VERY IMPORTANT - BEFORE YOU START THE EXAM:
1) Bubble in your name.
2) Bubble in your student number into the usual space.
3) There are two versions of this exam. You have version A. Before starting the exam, mark A on question 60.
4) MAKE SURE YOU PUT YOU EXAM IN THE CORRECT (VERSION A) PILE WHEN YOU FINISH!!

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1. A research group at CU wanted to test whether a single alcoholic beverage can impair a graduate student's ability to accurately trace the new CU logo. Students were tested before and after consuming the drink. In this experiment the independent variable is _____ and the dependent variable is _____.
   A) Student; Beverage
   B) Beverage ; Student
   C) Beverage; Tracing Ability
   D) Tracing Ability ; Beverage
   E) none of the above

2. The above experiment would be appropriately described as
   A) unethical
   B) a within-subjects design
   C) a between-subjects design
   D) a case study
   E) a survey

3. Confounding variables in the above experiment might include
   A) differences in size of the students
   B) differences in gender of the students
   C) differences in when and what the students last ate
   D) preexisting differences in tracing ability
   E) all of the above

4. In some studies, subjects are not assigned to conditions; instead subjects are selected because they are already living under these conditions (Ex. smokers and nonsmokers). Such studies are
   A) randomized designs.
   B) non-experimental designs.
   C) true experimental designs.
   D) quasiexperimental designs.
5. A major shortcoming of case-study research is that
   A) it is always done on sick people.
   B) it is impossible to study the subject carefully.
   C) it cannot be applied to laboratory animals.
   D) the degree to which the results can be generalized is often unclear.
   E) both A and B

6. A scientist whose area of research focuses on identifying effective therapeutics to treat patients having symptoms of Alzheimer’s disease is involved in what type of biopsychological research?
   A) Applied research
   B) Pure research
   C) Pseudo research
   D) none of the above

7. Using functional magnetic resonance imaging (fMRI), researchers have found that particular potions of the brain become more active during some types of learning tasks. This type of research falls into which of following division(s) of biopsychology.
   A) psychopharmacology
   B) comparative psychology
   C) cognitive neuroscience
   D) both A and B
   E) all of the above

8. Descartes’ mind-body dualism is defined as a philosophical view that considers:
   A) mind to be the product of neural activity.
   B) mind and body to be separate entities.
   C) reality to exist only when perceived by an observer.
   D) the senses as the source of knowledge.
   E) none of the above.

9. Most neuroscientists reject mind-body dualism because
   A) Electrical stimulation of the brain can trigger memories and emotions
   B) Some non-human species possess abilities once assumed to be purely psychological (Ex. self awareness), and thus purely human
   C) Even the most complex psychological processes (e.g. self-awareness, memory, or emotion) can be affected by damage to the brain
D) all of the above

10. Scientists rarely claim to have proven or disproven the theory or hypothesis. Why are they so wishy-washy?
   A) Scientists have commitment issues.
   B) Science builds on expanding information - theories or hypotheses are adjusted or discarded if no longer supported by the available information. Thus few results are considered "final."
   C) The complexity of the research and results often makes it difficult to obtain definitive answers.
   **D) B and C.**
   E) all of the above.

11. The human brain is composed of a variety of cell types including about 100 billion specialized to receive, integrate, and transmit electrochemical signals (often over long distances). These specialized cells are called
   A) ependymal cells.
   **B) neurons.**
   C) glial cells.
   D) microglia.
   E) oligodendrocytes.

12. The stain used by Santiago Ramón y Cajal to observe the silhouettes of individual neurons in great detail:
   **A) Golgi stain.**
   B) Nissl stain.
   C) myelin stain.
   D) green florescent protein stain.
   E) none of the above.

13. How does information most commonly flow through a neuron?
   A) Input to the soma flows through the dendrites to the axon.
   B) Input to the axon flows through the dendrites to the soma.
   **C) Input to the dendrites flows through the soma to the axon.**
   D) Input to the terminal buttons flows through the axon to the soma.
   E) none of the above

14. When you touch a hot stove ____ neurons in the peripheral nervous system send their ____ projections to the central nervous system.
   **A) Sensory ; Efferent**
   B) Sensory ; Afferent
C) Motor; Efferent
D) Motor; Afferent

15. A greater amount of branching on dendrites allows them to
   A) manufacture more proteins.
   B) have a larger surface area for receiving and integrating information from other neurons.
   C) release more neurotransmitter
   D) package more neurotransmitter
   E) C and D

16. Site where metabolic activities occur to provide energy for the other activities of the cell?
   A) plasma membrane
   B) endoplasmic reticulum
   C) mitochondria
   D) nucleus
   e) ribosomes

17. Interneurons
   A) are specialized to receive information from the environment and send it rapidly into the brain.
   B) typically have several axons and no dendrites.
   C) handle local information (Ex. integrating activity within a single brain structure).
   D) A and B
   E) B and C

18. With respect to the cerebellum (a brain structure important for some forms of fine motor control and learning), a neuron that conveys information toward the cerebellum is considered to be which of the following?
   A) afferent
   B) efferent
   C) motor
   D) postsynaptic
   E) none of the above

19. Axodendritic synapses
   A) always terminate on dendrites.
   B) are rare.
   C) are always excitatory.
   D) always produce action potentials in the postsynaptic neuron.
20. Oligodendrocytes can myelinate ________ axon(s) in the ________.
   A) a single; CNS
   B) multiple; PNS
   C) a single; PNS
   D) multiple; CNS

21. What disease is most strongly associated with the destruction of myelin?
   A) cystic fibrosis
   B) multiple sclerosis
   C) Parkinson's disease
   D) brain tumors

22. Glial cells that engulf cellular debris and trigger inflammation are
   A) Schwann cells
   B) astrocytes
   C) microglia
   D) oligodendrocytes
   E) epithelial cells

23. True or false? In adults, tumors in the brain typically arise from neurons.
   A) True
   B) False

24. What is/are the structure(s) that prevent(s) or slow(s) some chemicals and infectious agents from entering the brain?
   A) the hippocampus
   B) the threshold
   C) the tightly packed cells of the brain’s capillaries and surrounding astrocytes
   D) the blood-brain barrier
   E) C and D

25. What happens if a virus (Ex. like the one that causes chickenpox) crosses the blood-brain barrier and enters the brain?
   A) It is destroyed by natural killer cells.
   B) It gets trapped in a neuron, and then both of them are killed by cells of the immune system.
   C) It gets trapped in an astrocyte, and then both of them are killed by cells of the
immune system.

**D) It stays in the nervous system throughout the rest of the person’s life (usually dormant, unless the individual become immuno-suppressed for some reason).**

26. When we say that a neuron’s membrane is polarized, we mean that there is a difference in electrical charge between
   A) the axons and the dendrites
   B) the axon hillock and the cell body
   C) **the inside and the outside of the membrane**
   D) sodium ions and potassium ions
   E) none the above

27. Allowing only certain people to cross the street, and only a certain times, is most comparable to a neuron’s ____________.
   A) all or none law
   B) threshold of excitation
   C) resting potential
   D) **selective permeability**
   E) rate law

28. At resting membrane potential, what passive forces are acting on potassium?
   A) **The concentration gradient pushing it out of the cell, and the electrical gradient pushing it in.**
   B) The electrical gradient pushing it out of the cell, and the concentration gradient pushing it in.
   C) The electrical gradient and the concentration gradient pushing it out of the cell.
   D) The electrical gradient and the concentration gradient pushing it into the cell.
   E) None of the above.

29. Which feature of a neuron does the sodium-potassium pump make possible?
   A) the refractory period
   B) **the resting potential**
   C) selective permeability
   D) saltatory conduction
   E) A and B

30. The sodium-potassium pump
   A) **requires energy in the form of ATP.**
B) is a passive mechanism - it does not require energy.
C) plays a major role in reestablishing the resting potential following a single action potential.
D) can hyperpolarize the surrounding membrane.
E) can depolarize the surrounding membrane.

31. Which of the following is an advantage of having a resting potential?
   A) The toxic effects of sodium are minimized inside the cell.
   B) No energy is required to maintain it.
   C) The neuron is prepared to respond quickly to a stimulus.
   D) All of the ions are maintained in equal concentrations throughout the cytoplasm.
   E) All of the above.

32. Presynaptic neurons typically stimulate postsynaptic neurons by releasing
   A) a neurotransmitter.
   B) an electrical signal.
   C) a foul odor.
   D) an axon.
   E) a neurotoxin.

33. Which of the following would probably have the most influence on whether a neuron fires an action potential?
   A) synapses on its axon terminals
   B) synapses on its nucleus
   C) synapses on its cell body near the axon hillock
   D) synapses on its terminal buttons
   E) synapses on its dendrites

34. Ions pass through the neural membrane via specialized pores called
   A) post synaptic potentials (PSPs).
   B) vesicles.
   C) gap junctions.
   D) connexons.
   E) ion channels.

35. What is the result if a stimulus shifts the potential inside the neuron from the resting potential to a more negative potential?
   A) depolarization
   B) hyperpolarization
   C) an action potential
36. Active transmission is to passive transmission as
   A) excitation is to inhibition.
   B) Excitatory postsynaptic potentials (EPSPs) are to Inhibitory postsynaptic potentials (IPSPs).
   C) **action potentials are to postsynaptic potentials (PSPs).**
   D) EPSPs are to action potentials.
   E) IPSPs are to action potentials.

37. A single CNS neuron can receive thousands of synaptic inputs onto its dendrites. Which of the following is (are) true of these contacts?
   A) All of these synaptic contacts are all excitatory.
   B) Each of these synaptic contacts produces an action potential in the postsynaptic neuron.
   C) **Neurotransmitters released from the presynaptic terminal buttons bind to receptors on the dendrites to produce EPSPs and IPSPs.**
   D) All of the above
   E) A and B

38. The threshold for excitation refers to
   A) **having sufficient membrane depolarization to open voltage-sensitive sodium channels at the axon hillock.**
   B) having sufficient membrane hyperpolarization to open voltage-sensitive sodium channels at the axon hillock.
   C) the spatial summation of two postsynaptic potentials.
   D) the temporal summation of two postsynaptic potentials.

39. During the action potential, sodium ions move through voltage-gated channels as a direct result of
   A) the sodium-potassium pump.
   B) the electrostatic pressure.
   C) the concentration gradient.
   D) **B and C**
   E) none of the above

40. Action potentials begin with the
   A) **opening of voltage-activated sodium channels.**
   B) closing of voltage-gated sodium channels.
   C) dosing of voltage-gated potassium channels.
   D) opening of voltage-gated potassium channels.
E) refractory period.

41. A drug that blocks the sodium channels in a neuron's membrane will
   A) decrease the threshold.
   B) cause repeated action potentials.
   C) block action potentials.
   D) act like a local anesthetic.
   E) C and D.

42. Simultaneous weak stimuli at different locations produce greater responses than any one of the stimuli in isolation. What is this phenomenon called?
   A) Sherrington's law
   B) The All-Or-None law
   C) Temporal Summation
   D) Spatial Summation
   E) None of the above

43. We speak of the firing of action potentials as being “all-or-none.” This is because
   A) every depolarization produces an action potential.
   B) every hyperpolarization produces an action potential.
   C) action potentials are always maximal size, regardless of the strength of the stimuli that initiate them.
   D) all of the ions giving rise to an action potential move together, or not at all.

44. Stronger stimuli can trigger the production of more action potentials. This is referred to as
   A) the threshold of excitation.
   B) the all-or-none response.
   C) the graded response.
   D) the rate law.
   E) orthodromic conduction.

45. The brief period of time immediately after the initiation of an action potential when it is absolutely impossible to initiate another one in the same neuron is called the
   A) threshold of excitation
   B) threshold of inhibition
   C) absolute refractory period
   D) relative refractory period
46. A second action potential can occur during
   A) the relative refractory period following the first action potential.
   B) the absolute refractory period following the first action potential.
   C) the rising phase of the first action potential.
   D) the peak of the first action potential.

47. The wave of refractoriness that follows an action potential
   A) keeps the action potential from spreading actively back down the
      axon towards the soma.
   B) increases the firing rate
   C) increases the speed of axonal transmission
   D) produces salutatory conduction
   E) none of the above

48. Neurons do not normally fire more than 1000 times/second because
   A) the relatively refractory period is typically about 1 millisecond
   B) the absolute refractory period is typically about 1 millisecond.
   C) higher rates overexcite the cell.
   D) A and C

49. Due to improper preparation (incomplete removal of tetrodotoxin), casualties
    from Fugu consumption occur most commonly in this population:
    A) Restaurant patrons
    B) Fishermen
    C) Children
    D) Graduate students
    E) none of the above

50. Which of the following is true?
    A) Action potentials decrease in size as they travel to the axon terminal(s),
      while postsynaptic potentials remain the same size.
    B) Individual postsynaptic potentials decrease in size as they move
      farther from their site of origin, while action potentials finish at the
      same size they started.
    C) Both action potentials and postsynaptic potentials continuously decrease
      in size as they move farther from their site of origin.
    D) Both action potentials and postsynaptic potentials remain the same size as
      they spread.