I. Definitions
   A. Neuron
   B. Nerve Impulse

II. Neural Structure
   A. The Neuron
      1. Generalized Structure
      2. Classification of Neurons
         a. Structural   b. Functional
         i. multipolar  i. afferent (sensory)
         ii. bipolar    ii. efferent (motor)
         iii. unipolar  iii. association (interneuron)

   B. Neuroglia
      1. Peripheral Nervous System (PNS)
         a. Schwann cells
      2. Central Nervous System (CNS) *(FYI only)*
         a. Oligodendrocytes
         b. Astrocytes
         c. Microglia
         d. Ependymal Cells

III. Neurophysiology
   A. Membrane Potentials
      1. Ion Distribution
      2. Resting Potentials
      3. Types of Channels
         a. Leak Channels
         b. Gated Channels
            i. Chemically Gated (ligand gated)
            ii. Mechanically Gated
            iii. Voltage Gated

   B. Graded (local) Potentials

   C. Action Potentials
      1. Definition - An all-or-none, self-propagating, non-decremental depolarization followed by repolarization
      2. Sequence of Events
         a. Depolarization / Repolarization
3. Mechanism (how it works)
   a. Membrane Channels
      i. voltage gated sodium channels
      ii. voltage gated potassium channels
   b. impulse conduction
   c. Refractory Period
      i. absolute
      ii. relative

D. Synapse
   1. Basic Structure
      a. Electrical (rare)
      b. Chemical (neurotransmitters)
   2. Mechanism of Synaptic Conduction (the chemical synapse)
      a. The Neuromuscular Junction (classic model of a synapse)
      b. Second Messenger Systems

E. Pharmacology
   1. Agonists (mimicry)
   2. Antagonists (blocking)

F. The Big Picture (putting it all together)
   1. Signal Initiation (the graded potential)
      a. Receptor Potentials
      b. Synaptic Potentials
         i. Excitatory Post Synaptic Potentials (EPSP)
         ii. Inhibitory Post Synaptic Potentials (IPSP)
   2. Summation (integration)
      a. Spatial
      b. Temporal
   3. Signal Coding (amplitude modulation, frequency modulation)
   4. Modulation (Facilitation, Inhibition)

IV. Additional Key Terms (FYI)

Binder  cAMP  catecholamine  cholinergic  excitation  inhibition
ligand  monoamine oxidase (MAO)  postsynaptic  presynaptic  quanta
recruitment  spike potential
Study Questions – Neurophysiology:

1. What types of cells make up the nervous system?
2. Define “nerve impulse” (describe the different forms of “nerve impulse”).
3. Describe the general structure of neurons using the multipolar neuron as a model. Describe both the basic structural and functional divisions of the neuron.
4. Distinguish between the different functional and structural classes of neurons.
5. Describe the relationship between neuroglial cells and neurons.
6. Describe the myelin sheath—in terms of both structural and functional significance.
7. What does the term “saltatory conduction” mean?
8. Describe the distribution of ions across the cell membrane at rest. How does the cell maintain a “resting potential”?
9. Where are “leak” channels found and what is their significance?
10. Describe the function of “ligand” or “chemically” gated channels and their distribution in the neuron membrane (where are they found).
11. Describe the function of “voltage” gated channels and their distribution in the neuron membrane (where are they found).
12. Describe the properties of “graded potentials” and the location on the neuron where you would expect them.
13. Describe the relationship between “ligand” gated channels and “graded potentials”. How do the properties of “ligand” gated channels explain the properties of “graded potentials”?
14. Describe the properties of “action potentials” and the location on the neuron where you would expect them.
15. Describe the relationship between “voltage” gated channels and “action potentials”. How do the properties of “voltage” gated channels explain the properties of “action potentials”?
16. Describe the sequence of membrane permeability changes that occur through the complete course of an action potential beginning with the stimulus that initiates it.
17. Describe in detail the role of voltage gated sodium channels, voltage gated potassium channels and the sodium-potassium pump to the action potentials.
18. Compare and contrast the absolute refractory period and the relative refractory period. When do they occur, what is responsible for their occurrence, what is the effect of their occurrence?
19. Describe the basic structure of a chemical synapse.
20. Describe the sequence of events associated with synaptic transmission (beginning with the arrival of the AP at the synaptic terminal through the initiation of an AP in the post-synaptic cell).
21. Compare and contrast the post-synaptic events of primary and second messenger systems.
22. Which of the following determine the “content” of the synaptic message – the identity of the neurotransmitter or the receptor? Explain.
23. Compare and contrast receptor and synaptic potentials.
24. Compare and contrast “EPSP” and “IPSP”.
25. Define “spatial summation”. Provide an example.
27. What is the significance of the initial segment to summation? What is the significance of summation?
28. Describe how the location of an applied stimulus and its identity are determined by the nervous system.
29. How is the intensity of a stimulus represented by the nerve impulse within the dendrites and cell body, within the axon, and across the synaptic cleft?
30. Define “agonist” and “antagonist”. Explain these terms first with respect to summation of EPSPs and IPSPs and second with respect to chemicals applied to the synapse.