

SCIENCE OLYMPIAD

CAPTAINS TRYOUTS DIVISION C ANATOMY & PHYSIOLOGY

Written by Monta Vista Science Olympiad

INSTRUCTIONS:

1. Please turn in ALL MATERIALS at the end of the test.
2. Put your TEAM NAME AND NUMBER on every page that you write on.
3. DO NOT write on the questions sheets: only on the answer sheets.
4. This test is out of 172 points, with 93 questions. There will be a combination of short answer, fill-in-the-blank, matching, and multiple choice questions. There are also some bonus questions, with individual point values listed.
5. There are four sections. The first three sections are on individual systems, and the last section is diagrams of different systems to label.

Section 1: Respiratory System

Instructions: There are 20 multiple choice, fill-in-the-blank questions, and short answer questions, each worth 1 point unless specified otherwise. There are 65 total points in this section. Write or select the best answer.

- 1) List the seven functions of the respiratory system. (7 points)
- 2) The lungs help to synthesize the vasoconstrictor _____.
- 3) The vestibule of the nasal cavity is lined with
 - a) Simple squamous epithelium
 - b) Stratified squamous epithelium
 - c) Simple cuboidal epithelium
 - d) Stratified cuboidal epithelium
 Bonus: What is the biggest structural difference between simple and stratified epithelium? (1 point)
- 4) The erectile tissue in the _____ periodically restricts airflow through one fossa.
 Bonus: How many times does the airflow switch between fossa each hour?
- 5) The _____ and _____ ligaments link the larynx to other organs.
- 6) The right lung has _____ lobes and the left lung has _____ lobes.
- 7) Describe the two functions of the great (type II) alveolar cells. (4 points)
- 8) How is a pressure gradient formed when inhalation occurs? Discuss the pleurae in your response. (5 points)
- 9) When air builds up in the pleural cavity, it is called
 - a) Pneumothorax
 - b) Absorption atelectasis
 - c) Pleural collapse
 - d) Pulmonary collapse
- 10) Describe the pathway of air through the respiratory system starting with inhalation. (9 points)
- 11) Cystic fibrosis is named thus because of the cysts that form in the
 - a) Liver
 - b) Lungs
 - c) Small intestines
 - d) Pancreas
- 12) The CFTR gene on chromosome ____ creates a _____ that uses ATP for energy. A binding site on this protein is activated by _____ (process) by _____ (protein). (4 points)

13) True or False: Pleural pressure is slightly positive.

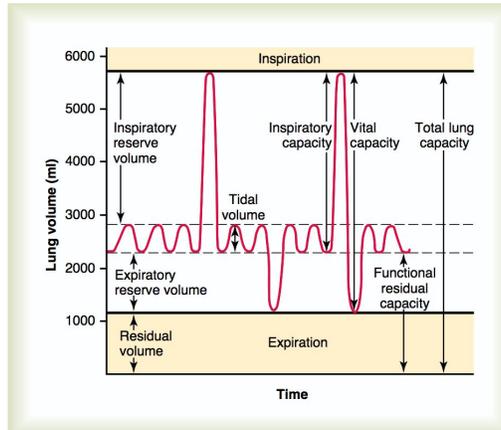
14) When the lungs are deflated, the elastin and collagen fibers are

- a) Contracted and unkinked
- b) Contracted and kinked
- c) Stretched and unkinked
- d) Stretched and kinked

15) The purpose of pulmonary surfactant is to

- a) Allow the lungs to expand and contract without friction
- b) Help repair epithelial damage
- c) Collapse alveoli and bronchioles during exhalation
- d) Reduce surface tension of water in alveoli

16) Using the image below, explain the significance of each labelled term and determine the values of each. (There should be 8 terms defined in your response; ignore “expiration”). (16 points)



17) Suppose that you are able to walk on the ocean floor without any additional equipment in order to maintain atmospheric pressure. Explain how the buffer effect of hemoglobin will ensure that the P_{O_2} will remain close to normal. (7 points)

18) True or False: Asthma as a result of allergic hypersensitivity is more common in younger people.

19) In people who experience asthma, their antibodies are attached to

- a) Mast cells
- b) Dust cells
- c) Squamous alveolar cells
- d) Great alveolar cells

20) Which of these tests can be used to diagnose COPD?

- a) X-ray
- b) Gas diffusion test
- c) Pulmonary function test
- d) Spirometry

Section 2: Digestive System

Instructions: There are 20 multiple choice, fill-in-the-blank questions, and short answer questions, each worth 1 point unless specified otherwise. There are 33 total points in this section. Write or select the best answer.

- 21) The opening of the esophagus into the stomach is known as
- Esophageal hiatus
 - Cardiac orifice
 - Pyloric sphincter
 - Upper esophageal sphincter
- 22) The _____ cells of the stomach secrete hydrochloric acid and intrinsic factor.
- 23) The chief cells of the stomach secrete
- HCl and intrinsic factor
 - Pepsinogen
 - Mucus
 - All of the above
- 24) The _____ of epithelial cells in the stomach prevent gastric juice from seeping out and digesting the stomach itself.
- 25) True or False: The enteroendocrine cells secrete serotonin, which stimulates HCl secretion.
- 26) Why do lacteals, not capillaries, absorb lipids in the small intestines? Be detailed in your explanation. (4 points + 1 bonus point possible)
- 27) Explain why a malfunctioning liver might lead to white and gray feces. (5 points)
- 28) Hepatitis ____ can only infect those already infected with hepatitis ____.
- 29) Which types of hepatitis are transmitted orally (through contaminated food and water)?
- A & B
 - B & C
 - B & D
 - A & E
- 30) Gastrin
- Causes secretion of very acidic gastric juice
 - Stimulates motor functions in body of stomach
 - Enhances activity of pyloric pump
 - All of the above

- 31) Cholecystokinin causes
- a) Release of bile from pancreas and gallbladder
 - b) Release of digestive enzymes from stomach
 - c) Inhibition of the vagus nerve
 - d) People to feel hunger
- 32) Ghrelin is also known as the _____ hormone. Its levels are _____ before a meal and _____ after. (3 points)
- 33) The _____ ions in saliva destroy bacteria and prevent tissue degradation.
- 34) The gastric glands secrete _____ (4 things). (4 points)
- 35) Explain briefly how HCl activates pepsinogen into pepsin. (2 points)
- 36) Intrinsic factor is secreted by _____ cells and absorbs _____ in the small intestine.
- a) Chief, vitamin A
 - b) Oxyntic, vitamin B-6
 - c) Parietal, vitamin B-12
 - d) Mucous neck, vitamin B-3
- 37) _____ splits peptides into individual amino acids.
- 38) Pancreatic amylase hydrolyzes most carbohydrates EXCEPT _____.
- 39) Trypsinogen is activated by the enzyme _____.
- 40) _____ and _____ are two imaging tests that are commonly used to diagnose appendicitis.

Section 3: Immune System

Instructions: There are 20 multiple choice, fill-in-the-blank questions, and short answer questions, each worth 1 point unless specified otherwise. There are 41 total points in this section. Write or select the best answer.

- 41) The functions of the lymphatic system are _____, _____, and _____.
- 42) _____ cells are what make people “immune” to contracting the same disease a second time.
- 43) How does the thymus change as an individual ages? (7 points)
- 44) Which cell type(s) is involved in both the specific and nonspecific defense system?
- 45) The process of _____ ensures that B and T cells do not attack the body itself.
- 46) Which organ of the immune system helps to control the number of red blood cells and blood storage?
- Kidney
 - Spleen
 - Thymus
 - Thyroid gland
- 47) Which white blood cell primarily produces histamine?
- Basophils
 - Eosinophils
 - Monocytes
 - Neutrophils
- 48) Macrophages and neutrophils contain strong _____ agents to kill bacteria.
- 49) Eosinophils
- Are strong phagocytes
 - Constitute 10% of blood leukocytes
 - Are most effective against parasitic infections
 - Do not exhibit chemotaxis
- 50) Compare and contrast humoral and cell-mediated immunity. (10 points)
- 51) _____ proteins present antigens to cytotoxic T cells.
- 52) Which lymphokine has the greatest effect in causing proliferation of cytotoxic T cells?
- Interleukin-1
 - Interleukin-2
 - Interleukin-3
 - Interleukin-4
- 53) Describe the process that cytotoxic T cells follow when attacking cells. (4 points)

54) Paralysis can be caused by _____ in which the body develops immunity against acetylcholine receptors.

55) Why is histamine released in an allergic reaction? (4 points)

Match the following diseases with their descriptions.

56) Multiple sclerosis

57) Rheumatoid arthritis

58) Contact dermatitis

59) Lupus

60) Celiac disease

a) Can result from poison ivy

b) Can involve inflammation of synovial membrane

c) Symptoms include chronic diarrhea

d) Myelin of neurons is destroyed

e) Can result in “butterfly rash”

Section 4: Diagrams

Instructions: There are 33 labels, each worth 1 point. Write the correct name of each label on the corresponding line of the answer sheet.

