nervous system. These have a special structure but vary greatly in size and shape. Each neuron has a cell body which encloses cytoplasm and has a nucleus. A number of processes arise from the cell body. There is usually a single axon and a variable number of dendrites. The medullated nerve fibres is composed of a shining, white, fatty substance called myelin.

30. (c) : Refer to answer 25.

31. (c) : Hypothalamus is thermoregulatory centre. Hence it is called “thermostat” of the body. It keeps body temperature at roughly 37°C by means of a complex thermostat system.

32. (b) : Certain components of the cerebrum and diencephalon constitute the limbic system. It is sometimes called the emotional brain because it controls emotional behaviour expressed in the form of joy, sorrow, fear, fight, friendship, liking and disliking. It also controls food habits and sex behaviours necessary for survival of the individual.

33. (d) : Language comprehension is a function of cerebrum. Cerebellum coordinates and controls rapid muscular activities such as running, typing, etc. Although it does not initiate such voluntary movements, but it is an important centre for coordinating movements and for controlling posture and balance. Cerebellum's function

is almost exclusively motor; but it is also implicated in some forms of learning.

34. (d) : Hypothalamus lies at the base of the thalamus. It provides anatomical connection between the nervous and endocrine systems by its relationship to the pituitary gland. Hypothalamus is thermoregulatory centre. Hence, it is called “thermostat” of the body. It keeps body temperature at roughly 37°C by means of a complex thermostat system. Any localised injury to hypothalamus will, hence, disrupt regulation of body temperature.

35. (b) : A - Cerebrum
B - Thalamus
C - Pons varolii
D - Cerebellum

36. (c) : Brain is the anterior most part of central nervous system. Human brain can be divided into three parts: forebrain, midbrain and hindbrain. Human hindbrain comprises pons, cerebellum and medulla (also called the medulla oblongata).

37. (a) **38. (c)**

39. (d) : The ventricles consist of four hollow, fluid filled spaces inside the brain. The third ventricle is also known as diacoel. The third ventricle consists of a narrow channel between the hemispheres through the area of the thalamus. It is connected by the cerebral aqueduct or aqueduct of Sylvius or iter in the midbrain portion of the brainstem to the fourth ventricle in the pons and medulla. Metacoel is the IV ventricle, rhinocoel is the I ventricle and paracoel is the II ventricle.

40. (d) : The anterior horns of spinal cord contains cells with fibres that form the anterior (motor) root end and are essential for the voluntary and reflex activity of muscles they innervate. If the anterior horn motor cells are destroyed, the nerves cannot regenerate and muscles are never useful again.

41. (c) : Options (a), (b) and (d) are reflex actions.

Autonomic nervous system is involved in peristalsis of intestine which is effected through mysentric plexus. Sympathetic fibres decrease peristaltic movements while parasympathetic fibres increase these movements.

42. (b) : By training, a particular response can be obtained to a stimulus other than the one which normally evokes that response. Such a reflex is known as the conditioned reflex. The conditioned reflexes were first demonstrated in 1920's by the Russian physiologist I.P. Pavlov. He found that the sight and smell of food reflexly cause flow of saliva in hungry animals. He rang a bell every time he offered food to a dog. The bell did not induce salivation by itself in the beginning of the experiment.

Gradually, the dog learnt to associate the bell with food. Eventually, mere ringing of bell, without presenting food, induced salivation in the dog. Thus, ringing of bell can substitute sight of food to cause salivation. Pavlov called sound of the bell as conditioned stimulus and salivation in response to bell as a conditioned response, food itself as unconditioned stimulus, and salivation, in response to food an unconditioned response. A conditioned reflex is established when a new sensory clue (the bell) becomes associated with an inborn reflex (salivation).

43. (c)

44. (a)

45. (c) : Cones contribute to daylight vision whereas rods contribute to twilight vision.

46. (d)

47. (a) : Lens is a transparent, biconvex structure that bends light waves as they pass through its surface. In the human eye, the lens is held in its place by suspensory ligaments attached to the ciliary body.

48. (b)

49. (c) : Photoreceptors in human eye are unique because they are only type of sensory cells that are relatively depolarised (about -35mV) when it is at rest (*i.e.*, in the dark), and hyperpolarised (to about -70mV) in response to adequate light stimulus. Nociceptors respond to potentially damaging stimuli that result in pain. Meissner's corpuscles are a type of mechanoreceptor, responsible for touch sensitivity. Receptors generally produce graded potentials called receptor potentials.

50. (d) : The rods contain a photosensitive pigment called the rhodopsin. Rhodopsin is composed of opsin and retinene. The opsin is a protein and is called scotopsin in rhodopsin. The retinene is an aldehyde of vitamin A and is called retinal.

51. (c) : A small oval, yellowish area of the retina lying exactly opposite the centre of the cornea is named the macula lutea or yellow spot which has at its middle a shallow depression, the fovea centralis. The fovea centralis has cone cells only. It is devoid of rods and blood vessels. The fovea centralis is the place of most distinct vision.

52. (d) : Vestibular apparatus is a part of inner ear which is located above the cochlea. It consists of three semicircular canals, which detect movements of the head, and the utricle and saccule which detect the position of head. It does not play any role in hearing, but is responsible for maintaining the balance of the body and posture.

53. (c) : Retinal pigment is an aldehyde of vitamin A.

54. (c) : In the given figure, A is retina which is the innermost layer, containing photoreceptors rods and cones. B is blind spot. Optic nerves pierce through retina at blind spot. It has no visual cells. C is aqueous humor. It nourishes cornea and lens both of which are avascular. D is sclera. It is the outermost covering and maintains shape of eyeball. It also protects inner layers of the eye.

55. (c) : Refer to answer 52.

56. (c)

57. (b) : Cartilage is avascular, as the blood vessels innervate only perichondrium through which nutrition diffuses into cartilage cells. Cornea is also avascular.

58. (d) : Cornea is a transparent portion that forms the anterior one-sixth of the eye ball. The cornea admits and helps to focus light waves as they enter the eye. The cornea is avascular (*i.e.*, has no blood supply). This part of eye absorbs oxygen from the air. The cornea was one of the first organs to be successfully transplanted because it lacks blood vessels.

59. (b) : A → Perilymph

B → Tectorial membrane

C → Endolymph

D → Sensory hair cells

60. (a) : Rod cell is a type of light-sensitive receptor cell present in the retina of vertebrates. Rods contain the pigment rhodopsin and are essential for vision in dim light. They are not evenly distributed on the retina, being absent in the fovea and occupying all of the retinal margin. Cone cell is a type of light-sensitive receptor cell, found in the retina of all diurnal vertebrates. Cones are specialized to transmit information about colour and are responsible for the visual acuity of the eye. They function best in bright light. They contain pigment iodopsin. They are not evenly distributed on the retina.

61. (c) : Bowman's gland, also called olfactory gland is any of the branched tubuloalveolar glands situated in the mucous membrane of the olfactory region of the nasal cavity that produce mucus to moisten the olfactory epithelium and dissolve odour-containing gases.

62. (b)

63. (b) : The rod cells of eye contain a purplish pigment called visual purple, or rhodopsin. They function in dim light and at night. Bright light splits rhodopsin into a lipoprotein scotopsin and a carotenoid pigment retinene. The splitting of rhodopsin depolarizes the rod cell. In the dark, rhodopsin is resynthesized from scotopsin and retinene. This process is called "dark adaptation." It makes the rods functional. It takes some time for rhodopsin to be reformed. This is why on entering a dark room at

daytime or on coming out of a well lighted room at night, we feel blind for a while. When we go from darkness into bright light, we feel difficulty in seeing properly for a moment till rhodopsin is bleached and cones become functional.

64. (c) : Refer to answer 58.

65. (a) : Photosensitive means sensitive to light. The rod cells of retina contain a purplish pigment called rhodopsin. They function in dim light and at night. Rhodopsin consists of a protein component, opsin, linked to a nonprotein chromophore, retinal (or retinene), a derivative of vitamin A. Light falling on the rod is absorbed by the retinal, which changes its form and separates from the opsin component. This initiates the transmission of a nerve impulse to the brain.

66. (a) : Pupil is the opening which controls the amount of light entering in eye. When light intensity is high, it decrease in size and when light intensity is low it dilates to allow more light in the eye to make eye enable to see the object.

67. (d) : A small area of the optical part of the retina lying exactly opposite to the centre of the cornea is called the macula lutea, or yellow spot which has a yellow pigment (xanthophyll). The macula lutea has at its middle a shallow depression, the fovea centralis. The fovea has cone cells only and is the place of most distinct vision. Away from the fovea, the rod and cone cells occur

in equal numbers and at the periphery of the retina, the rods are more numerous than the cones. This is why we see better in dimlight by looking out of the corner of the eye. The point on the retina from where the optic nerve starts is called the blind spot, or optic disc, as it lacks the receptor cells and is insensitive to light.

68. (d) : At the junction of the sclera and the cornea, the vascular coat sharply bends into the cavity of the eyeball to form a thin, coloured partition. This partition is called iris. It is perforated at the middle by an aperture called pupil. The iris contains two sets of smooth muscles: sphincters and dilators. These muscles regulate the amount of light entering the eyeball by varying the size of the pupil. The sphincter muscles are arranged in rings. Their contraction makes the pupil smaller in bright light so that less light enters the eye. The dilator muscles are arranged in a radial manner. Their contraction widens the pupil in dim light to let in more light. Iris, by regulating the size of the pupil, allows light to pass only through the centre of the lens, which is optically the most effective part.

69. (d)

70. (b) : The retina consists of both pigmented layer and the sensory layer. The pigment cells reinforce the light absorbing property of choroid in reducing the scattering of light in the eye. The sensory layer consists of rods and cones required for vision.

