1) In deuterostomes in early stages of cell division:
   a) Cleavage is spiral and determinate
   b) The anus develops from the blastopore
   c) The coelom forms from the ectoderm

2) In the diagram above of a bilateral animal body plan, the tissue layers are (from outside to inside):
   a) Covering (from ectoderm), muscle (from mesoderm), pseudocoelom, digestive system (from endoderm)
   b) muscle (from mesoderm), mesoglia, coelom, digestive system (from endoderm)
   c) gastroderm, mesoglia, gastrovascular cavity, digestive system (from ectoderm)

3) For a 1 mm spherical sea creature to use its body surface for respiration
   a) Oxygen concentrations need to be 71% of normal levels
   b) Oxygen concentrations need to be 3 times normal levels
   c) Oxygen concentrations need to be 0.1% of normal levels

4) Consider a 1 cm cube vs. a 2 cm cube
   a) Surface area/volume is 6 for a 1 cm cube and 3 for a 2 cm cube
   b) Surface area/volume is the same for both cubes
   c) The volume of both cubes is the same

5) The hydra:
   a) Has less surface area compared to a cube of the same mass
   b) Lacks a gastrovascular cavity
   c) has a body structure in which all of its cells are in contact with water so that oxygen only diffuses a short distance

6) The structure above is part of:
   a) The gastrovascular cavity
   b) The alimentary canal
   c) The fish gill

7) Counter current exchange:
   a) Allows complete oxygenation of the blood
   b) Reduces the diffusion distance of oxygen
   c) Allows complete nutrient uptake

8) The pathway of airflow when a bird breathes is:
   a) Mouth → bronchi → bronchiole → alveoli
   b) Mouth → trachea → posterior air sac → lung → anterior air sac → mouth
   c) Spiracle → trachea → tracheole → body cell

9) Annelids use the following to supply oxygen to respiring cells:
   a) Open circulatory system
   b) Closed circulatory system
   c) Tracheal system

10) Which of the following have high metabolic rates:
    a) Jellyfish
    b) Clams
    c) Birds
11) The brain monitors this in the blood to control breathing:
   a) pH
   b) amino acids
   c) glucose

12) Which of the following have an open circulatory system:
   a) Insects
   b) Squid
   c) Flatworm

13) The hemoglobin Bohr effect refers to:
   a) Increased hemoglobin oxygen affinity at low pH
   b) Decreased hemoglobin oxygen affinity at low pH
   c) Increased hemoglobin oxygen affinity at high temperature

14) Arteries:
   a) Always carry oxygenated blood
   b) Have valves to prevent backflow
   c) Carry blood away from the heart

15) Name the cardiovascular system that exhibits the following flow pattern: i) deoxygenated blood arrives in the left atrium, ii) enters a ventricle, iii) is pumped out to the body, lung and skin capillaries, iv) blood from the lung and skin capillaries arrives in the right atrium, iv) enters a ventricle, v) is pumped out to the body, lung and skin capillaries.
   a) 2 chambered heart
   b) 3 chambered heart
   c) 4 chambered heart

16) A disadvantage of the 2 chambered heart vs. 3 chambered heart system is:
   a) Heart ventricle must pump blood through two capillary beds
   b) Blood backflows from the ventricle into the atrium
   c) Blood cannot be fully oxygenated in the 2 chambered system

17) The purpose of the septum in the heart is:
   a) To prevent oxygenated and deoxygenated blood from mixing
   b) To lower blood pressure
   c) To increase surface area for absorption of oxygen

18) One of the events that results in increased blood glucose is:
   a) Secretion of insulin by the pancreas alpha cells
   b) Breakdown of glycogen
   c) Higher blood pressure

19) Loss of the liver would result in:
   a) Inability to secrete glucagon
   b) Reduced ability to remove glucose from the bloodstream
   c) Inability to secrete adrenaline

20) The adrenal gland
   a) Is located at the junction between the small intestine and large intestine
   b) Is located at the base of the brain
   c) Is located above the kidney

21) This sequence of events: releasing hormone \( \rightarrow \) ACTH \( \rightarrow \) corticosteroids is what happens in:
   a) Long term stress
   b) Short term stress
   c) Protein digestion

22) The pH of the stomach is:
   a) 12; this causes hydrolysis of protein
   b) 2; this is sufficient to dissolve metal like nails
   c) 7; this is the pH that activates pepsin

23) Enteropeptidase activates:
   a) Pepsin
   b) Amylase
   c) Trypsinogen

24) Which of the following has the highest surface area:
   a) Stomach
   b) Small intestine
   c) Large intestine

25) Intracellular digestion involves:
   a) The pancreas
   b) Vacuoles
   c) The gastrovascular cavity

26) Which organism has the largest cecum:
   a) Human
   b) Coyote
   c) Horse
27) Which of the following is a major site of cellulose digestion/degradation:
   a) Human large intestine
   b) Cow cecum
   c) Koala stomach

28) Which of the following DOES NOT form a long chain that is part of strong fibers:
   a) Hemoglobin
   b) Cellulose
   c) Collagen

29) Which of the following have radial symmetry:
   a) Rotifer
   b) Nematode
   c) Ctenophore

30) The gastrovascular cavity increases surface area in:
   a) Annelids
   b) Molluscs
   c) Flatworms

31) Increased surface area:
   a) Increases the ability to take up oxygen
   b) Decreases the ability to absorb nutrients
   c) Increases the ability to retain body heat

32) The part of the hemoglobin molecule that binds to oxygen is:
   a) Globin
   b) Heme
   c) Copper

33) Epinephrine:
   a) Increases breathing
   b) Increases glucose conversion to glycogen
   c) Causes the release of corticosteroids

34) In the tubeworm chemoautotrophic-invertebrate symbiosis found at deep-sea vents the source of energy used for carbon fixation is:
   a) Light
   b) Sulfide oxidation
   c) Heat

35) Which of the following is one of the most abundant proteins in humans?
   a) Collagen
   b) Hemoglobin
   c) Pepsin

36) Humans are:
   a) Parazoa
   b) Eumetazoa
   c) Radiata

37) In the mackerel, the surface area available for gas exchange increases:
   a) 1000 fold because of gills
   b) 20 fold because of gills
   c) 2 fold because of gills

38) The phylum platyhelminthes:
   a) Includes bryozoa
   b) Is now extinct
   c) Includes flatworms

39) Microvilli:
   a) Function in detecting hormone signals in the blood
   b) Increase surface area available for oxygen diffusion
   c) Increase the body’s ability to absorb nutrients

40) The normal blood glucose level in humans is:
   a) Highly fluctuating depending on whether you have just eaten food
   b) Around 900 mg/liter
   c) Over 900 kg/liter

41) Two chambered hearts are present in
   a) Fishes
   b) Birds
   c) Fishes and amphibians

42) What kind of cardiovascular system has hemolymph and sinuses:
   a) 4 chambered heart cardiovascular system
   b) Open circulatory system
   c) Closed circulatory system

43) Hyperventilation by free divers:
   a) Increases hemoglobin levels
   b) Decreases blood oxygen
   c) Decreases blood carbon dioxide

44) In which of the following structures of the human circulatory system would blood be under high pressure and deoxygenated:
   a) Aorta
   b) Pulmonary artery
   c) Capillary
45) Parietal cells:
   a) Produce chymotrypsinogen
   b) Produce saliva
   c) Produce hydrochloric acid

46) The easter bunny
   a) Has a 4 chambered heart
   b) Has a 4 chambered stomach
   c) Is a protostome

47) Ascorbate:
   a) is needed to make collagen with the proper melting temperature
   b) is not necessary for human health
   c) causes scurvy in humans

48) Animals in the phylum ctenophora are:
   a) Bilateral
   b) Eumetazoans
   c) Protostomes

49) Which of these phyla are not deuterostomes:
   a) Arthropods
   b) Echinoderms
   c) Chordates

50) Clams and snails
   a) Are in the phylum Annelida
   b) Do not have a coelom
   c) Have an open circulatory system

51) You have exam version “A” please mark “A” in the space for question 51

Answers:
Exam A
1   b
2   a
3   a
4   a
5   c
6   c
7   a
8   b
9   b
10  c
11  a