Study Guide 1: Chapters 1-3

Chapter 1: Brain Basics

1. What is the largest part of the human brain and what is its function?

The cerebrum is the largest part, integrating sensory inputs that lead to behavioral output.

2. The cerebrum is divided into ___two___ hemispheres, bridged together by a bundle of fibers called the ___corpus callosum___. (6)

3. Covering the outermost layer of the cerebrum is the ___cortex___. (6)

4. What are the functions of the four lobes? (6)

Many possible answers here, for example:
Frontal lobe: executive function, working memory
Temporal lobe: language processing, auditory processing, attention
Parietal lobe: sensorimotor integration
Occipital lobe: visual processing

5. What is the amygdala responsible for? (6)

Emotional processing, e.g. fear, anger, etc.

6. The ___cerebellum___ controls movement and cognitive processes that require precise timing. (6)

7. What is the difference between gray matter and white matter? (7)

gray matter consists of cell bodies, while white matter consists of the axons and act as more connective fibers

8. What are the two branches of the autonomic nervous system and what are their functions? (7)

The sympathetic nervous system controls fight-or-flight reactions, preparing the body for reaction to dangerous situations (e.g. faster heart rate, pupil dilation, faster breathing, etc.).
The parasympathetic nervous system is the "rest-and-digest" system that has generally the opposite effects of the sympathetic nervous system.

9. How many neurons are in the mammalian brain?

Approximately 86 billion

10. The three main components of a neuron are the cell body, dendrites, and axon. What are the functions of each component? (7)

The cell body is the portion containing the nucleus; proteins, energy, etc. are made here.
The dendrites are the portion receiving input from previous neurons that synapse on them.
The axon is the portion that outputs information from this neuron to the next neuron.

11. _____Synapses_____ are the contact points where one neuron communicates with another. (7)

12. Many axons are covered with a myelin sheath, which

_____speeds up_____ the transmission of electrical signals along the axon.

This sheath is made by specialized cells called _____oligodendrocytes_____. (8)

13. Nerve impulses involve the opening and closing of

_____ion channels_____. (8)

14. An action potential occurs as the neuron switches from an internal

_____negative_____ charge to a _____positive_____ charge. (8)

15. When these voltage changes reach the end of an axon, they trigger the release of _____neurotransmitters_____. (8)

16. NAME THE NEUROTRANSMITTER (pgs 9-11)

a. The first neurotransmitter identified, it is release by neurons connected to voluntary terminals. It is implicated in myasthenia gravis, a disease characterized by fatigue and muscle weakness due to the blocking of receptors for this neurotransmitter.

Acetylcholine

b. This amino acid neurotransmitter INHIBITS the firing of neurons. Its activity is increased by benzodiazepines and anticonvulsants.

GABA (Gamma aminobutyric acid)

c. This amino acid neurotransmitter acts as excitatory signals, activating N-Methyl-d–aspartate (NMDA) receptors which have been implicated in learning and memory. Overstimulation by this neurotransmitter of NMDA receptors, however, can cause nerve cell damage or cell death.

Glutamate

d. This catecholamine neurotransmitter is involved in movement, cognition/emotion, and the endocrine system. Deficits of this neurotransmitter in the substantia nigra is implicated in Parkinson's disease whereas blocking receptors of this neurotransmitter is the main action of many antipsychotic drugs.

Dopamine

e. This catecholamine neurotransmitter is secreted by the sympathetic nervous system to regulate heart rate. Acute stress also releases this neurotransmitter from the adrenal medulla.

Epinephrine (adrenaline)

d. This neurotransmitter is present in blood platelets and is involved in sleep, mood, depression and anxiety. Drugs that alter this neurotransmitter's activity have been useful to relieve depression symptoms.

serotonin

e. This neurotransmitter is a gas (two possible answers).

nitric oxide (NO), carbon monoxide (CO)

17. Receptors _____ convey the chemical message of a neurotransmitter from the cell membrane to the cell's internal biochemical machinery. (12)

18. When norepinephrine binds to receptors on the surface of the neuron, the activated receptor binds a G protein which causes adenyl cyclase _____ to convert ATP to cAMP _____ the second messenger. (12)

Chapter 2: The Developing Brain

1. The three stages of neuron development are induction, proliferation, and migration _____. (13)

2. During embryonic development, three layers emerge – the endoderm, the ectoderm, and the mesoderm _____. (13)

3. Growth cones _____,_____ enlargements on the axon's tip, actively explore the environment as they seek out their precise destination. (15)

4. Some signaling molecules are netrin, semaphorin _____, and ephrin. The first netrin was discovered in a worm _____ and shown to guide neurons around the worm _____'s "nerve ring." (15)

5. Myelination _____, the wrapping of axons by extensions of glia, increases the speed _____ at which signals may be sent from one neuron to another by a factor up of to 100x.

6. In between the myelin are gaps, called nodes of Ranvier _____, that are not covered in myelin.

7. Apoptosis _____, programmed cell death initiated in the cells, allows paring back.