

12. Choose the *true* statement:

- A. The modality of energy a given sensory receptor responds to in normal functioning is known as the "adequate stimulus" for that receptor.
- B. Receptor potentials are "all-or-none," that is, they have the same magnitude regardless of the strength of the stimulus.
- C. When the frequency of action potentials along sensory neurons is constant as long as a stimulus continues, it is called "adaptation."
- D. When sensory units have large receptive fields, the acuity of perception is greater.

13. Which best describes "lateral inhibition" in sensory processing?

- A. Presynaptic axo-axonal synapses reduce neurotransmitter release at excitatory synapses.
- B. When a stimulus is maintained for a long time, action potentials from sensory receptors decrease in frequency with time.
- C. Descending inputs from the brainstem inhibit afferent pain pathways in the spinal cord.
- D. Inhibitory interneurons decrease action potentials from receptors at the periphery of a stimulated region.

14. What is the gate control theory of pain?

- A. It proposes that pain is modulated by a balance of excitatory and inhibitory inputs in the spinal cord.
- B. It proposes that pain is modulated by a balance of endogenous opioids and substance P in the brainstem.
- C. It proposes that pain is modulated by a balance of top-down and bottom-up influences in the cortex.
- D. None of the above.

Case question: A 45-year-old man presents to the emergency department with sudden onset of numbness and tingling in his left arm and leg. He also reports difficulty walking and maintaining his balance. He has a history of hypertension, diabetes, and smoking. His vital signs are: blood pressure 180/100 mmHg, pulse 90 beats per minute, respiratory rate 18 breaths per minute, temperature 36.5°C, and oxygen saturation 98% on room air. On physical examination, he has decreased sensation to light touch, pain, temperature, and vibration in his left upper and lower extremities. He also has reduced muscle strength and reflexes on the left side.

15. What is the most likely diagnosis for this patient?

- A. Stroke
- B. Multiple sclerosis
- C. Guillain-Barré syndrome
- D. Peripheral neuropathy

**SECTION A- IN THIS SECTION SELECT ONE BEST ANSWER FROM THE OPTIONS**

1. Halothane has a blood:gas partition coefficient of 2.4 while isoflurane has a partition coefficient of 1.4; what can you deduce from this statement?
- B. Isoflurane has more rapid onset of anaesthesia and faster recovery than halothane
  - C. Halothane has more rapid onset of anaesthesia and faster recovery than isoflurane
  - C. Isoflurane is more soluble in blood than halothane
  - D. Isoflurane is a more potent anaesthetic agent than halothane
2. A 55-year-old woman undergoes surgery. She receives several drugs for pre-anaesthesia care, intubation, and intraoperative skeletal muscle paralysis; and a mixture of inhaled agents to provide balanced anaesthesia. Toward the end of the procedure, she develops a rapidly progressing fever, hypertension, hyperkalemia, tachycardia, muscle rigidity, and metabolic acidosis. What drug combination most likely interacted and elicited this reaction?
- A. Fentanyl and midazolam
  - B. Nitrous oxide and etomidate
  - C. Propofol and midazolam
  - D. Succinylcholine and isoflurane
3. Which of the following statements is true concerning local anaesthetics?
- A. Lignocaine is more likely to cause allergic reactions compared to procaine
  - B. Prilocaine is metabolized in the liver
  - C. Ester type local anaesthetics include lignocaine
  - D. Bupivacaine is a short acting local anaesthetic
4. Midazolam was the first drug given to a patient, right before she was transported into the operating theatre. In addition to causing sedation, anxiety relief, and generally "smoothing" the induction of anaesthesia, what are the most likely effects you would expect to occur as a result of pre-medicating with midazolam?
- A. Providing analgesic effects
  - B. Preventing seizures likely to be caused by the propofol
  - C. Providing amnesic effects
  - D. Prolongation of cardiac arrhythmias
5. Which of the following anaesthetics would be most suitable in a patient with poor cardiovascular function?
- A. Halothane
  - B. Propofol
  - C. Ketamine
  - D. Thiopentone
6. A 45-year-old man has been receiving an anti-seizure drug for the past 3 months. An electroencephalogram showed left temporal sharp waves, and the neurologist decided to add lamotrigine to the patient's regimen. A relatively low dose of lamotrigine was prescribed because the drug the patient was already taking can inhibit the metabolism of lamotrigine. Which of the following was most likely that drug?
- A. Phenytoin
  - B. Phorbolbital
  - C. Clonazepam
  - D. Valproic acid

7. A patient in the neurology unit develops status epilepticus, and at the time there is no good information about the aetiology. What drug should be given first for the fastest suppression of the seizures?
- A. Lorazepam
  - B. Phenobarbital
  - C. Phenytoin
  - D. Valproic acid
8. A 32-year-old woman was brought to the emergency department because of a generalised tonic-clonic seizure. Her husband stated that his wife had had epilepsy since childhood, but the seizures were only partially controlled by medication. Which of the following pairs of neurotransmitters are thought to be most involved in seizure disorders?
- A. GABA and acetylcholine
  - B. GABA and glutamate
  - C. Serotonin and glutamate
  - D. Serotonin and acetylcholine
9. A 47-year-old woman complained to her physician of blurred and double vision. She had been suffering from a central nervous system disorder and had been receiving drug treatment for 6 months. Physical examination showed mild hirsutism, broadening of her lips and nose, and thickening and bleeding of her gums. Which of the following drugs most likely caused these adverse effects?
- A. Diazepam
  - B. Valproic acid
  - C. Phenytoin
  - D. Gabapentin
10. An 8-year-old girl is brought to the hospital by her mother, who has observed that her daughter experiences frequent impairments of consciousness associated with episodes of staring into space lasting approximately 30 seconds. Further neurologic evaluation indicates signs and symptoms consistent with absence seizures. Which of the following drugs is generally considered the preferred starting agent for this type of epilepsy?
- A. Carbamazepine
  - B. Vigabatrin
  - C. Felbamate
  - D. Ethosuximide
11. The distance from between one stimulating electrode to recording electrode is 4.5cm. When the axon is stimulated, the latent period is 1.5ms. What is the conduction velocity of the axon?
- A. 15 m/s
  - B. 30 m/s
  - C. 40 m/s
  - D. 67.5 m/s

$$4.5 \text{ cm} = \frac{1.5 \text{ ms}}{1000} \times v$$

$$4.5 \times 10^{-2} = \frac{1.5}{1000} \times v$$

$$4.5 \times 10^{-2} \times 1000 = 1.5 \times v$$

$$45 = 1.5 \times v$$

$$v = \frac{45}{1.5}$$

$$v = 30 \text{ m/s}$$

39. The cavernous sinus has been coined the "anatomic jewel box" because it shares an intimate relationship with several important structures. The following structures pass within the lumen of the cavernous sinus:
- A. Abducens nerve and vertical segment of internal carotid artery
  - B. Trochlear nerve and vertical segment of internal carotid artery
  - C. Abducens nerve and horizontal segment of internal carotid artery
  - D. Trochlear nerve and horizontal segment of internal carotid artery
40. Which of the following operculum contains the primary gustatory cortex:
- A. Parietal operculum
  - B. Occipital operculum
  - C. Frontal operculum
  - D. Temporal operculum
41. A 30-year-old woman complains of unsteadiness while standing or walking. She tends to deviate to the right. Neurologic examination reveals the following signs: dysmetria on the right, dysdiadochokinesia, and a nystagmus that is more marked when she looks to the right side. The lesion is most likely found in the:
- A. Cerebellar hemisphere, left side
  - B. Cerebellar hemisphere, right side
  - C. Medial medulla, left side
  - D. Medial medulla, right side
42. The nerve which carries sensations of taste from the area of the tongue posterior to the row of vallate papillae is:
- A. Chorda tympani (from VII)
  - B. Branches of vagus (X)
  - C. Glossopharyngeal nerve (IX)
  - D. Lingual of V-3
43. Which of the following is picking up conscious proprioception coming from the lower limbs?
- A. Fasciculus cuneatus
  - B. Fasciculus gracilis
  - C. Spinothalamic tract
  - D. Dorsal spinocerebellar tract

55. During a routine examination, the physician attempted to elicit a gag reflex response in the patient by stroking the posterior pharynx with a cotton-tipped probe. This reflex is initiated primarily by activating the sensory endings of:

- A. Cranial nerve V
- B. Cranial nerve VII
- C. Cranial nerve IXs
- D. Cranial nerve XI

56. The <sup>afferent</sup> efferent fibres from the olfactory bulb arise from which one of the following neurons?

- A. Periglomerular cells
- B. Granule cells
- C. Mitral cells
- D. Golgi cells

57. The **correct** order of the olfactory pathway includes:

- A. Olfactory nerve, olfactory receptors, olfactory bulb, olfactory tract, primary olfactory cortex
- B. Olfactory bulb, olfactory receptors, olfactory nerve, olfactory tract, primary olfactory cortex
- C. Olfactory receptor, olfactory nerve, olfactory bulb, olfactory tract, primary olfactory cortex
- D. Olfactory nerve, olfactory tract, olfactory bulb, olfactory receptor, primary olfactory cortex

58. The deep nuclei of the cerebellum include which of the following?

- A. Globose, fastigial, emboliform and dentate
- B. Globose, substantia nigra, dentate, red
- C. Dentate, fastigial, caudate, globus pallidus
- D. Caudate, globus pallidus, substantia nigra, dentate

59. Which lobe contains the primary visual cortex?

- A. The temporal lobe
- B. The hippocampal lobe
- C. The frontal lobe
- D. The occipital lobe

33. All the following structures form part of the cerebellar circuitry except:

- A. Cerebellar pedunculi
- B. Pontine nuclei
- C. Red nucleus
- D. Descending motor pathways

34. A 34-year-old female is diagnosed with locked in syndrome. Which of the following is not a feature of this syndrome?

- A. Absent motor function
- B. Intact cognition
- C. Damage to ventral midbrain
- D. Patient able to open eyes

35. A 15-year-old Jason Phiri is diagnosed with coma. All the following is true to his condition except:

- A. Eyes may be open
- B. Has been in this state for minimum of 30 min
- C. Caudal reticular formation may be damaged
- D. Midbrain lesions may cause a blown pupil

None of the following descending tracts terminates at all levels of the spinal cord except:

- A. Rubrospinal
- B. Medial vestibulospinal
- C. Tectospinal
- D. Reticulospinal

37. All the following are motor cranial nerve nuclei except:

- A. Nucleus ambiguus
- B. Superior salivatory nucleus
- C. Vestibular nuclei
- D. Edinger-Westphal nucleus

38. The following symptoms are correctly matched due to damage e.g., by ischemia:

- A. Dysarthria ..... corticobulbar pathways
- B. Hemiparesis ..... cerebellar pathways
- C. Incoordination ..... trigeminal system
- D. Somnolence ..... corticospinal tracts

28. The concerned mother of a 16-year-old girl brings her to the family physician. The girl explains that she occasionally has drops of a white fluid coming from her breasts. Further examination confirms that the girl is not sexually active and is not pregnant. An MRI reveals a small tumor in the area of the pituitary and hypothalamus.

Based on this girl's signs and symptoms, she is most likely suffering from which of the following?

- A. Excessive corticotrophin production
- B. Excessive growth hormone production
- C. Excessive luteinizing hormone production
- D. Excessive prolactin production

29. A 16-year-old boy is brought to the Emergency Department following a diving accident at a local quarry. The initial examination reveals a bilateral loss of motor and sensory function from about T4 down including the lower extremities. At 36 hours after the accident, the boy is able to dorsiflex his toes, slightly move his right lower extremity at the knee, and is able to perceive pinprick stimulation of the perianal skin (sacral sparing). Which of the following most specifically describes the spinal cord lesion in this patient?

- A. Complete
- B. Hemisection
- C. Incomplete
- D. Large syringomyelia

30. Which of the following represents an ipsilateral olfactory tract

- A. Olfactory receptor neuron → tufted cell → mitral cell → primary olfactory cortex
- B. Olfactory receptor neuron → glomerulus → septal area
- C. Olfactory receptor neuron → glomerulus → primary olfactory cortex
- D. Olfactory receptor neuron → mitral cell → olfactory tubercle

31. Pars opercularis of Broca's area is found between the following parts of the lateral sulcus of Sylvius:

- A. Stem and anterior ramus
- B. Stem and posterior ramus
- C. Anterior and posterior rami
- D. Ascending and anterior rami

32. Concerning cells of Betz, which of the following is true?

- A. Are giant cells found in layer 3 of cerebral cortex
- B. Have one apical dendrite and project to corticospinal tracts
- C. Are the largest cells in the CNS, sometimes reaching 500  $\mu\text{m}$
- D. Are lower motor neuron cells that contribute to the corticospinal tracts

22. Which of the following gross structures is NOT found on the rhomboid fossa?

- A. Median sulcus
- B. Facial colliculus
- C. Sulcus limitans
- D. Tuber cinereum

23. How many segments has an adult spinal cord?

- A. 30
- B. 31
- C. 32
- D. 33

24. Which of the following locomotor conditions can follow ligation of the abdominal aorta at the level of T12?

- A. Uniplegia
- B. Hemiplegia
- C. Paraplegia
- D. Quadriplegia

25. Which of the following statements is CORRECT about the spinal gray matter?

- A. Anterior gray column predominated with pseudounipolar neurons
- B. The central canal is posterior to the posterior gray commissure
- C. Rexed lamina I is anteromedial to Rexed lamina VII
- D. Posterior horn cells synapse with central processes of sensory neurons

*The following two (2) questions depend on the scenario given below.*

A 41-year-old man is brought to the Emergency Department after an accident at a construction site. The examination reveals a weakness (hemiplegia) and a loss of vibratory sensation and discriminative touch all on the left lower extremity, and a loss of pain and thermal sensations on the right lower extremity. CT shows a fracture of the vertebral column adjacent to the T8 level of the spinal cord.

26. Damage to which of the following fiber bundles or tracts would most likely explain the loss of vibratory sensation in this man?

- A. Cuneate fasciculus on the left
- B. Cuneate fasciculus on the right
- C. Gracile fasciculus on the left
- D. Gracile fasciculus on the right

27. The loss of pain and thermal sensation in this man reflects damage to which of the following fiber bundles or tracts?

- A. Anterolateral system on the left
- B. Anterolateral system on the right
- C. Cuneate fasciculus on the left
- D. Gracile fasciculus on the left

D. Left sided loss of tactile discrimination

50. A 10-year-old boy has right arm and leg dystaxia, nystagmus, hoarseness, along with miosis and ptosis on the right. Bronchoscopy reveals a paralysis of the vocal cord on the right. The lesion site responsible is most likely the to be:
- A. right ventral aspect of the medulla
  - B. left red nucleus
  - C. dorsolateral medulla
  - D. dorsolateral pons
51. A patient is said to have had injury to their left lateral geniculate body, what symptoms will they exhibit?
- A. Ipsilateral anosmia
  - B. Contralateral anosmia
  - C. Ipsilateral loss of sight
  - D. Contralateral loss of sight
52. As a result of a vascular lesion of the brainstem, an afflicted individual displays a rather extensive marked rigidity in his limbs. The pathway most likely responsible for this rigidity is the:
- A. Medial longitudinal fasciculus
  - B. Tectospinal tract
  - C. Lateral reticulospinal tract
  - D. Lateral vestibulospinal tract
53. Conscious proprioception from the upper limbs to the thalamus is mediated through the:
- A. Nucleus gracilis
  - B. Nucleus cuneatus
  - C. Spinal trigeminal nucleus
  - D. Inferior olivary nucleus
54. An 80-year-old man was brought to the emergency room after complaining of an inability to swallow food. The structure most closely linked to this dysfunction is:
- A. Inferior olivary nucleus
  - B. Pyramids
  - C. Spinal trigeminal nucleus
  - D. Nucleus ambiguus

	pain	
9.	Step 1 of WHO analgesia ladder with no anti-inflammatory activity	Paracetamol ✓
10.	Step 1 of WHO analgesia ladder with anti-inflammatory activity	NSAIDS ✓

#### OPTIONS

- Methadone ✓
- Morphine ✓
- Codeine ✓
- Fentanyl ✓
- Naloxone/ Naltrexone
- Serotonin-norepinephrine Reuptake Inhibitors (SNRIs)
- Pethidine (meperidine)
- Tramadol
- NSAIDs ✓
- Paracetamol ✓

#### SECTION C-CLINICAL SCENARIO [20 MARKS]- INDICATE THE ANSWERS ON THE SPACE PROVIDED BELOW THE QUESTION

A 70-year-old Mr. Mundia Mulope was walking in the hallway at home, and at 10:00 hrs, he suddenly developed right sided facial reduced pain and temperature sensation with left sided reduced pain and temperature of the body. This is accompanied with nausea and vomiting. He had a history of severe diffuse atherosclerosis, including coronary artery disease and peripheral vascular disease requiring multiple bypass operations. He was also a heavy smoker for over 40 years. On examination, he is noted to have Horner's syndrome, nystagmus and a positive Romberg's sign.

- i. What is the your most likely diagnosis for Mr. Mulope? [2]
- ii. According to the Wells score, this patient is at an increased risk of developing thromboembolism. Which artery is most likely involved? Specify the side. [2]
- iii. Which specific region of Mr. Mulope's brain is ischemic? [2]
- iv. Going by the symptoms and signs of Mr. Mulope, list any three (3) affected specific structures of the CNS passing in the above-mentioned region. [3]
- v. List any two (2) cranial nerve nuclei associated with this condition. [2]
- vi. What are the features of Horner's syndrome. [3]
- vii. How would you explain the development of Horner's syndrome in this patient? [2]
- viii. What is Rhomberg's sign? [2]
- ix. List any two radiological tests that can be performed in this patient? [2]

60. The auditory cortex is found in the

- A. Parietal lobes
- B. Temporal lobes**
- C. Occipital lobe
- D. Frontal lobe

**SECTION B. MATCHING QUESTIONS. TOTAL MARKS IN THIS SECTION IS 20 MARKS.**

**QUESTION A. MATCH ITEMS IN COLUMN II TO COLUMN I BY INSERTING THE CORRECT LETTER IN THE MIDDLE COLUMN.**

COLUMN I	ANSWER	COLUMN II
1. Anterior	B	A. Magnocellular
2. Dorsomedial	B	B. Obesity
3. Lateral	A	C. Receptors for estradiol
4. Paraventricular	C	D. Corticotropin releasing hormone
5. Supraoptic	D	

COLUMN I	ANSWER	COLUMN II
1. Ligamentum denticulatum	D	A. Coccyx
2. Filum terminale	D	B. L2
3. Conus medullaris	B	C. Lumbar cistern
4. Cauda equina	B	D. Pia mater
5. Dura mater	C	

**QUESTION B. Match the INDICATIONS in Column A with the ANALGESIC DRUGS shown below the table and write down your answer in Column B**

COLUMN A: INDICATION	COLUMN B: DRUG
1. Labour Pain (causes less fetal respiratory depression)	Pethidine
2. Prototype opioid strong analgesic activity	Tramadol
3. Detoxification of opioid addiction.	Morphine
4. Very lipid soluble potent opiate analgesic and anaesthetic.	Methadone
5. Management of mild to moderate pain, dry cough and diarrhoea	Fentanyl
6. Management of moderate to severely moderate pain	Codeine
7. Used to treat opioid overdose antagonists of $\mu$ ( $\mu$ ), $\kappa$ (kappa), and $\delta$ (delta) receptors.	Tramadol
8. Recommended 1st line treatment for neuropathic	Naloxone
	SNRIs