UMich Anatomy Answer Key

Total Points: 214

Station 1
(1pt each → 8pts total)

1. Pulmonary venule
2. Bronchiole
3. Pulmonary arteriole
4. Pores of Kohn
5. Alveolar duct
6. Pulmonary capillaries
7. Alveoli
8. Alveolar sac

Bonus:

1. (1 bonus pt) The study of laughter and its effects on the body

Station 2

1. (1pt per correct term, 1pt per correct description → 8pts total)
   - Mucosa: This is the deepest layer of the alimentary canal formed by epithelium and lamina propria. Its functions are to secrete mucus/digestive enzymes, absorb end products of digestion into blood, and protect against disease.
   - Submucosa: external to mucosa and made of areolar connective tissue; contains blood and lymphatic vessels and nerve fibers; also has elasticity that enables stomach to regain shape
   - Muscularis Externa: responsible for segmentation and peristalsis (movement of food through GI tract) and prevents backflow; made of smooth muscle
   - Serosa/Adventitia: connective tissue; Most superficial layer and is made of areolar tissue covered in mesothelium (adventitia in esophagus → +1 extra if mentioned)
2. (2pts) Organ: Esophagus
   (1pt each of rest → 4pts total)
   A) Mucosa
   B) Serosa
   C) Muscularis mucosa
   D) Lumen
3. (1pt each → 4pts total)
   B: Liver
   C: Gallbladder
   F: Salivary Glands
   J: Pancreas

Station 3

1. (1pt per enzyme class name, 1pt per correct corresponding reason → 8 pts total)
   Proteases and peptidases: split proteins into peptides/amino acids
   Lipases: split fat into fatty acids and glycerol
   Amylases: split carbohydrates into simple sugars
   Nucleases: split nucleic acids into nucleotides

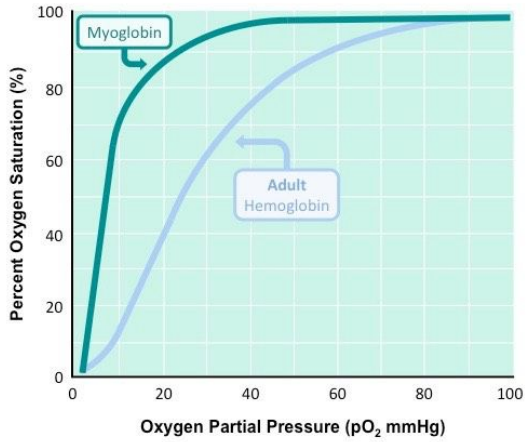
(#2-5: 1pt per organ of origin, 1pt per function → 8pts total)

2. Trypsin: found in pancreas; one of the major digestive enzymes that cleaves large proteins into smaller polypeptide chains for further digestion in the small intestine
3. Pepsin: found in stomach; one of the major digestive enzymes that cleaves large proteins into smaller polypeptide chains for further digestion in the small intestine
4. Lysozyme: found in mouth/saliva; hydrolyzes and breaks down sugars
5. Maltase: brush border of small intestine; breaks down sugars, specifically maltose to glucose
6. (1pt definition, 2pts explanation → 3pts total) Peristalsis is the constriction and relaxation of the esophagus, stomach, and gut. These continuous smooth muscle movement creates "waves" that push contents of the alimentary canal forward.
7. (1pt) Starches and sugars are digestible; (1pt) digestion starts in the mouth with saliva; (1pt) absorbed by upper and lower parts of small intestine by villi

Station 4

1. (1pt) Cirrhosis
2. (1pt) Hepatocellular carcinoma (0.5 pts for Liver cancer/cirrhosis/related answers)
3. (1pt for each of the following mentioned, cap at 3pts max) Heavy alcohol usage, alfatoxin exposure due to his peanut farm connections; Type 2 diabetes
4. (1pt) Hepatitis

Station 5

1. 

(2pts per correct curve shape, 1pt per correctly labeled axis → 6 pts total)
*numbers on axes not necessary, only shape. Full points only if hemoglobin curve is s shaped and myoglobin is logarithmic and looks similar to the diagram shown

(Station 5 continued)

2. (Need 3 responses, 2pts per cause, 2pts for specifying direction shifts → 12 pts total)
    - Lower pH shifts right and increase shifts right
    - Carbon dioxide: high amounts left
    - Temperature: hyperthermia is right and hypothermia is left
    - High carbon monoxide shifts left
    - Fetal hemoglobin shifts left relatively
    - methemoglobin causes a left shift
    - 2,3 BPG increase shifts right
3. (1pt) -6 mm Hg (+/- 2)
4. Chemoreceptors stimulate respiratory centers and results in an (1pt) <u>increased respiratory rate</u>
5. (2pts total) Carbon dioxide is either bound to hemoglobin [1] or carried through bicarbonate (HCO_3^-) [1]

Station 6

(#1-8: 1pt each → 8pts total)

1. Inspiratory Reserve Volume (IRV)
2. Inspiratory Capacity (IC)
3. Vital Capacity (VC)
4. Total Lung Capacity (TLC)
5. Tidal Volume (TV)
6. Expiratory Reserve Volume (ERV)
7. Residual volume (RV)
8. Functional Residual Capacity (FRC)
9. (2pts) 7.5 L/min
10. (2pts) 0.75 L

Station 7

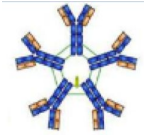
1. (1pt) Cystic Fibrosis
2. (3pts total) Caused by a genetic mutation in CFTR gene that causes affects a membrane protein and chloride channel in cells [1]. The protein is a channel across the membranes of cells that produce mucus, sweat, saliva, tears, and digestive enzymes [1]. A defect in this gene results in thick mucus and other related problems depending on the mutation and its severity [1].
3. (2pts total) People with 2 copies of the recessive mutation on the CFTR gene [1]. It is most common among Caucasians of Northern Europe but is known to occur in all ethnic groups [1].
4. (2pts total) Most often, cystic fibrosis is diagnosed via routine routine screenings during infancy [1]. Screenings will show higher levels of immunoreactive trypsinogen (IRT), genetic tests, and salt sweat tests [1].

(Station 7 continued)

5. (4 possible pts) There is no cure for CF [1] but there are treatments for symptoms. Accept any of the following answers: antibiotics, anti-inflammatory medications, pancreatic enzymes, bronchodilators, mucus-thinning drugs [1pt each, 3 pts max]

Station 8

All questions at this station worth 1pt each, except #1 and #2, which are worth 2pts each.

1. 
2. 
3. IgM
4. IgG
5. IgA
6. Gamma (γ)
7. Epsilon (ε)
8. Delta (δ)
9. Secreted into mucus, tears, saliva
10. Antibody of allergy and anti-parasitic activity
11. B-cell Receptor

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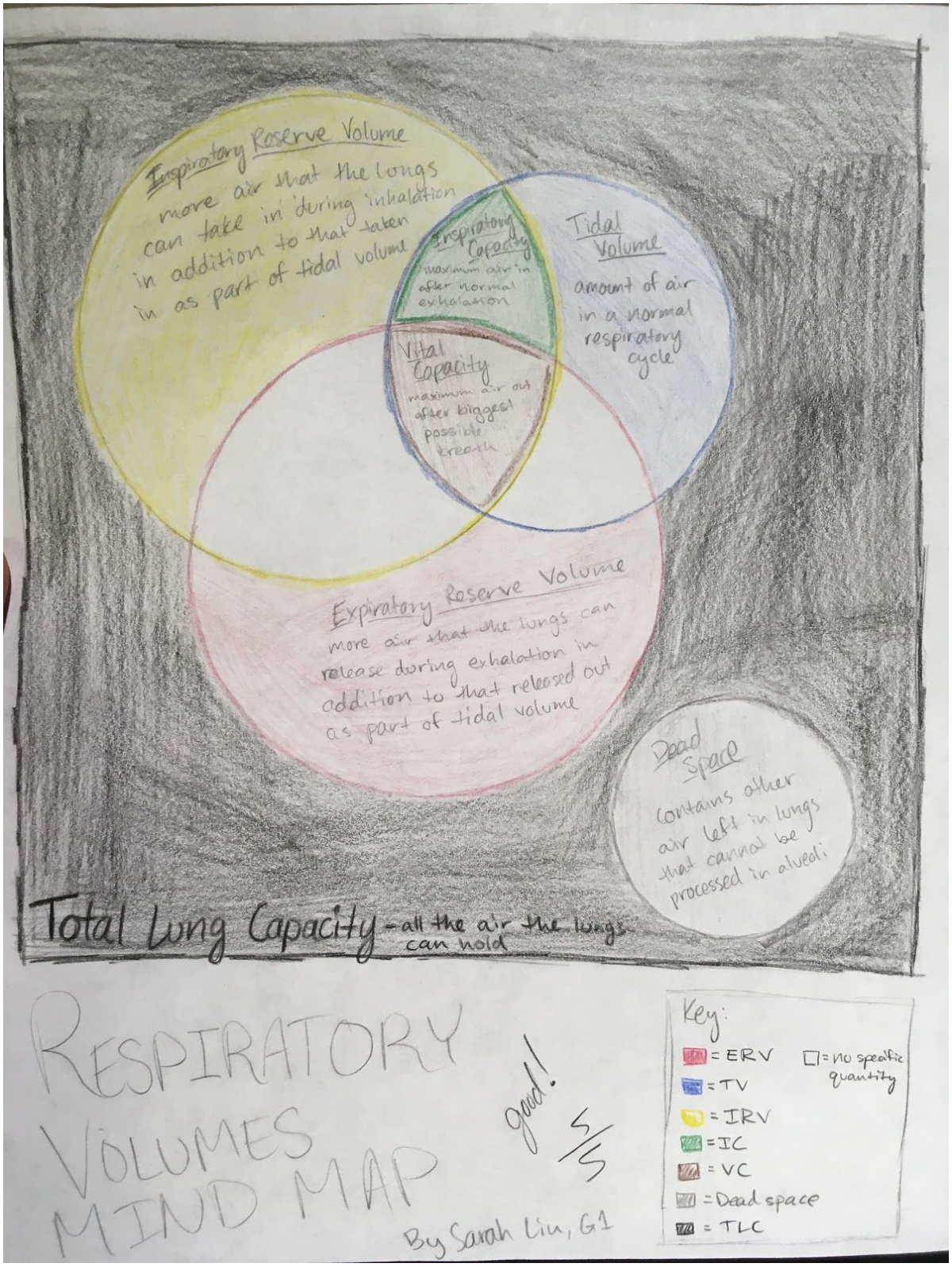
Station 9

(Color scheme isn't the same, but basically this setup. 1pt per correctly placed and labeled volume/capacity, 1pt per correct definition → 14 pts total)



Station 10

All questions at this station worth 1pt, except #5, which is worth 2.

1. Medulla
2. Cortex
3. Capsules
4. Lobules
5. The thymus is important in the development of T-lymphocytes.
6. Lymphatic nodule
7. Cortex
8. Medulla
9. Capsule
10. B and T lymphocytes [0.5 pts each]

Station 11

All questions at this station worth 1pt each.

1. Graves Disease
2. Rheumatoid Arthritis
3. Phototoxic/Photocontact Dermatitis
4. Multiple Sclerosis
5. HIV/AIDS

Station 12

All questions at this station worth 1pt each.

1. T
2. T
3. F
4. T
5. F
6. T
7. T

Station 13

All questions at this station worth 1pt each.

1. T
2. T
3. T
4. F
5. T
6. F
7. F

Station 14

1. (1pt) Rheumatoid arthritis
2. (3pts total) The immune cells in his body are attacking the tissue at the joints when they're technically not supposed to [1], creating inflammation that causes the synovium in the joints to thicken [0.5] and not produce synovial fluid that lubricates the joints [0.5], causing swelling and rough joint movements [1], which cause pain.
3. (2pts total) The neutrophil count would be high [1] because neutrophils are generally the first cells to arrive to respond to infection and inflammation in immune responses [1], which is what occurs in RA.
4. (1pt) No
5. (Need only one response, worth 1pt) Examples may include: physical therapy, disease-modifying antirheumatic drugs (DMARDs), nonsteroidal anti-inflammatory drugs (NSAIDs), low-dose corticosteroids, biological response modifiers, JAK inhibitors, education of the patient, x-ray or ultrasound check-ups, blood test check-ups, surgery, consumption of antioxidants or supplements, hot/cold therapies
6. (2pts total) You should recommend him to continue to monitor the condition of the inflammation [0.5], do some physical therapy [0.5] every day, should he try to practice, not to do it too intensely for prolonged periods of time [0.5], and, if need be, take necessary medications as prescribed to reduce inflammation and pain [0.5].

Station 15

1. (1pt each, 2 total) 2, 4
2. (1pt) Common bile duct
3. (1pt each, 4 total) Nuclease, lipase, trypsin, chymotrypsin
4. (1pt each, 4 total) All of them are correct
5. (1pt) 4
6. (Need two responses, 1pt each → 2pts total) Examples may include:
   - Difficulty digesting fatty foods
   - temporary or chronic diarrhea
   - temporary constipation
   - pain from possibly retained gallstones
   - intestine injury
7. (3pts total) While bile is very important to proper digestion of fats, the gallbladder only stores and controls the release of bile [1]. It does not produce it - the liver does that [1]. And even if the gallbladder is removed, bile can still get from the liver to the intestine through the bile ducts [1], its flow just isn't controlled.

Station 16

1. (3pts total) Because the partial pressure of oxygen in the air at high altitudes is much lower compared with that at low altitudes [1], people unaccustomed to the environment breathe more rapidly [1] to get more oxygen to maintain normal levels of it in their lungs to facilitate the necessary gas exchange [1].

(Station 16, continued)

2. (5pts total) Alkalosis [2] - rapid breathing causes increased release of CO_2 from the body, which then in turn causes the concentration of carbonic acid to drop [1]. As the levels of carbonic acid drop, the bicarbonate/carbonic acid equilibrium shifts to the left of the equation, causing drops in the hydronium ion concentration and the bicarbonate ion concentration [1]. The drops in the hydronium ion concentration raise the pH to be more basic, which is what occurs in alkalosis [1].
3. (1pt each type of edema → 2pts total) Pulmonary and cerebral edema ("buildup of fluid in the lungs and brain" is acceptable too)
4. (Need 3 responses, 1pt each, 3pts total) Examples include: hyperventilation, fatigue, cyanosis, headache, vomiting, hallucinations, death
5. (1pt) They carry supplemental compressed air/oxygen tanks with them [NOTE: I originally meant for this answer to be for someone reaching the summit. However, I did not specify that in the original set of stations. Because of this, we accepted the answer of "acclimatization to the environment" for full credit since it technically is right given the lack of specificity of the conditions, although it technically is less specific than oxygen tanks due to the "death zone" near the top of Mt. Everest]
6. (3 bonus pts total) Edmund Hillary [1] and Tenzing Norgay [1], 1953 [1]

Station 17

1. (2pts total) Immunoglobulin E (IgE) antibodies cause release of histamines in response to the allergen [1], which elicit inflammatory responses [1].
2. (2pts total) While an allergy is caused by an inflammatory immune response from IgE antibodies [1], an intolerance is not caused by an immune response, rather, it is a form of discomfort caused by problems involving systems other than the immune system [1], such as lacking a digestive enzyme needed to break down a particular substance.
3. There are several possible, plausible reasons. [only one needs to be stated, worth 1pt]
    - The allergen that the person is sensitive to
    - The part of the body where inflammatory chemicals are released
    - The amount of IgE antibodies at the site of the reaction
    - The amount of mast cells at the site of the reaction
    - The amount of chemicals such as histamines and cytokines that are released by mast cells
    - The amount of leukocytes at the site of the reaction
    - how much of the allergen they have come in contact with in the past (the concept of building tolerance..ish)
4. Possible reasons include the following [only one needs to be stated, worth 1pt]
    - It depends on how "allergic" the patients being tested are to the allergens
    - It can depend on the current health statuses of the patients (allergic reactions may not be as severe when a person is healthy vs when they aren't)

(Station 17, continued)

- It can depend on the person's lifestyle choices
- It is very hard to get a representative sample of test subjects
- Testing of such thresholds on subjects are usually more dependent on clients' subjective responses rather than objective observations by the clinicians, making it hard to quantify due to people's differing pain/discomfort thresholds.

5. Examples may include the following [only one treatment/mechanism needs to be stated, 1pt for treatment, 1pt for correct corresponding mechanism → 2pts total]:
   - Avoidance - no allergic response even occurs since the allergen doesn't interact with the body
   - Epipen - injection of epinephrine reverses symptoms of inflammatory response, especially of an anaphylactic reaction. One symptom that is treated includes plummeting blood pressure, in which the epinephrine re-constricts the blood vessels to raise blood pressure again. Another symptom example is that epinephrine relaxes the muscles surrounding someone's airway, which typically constricts during a severe allergic reaction.
   - Antihistamines such as Benadryl - block the production of histamines that trigger swelling
   - Mast cell stabilizers - prevent mast cells from degranulating and releasing histamines and cytokines, preventing inflammatory immune response
   - Decongestants - shrink swollen membranes in the nose/nasal cavity
   - Corticosteroids - reduce swelling, relieve itching

Station 18

1. (1pt total) Since glucuronic acid is hydrophilic [0.5], its attachment to hydrophobic bilirubin causes the overall solubility of bilirubin in water to increase [0.5].
2. (1pt) F
3. (1pt) T
4. (1pt) It would cause bilirubin levels to increase
5. (1pt) Yes
6. (3pts total) When erythrocytes burst open as a result of *Plasmodium* reproduction, more hemoglobin is released into the blood [1]. Breakdown of hemoglobin directly leads to the production of more bilirubin [1], and all that bilirubin will be conjugated [1], leading to overall increased levels of it in the blood.