

Anatomy & Physiology Fall 2021 Invitational Tournament**School Name****Team: A B C****Time:****Score:****Rank:**

You have 50 minutes to take this test. You are allowed one double-sided cheat sheet and up to 2 non-programmable/non-graphing calculators. Tiebreakers are at the end of the test, and will also contribute to the final score. Highest score wins. Point values listed in parenthesis for each section. For multiple choice, choose the best answer; some may have more than 1 right answer. (out of 214pts)

Nervous System:

1. What is the brain region that is best known as the sensory routing system, and if cortical nerves from sensory organs bypass this region, the cortex won't be able to perceive the sensation of those sensations? (2 pts)
 - a. Hypothalamus
 - b. Post central gyrus
 - c. Cerebrum
 - d. **Thalamus**
2. What is the neurotransmitter used in the sympathetic nervous system? (2pts)
 - a. **Epinephrine**
 - b. Dopamine
 - c. GABA
 - d. Glutamate
3. What is the brain's main excitatory neurotransmitter? (2pts)
 - a. GABA
 - b. **Glutamate**
 - c. Glycine
 - d. Serotonin
4. Initial depolarization of an action potential is because of what? (2pts)
 - a. Potassium ions entering the cell
 - b. Potassium ions exiting the cell
 - c. **Sodium ions entering the cell**
 - d. Sodium ions exiting the cell
 - e. Calcium ions entering the cell
 - f. Calcium ions exiting the cell
5. The movie Ice Castles (1978), involves a rising ice skater star who suffers a serious head injury after attempting a difficult jump. She suffers a blood clot in her brain that robs her of her eyesight, making her see only light and blurry shapes. Which brain lobe could the blood clot have been located in? (2 pts)

Occipital lobe
6. Sometimes anti seizure medicine is not effective in very severe cases of epilepsy seizures, which requires an operation in which this brain part is severed, which prevents the communication of information between brain hemispheres causing a loss of certain functions. What is that brain part? (2pts)
 - a. Cerebrum

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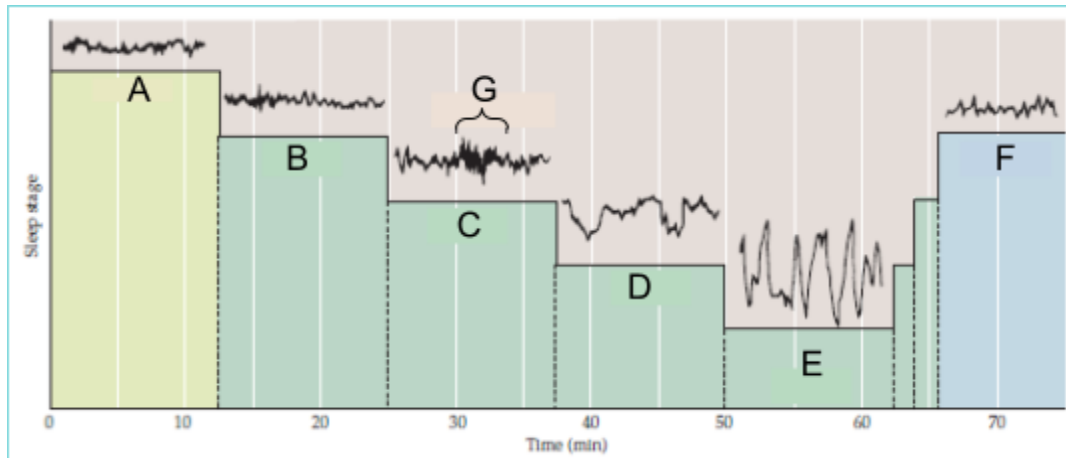
Rank:

- b. Brainstem
 - c. **Corpus callosum**
 - d. Thalamus
7. Which brain region regulates vital functions like breathing and your heartbeat? (2pts)
Medulla
8. Jungkook is practicing for a dance choreo for a performance but keeps getting frustrated at the inability of his legs to execute what he wants them to do. Information is sent from the brain down to his muscles to coordinate their movement. What type of neurons are these? (2 pts)
- a. Interneurons
 - b. Afferent neurons
 - c. Motor glial neurons
 - d. **Efferent neurons**
9. Kotoko goes to the doctor for a really serious head rash that is painful and blistering. She also feels painful pins and needles, and a slight fever. Her doctor asks if she had chicken pox as a kid. What is her doctor's suspicion of the disorder Kotoko has and give a brief description of the potential etiology (cause)? (4 pts)
Shingles/herpes zoster (2pt); varicella-zoster virus is dormant/inactive in nerves in body and becomes active again (2pt)
10. What is the approximate resting potential of a neuron? (2pts)
-70 mV
11. At resting membrane potential, potassium wants to move ___ **out of**/into___ the cell, and sodium wants to move ___ **out of/into** ___ the cell? (circle the right word) (4 pts)
12. Explain why white matter is called white matter and gray matter as gray matter? (4 pts)
Gray matter consists of cell bodies/somas and dendrites and axon terminals (up to 2pts, 1 pt for each), while white matter consists of axons/axon bundles (1 pt) that are wrapped in myelin (1 pt).
13. What layer of brain covering is named for its spider web-like appearance? (2pts)
Arachnoid mater
14. Identify the cranial nerve that is being examined by each clinical test listed below. (6 pts)
- a. Sticking out the tongue and looking at the symmetry.
CN XII/hypoglossal
 - b. Examining the strength and evenness of a shrug.
CN XI/accessory
 - c. Biting down on a pencil, sensation of a Q-tip on the skin, and the corneal reflex.
CN V/Trigeminal
 - d. Smelling strong aromatic oils or salts.
CN I/Olfactory

- e. Rinne or Weber test with a with a tuning fork, and testing for balance while standing.
 CN VIII/Vestibulochochlear
- f. Saying “Ah!” and looking at the position of the uvula, and testing the gag reflex.
 CN IX/glossopharyngeal

1 point for each correct identification. Can use either the Roman numerical or word name of the cranial nerve.

15. Use the figure below to answer question #7.



- a. Identify and briefly describe the type of brainwave or the stage labeled in the figure below. For brainwaves give the wavelength range for #A-G, except for F. Assume the person who they got this EEG from started at a very relaxed and calm, meditative state of awakesness. (15 pts)
- A: Alpha; 9-14 Hz; during relaxed, calm, meditation, or creative visualization awakesness (1 pt for each section labeled, total of 3 pts)
 - B: Theta; 4-8 Hz; deep relaxation and mediation, problem solving (1 pt for each section labeled, total of 3 pts)
 - D+E: Delta; 1-3 Hz; deep, dreamless sleep (1 pt for each section labeled, total of 3 pts)
 - F: REM; dreaming, eyes darting around, brain activity increases (1 pt for each section labeled, total of 2 pts)
 - G: sleep spindle; 10-12 Hz, short burst of of brain activity (1 pt for each section labeled, total of 3 pts)
- b. The green bars label stages I-IV. What are those sleep stages called? (1 pt)
 Non-rapid eye movement/non-REM sleep

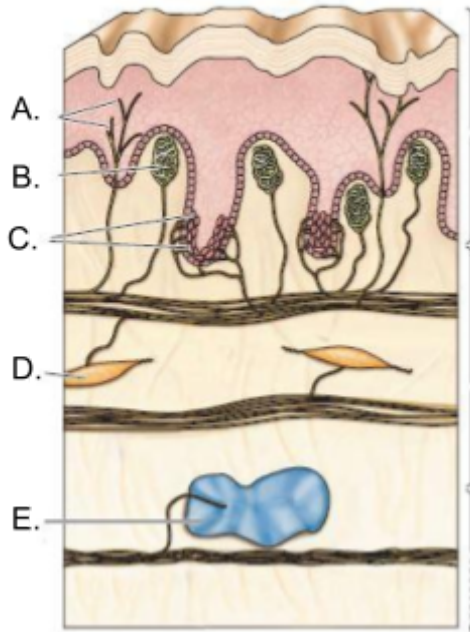
16. During a lumbar puncture, a needle is inserted between usually the third and fourth lumbar vertebrae. This is usually to diagnose meningitis, tuberculosis, encephalitis, and many other diseases. What fluid is collected for this testing in this procedure? (2 pts)
- Blood
 - Cerebral spinal fluid**
 - Subarachnoid fluid
 - Interstitial fluid
17. Which of these drugs can act as a stimulant on the body? (2pts)
- A cup of espresso**
 - Smoking cannabis
 - A shot of vodka
 - Smoking a cigarette**
18. Explain the function of myelination, which cells do this (give context), and an example of a related disorder. (9 pts)
- coat/sheath axons (1pt) with a lipid/fat layer (1pt) to prevent decay of action potential/insulate axon to prevent action potential decay (1pt)
 - oligodendrocytes (1pt) in central nervous system (1 pts) and Schwann cells (1pt) in the peripheral nervous system (1pt)
 - Multiple Sclerosis (2pt)
19. Which meningeal layer is proximal to the central nervous system? (2pts)
- Pia mater**
20. Dopamine is a neurotransmitter that helps coordinate body movement. What pathology is the result of a loss of midbrain dopaminergic neurons? (2pts)
- Parkinson's Disease**
21. What type of conduction is the node-to-note traveling of action potentials called? (2pts)
- Saltatory conduction**
22. Auditory information is processed in which lobe of the cerebrum? (2pts)
- Temporal lobe**
23. How many pairs of cranial nerves are there and how many pairs of spinal nerves? (4 pts)
- 12 pairs of cranial nerves (2 pts) and 31 pairs of spinal nerves (2 pts)**
24. People who suffer a stroke in this region can still speak words fluently but what they say lacks total meaning and is gibberish. What is that region? (2 pts)
- Wernicke's area**

Sense Organs:

- What is the point in the retina called where the optic nerves exit from and contains no photoreceptors and thus is a blind spot? (2 pts)
- Optic disk**
- Yasmina goes to the doctor for issues seeing in dim light. What is the medical scientific name for this eye defect and briefly explain a probable cause? (3 pts)

Nyctalopia (2pts); rhodopsin in rods not function properly (1 pts)

3. Identify the touch receptors as labeled in the image below and give a brief description of the function (10 pts)



- A. Free nerve endings-detect mechanical, chemical or thermal stimuli; pain and temperature;unspecialized
 - B. Meissner corpuscle-light/sensitive touch and pressure
 - C. Merkel disks- pressure, position, and deep static touch features, such as shapes and edges; high spatial resolution
 - D. Ruffini corpuscle- sustained/continuous pressure
 - E. Pacinian corpuscle- heavy/deep pressure
- 1 point for each correct name identification and 1 point for each correct function.
4. What are the names of the muscles that allow focusing of the eye by changing the shape of the lens? (2 pts)
- Ciliary muscles
5. Name the three bones that make up the middle ear. (3pts)
- Hammer, Anvil, Stirrup (1 pt each)
6. This structure in the eye serves to control the amount of light entering the eye by dilating and constricting the pupil. (2pts)
- a. Lens
 - b. Cornea
 - c. Iris
 - d. Ciliary bodies
7. There are two types of light receptors on the retina - rods and cones. What is the difference between these two receptors? (4 pts)

Rods - detect dimness/brightness and motion (1 pt each)

Cones - detect color and fine details (1 pt each)

8. Gustatory sense is refers to what? (2pts)

taste

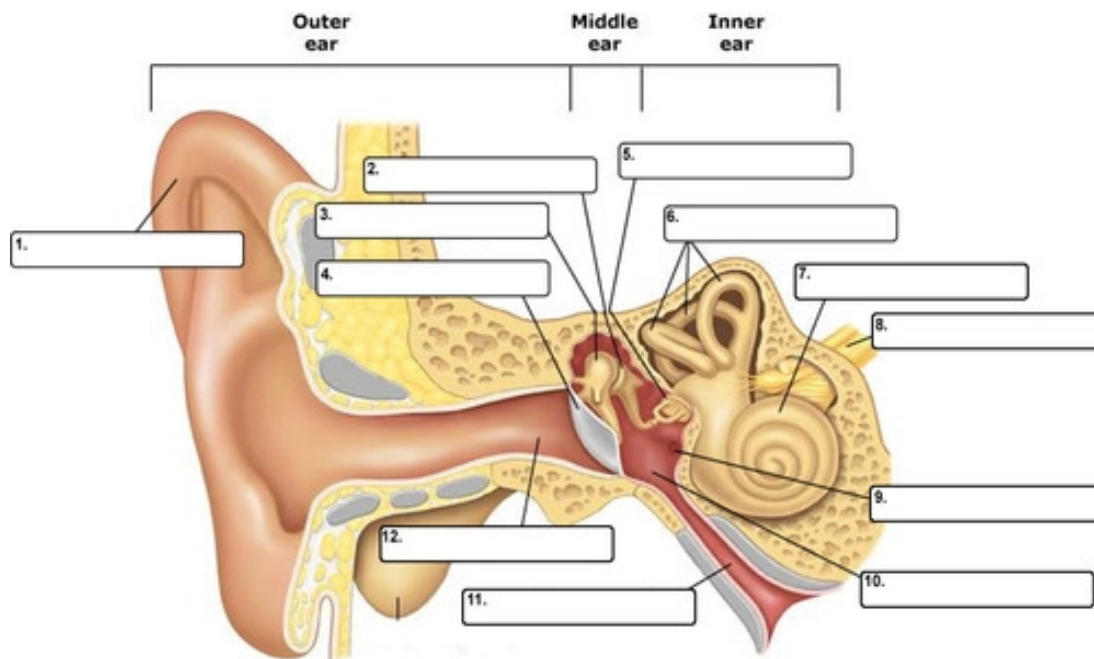
9. What is the function of the vestibule located in the inner ear? (4 pts)

Senses position and linear motion of the head (2 pts each)

10. Mark goes to the eye doctor and reports cloudy spots in his field of vision and difficulty seeing at night. He also says that his eyes seem to be more sensitive to light. What is the likely diagnosis and what structure is affected? (2 pts)

- a. Cataracts; retina
- b. Cataracts; lens
- c. Macular degeneration; retina
- d. Macular degeneration; lens

Answer the following questions regarding auditory sensation



11. Label the above diagram on your answer sheet (6pts)

(1. Pinna of the ear, 2. Incus, 3. Malleus, 4. Tympanic membrane, 5. Stapes, 6. Semicircular canals, 7. Cochlea, 8. Vestibulocochlear nerve, 9. Round window 10. Tympanic cavity, 11. Eustachian canal, 12. Auditory canal)

12. Explain the place theory of audition, and discuss what the tonotopic organization of hair cells refers to. (6pts)

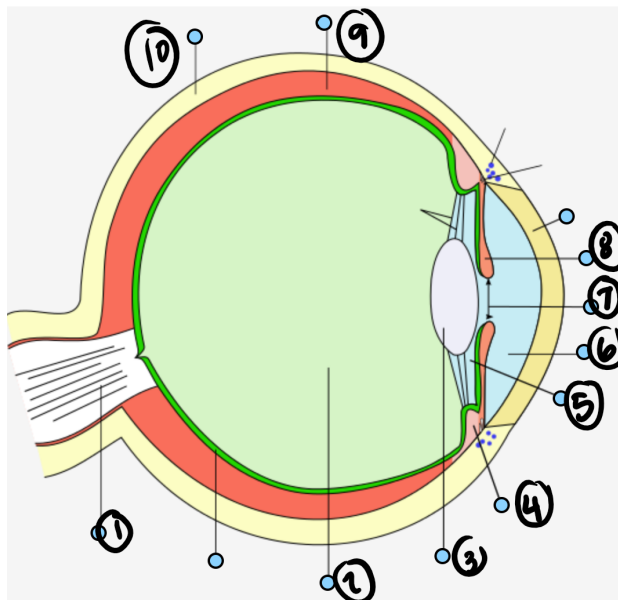
(The place theory of audition states that the location of hair cell vibrations on the basilar membrane dictates the perception of pitch when the hair cell is vibrated(2pst) . High frequency pitches cause vibrations close to the oval window, while low-frequency pitches cause vibrations at the apex, away from the oval window.(2pts) Tonotopic organization of hair cells describes how the location of each hair cell corresponds to the pitch of sound.(2pts)

13. Explain the purpose of the round window. (2pts)

(The round window allows for the displacement of perilymph in the cochlea, allowing for the movement of hair cells inside.)

Use Diagram for Questions 14-16

14. Label the Diagram Below(10pts)(1pt for each)



(1. Optic nerve and/or retinal vessels, 2. Vitreous humor, 3. Lens, 4. Ciliary Muscle, 5. Posterior chamber or zonule fibers, 6. Aqueous humor. 7.Pupil, 8. Iris, 9. Choroid, 10. Sclera)

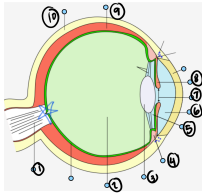
15. On the above diagram, what is the function of the layer that is labelled #10.(2pts)

Can include any of the following. Need one to get points.

- A tough protective layer of connective tissue
- helps maintain the shape of the eye
- provides an attachment for the muscles that move the eye

16. Draw a star on the diagram above to identify the blind spot/ optical disk. (2pts)

Must draw star in the triangular wedge near optic nerve

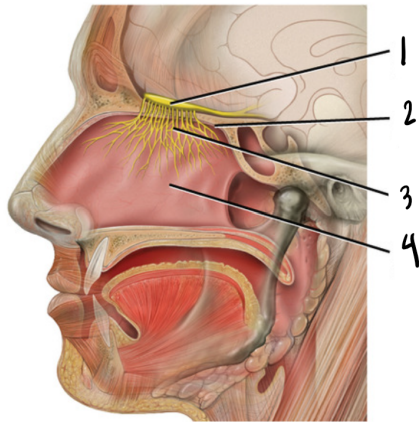


17. Describe the basic aspect of static equilibrium and dynamic equilibrium in the ear. In which process are the maculae utilized?(6pts)
(2pts each)
Static-When the body is not moving
Dynamic-Receptors in the semicircular canals respond to angular or rotary movements of the head.
Maculae utilized in static equilibrium
18. What are proprioceptors?(2pts)
- Receptors that help maintain internal homeostasis
 - Receptors that sense pressure
 - Receptors that detect stretch and stimulate a reflex contraction
19. How many specialized receptor cells are in each of your taste buds?(2pts)
- 1000
 - 100
 - 20
 - 5
 - 1
20. Olivia Rodriguez failed to get her driving license because she has trouble seeing far away things clearly? What common eye defect could she have?(2pts)
- Myopia
 - Hyperopia
 - Cataracts
21. List the 5 types of sensory receptors and provide an example or function of each. (10 pts)

1pt for each receptor and 1pt for example//function for each of the 5

- Mechanoreceptors - pressure receptors, stretch receptors, and specialized mechanoreceptors involved in movement and balance.
- Thermoreceptors - skin and viscera, respond to both external and internal temperature
- Pain receptors - stimulated by lack of O₂, chemicals released from damaged cells and inflammatory cells
- Chemoreceptors - detect changes in levels of O₂, CO₂, and H⁺ ions (pH) as well as chemicals that stimulate taste and smell receptors
- Photoreceptors - stimulated by light

22. Label the Diagram Below(4pts)



(1. Olfactory bulb, 2. Olfactory epithelium, 3. Nerve Endings, 4. Nasal Cavity)

23. Visceral Nociceptors respond to lack of _____.(1pt)

O₂

24. Which touch receptor senses pressure and vibration changes deep in your skin.(1pt)

- a. Pacinian corpuscles
- b. Meissner's corpuscles
- c. Merkel disks

Endocrine System:

1. What are the main hormones released from the adrenal medulla? (4 pts)

Epinephrine/adrenaline (2pts)

2. Describe the difference between how steroid and peptide/amine hormones act on the cell. (6 pts)

Steroid= fat soluble (1), bind to receptors inside the cell (1), directly interacts with DNA to turn genes on or off (1)

Peptide/amines= water soluble (1), not pass through the cell membrane/bind to receptors on the outside of cell membrane (1), requires a 2nd messenger signal (1)

3. In what organ is the pineal gland located in and what does it secrete and describe its role? (5 pts)

Brain (1pt); melatonin (2pts)- regulates our internal clocks and any rhythmic activities/plays role in sleep and wake cycles (2pts)

4. Which of the following hormones is NOT released by the pituitary gland? (2 pts)

- a. Follicle stimulating hormone
- b. Antidiuretic hormone
- c. Oxytocin
- d. Aldosterone

5. What is the name of the autoimmune disorder which targets the thyroid gland and damages the tissues causing hypothyroidism? (2 pts)
Hashimoto's disease
6. Type 1 Diabetes Mellitus is a result of: (2 pts)
 - a. Insulin insensitivity
 - b. Immune system destruction of insulin-producing beta cells**
 - c. Defective GLUT 4 receptors
 - d. Weight gain and excessive sugar intake through the diet
7. A forensic scientist is examining the remains of a body discovered in the desert with very little identifiable information. They locate a shrunken gland below the thyroid between the right and left lung. Is the victim young or old? Also what is the gland the scientist had located to help judge their decision and why were they able to make that decision based off of that? (7 pts)
Older (1pt)
thymus (2 pt)
Secretes thymosin (1 pt) which stimulates T-cell (1 pt) (that is a type of white blood cell) production in children. This gland shrinks with age as we are exposed to more germs and build up our stores of antibodies. (2 pt)
8. Tumors in this gland can cause changes in vision due to its proximity to the optic nerve. What is the gland? (2 pts)
 - a. Pituitary gland**
 - b. Hypothalamus
 - c. Lacrimal gland
 - d. Pineal body
9. Which of the following is false regarding the function and derivation of various steroid hormones (2pts)
 - a. It is thermodynamically favorable for steroid hormones to pass through the cell membrane because their hydrophobic core can easily pass through the lipid bilayer, even with hydrophilic functional groups.
 - b. Adrenal androgens are secreted from the zona reticularis of the adrenal gland and typically consist of a 19 carbon molecular backbone.
 - c. Glucocorticoids are a class of corticosteroids and are often the first-line of therapy for autoimmune inflammatory diseases.
 - d. The androgenic steroid DHT is often used as a treatment for androgenetic alopecia, a type of pattern baldness, because it promotes hair growth at the follicle.**
10. Explain the relation between oxytocin and prolactin? (6 pts)
Both are involved in breastfeeding (2pts); prolactin stimulates milk production in milking mothers (2pts) and oxytocin also allows for milk to be released from breast tissue (2pts)

11. What is MSH stand for, what does it do, and where is it released from? (6 pts)

Melanocyte-stimulating hormone (2pts); increases production of skin pigment melanin (2pts); released from anterior pituitary

12. Describe the difference between the posterior pituitary and anterior pituitary gland according to their association with the hypothalamus. Also list and describe 2 hormones for each. (10 pts)

- Anterior = endocrine/hormonal (1 pt)

Some possible hormones:

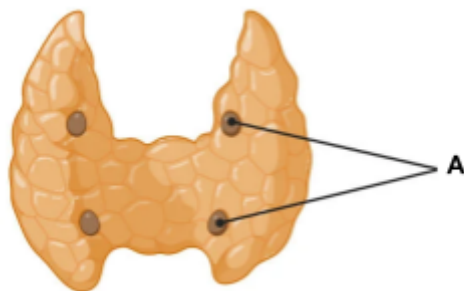
- Follicle stimulating hormone (FSH) and luteinizing hormone (LH) which regulate production of estrogen and progesterone
- Thyroid stimulating hormone (TSH) which stimulates the thyroid to release thyroxin
- Adreno-corticotropic hormone (ACTH) which stimulates release of chemicals from the adrenal cortex
- Growth hormone (GH) stimulate cell growth
- Melanocyte-stimulating hormone (MSH) which increases production of the skin pigment melanin
- Prolactin stimulates production of milk in nursing mothers

- Posterior = neuronal (1 pt)

- Oxytocin which stimulates contractions of the uterus during childbirth and allows the milk to be released from the breast tissue
- Antidiuretic hormone (ADH) which stimulates the kidneys to reabsorb more water from the collecting ducts in the kidneys so there is more water in the blood

1 pt for each correct hormone, 1 pts for each correct description

13. What is the endocrine gland labeled with the letter A in the picture below and does it regulate? (4 pts)



Parathyroid gland (2 pts); regulates amount of calcium in blood and absorption by bones (2 pts)

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14. What does ADH stand for, what does it do, and where is it released from? (6 pts)

antidiuretic hormone (2 pts); stimulates the kidneys to reabsorb more water from the collecting ducts in the kidneys (1 pt), so there is more water in the blood/increases blood volume (1 pts); released from anterior pituitary (2 pts)

15. Melissa goes to the doctor for diarrhea. Her doctor notices that she has thickened skin on her shins as well as bulging eyes. He writes her a blood test for her thyroid hormone levels. Based on her symptoms, what does her doctor suspect Melissa has? (2 pts)

Graves disease

16. Hypersecretion by an endocrine gland is most often caused by what? If this cause goes untreated in childhood, what symptoms/conditions can it result in? (2 pts)

Tumor (1 pt); It can result in very long arms and legs and tall stature, also known as gigantism (1 pt)

17. Which disease is caused by hyposecretion of the endocrine gland, and results in pancreatic cells being destroyed? Be as specific as possible. (2 pts)

Type 1 Diabetes (1 pt for Diabetes, 1 pt for Type)

18. Caitlyn has severe mental deficiency due to a lack of iodine, which has caused motor spasticity, deaf mutism, and squint. What condition is she experiencing right now? (1 pt)

Cretinism (1 pt)

19. Billy is experiencing an intense amount of swelling in his neck, followed by a cough and quite a bit of hoarseness. What condition is he experiencing? What treatments are available for this condition? (2 pts)

Goiter (1 pt); Treatments available include Radioactive iodine treatment, Thyroidectomy, Medications for increasing hormone production, blocking hormone activities, and managing pain. (1 pt)

20. What are 3 factors that can make someone be more likely to develop hypoglycemia? (3 pts)

Have type 1 diabetes, take insulin or some other diabetes medicines, are aged 65 or older, had low blood glucose before, and have existing health problems such as heart diseases, kidney disease, and cognitive impairment (any of these 3- 3 pts)

21. Dehydroepiandrosterone sulfate, also known as DHEA, is produced by which hormonal gland? (1 pt)

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Adrenal Gland (1 pt)

22. In addition to oxytocin, the pituitary gland produces 3 other hormones. Name them, and their function. (6 pts)

Luteinizing Hormone (1 pt) - Controls estrogen and testosterone production/ovulation (1 pt)

Follicle Stimulating Hormone (1 pt) - Controls production of eggs and sperm (1 pt)

Prolactin (1 pt) - Promotes breast-milk production (1 pt)

23. Type 2 Diabetes accounts for about ___ of all diagnosed cases, while Type 1 Diabetes accounts for __. (2 pts)

- a. 45%, 55%
- b. 85%, 15%
- c. **90%, 10% (1 pt each blank)**
- d. 30%, 70%

Tie Breakers:

1. Which neurotransmitter is biosynthesized from the precursor tryptophan? (1pt)

Serotonin/5-HT/5-hydroxytryptamine

2. Compare and contrast the structure, function, and location of muscle spindles and golgi tendon organs. (4pts)

Muscle spindles - L: muscle belly(0.5pt); F: Conveys muscle length information(0.5pt); S: Intrafusal muscle fibers, (1a) primary afferent, (II) secondary efferent neurons (1/3 pt for each).

Golgi Tendon Organs: Located at tendon insertion of muscle; F: Conveys muscle tension information (0.5pt); S: Capsule of 10-20 muscle fibers, intrafusal fibers, perforated by Ib afferent nerve fibers (1/3 pt for each).

3. Briefly describe the mechanism of cortisol release AND describe the general mechanism of cortisol activity. (3pts)

Corticotropin Releasing Hormone(0.5pt) released by PVN of Hypothalamus (0.5pt). CRH acts on anterior pituitary to produce ACTH (Adrenocorticotrophic hormone) (0.5pt).

ACTH acts on the adrenal cortex to produce cortisol (0.5pt).

Activity: Cortisol binds to glucocorticoid receptors. Receptor-cortisol complex then affects gene transcription. (1pt)