**Neurons & Nerve Transmission**

Q1. Define the term ‘action potential’.

Q2. Complete the table below:

|  |  |  |
| --- | --- | --- |
| **State** | **Membrane Potential (mV)** | **Event/s** *(describe membrane proteins involved, movement of ions etc.)* |
| **Rest / Polarised** |  |  |
| **Depolarisation** |  |  |
| **Repolarisation** |  |  |
| **Hyperpolarisation** |  |  |

Q3. All neurons have a threshold potential. Describe the events that occur to bring the membrane to the threshold potential.

Q4. Explain what the refractory period is and how long it lasts for.

Q5. a) Give the structural and functional classification of the neuron pictured below.

 Structural: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Functional: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) Label structures (A-G).



Q6. Contrast between nerve transmission along a myelinated and an unmyelinated fibre.

Q7. The following diagrams show different phases of nerve transmission (not in any particular order). Identify the state/phase for each.



1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Q8. Complete the table below:

**Structural Classification of Neurons**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Neuron** | **Number of dendrites connecting with the cell body** | **Number of axons** | **Examples** |
| Bipolar |  |  |  |
| Multipolar |  |  |  |
| Pseudounipolar |  |  |  |
| Unipolar |  |  |  |

Q9. State the function/s of

1. Motor neurons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Sensory neurons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Interneurons: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Q10. The next two multiple choice questions refer to the diagram shown below, which represents a nerve impulse moving along the axon of a neuron. The flow of ions across the axon membrane is represented by arrows.



1. Which of the following is correct?
2. Arrow A represents potassium ions
3. Arrow B represents chloride ions
4. Arrow A represents sodium ions
5. Arrow B represents calcium ions
6. What is occurring between arrows A and B?
7. Action potential
8. Resting state
9. Repolarisation
10. myelination

Q11. Multiple sclerosis causes demyelination of nerve cells in the brain and spinal cord. Using your knowledge of nerve transmission, explain why the nerve cells in a person with this condition would unable to communicate effectively with one another.

Q12. Describe what is meant by the ‘all or none response’ and explain why it is that we are able to distinguish between stimuli of different intensities.

**Nerve Transmission – Fill in the blanks**

* The potential for a neuron at rest is \_\_\_\_\_\_\_\_\_\_\_\_\_. The resting membrane potential is generated by differences in the ion concentrations of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fluids and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fluids, and the differential permeability of the membrane to those ions.
* The resting membrane potential is ‘maintained’ by passive \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pump (which ejects three \_\_\_\_\_\_\_\_\_\_ out of the cell, to every two \_\_\_\_\_\_\_\_\_\_ back into the cell).
* During rest \_\_\_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_ channels are closed.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will cause some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels to open and \_\_\_\_\_\_\_\_\_\_\_\_ ions enter the cell.
* If there is enough sodium ions entering this will cause the membrane potential to rise to \_\_\_\_\_\_\_\_\_\_\_\_. This is known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ potential. Once the threshold is exceeded more sodium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_ channels open, causing a great influx of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions.
* During \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the inside becomes more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in relation to outside and the voltage rises quickly to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* As soon as the voltage reaches +30mV, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels close and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ voltage-gated channels open causing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions to diffuse out of the neuron. This is known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. During this phase the inside becomes \_\_\_\_\_\_\_\_\_\_\_\_\_\_ once again and the outside \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* During repolarisation the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels close \_\_\_\_\_\_\_\_\_\_\_\_\_\_, allowing more \_\_\_\_\_\_\_\_\_\_\_\_\_ ions to diffuse out of the membrane. This brings the potential below resting membrane potential. This dip in voltage is known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The neuron then returns to resting potential.
* The depolarisation-repolarisation is known as an \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Once a section has undergone an action potential, it cannot be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ again. This is known as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ period.
* A refractory period ensures that an action potential does not \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but instead keep going in \_\_\_\_\_\_\_\_\_\_\_\_ direction, from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_ terminals.
* If the axon is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then the action potential takes place between Schwann cells at the \_\_\_\_\_\_\_\_\_ \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ at a much \_\_\_\_\_\_\_\_\_\_\_\_\_ rate. The name for this type of transmission is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* If the axon is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, then the action potential occurs down the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ length of the axon, as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in one section triggers \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the adjacent section. This type of nerve transmission is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.