HAND IN
answers recorded
on question paper

Name:_____ Student ID Number:_____

Queen's University
Faculty of Arts and Science
Department of Psychology
Psyc 271
Brain and Behavior
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Instructions: The examination is THREE HOURS in length. No Aids are allowed. Please answer all questions in the space provided in the exam. Put your name and student number on this and the top of all following pages. Good luck !!

Please note: If the instructor is unavailable in the examination room and if doubts exist as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of the assumption made.

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1. The sodium-potassium pump maintains a negative charge inside the cell by
   a. transporting Na out of and K into the cell.
   b. transporting Na and K out of the cell.
   c. transporting Na into and K out of the cell
   d. transporting Na and K into the cell
   e. removing negatively charged Cl ions from the cell

2. When a neuron is at rest, the concentration of
   a. chloride and potassium is higher in the ICF relative to the ECF.
   b. organic anions and potassium is higher in the ICF relative to the ECF.
   c. chloride and potassium is higher in the ECF relative to the ICF.
   d. chloride and organic anions is higher in the ECF relative to the ICF
   e. none of the above re correct.

3. Which of the following terms describes conduction of subthreshold disturbances of the membrane potential of an axon?
   a. Cable properties.
   b. All-or-none law.
   c. Rate law.
   d. Action potential.
   e. hyperpolarization.

4. Opening of potassium (K) channels normally produces
   a. influx of K into the cell -> EPSP
   b. efflux of K out of cell -> EPSP
   c. influx of K into cell -> IPSP
   b. efflux of K out of cell -> IPSP
   e. influx of K into cell -> action potential

5. Toward the beak is toward the tail as rostral is to _____.
   a. anterior
   b. ventral
   c. dorsal
   d. caudal
   e. medial

6. The forebrain is associated with the
   a. cerebral aqueduct.
   b. fourth ventricle.
   c. tectum.
   d. lateral and third ventricles.
   e. cerebellum

7. The following structures connect the two cerebral hemispheres
   a. corpus callosum and amygdala
   b. corpus callosum and anterior commissure
   c. corpus callosum and hippocampal fibers
   d. corpus callosum is the only connection between the cerebral hemispheres
   e. corpus callosum and the lateral commissure

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8. An efferent neuron whose cell body is located in a sympathetic or parasympathetic ganglion is a _____ neuron.
   a. preganglionic
   b. ganglionic
   c. postganglionic
   d. presympathetic
   e. none of the above

9. Dorsal spinal roots are
   a. associated with outgoing motor functions
   b. carry incoming sensory signals
   c. project to the brainstem
   d. receive projections from the ventral horn
   e. control movements of facial muscles

10. The final step in synthesis of _____ occurs in the synaptic vesicles themselves.
   a. norepinephrine
   b. epinephrine
   c. dopamine
   d. serotonin
   e. GABA

11. The enzyme monoamine oxidase destroys
   a. acetylcholine and dopamine
   b. dopamine and serotonin
   c. serotonin and GABA
   d. GABA and glutamate
   e. noradrenaline and acetylcholine

12. Which labeling method uses chemicals that are taken up by dendrites or cell bodies and subsequently transported through axons toward terminal buttons?
   a. Anterograde.
   b. Retrograde.
   c. Postsynaptic.
   d. Presynaptic.
   e. transsynaptic

13. Astrocytes play important roles in the central nervous system. Name five (5) different functions associated with astrocytes (5 points).

   a._____

   b._____

   c._____

   d._____

   e._____

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14. Cholinergic cell bodies that project to the neocortex are located in the

_____, while cholinergic cells that project to the hippocampus are

located in the _____ (2 points).

15. Which cell group in the brainstem contains cell bodies of neurons that secrete noradrenaline (1 point) ?

_____

16. The cell membrane consists of
    a. lipid and phosphate molecules
    b. lipid and cytoplasm molecules
    c. neurofilaments and microtubules
    d. enzymes and endoplasmic membranes
    e. none of the above

17. When the cell is at the resting membrane potential, chloride ions
    a. enter the cell due to forces of diffusion and electrostatic pressure
    b. enter the cell due to electrostatic pressure only
    c. enter the cell due to diffusion forces only
    d. always enter the cell by means of the Cl-K pump
    e. do not enter the cell

18. Positively charged ions are called _____, whereas negatively charged ions are called _____. (2 points)

19. Define "absolute refractory period" (1 point).

_____

_____

20. What are the two main advantages of saltatory conduction in mylinated axons relative to transmission in unmylinated axons? (2 points)

    Advantage One: _____

    Advantage Two: _____

21. A receptor that consists of both a binding site for the neurotransmitter and an ion channel is called a _____ receptor, whereas a receptor that is linked to a G protein and 2nd messenger is called a _____ receptor. (2 points)

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22. When the same input to a neuron is active repeatedly and in quick succession,
    a. spatial summation can occur
    b. temporal summation can occur
    c. the postsynaptic neuron becomes unresponsive
    d. the presynaptic cell always reduces its activity
    e. postsynaptic autoreceptors limit further transmitter release

23. During early brain development, radial glial cells
    a. guide neural migration
    b. guide myelination
    c. determine which neurons die
    d. form the neural tube
    e. determine which neurons survive and which neurons do not

24. Match each of the following five brain structures with one of the five subdivisions of the central nervous system listed below (5 points). The brain structures are:

    thalamus; medulla; basal ganglia; tectum, cerebellum

Subdivision	Brain Structure
Telencephalon	_____
Diencephalon	_____
Mesencephalon	_____
Metencephalon	_____
Mylencephalon	_____

25. The superior colliculus receives _____ sensory input, whereas the inferior colliculus receives _____ sensory input. (2 points)

26. A novel drug to improve learning and memory is tested in old rats. When old rats receives 10 mg of the drug, they performs better than old rats given a placebo, and there are no side-effects. When rats are given 70 mg of the drug, they become sick. The therapeutic index of this drug is
    a. 10
    b. 70
    c. 7
    d. 1
    e. 100

27. The major excitatory transmitter in the brain is
    a. GABA
    b. glycine
    c. glutamate
    d. calcium
    e. serotonin

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28. The most common pharmacological treatment approach in Alzheimer's disease consists of administering
    a. acetylcholine
    b. acetylcholinesterase inhibitors
    c. choline acetyltransferase inhibitors
    d. cholinergic antagonists
    e. nicotine

29. List four characteristic features of neurons in both the magnocellular and parvocellular visual pathways (4 points).

Magnocellular	Parvocellular
a)	
b)	
c)	
d)	

30. Most cells in the retina, LGN, and primary visual cortex have receptive fields with a centre-surround organization. Which cell type in the striate cortex (V1) appears to be an exception to this rule (1 point)

    _____

31. A person with damage to area V4 is likely to have problems with the perception of _____, whereas a person with V5 damage probably has an impairment with the perception of _____. (2 points)

32. Two parallel somatosensory pathways carry information from somatosensory receptors to the parietal lobe. What are they ? (2 points)

    a) _____

    b) _____

33. For each of these two pathway (see above), mention one type of somatosensory information that is transmitted in these pathways. (2 points)

    Pathway (a) in above answer transmits: _____

    Pathway (b) in above answer transmits:_____

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34. The part of the visual field to which a neuron responds is called the _____ of the neuron.
    a. ON-center
    b. OFF-center
    c. magnocellular visual field
    d. receptive field
    e. stimulatory field

35. Jerky, step-like eye movements that shift the gaze to an object of interest are
    a. vergence movements
    b. saccades
    c. smooth pursuit
    d. ocular pursuit
    e. vestibular pursuit

36. The fovea
    a. has more rods than cones
    b. has more cones that rods
    c. has equal numbers of rods and cones
    d. has the highest sensitivity to light
    e. both b and d are correct

37. Bipolar cells in the retina receive inputs from _____ and have outputs to _____ (2 points).

38. Damage to the dorsal stream of the visual system results in
    a. deficits with spatial localization of objects
    b. visual agnosia
    c. color blindness
    d. deficient face perception
    d. none of the above

39. Damage to the primary auditory cortex can results in
    a. deafness
    b. deficits in detecting brief sounds
    c. deficits in detecting quick successions of sounds
    d. auditory agnosia
    e. b, c, and d are correct

40. A specific animal species depends heavily on sounds in the range of 25-27 kHz to recognize and communicate with conspecifics. The primary auditory cortex of members of this species is likely to have
    a. a relatively small region devoted to sound frequencies between 25-27 kHz.
    b. a relatively large region devoted to sound frequencies between 25-27 kHz.
    c. a general enlargement of all frequency bands.
    d. no frequency band-specific subdivisions.
    e. only neurons responsive to sounds between 25-27 kHz.

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41. The vestibular sacs signal
    a. linear acceleration of the head.
    b. angular acceleration of the head.
    c. static head position.
    d. both a and c are correct.
    e. both b and c are correct.

42. Temperature changes are signaled by
    a. Ruffini endings
    b. Pacinian corpuscles
    c. Meissner corpuscles
    d. free nerve endings
    e. Merkel cells

43. All of the following statements are correct EXCEPT
    a. The somatosensory cortex has a columnar organization.
    b. Light touch of the skin and deep stimulation of a joint are detected by the same neurons in the somatosensory cortex.
    c. Visual, auditory, and somatosensory cortex all show a topographical, map-like representation of sensory information.
    d. Neurons in the somatosensory cortex have receptive fields with ON-OFF (center-surround) organization.
    e. Incoming sensory information can be modulated before it reaches the somatosensory cortex.

44. Olfactory receptor cells
    a. are unipolar neurons
    b. have receptors coupled to G-proteins
    c. have ionotropic receptors
    d. have axons that form the olfactory tract
    e. both b and d are correct

45. Name two areas of the central nervous system that receive direct, monosynaptic inputs from the olfactory bulb (2 points).

    a. _____

    b. _____

46. Which of the following produces movement of the limbs?
    a. extrafusal muscle
    b. intrafusal muscle
    c. gamma motor neurons
    d. single-unit smooth muscle
    e. multiunit smooth muscle

47. Which receptors detect the strength or force of muscle contractions?

    _____

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48. An action potential in a muscle cell causes the release of _____ from the sarcoplasmic reticulum into the cytoplasm.
    a. sodium
    b. potassium
    c. serotonin
    d. calcium
    e. acetylcholine

49. The role of ATP during muscle contraction is to
    a. form a cross-bridge
    b. open Na channels
    c. break a cross-bridge
    d. form a motor unit
    e. strengthen the muscle

50. Depolarization at the neuromuscular junction is called
    a. rowing.
    b. an endplate potential.
    c. a muscle twitch.
    d. postsynaptic repolarization.
    e. muscle potential

51. Alpha motor neurons release the neurotransmitter _____ which binds to _____ receptors on the muscle cell (2 points).

52. Which of the following controls the sensitivity of the muscle spindle?
    a. Motor endplate.
    b. Gamma motor neuron.
    c. Extrafusal muscle fiber.
    d. Golgi tendon organ.
    e. alpha motor neurons.

53. The tension feedback reflex
    a. is a monosynaptic reflex
    b. is initiated by the muscle spindle
    c. is triggered by the Golgi tendon organ
    d. involves a glycine interneuron
    e. both c and d are correct

54. The supplementary motor and premotor areas are located in the _____ lobes.

55. Damage to the pyramidal tract interferes with
    a. movements of the upper legs.
    b. finger movements.
    c. postural reflexes.
    d. walking/stepping.
    e. activity of anti-gravity muscles

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56. Which motor pathway controls movements of facial muscles?

_____

57. Damage to the rubrospinal tract results in
    a. deficits with finger and toe movements
    b. deficits with autonomic movements (coughing, respiration)
    c. deficits with arm flexion
    d. deficits in standing
    e. deficits in head and eye movements

58. Damage to the cerebellum causes
    a. impaired movement timing.
    b. decomposition of movement.
    c. lack of balance/posture.
    d. impairments in using visual feedback to guide movements
    e. all of the above.

59. Basal ganglia anatomy: The _____ receives inputs from the caudate-putamen and projects to the globus pallidus.

60. Match damage of these three brain structures with three neurological motor disorders (3 points).
    a) damage of the substantia nigra results in _____

    b) damage to the caudate putamen results in _____

    c) damage to the subthalamic nucleus results in _____

61. Three symptoms of Parkinson's disease are (3 points)

    a._____

    b._____

    c._____

62. The EEG measures changes in extracellular currents generation by
    a. action potentials in cortical interneurons
    b. action potentials in cortical pyramidal cells
    c. postsynaptic potentials in cortical interneurons
    d. postsynaptic potentials in cortical pyramidal cells
    e. postsynaptic potentials in subcortical neurons

63. The highest amount of information processing in the brain occurs during
    a. delta activity.
    b. beta activity.
    c. theta activity.
    d. alpha activity.
    e. large-amplitude activity.

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64. The EEG is dominated by delta activity. This person is probably
    a. awake and moving
    b. awake but immobile
    c. drowsy
    d. in light (stage 1-2) sleep
    e. in deep (stage 3-4) sleep

65. Provide a list of six typical physiological characteristics of REM sleep (each is worth 0.5 points for a total of 3 points).

    a) _____

    b) _____

    c) _____

    d) _____

    e) _____

    f) _____

66. Which of the following statements is INCORRECT?
    a. elderly people spend more time in deep slow way sleep than children
    b. young adults spend more time in deep slow wave sleep than elderly
    c. elderly wake up more frequently during the night than children
    d. for all age groups, deeper sleep tends to occur during the first half of the night
    e. sleep architecture changes during the aging process

67. Which two neurotransmitter systems are critical for producing high-frequency, low-amplitude beta activity in the EEG? (2 points)

    _____

68. Classic experiments by Bremer showed that surgical cuts at the midpontine level (high encephale isole) in animals result in
    a. continuous slow wave sleep
    b. no change in sleep-waking states
    c. chronic wakefulness/insomnia
    d. coma
    e. brain death

69. Where in the brain is electrical stimulation most effective in waking up sleeping animals?

    _____

70. Three different neurotransmitters thought to promote wakefulness are (3 points)

    a)_____ b)_____ c)_____

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71. The neurotransmitter most closely involved in producing REM sleep is
    a. noradrenaline
    b. serotonin
    c. GABA
    d. glutamate
    e. acetylcholine

72. Damage to the subcoerulear nucleus results in
    a. loss of EEG desynchronization during REM sleep
    b. loss of muscular paralysis during REM sleep
    c. loss of eye movements during REM sleep
    d. loss of dreaming during REM sleep
    e. loss of autonomic changes during REM sleep

73. During several days of training in a maze, rats
    a. showed no changes in their sleep patterns
    b. showed an increased in REM sleep throughout the entire training period
    c. showed an increase in REM sleep when the most learning occurred
    d. showed an increase in REM sleep after the task was acquired
    e. showed a decrease in REM sleep due to high levels of stress

74. Which disorder is characterized by the inability to sleep and breath simultaneously?

    _____

75. Four causes of insomnia are? (0.5 point each, total of 2 points)

    a._____

    b. _____

    c. _____

    e. _____

76. Four symptoms of narcolepsy are (0.5 point each, total of 2 points)

    a. _____

    b. _____

    c. _____

    d. _____

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77. The primary biological clock that controls sleep-wake cycles is located in the
    a. pineal gland.
    b. pituitary gland.
    c. suprachiasmatic nucleus.
    d. superior colliculus.
    e. superior peduncle.