Student Name: _____ /125
Student Name: _____

Science Olympiad 2016-2017: Anatomy and Physiology Practice Test (Nervous, Endocrine, Sensory)

Written By: Cherrie Lan

First Section: Multiple Choice

Second Section: Short Answer, True/False, and Matching

Third Section: Long Answer

Fourth Section: Cases

Fifth Section: Labeling

Questions of all 3 systems are mixed up throughout all 6 sections.

Tiebreakers have an * next to the number of the question. Each tiebreaker counts for 0.5 points. Tiebreakers are not included in the final score total, just add on 0.5 points.

This is a pretty long test, so try to be careful with time. Come back to harder questions later; try to finish as much as you can. Good luck!

Section 1: Multiple Choice. Each question will be scored as 1 point. All or nothing. Circle the letter of your choice.

1. Which type of neuron is most abundant?

a) Sensory Neuron
b) Interneuron
c) Motor Neuron
d) Central Neuron
e) NOTA

2. Name the gland that produces melatonin.

a) Pituitary Gland
b) Pineal Gland
c) Hypothalamus
d) Thyroid Gland
e) NOTA

3. Put in order the steps of a synapse.

I. Neurotransmitter molecules are stored in vesicles.
II. Released neurotransmitter molecules bind with autoreceptors and inhibit subsequent neurotransmitter release.
III. Released neurotransmitter molecules are deactivated either by reuptake or enzymatic degradation.
IV. Neurotransmitter molecules are synthesized from precursors under the influence of enzymes.
V. Released neurotransmitter molecules bind to postsynaptic receptors.
VI. Action potentials cause vesicles to fuse with the presynaptic membrane and release their neurotransmitter molecules into the synapse.
VII. Neurotransmitter molecules that leak from their vesicles are destroyed by enzymes.

a) I, VII, IV, VI, II ,V, III
b) III, VII, I, IV, II, VI, V
c) I, II, III, IV, V, VI, VII
d) IV, I, VII, VI, II, V, III
e) NOTA

4. Graves Disease is caused by:

a) A sodium deficiency
b) A problem with genetics
c) A thyroid hormone deficiency
d) Lack of Vitamin A
e) NOTA

5. Which of the 3 ossicles of the middle ear is known as the “hammer”?

a) Malleolus
b) Incus
c) Stapes
d) Cochlea
e) NOTA

6. What is the name of the innermost membrane of the meninges?

a) Dura Mater
b) Pia Mater
c) Arachnoid Mater
d) Ruber Mater
e) NOTA

7. What gland produces the hormone prolactin?

a) Anterior lobe of the pituitary gland
b) Posterior lobe of the pituitary gland
c) Hypothalamus
d) Thalamus
e) NOTA

8. Which of the four regions of the brain is responsible for proper balance and posture?

a) Brain Stem
b) Diencephalon
c) Cerebellum
d) Cerebral Hemispheres
e) NOTA

9. What is the resting membrane potential?

a) -90 mV
b) -82 mV
c) -70 mV
d) 20 mV
e) NOTA

10. When using an electroencephalogram, which type of brain wave is detected when you are awake?

a) Alpha
b) Beta
c) Theta
d) Delta
e) NOTA

11. What type of receptor responds to light?

a) Thermoreceptor
b) Mechanoreceptor
c) Nociceptor
d) Chemoreceptor
e) NOTA

12. Which endocrine gland produces oxytocin?

a) Pineal Gland
b) Pituitary Gland
c) Thyroid Gland
d) Hypothalamus
e) NOTA

13. Gavin, a 60 year old man, comes to his doctor one day, complaining that his vision had started to go gray. When the doctor asked him if he had felt pain in the past, Gavin said that it was painless and nothing had happened until his vision had started to fade.

What disorder is this?

a) Conjunctivitis
b) Cataracts
c) Glaucoma
d) Phakomatose
e) NOTA

14. What are the hormones of the pituitary gland controlled by?

I. Inhibiting Hormones
II. Releasing Hormones
III. Both I and II
IV. Neither I nor II

a) I
b) II
c) III
d) IV
e) NOTA

15. What type of gland is the pancreas?

I. Endocrine Gland
II. Exocrine Gland
III. Both I and II
IV. Neither I nor II
a) I
b) II
c) III
d) IV
e) NOTA

16. What is the primary function of renin?

a) Increase drowsiness
b) Increase tendency to eat
c) Decrease weight
d) Increase blood pressure
e) NOTA

17. _____ is the sensory speech area of the brain and _____ is the motor speech area.

a) Broca's area, Wernicke's area
b) Wernicke's area, Broca's area
c) Auditory cortex, motor cortex
d) Angular gyrus, motor cortex
e) NOTA

18. Which lobe of the brain houses the visual areas and is responsible for combining and recognizing visual images?

a) Frontal Lobe
b) Parietal Lobe
c) Temporal Lobe
d) Occipital Lobe
e) NOTA

19. Regulation of body temperature is regulated by the:

a) Hypothalamus
b) Thalamus
c) Hippocampus
d) Medulla Oblongata
e) NOTA

20. Jane, a 13 year old girl, is brought to her doctor one day, sporting an reddened eye. During her stay at the doctor's office, she kept rubbing her eyes, saying they itched. The doctor, after examining and diagnosing the disorder, told Jane to not wear her contacts until the disorder was treated, and to be careful not to touch anyone or contaminate anything, as the disorder was contagious.

What disorder is this?

a) Oculitis
b) Blepharitis
c) Conjunctivitis
d) Ophthalmitis
e) NOTA

21. What do muscarinic receptors bind to?

a) Norepinephrine
b) Acetylcholinesterase
c) Acetylcholine
d) Neuropeptides
e) NOTA

22. Stimuli for pain is detected by:

a) Thermoreceptor
b) Mechanoreceptor
c) Chemoreceptor
d) Free nerve endings
e) NOTA

23. What disease is caused by the loss of dopamine?

a) Parkinson's Disease
b) Huntington's Disease
c) Fahr's Syndrome
d) Wilson's Disease
e) NOTA

24. Cerebrospinal Fluid is found between the:

a) Arachnoid Mater and the Dura Mater
b) Pia Mater and the Dura Mater
c) Arachnoid Mater and the Pia Mater
d) Pia Mater and the Cerebrospinal Layer
e) NOTA

25. What is the frequency of a theta wave?

a) Less than 4 Hertz
b) 4-7 Hertz
c) 8-13 Hertz
d) Greater than 13 Hertz
e) NOTA

Section 2: Short answer and True/False. Each short answer question counts for 2 points, each true/false question counts for 1 point, and each matching question counts for 1 point, while the question afterwards counts for 2. No need for complete sentences. Circle the letter T for true and the letter F for false. Partial credit on short answer, none on T/F. Write the letter of the answer on the line. No partial credit for matching.

Short Answer

1. Which gland produces calcitonin, what chemical class is it, what is it used for, and what regulates it?

Gland: Thyroid Gland / Chemical Class: Peptide / Used for: Reduces blood calcium level / Regulated By: Calcium level in blood.

2. What is the role of a microglial cell?

Monitors the health of nearby neurons, and dispose of debris, including dead brain cells and bacteria. Immune defense against invading organisms.

3. What is the difference between a general sense and a special sense?

General senses are scattered all over the body and relatively simple in structure, while the receptors for the special senses are located in specific places in the head, are anatomically different from one another, and are more complex than the general senses.

4. Name two possible causes of hypoglycemia.

Answers may vary. Some acceptable answers include: Side effect of drugs used for the treatment of diabetes, having either type 1 diabetes or type 2 (only accept ONE if they list both), excessive alcohol consumption, severe illnesses of the liver, and insulin overproduction.

5. What are collections of neurons called in the central nervous system and what are they called in the peripheral nervous system?

In the central nervous system, collections of neurons are called nuclei, and in the peripheral nervous system, they are called ganglia.

6. Describe the all-or-nothing law.

A principle that states that the strength of a response of a nerve cell or muscle fiber is not dependent upon the strength of the stimulus. If a stimulus is above a certain threshold, a nerve or muscle fiber will fire. If not, it won't fire.

7. Mary was really tired one morning, so she wasn't really watching where she was stepping. As a result, she accidentally stepped on a tack that fell out of one of her posters on the wall. Describe the reflex arc that follows.

Arrival of stimulus (tack) and activation of receptor, Activation of a sensory neuron, Information processed in CNS, Activation of a motor neuron, Response by effector (lifts foot).

*8. What causes the irises of albino people to appear red or pink?

Albino people have no pigment in the irises of their eyes, so only the blood vessels show, making the iris appear red or pink.

True/False

(T/F) 1. The lack of red or green receptors is most common in partial color blindness.

(T/F) 2. The temporal lobe of the brain specializes in sight.

(T/F) 3. Steroids are water-soluble.

(T/F) 4. Parathyroid hormone is regulated by potassium level in blood.

(T/F) 5. In electroencephalography (EEG), the recording during a seizure is said to be interictal.

(T/F) 6. Alcohol causes high blood pressures in blood.

(T/F) 7. Nicotine causes the arteries to narrow.

(T/F) 8. Serotonin is a monoamine.

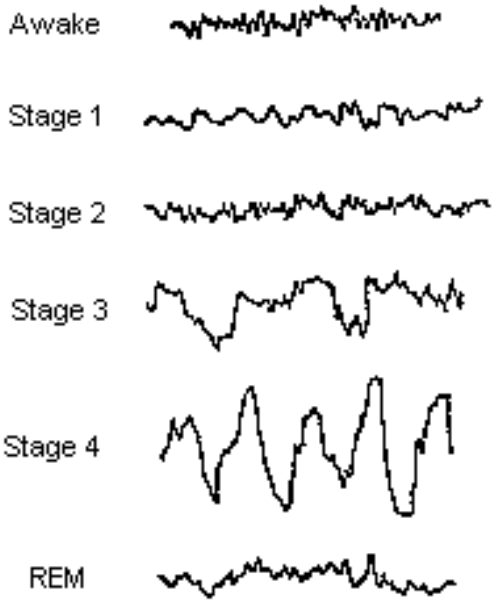
(T/F) 9. Histamine-gated chloride channels produce fast inhibitory postsynaptic potentials.

(T/F) 10. There are 31 pairs of nerves in the spinal cord.

(T/F) * 11. The average human brain weighs about 3 pounds.

Matching

Match the brainwave with the stage of sleep in the sleep cycle, and put the cycle in order, in the numbers of the questions, starting from Awake to REM Sleep.



1. d
2. f
3. a
4. e
5. c
6. b

1) Awake
2) 1st Stage
3) 2nd Stage
4) 3rd Stage
5) 4th Stage
6) REM Sleep

Put the numbers in order: 3, 6, 5, 1, 4, 2

Section 3: Long Answer. Answer as completely as you can. Partial credit is given. Each question counts for 5 points.

1. Describe what happens to a person's insulin levels when a person is afflicted with Diabetes type 1.

In people with Type 1 diabetes, insulin levels are very low. It is not known why, but the pancreatic islet cells quit producing insulin in the quantities needed to maintain a normal blood glucose level. Without sufficient insulin, the blood glucose rises to levels which can cause some of the common symptoms of hyperglycemia.

2. Establish the similarities and differences of cones and rods in sight.

Both cones and rods are types photoreceptors in the eyes. However, rods are active at low-light levels, see in black and white, and have a low spatial acuity (detection of an object's shape). Cones are active in higher light levels, see in color, and have a high spatial acuity.

3. What happens to a person when Broca's area (in the brain) is damaged?

Words may be uttered very slowly and poorly articulated; damage significantly affects use of spontaneous speech and motor speech control. People afflicted by Broca's aphasia have great difficulty with repetition and a severe impairment in writing. In some patients, however, understanding of spoken and written language can be well-preserved.

Section 4: Cases. Here are cases of a disorders and diseases. All multiple choice count as 1 point. All short answer count as 2 points. Answer to the best of your abilities.

Case #1:

One day, Tina, a 24 year old woman, was taking a walk around her college campus at MIT in the summer, relieved that finals was finally over. She walked for a while, then decided to head back to her dorm. However, when she looked at the street signs as she walked by, they appeared blurry. Getting worried, she called an eye doctor and scheduled an appointment the next day.

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As she was waiting in the room for her appointment, she remembered having difficulty reading the morning paper that day from the table, while eating breakfast. She also remembered several instances during work while she was typing up notes for a long time and got headaches after a while, and that sometimes she had to squint to see the screen clearly.

1. What is this condition called?

a) Myopia b) Hyperopia c) Nyctalopia d) Presbyopia e) NOTA

Dr. Gold called her name by the doorway the led to all the offices. “Tina!” Tina immediately responded and walked to the doorway.

2. What receptors responded to Dr. Gold’s voice?

a) Chemoreceptors b) Thermoreceptors c) Photoreceptors d) Mechanoreceptors e) NOTA

Dr. Gold prescribed a pair of glasses that would help her vision.

3. What type of lenses would this pair of glasses have, due to her condition?

a) Concave b) Convex

4. What will the glasses do to help Tina see better?

a) Cause the image to focus in on the retina
b) Cause the image to focus in behind the retina
c) Cause the image to focus in in front of the retina
d) Cause the image to flip upside down
e) NOTA

Case #2:

Meet Viktor. He is a 64 year old male, and loves Pokemon. One day in the morning while playing Pokemon GO at the mall, he suddenly begins to cough and wheeze. In the afternoon, he decided to jog a bit in the park, also on the hunt for some Pokemon. Unfortunately, he quickly became short of breath, which wasn't usual, so he returned home. Later that night, Viktor starts to experience throat tightness and has more trouble breathing. So he makes an appointment with his doctor for next morning.

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The next day at his appointment, Viktor told Dr. Weiler about his abnormalities yesterday. After some lab imaging Dr. Weiler determines that Viktor is in need of partial thyroidectomy.

1. What disorder does the patient have?

a) Goiter
b) Hyperglycemia
c) Graves Disease
d) Hypothyroidism
e) NOTA

2. What is the best method of non invasive treatment?

a) Thyroid hormone suppressive therapy
b) Radioactive Iodine Treatment
c) Electrotherapy
d) Recombinant human TSH
e) NOTA

3. Which age group and gender is most commonly affected by this disease?

a) Males Ages 19-34
b) Females Ages 21-33
c) Males Below 20 and above 21
d) Females Ages 40-43
e) NOTA

4. What causes this disease?

When a thyroid produces too much thyroid hormone (hyperthyroidism).

Case #3:

Gabriella, a 34 year old female, is reading a bedtime story to her two children as she suddenly begins to feel fatigued and dizzy. She gets up the climax of the story, when her vision started to become blurry and she suddenly faints. “Oh no! That was the best part!” cried her 5 year old son, Matt. Her 12 year old daughter, Olivia, frantically screamed, and immediately ran to the phone and dialed 911.

“Why is daddy always so irresponsible?” Olivia muttered before dialing.

She wakes up in the hospital a few hours later and, while asking where she was and why she was there, had slurred speech. As she sat up to stretch, she winced, because her muscles had become unnaturally cramped. Dr. Ashlar approached her and asked her to tell him what had happened. Gabriella couldn’t remember anything, due to her fainting, and seemed to have difficulty understanding him. He decided to conduct an MRI exam, and observed deteriorated nerve tissue.

1. What disease is this?

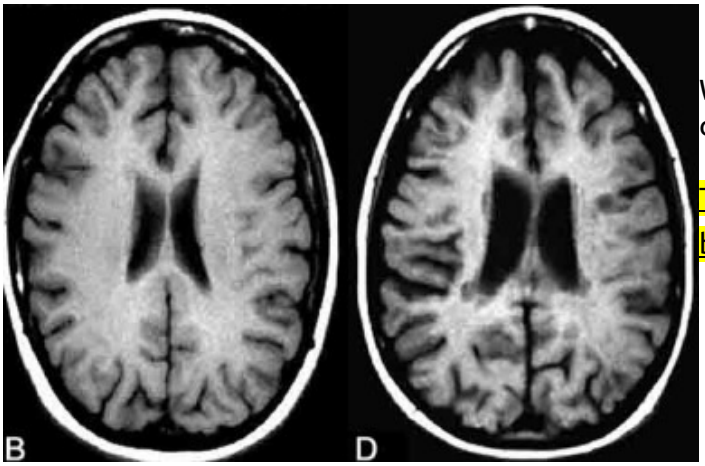
a) Wernicke’s Aphasia
b) Cerebral Palsy
c) Epilepsy
d) Multiple Sclerosis
e) NOTA

2. List 5 Symptoms of this disease not experienced by Gabriella. (Each counts for 1 point).

I Tremors- in precise movements or in hands and limbs
II. Anxiety or mood swings
III. Heat intolerance
IV. Overactive reflexes
V. Abnormality of taste

Also acceptable: Pain areas in the back or in the eyes, pain circumstances that occur in the back due to head nod or with eye movement, difficulty walking, inability to rapidly change motions, involuntary movements, muscle paralysis, muscle rigidity, muscle weakness, problems with coordination, stiff muscles, clumsiness, muscle spasms, heat intolerance, poor balance, vertigo, weakness, excessive urination at night, leaking of urine, persistent urge to urinate, urinary retention, pins and needles,uncomfortable tingling and burning, double vision, vision loss, sexual dysfunction, anxiety, mood swings, impaired voice.

3. The MRI to the right is a 2nd MRI taken of Gabriella. The MRI to the left is of a normal brain.



What in the scan points to Gabriella’s disease?

The loss of white matter in Gabriella’s brain and deteriorated nerve tissue.

Case #4:

Ludwig Van Beethoven was born in December of the year 1770. He was known as a fantastic piano player from a young age, giving his first public performance on March 26th 1778, at the age of 7 ½. He went on to become a fantastic composer, writing many pieces, the best known being 9 symphonies, 5 concertos for piano, 32 piano sonatas and 16 string quartets. He also composed other chamber music, choral works and songs. However, later on into his career, he started becoming deaf. Amazingly, his best pieces were written after his deafness, but his deafness has still been a mystery. One of the theories was a disorder, although it is still controversial. Here are some clues to help you determine the disorder.

- Beethoven was 26 when the symptoms showed, buzzing noises and other sounds in his ears. He lost 60% of his hearing at the age of 31, and was completely deaf at the age of 46.
- This disorder lasts for years or can even be lifelong.
- It is an inherited disorder that causes hearing loss due to the ear's inability to amplify sound.

1. What disorder is this?

a) Otitis Media
b) Presbycusis
c) Ménière's disease
d) Otosclerosis
e) NOTA

2. What causes the hearing loss in this disorder?

a) The result of the abnormal amount of endolymph in the inner ear.
b) The the middle ear becomes inflamed and infected.
c) The stapes becomes stuck in place and unable to vibrate.
d) Cumulative effects of repeated exposure to loud sounds.
e) NOTA

3. What treatments could be administered to treat this disorder? List two. (Each is 1 point).

Hearing aids, stapedectomy, cochlear implantation, sodium fluoride.

Section 5: Labeling. Each question counts for 1 point. Label as specifically as you can. Please write your answer next to the number. Number 17 is as a whole.

Eye Labeling

1. Ciliary Body
2. Cornea
3. Iris
4. Pupil
5. Anterior segment. Also accept: Anterior Chamber, Posterior Chamber
6. Lens
7. Posterior segment. Also accept: Vitreous, Vitreous humor, Vitreous fluid
8. Sclera
9. Choroid
10. Retina
11. Fovea Centralis
12. Optic Nerve
13. Optic Disc (blind spot)

Brain Labeling

1. Frontal Lobe
2. Hypothalamus
3. Optic Chiasma
4. Pituitary Gland
5. Temporal Lobe
6. Mammillary Gland
7. Pons
8. Medulla Oblongata
9. Spinal Cord
10. Parietal Lobe
11. Corpus Callosum
12. Fornix
13. Choroid Plexus
14. Occipital Lobe
15. Thalamus
16. Pineal Gland/Body
17. Midbrain
18. Fourth Ventricle
19. Cerebellum