YOU CAN PICK YOURS UP AFTER 3 PM TOMORROW, FRIDAY, APRIL 30. FINAL GRADE WILL BE ON THE LOWER RIGHT HAND CORNER.

HSS 307: Human Physiology **CORRECT ANSWERS IN RED**
Final Exam
Name_____

Please circle the correct response(s). There may be 0-4 correct responses. **Assume healthy conditions, unless otherwise specified**.

1. Under normal conditions in the human body:
    a. Plasma and interstitial fluid are generally similar in sodium, potassium, chloride and calcium concentrations (P.9 AND TABLE 9.1 FOR THE CNS; OUTSIDE THE CNS, CAPILLARIES ARE VERY PERMEABLE TO THESE SOLUTES. TABLE 9.1 ALSO SHOWS THAT THESE SOLUTE CONCENTRATIONS ARE GENERALLY SIMILAR)
    b. Glomerular filtrate in considered extracellular fluid (P.6 AND FIG.1.5; GLOMERULAR FILTRATE IS THE FLUID THAT ENTERS THE KIDNEY TUBULE WHICH IS IN THE EXTERNAL ENVIRONMENT. FLUID IN THE EXTERNAL ENVIRONMENT IS NOT PART OF TBW AND THEREFORE, ECF)
    c. Secretion in the nephron moves substances from the internal to the external environment (FIG.1.4; NEPHRON IS CONSIDERED EXTERNAL ENVIRONMENT)
    d. Interstitial fluid makes up almost 80% of the body's extracellular fluid (P.8; ISF MAKES UP 11 L OUT OF THE BODY'S ECF OF 14 L. THIS IS JUST UNDER 80%)

2. During the relative refractory period:
    a. Graded potentials can be summed (P.180 and 188; GRADED POTENTIALS, INDEPENDENT OF ACTION POTENTIALS CAN ALWAYS BE SUMMED)
    b. The strength of stimulus required to initiate graded potentials in that neuron gradually increases (P.180 and 188; GRADED POTENTIALS CONTINUE WITH OR WITHOUT ACTION POTENTIALS. RELATIVE REFRACTORY PERIODS ONLY REFER TO ACTION POTENTIALS)
    c. Another action potential could be generated in that neuron (P.187; THIS IS THE DEFINITION OF THE RELATIVE REFRACTORY PERIOD)
    d. Cell membrane permeability to potassium generally decreases (FIGS.7.13b + 7.17a; PUT THE TWO FIGURES TOGETHER AND YOU CAN SEE THAT POTASSIUM PERMEABILITY GENERALLY DECREASES DURING THE RELATIVE REFRACTORY PERIOD)

3. The following can be summed:
    a. An IPSP and EPSP in different neurons (P.205; IPSP'S AND EPSP'S ARE SIMPLY GRADED POTENTIALS. THERE'S NO WAY THEY CAN BE SUMMED FROM TWO DIFFERENT NEURONS BECAUSE NEITHER EVER LEAVES A NEURON)
    b. EPSP and IPSP occurring at the same synapse (P.204 AND CLASS DISCUSSION; A SYNAPSE IS EITHER INHIBITORY OR EXCITATORY. IT CAN'T BE BOTH)

c. Graded potentials in the post-synaptic neuron's axon terminals of an axo-axonic synapse (FIG.8.9; THERE ARE NO GRADED POTENTIALS HERE SINCE THIS SYNAPSE OCCURS AT THE POST-SYNPATIC NEURON'S AXON TERMINALS)
d. Action potentials from two different neurons (ACTION POTENTIALS ARE NEVER SUMMED!)

4. The blood-brain barrier:
    a. Separates the peripheral from the central nervous systems (FIG.9.1; THE BBB IS THE CAPILLARY WALL – IT SEPARATES TWO TYPES OF EXTRACELLULAR FLUIDS)
    b. Separates two types of intracellular fluids (P.221; THE BBB SEPARATES PLASMA FROM CSF – TWO TYPES OF EXTRACELLULAR FLUIDS)
    c. Prevents glucose from entering CSF of the central nervous system via simple diffusion (P.223; ALMOST VERBATIM; GLUCOSE ENTERS VIA FACILITATED DIFFUSION)
    d. Prevents hydrophobic molecules in the plasma from diffusing across cell membranes, thereby protecting cells of the CNS (P.223; HYDROPHOBIC CAN DIFFUSE EASILY ACROSS CELL MEMBRANES OF CNS CAPILLARIES SINCE THEY ARE LIPID-SOLUBLE)

5. In the special sense of vision:
    a. Myopia can be caused by an eyeball that is too long from lens to fovea (P.274; LONGER LENGTH LEADS TO CONVERGENCE SHORT OF THE FOVEA OR RETINA)
    b. Emmetropia needs no accommodation or correction for near or far objects (FIG.10.27a; NEEDS ACCOMMODATION FOR NEAR OBJECTS)
    c. Color acuity is at its highest at the optic disk (P.270; COLOR CANNOT BE PERCEIVED FROM ANY LIGHT RAYS CONVERGING ON THE OPTIC DISK BECAUSE THERE ARE NO PHOTORECEPTORS THERE)
    d. Hyperopia needs accommodation and correction to view near objects (FIG.10.27b)

6. In excitation-contraction coupling:
    a. Tropomyosin acts as both a regulatory and contractile protein (p.325, ONLY A REGULATORY, DOES NOT CONTRACT)
    b. An action potential in the motor neuron always causes an action potential in the muscle fiber it innervates (P.329; VERBATIM)
    c. Muscle cell graded potentials are caused by the ACh neurotransmitter (P.329, CAN'T BE GRADED SINCE THEY ARE ALWAYS ABOVE THRESHOLD FOR DEPOLARIZING AND ARE THUS ACTION POTENTIALS)
    d. The graded potentials in the muscle cell, much like those in neurons, are summed (P.329, CAN'T BE GRADED SINCE THEY ARE ALWAYS ABOVE THRESHOLD FOR DEPOLARIZING AND ARE THUS ACTION POTENTIALS – WHICH ARE NEVER SUMMED)

7. The following never occur(s) during systole:

a. Aortic pressure > ventricular pressure (FIG.13.18; THIS HAPPENS DURING ISOVOLUMETRIC CONTRACTION, PART OF SYSTOLE)
b. Both semilunar valves are open (FIG.13.18; BOTH ARE OPEN IN PHASE 3 OF SYSTOLE)
c. Atrial pressure is higher than ventricular (FIG. 13.18; NEVER HAPPENS IN PHASES 2 AND 3, THE PHASES OF SYSTOLE)
d. Left ventricular AV and semilunar valves are both open (FIG.13.18; THIS NEVER HAPPENS, PERIOD)

8. The systemic circuit is different from the pulmonary circuit in the following:
   a. Pressure drop across the circuit (FIG.14.3; MUCH GREATER IN THE SYSTEMIC)
   b. Blood volume at any given time (FIG.14.22; MUCH GREATER IN SYSTEMIC)
   c. Capillary net filtration pressure (P.416; ONLY SYSTEMIC HAS CAPILLARY FILTRATION PRESSURE WHERE EXCHANGE BETWEEN FLUIDS OCCURS. PULMONARY CAPILLARIES HAVE EXCHANGE BETWEEN FLUID AND GAS, WHERE FILTRATION CANNOT OCCUR)
   d. Venous pressure at junction with the heart (FIG.14.3; BOTH ARE ZERO)

9. Alveoli:
   a. Pressure (P_{alv}) is always less than intrapleural pressure (P.462; ALWAYS GREATER THAN)
   b. Contain a lower PO_2 than atmospheric air due, in part, to not containing 100% fresh air (P.483; THE ANATOMICAL DEAD SPACE IS ONE OF THE CONTRIBUTING FACTORS FOR WHY PO2 IN THE ALVEOLI IS LESS)
   c. Just after a maximal inspiration, only receives about 70% of inspired air (P.473; 30% STAYS IN ANATOMICAL DEAD SPACE)
   d. In one minute, experience a doubling of alveolar ventilation by doubling respiratory rate (TABLE 16.1; 4200 to 8400 mL/min)

10. According to the hemoglobin-oxygen dissociation curve:
    a. % O2 saturation can be as low as 40% (FIG.17.8; NOT UNDER NORMAL CONDITIONS, AS SPECIFIED AT THE TOP OF THIS EXAM)
    b. De-oxygenated blood in the systemic circulation has a $PO_2 = 0$ (FIG.17.8; THE DOTTED LINES SHOW THE NORMAL RANGE; DE-OX BLOOD STILL HAS A PO2 OF ABOUT 40)
    c. Increased hydrogen ion concentration resulting from exercising muscle leads to less affinity for oxygen at the same PO2 (P.490-91; EXERCISING MUSCLE IS ACTIVE TISSUE WHICH DECREASES AFFINITY DUE TO LOWER pH)
    d. Hypothermia would likely lead to decreased affinity of oxygen to hemoglobin (P.490 AND FIG.17.10; INCREASED AFFINITY)

11. The anterior pituitary, like the posterior pituitary gland:

a. Secretes hormones synthesized by neurons in the hypothalamus (FIG.6.4; ANTERIOR PITUITARY DOES NOT SECRETE THESE; IT SECRETES HORMONES SYNTHESIZED IN ITS OWN ENDOCRINE CELLS)
b. Contain target cells for releasing hormones (P.153-54; ONLY THE ANTERIOR PITUITARY DOES)
c. Secretes at least one non-trophic hormone (FIG.6.5; ANTERIOR – PROLACTIN AND POSTERIOR – OXYTOCIN AND ADH)
d. Synthesizes hormones (FIG.6.3 AND 6.4; ANTERIOR YES; NOT THE POSTERIOR PITUITARY WHICH SECRETES HORMONES SYNTHESIZED IN THE HYPOTHALAMUS)

12. Glucagon, unlike insulin:
a. Has a significant effect on transport of nutrients across cell membranes of the liver (P.615; NEITHER DOES)
b. Can be secreted during both the absorptive and post-absorptive states (P.615 AND P.617; INSULIN DURING ABSORPTIVE ONLY, GLUCAGON DURING BOTH UNDER THE INFLUENCE OF INCREASE PLASMA AMINO ACIDS)
c. Promotes glycogenolysis in skeletal muscle (P.616 AND FIG.21.7; NEITHER DOES. GLUCAGON DOES, HOWEVER, PROMOTE GLYCOGENOLYSIS IN THE LIVER)
d. Controls plasma glucose via negative feedback (P.616; BOTH DO)

13. In the nephron, the proximal tubule shares these characteristics with the distal tubule:
a. Secretion of hydrogen (TABLE 18.2)
b. Excretion of water (TABLE 18.2; THERE IS NO EXCRETION IN EITHER)
c. Glucose reabsorption via sodium cotransport (TABLE 18.2 AND FIG.18.15; THIS ONLY HAPPENS IN THE PROXIMAL)
d. Non-regulated solute reabsorption via active transport (P.522 AND P.526; ONLY THE PROXIMAL IS CONSIDERED THE UNREGULATED SIDE)

14. The following hormones have a generally inhibitory action on plasma volume:
a. Aldosterone (FIG.19.16; STIMULATES SODIUM REABSORPTION WHICH INCREASES ADH SECRETION AND PLASMA VOLUME)
b. ADH (FIG.19.16 AND P545; INCREASES PLASMA VOLUME)
c. Renin (FIG.19.15; RENIN INDIRECTLY STIMULATES ALDOSTERONE WHICH INCREASES PLASMA VOLUME)
d. ANP (P.552 AND FIG.19.18; ANP DECREASES SECRETION OF RENIN AND ALDOSTERONE WHICH INHIBITS IN INCREASES IN PLASMA VOLUME)