1. Explain how the nervous system is divided into sub-systems. What is the main function of each sub-system?

**NERVOUS SYSTEM**

- Central Nervous System
  - Brain
  - Spinal Chord
- Peripheral Nervous System
- Autonomic Nervous System
  - To Smooth Muscles
- Somatic Nervous System
  - To Skeletal Muscles, exterior sensory organs
- Sympathetic Nervous System
  - “Fight or Flight”
- Parasympathetic Nervous System
  - Non-emergency Situations

2. Draw and label a simple motor neuron and state the function of each labelled part.

See Notes

3. What are the three types of neurons? Describe each and state their function(s).

- SENSORY NEURON: (afferent neuron) - takes a message from a sense organ to CNS. Has long dendrite and short axon
- MOTOR NEURON: (efferent neuron) - takes message away from CNS to a muscle fiber or gland. Short dendrites, long axon.
- INTERNEURON: (association neuron or connector neuron): completely contained within CNS. Conveys messages between parts of the system. Dendrites, axons, may be long or short.
4. What is an action potential? Describe the sequence of events in the transmission of a nerve impulse. Be sure to indicate the role of Na+ and K+.
   - See notes p. 2-3

5. Why does nervous transmission occur in one direction only?
   - During the recovery phase (refractory period) sodium gates are unable to open therefore the impulse cannot go in the reverse reaction

6. Describe the structure of myelinated nerve fiber and relate this to the efficiency of impulse conduction. How fast do nerve impulses travel?
   - Myelinated nerve fibers contain an insulating sheath (lipids that cause the fiber to appear whiteish) formed by tightly packed spirals of the cell membrane of Schwann cells
   - an insulating sheath is interrupted by gaps called Nodes of Ranvier
   - Results in an increase in the speed of the impulses as the impulse jumps from node to node

7. Draw a synapse, identify its major components, and explain how impulses travel across the synaptic cleft. List the sequence of events in a transmission across a synapse.
   - See notes p. 4

8. Describe how transmission of impulses across synapses can be controlled.
   - Neurotransmitters are degraded by enzymes
   - Neurotransmitters are reabsorbed into the presynaptic cleft

9. What is a reflex arc? Describe the sequence of events that would occur if you accidentally extended your arm into the path of a Bunsen burner flame.
   - automatic, involuntary responses to changes occurring inside or outside the body. Can involve the brain (e.g. blinking) or not involve brain (e.g. withdraw hand from hot stove).
   - The Reflex arc is the main functional unit of the nervous system. It allows us to react to internal and external stimuli.
     - Sensory neuron - receives information – high temperature
     - Interneuron – relays this information to the motor neuron
     - Motor neuron - takes this message to an effector. In this case the muscle of your arm.
     - Effector – arm muscle contracts and it is pulled away from the heat source

10. What are meninges, and in what nervous system do you find them?
    - three protective membranes that protect the brain and spinal cord
    - found between the brain and the skull
    - found between the vertebrae and spinal cord

11. Describe the composition, structure, and function of the spinal cord.
    - See notes p. 8-9
12. How does the somatic nervous system differ from the autonomic nervous system?
   • See notes p. 7-8

13. Describe the physiological events associated with the "fight or flight" response. Which system controls this response?
   • See notes p. 8

14. Briefly describe the function of the following parts of the brain:
   • See notes p. 9
     - medulla oblongata
     - thalamus
     - hypothalamus
     - cerebrum
     - cerebellum
     - corpus callosum

15. Make a table that lists the four lobes of the cerebral cortex and give at least two functions of each. Make a sketch that shows the locations of these lobes on the brain.
   • See notes p. 10-11

16. Compare and contrast the Extrapyramidal System and Limbic System with respect to structure and function.
   • See notes p. 11

17. Compare and contrast short-term memory with long-term memory. Where are memories stored in the brain?
   • See notes p. 10-11

18. What is an EEG, and what can it be used to do?
   • See notes p. 11

19. What is REM sleep? What mental process does it coincide with? How often do periods of REM occur per night, on average?
   • See notes p. 11

20. Explain the 5 ways that drugs act at synapses.
   • See notes p. 12

21. Compare, contrast, and give specific examples of inhibitory and excitatory neurotransmitters.
   • See notes p. 12

22. Describe the ways in which stimulant and depressant drugs can affect neurotransmitter action.
   • See notes p. 12
23. What are **opioids**, and how do they work?
   - Opioids (e.g. endorphins and enkephalins) are neurotransmitters that act as natural pain relievers
   - When painful stimuli is felt other neurotransmitters are released from certain neurons in the spinal chord that create the sensation of pain
   - Opioids prevent the release of the neurotransmitter that causes the sensation of pain

24. How do neuro-poisons such as **strychnine** and **nerve gas** work? What are the symptoms of exposure?

   **NOT TESTABLE**
   - Nerve gas blocks the action of acetylcholinesterase – the enzyme that breaks down acetylcholine
   - Strychnine increases the reflex irritability of the spinal cord, which results in a loss of normal inhibition of the body’s motor cells,
     - causes painful muscle contractions and convulsions, pulling the head back and arching the back; death usually results from respiratory muscle spasm
   - Basically these poisons alter the normal functioning of the nervous system which is responsible for all of our bodies physiological functions

25. How do **narcotics** such as **heroin** and **morphine** work? **NOT TESTABLE**
   - They mimic opioids
   - See notes p. 12

26. Explain the biochemical events that occur when an impulse is transmitted through a reflex arc. Begin with the opening of the sodium gates in a sensory receptor.

   - Stimulus (electric shock, pH change, mechanical stimulation…) that is sensed reaches a threshold and causes an action potential to occur
   - Action potential through motor neuron (see notes p. 2-3)
   - Transmission across synapse to interneuron (see notes p. 5-6)
   - AP through interneuron \(\rightarrow\) synapse
   - AP through motor neuron \(\rightarrow\) effector

27. It has been noted that after continuous stimulation for extended periods of time, it becomes difficult to conduct a nerve impulse along a fibre. Suggest two reasons for this.

   - Same stimulation does not reach the threshold
   - The reticular activating system (RAS) may filters out this information

28. Assume that the action of pain killers interferes with the normal transmission from one neuron to another. Suggest two different mechanisms that would result in the brain detecting less pain.

   - See notes p. 12 (same reasoning as “Drug Action on Neurotransmitters”)

29. Explain the differences in structure and function between the left and right sides of the brain.

   - See notes p. 10