Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_

Period \_\_\_\_\_\_

**Action Potential Worksheet**

1. Explain how an action potential and graded potential are different.

*Action potentials are depolarization events that exceed the “threshold”. Graded potentials are depolarization events that do not exceed the “threshold.” Graded potentials include depolarizations that stay below threshold (less negative) or hyper-polarizations that dip below resting potential (more negative).*

2. Describe the following in your own words

a. resting potential

*The membrane potential of a resting neuron (not sending signals = - 60 to -80 mV). We’ll use -70 mV .*

b. depolarization

*Reduction in magnitude of the membrane potential (shifting toward positive) caused by influx of Na+.*

c. hyperpolarization

*Increase in the magnitude of membrane potential (shifting toward more negative) K+ leaves axon.*

d. repolarization

*Resting membrane potential reached by outflow of K+ from axon. Could be in a more negative or a more positive direction.*

e. threshold

*The value where if membrane voltage is exceeded (-55mV) the depolarization continues as a depolarization event resulting in an action potential.*

3. What triggers an action potential? What happens to the membrane to trigger an action

 potential?

*Stimuli causes the voltage gated sodium channels to open depolarizing the membrane to a point above the threshold.*

4. What is a positive feedback loop? How does a neuron create a positive feedback loop?

*The stimulus is increased in the response. Na+ rushes into the axon depolarizing it. This causes the next bit of axon to open its gated sodium ion channels to allow more Na+ in depolarizing it also and on and on it progresses.*

5. What is the role of the voltage-gated sodium channels for producing an action potential?

*The gated channels allow the Na+ into the axon, raising membrane potential above the threshold.*

6. What is the role of the voltage-gated potassium channels?

*These repolarize the membrane resetting the interior to negative when K+ moves out of the cytoplasm. K+ gates close after Na+ gates have closed, this is what causes the hyperpolarization.*

7. What would happen if the voltage gated sodium and potassium channels opened

a. at the same time?

*It is unlikely the membrane would become depolarized because although Na+ is coming in, K+ would be leaving simultaneously (canceling each other out).*

b. further apart? (longer delay)

*The nerve (neuron) would be unable to propagate a new signal because negative charge on the inside would be restored much more slowly (reduced functionality of signaling).*

8. What is the absolute refractory period? What is the relative refractory period?

*Absolute refractory period - Action potential from initiation to the peak of the action potential (stimulus in this zone will not lead to another action potential – resting potential has not been restored).*

*Relative refractory period - After the falling side of the action potential during hyperpolarization and rise back to resting potential. (a stronger than normal stimulus would be required to elicit a new action potential since the membrane potential is more negative in this zone)*

9. Consider the following three diagrams of a nerve cell membrane. They show resting potential,

 depolarization, and hyperpolarization. Figure out which one is which, label them, and number

 the diagrams in the order they occur in a cell that undergoes an action potential.



 *Hyperpolarization* *Depolarization Resting*

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