Name: _________________________________

Instructions
This exam consists of 50 questions. You may write on the exam itself, but be sure to answer all your questions on a “Scantron” sheet with a #2 pencil. For each question there is one response that is the best response. You must select the one best response to receive credit for each question.

Read all responses for a question before selecting your answer! I recommend that you first write your answers on the exam itself, then fill in the answers on the answer sheet. If you fill in a response on the answer sheet and wish to change your response, then be sure to completely erase the errant response.

Be sure to write your name on this exam booklet and on the answer sheet. Turn in both the exam booklet and answer sheet as you leave the testing center. If you believe that a question is written incorrectly, then attach a note to the front of this exam.
1. While looking at a cat in lab, Dr. Hubley points to a structure he says is an artery. If Dr. Hubley is correct, and this structure is an artery, then it **MUST** have which of the following functions?
   a. transport oxygenated blood through the body
   b. transport blood away from the heart
   c. exchange of oxygen and carbon dioxide between the blood and surrounding tissues
   d. transport blood through the pulmonary circuit

2. Which one of the following lists shows the layers of the wall of an **artery** in order from thinnest to thickest?
   a. tunica intima—tunica media—tunica externa
   b. tunica intima—tunica externa—tunica media
   c. tunica externa—tunica intima—tunica media
   d. tunica media—tunica externa—tunica intima
   e. None of the responses above is correct.

3. Which capillaries are used for filtration of blood in the kidneys?
   a. colloid capillaries
   b. continuous capillaries
   c. fenestrated capillaries
   d. hepatic capillaries
   e. sinusoidal capillaries

4. Venules and many veins have valves inside them to prevent blood flowing in the wrong direction. This is necessary in venules and veins because
   a. the difference in pressure from the capillaries to the right atrium is relatively low.
   b. the tunica media in these vessels is thick.
   c. pressure in the venae cavae is greater than pressure in the capillaries.
   d. All of the responses above are correct.
   e. None of the responses above is correct.

5. Which one of the following terms is best defined as “the force exerted on a vessel wall by the blood contained within”?
   a. blood flow
   b. blood pressure
   c. resistance
   d. viscosity
6. Which one of the following equations shows the relationship between flow, pressure, and resistance?
   a. \( R = F^2 \)
   b. \( F = \Delta P \times R \)
   c. \( F = \Delta P \div r^4 \)
   d. \( \Delta P = F \div R \)
   e. \( F = \Delta P \div R \)

7. **Resistance** to the flow of blood through a vessel is generally determined by three factors. Which response includes these three factors?
   a. blood temperature, vessel diameter, vessel radius
   b. vessel diameter, blood viscosity, blood type
   c. vessel diameter, oxygen content, blood viscosity
   d. vessel length, oxygen content, vessel diameter
   e. blood viscosity, vessel diameter, vessel length

8. In order to adjust the resistance to blood flow quickly, the central nervous system can make changes to which of the following factors?
   a. blood temperature
   b. vessel diameter
   c. vessel length
   d. oxygen content
   e. blood viscosity

9. Consider the following structures. During ventricular systole, which would have the **LOWEST** pressure?
   a. aorta
   b. capillary in the brain
   c. common carotid artery
   d. external jugular vein
   e. superior vena cava

10. Which definition is the best definition of “pulse pressure”?
    a. The rate at which the heart beats, or pulse.
    b. The pressure exerted on a blood vessel when the ventricles are in systole.
    c. The difference between systolic pressure and diastolic pressure.
    d. The diastolic pressure plus 1/3 of the systolic pressure.
11. Short-term control of blood pressure is accomplished through some fairly simple reflex arcs. Which control center influences blood pressure by changing total peripheral resistance?
   a. cardioacceleratory center
   b. cardioinhibitory center
   c. vasomotor center
   d. Responses “a” and “b” are both correct.
   e. All of the responses above are correct.

12. While Henry was dissecting his cat, he accidentally cut his own brachial artery. (Henry is not very good at dissection!) After losing a considerable amount of blood, his blood pressure has fallen dangerously low. Which of the following statements is likely true about Henry?
   a. His baroreceptors are sending increased signals to his medulla.
   b. His cardioacceleratory center is sending increased signals to his heart.
   c. His cardioinhibitory center is sending increased signals to his heart.
   d. His vasomotor center is being inhibited by increased signals from the baroreceptors.

13. Consider once more Henry’s situation. In response to falling blood pressure, which of the following statements is most likely true?
   a. Henry’s nervous system is causing the majority of blood vessels in his body to constrict.
   b. Henry’s nervous system is causing the majority of blood vessels in his body to dilate.
   c. Under these conditions, Henry’s nervous system will not have any effect on his blood vessels.

14. In which location would you most likely find baroreceptors?
   a. medulla oblongata
   b. common carotid artery
   c. inferior vena cava
   d. external iliac artery
   e. left ventricle

15. What nerve carries parasympathetic signals from the cardioinhibitory center to the heart?
   a. spinal nerve T5
   b. trigeminal nerve
   c. cardial nerve
   d. spinal nerve L4
   e. vagus nerve
16. A high level of carbon dioxide in the blood typically leads the body to respond by increasing
   a. cardiac output.
   b. total peripheral resistance.
   c. blood pressure.
   d. All of the responses above are correct.
   e. None of the responses above is correct.

17. According to the **direct** renal mechanism of blood pressure regulation,
   a. high blood pressure leads to a decrease in urine formation.
   b. high blood pressure leads to an increase in urine formation.
   c. high blood pressure stimulates the production of renin.
   d. high blood pressure inhibits the production of renin.

18. If Sally’s blood pressure becomes low for an extended period of time, then levels of which of the
    following chemicals should increase?
   a. aldosterone
   b. angiotensin II
   c. renin
   d. All of the responses above are correct.
   e. None of the responses above is correct.

19. The indirect renal mechanism of blood pressure regulation raises blood pressure primarily by
    increasing TPR and increasing
   a. activity of the cardioacceleratory center.
   b. activity of the cardioinhibitory center.
   c. blood viscosity.
   d. blood volume.
   e. production of urine.

20. The flow of blood through tissue or an organ is known as _____________.
   a. resistance
   b. perfusion
   c. osmosis
   d. velocity
   e. autoregulation
21. Of the three types of blood vessels, capillaries have the _________ total cross-sectional area and the _________ velocity of blood flow.
   a. greatest, fastest
   b. greatest, slowest
   c. least, fastest
   d. least, slowest

22. Which one of the following structures would contain fluid with the greatest pressure?
   a. blood capillary
   b. lymph capillary
   c. subclavian vein
   d. lymphatic trunk
   e. lymphatic collecting vessel

23. Lymph entering the thoracic duct does NOT come from
   a. the right arm
   b. the left arm
   c. the right leg
   d. the left leg
   e. More than one of the responses above is a correct response.

24. What is the main solid tissue in the lymphatic system?
   a. hyaline cartilage
   b. lymph
   c. areolar tissue
   d. reticular tissue
   e. stratified squamous tissue

25. Which organ does not contain diffuse lymphatic tissue?
   a. liver
   b. pancreas
   c. brain
   d. lungs
   e. rectum
26. What does the “M” in “MALT” stand for?
   a. macrophage
   b. monocyte
   c. mast cell
   d. mucosa
   e. many

27. The Peyer’s patches, appendix, and spleen all contain
   a. lymph nodes.
   b. lymphatic follicles.
   c. red pulp.
   d. white pulp.
   e. All of the responses above are correct.

28. Which structures divide a lymph node into compartments?
   a. trabeculae
   b. medulla
   c. lymph sinus
   d. cortex
   e. outer capsule

29. Which of the lists below shows the pathway of lymph through a lymph node?
   a. efferent lymphatic vessel → afferent lymphatic vessel → lymph sinus
   b. afferent lymphatic vessel → lymph sinus → efferent lymphatic vessel
   c. lymph sinus → afferent lymphatic vessel → efferent lymphatic vessel
   d. efferent lymphatic vessel → lymph sinus → afferent lymphatic vessel
   e. afferent lymphatic vessel → efferent lymphatic vessel → lymph sinus

30. Which structure is important in helping T cells become functional?
   a. spleen
   b. tonsils
   c. thymus
   d. All of the responses above are correct.
   e. None of the responses above is correct.
31. Which of the following items is **NOT** part of the innate system of immunity?
   - a. inflammation
   - b. macrophage
   - c. natural killer cell
   - d. plasma cell
   - e. skin

32. Fever occurs in response to chemicals called
   - a. complement.
   - b. cytokines.
   - c. lysozyme.
   - d. perforins.
   - e. pyrogens.

33. Which of the following chemicals is secreted as a surface defense?
   - a. complement
   - b. lysozyme
   - c. perforin
   - d. prostaglandin

34. Which one of the following cells is **NOT** considered a phagocytic cell?
   - a. eosinophil
   - b. macrophage
   - c. natural killer
   - d. neutrophil

35. Which of the following chemicals appears most important in hindering the reproduction of viruses and stimulating the activity of macrophages?
   - a. complement
   - b. interferon
   - c. lysozyme
   - d. perforin
   - e. prostaglandin
36. Which of the following cells **IS** a lymphocyte but **IS NOT** part of the adaptive immune system?
   a. CD4 cell
   b. CD8 cell
   c. memory cell
   d. natural killer cell
   e. plasma cell

37. Which of the following statements is **NOT** true?
   a. A “self-antigen” helps the body’s immune system to recognize its own cells.
   b. Major histocompatibility proteins are considered “self-antigens.”
   c. An “antigen” is a substance that may provoke an immune response.
   d. “Foreign antigens” are only produced by macrophages and dendritic cells.
   e. An “antibody” is a protein molecule made of four polypeptide chains.

38. A B cell that has antigen receptors on its surface, but has not encountered antigen, is said to be
   a. immunocompetent
   b. naïve
   c. activated
   d. Responses “a” and “b” are both correct.
   e. Responses “b” and “c” are both correct.

39. Which one of the following terms is not normally associated with B cells?
   a. antibody
   b. clonal selection
   c. humoral immune response
   d. perforin
   e. plasma cell

40. Which of the following cells is considered an antigen-presenting cell?
   a. CD4 cell
   b. CD8 cell
   c. dendritic cell
   d. helper T cell
   e. More than one of the responses above is correct.
41. James was bitten by a snake and given antivenom as a treatment. What kind of immunity was given to James by the antivenom?
   a. natural and active
   b. natural and passive
   c. artificial and active
   d. artificial and passive

42. Rosie was given a vaccination against the measles virus when she was a young child. When she was 14 years old, she was actually exposed to the measles virus for the first time. Mary did not get sick either from the vaccine or from exposure to the actual virus. What kind of response did Rosie’s immune system have to the measles virus when she was 14?
   a. a primary immune response
   b. a secondary immune response
   c. a tertiary immune response
   d. All of the responses above are correct.
   e. None of the responses above is correct.

43. Which one of the following is an example of natural, active immunity?
   a. A person is vaccinated against smallpox.
   b. A person gets bitten by a venomous snake and is given an injection of antivenom.
   c. A person gets the flu in November, and never gets that strain of flu again
   d. A newborn baby ingests antibodies in his mother’s milk.
   e. More than one of the responses above is correct.

44. Antibody molecules bound to a pathogen can help complement to cause ______ of the pathogen.
   a. agglutination
   b. aggregation
   c. concentration
   d. lysis
   e. precipitation

45. In order to be activated, a CD8 cell requires costimulation and the recognition of
   a. endogenous antigens and class I MHC proteins.
   b. endogenous antigens and class II MHC proteins.
   c. exogenous antigens and class I MHC proteins.
   d. exogenous antigens and class II MHC proteins.
46. If a macrophage phagocytizes a virus, the macrophage may display antigens from the virus along with ___________ on its surface. These antigens may then be recognized by ___________ cells.
   a. MHC I; helper T
   b. MHC II; helper T
   c. MHC I; cytotoxic T
   d. MHC II; cytotoxic T

47. Frank is 42 years old and he has been infected by the H1N1 flu virus. Which of the following cell types can take part in fighting this infection?
   a. B cells
   b. helper T cells
   c. cytotoxic T cells
   d. All of the responses above are correct.
   e. None of the responses above is correct.

48. Which of the following events is required for activation of a T cell?
   a. T cell binds to foreign antigen
   b. T cell binds to MHC
   c. T cell is costimulated by chemicals released by other cells
   d. All of the responses above are correct.
   e. None of the responses above is correct.

49. Which type of cell will be part of a clone of helper T cells?
   a. B cells
   b. cytotoxic T cells
   c. memory cells
   d. natural killer cells
   e. All of the responses above are correct.

50. You have a test tube that contains a live population of E. coli bacteria. You add some antibody molecules against E. coli to the test tube, but no other chemicals or cells. Will the antibody molecules kill the E. coli bacteria?
   a. yes
   b. no