HSS 307: Human Physiology
Exam 2
Name__________________________

Please circle the correct response(s). There may be 0-4 correct responses for each item.

1. During excitation-contraction coupling, ATP provides the energy for:
    a. Summing of action potentials on the motor neuron (ACTION POTENTIALS ARE NEVER SUMMED!)
    b. Active transport of neurotransmitter to the plasma membrane of the muscle fiber (P.329, NEUROTRANSMITTER DIFFUSES ACROSS THE SYNAPTIC CLEFT – DIFFUSION IS PASSIVE AND TAKES NO ENERGY)
    c. Active transport of Ca^{++} ions into the sarcoplasmic reticulum (FIG.12.8 STEP 6, AND PHYSIO CD)
    d. Active transport of Ca^{++} ions from sarcoplasmic reticulum to troponin (P.329-30; CALCIUM DIFFUSES THERE - TAKES NO ENERGY)

2. During muscle fiber summation:
    a. There is a net accumulation of Ca^{++} ions in the muscle fiber's intracellular fluid (P.338; INTRACELLULAR FLUID AND CYTOSOL ARE THE SAME THING IN MUSCLE CELLS)
    b. Action potentials on the muscle fiber overlap in time (P.337, ONLY OCCURS WHEN MUSCLE TWITCHES OVERLAP IN TIME; ACTION POTENTIALS ARE ALL-OR-NONE AND CANNOT OVERLAP)
    c. Binding sites on troponin are more saturated with Ca^{++} than in treppe (P.337, 338)
    d. Fiber length is optimal to maximize participation of myosin crossbridges in force generation (P.340, FIBER LENGTH IS INDEPENDENT OF SUMMATION; BOTH ARE FACTORS THAT AFFECT FORCE GENERATED)

3. Slow twitch red fibers differ from fast twitch white fibers in the following:
    a. Oxygen-carrying capacity (TABLE 12.1, MYOGLOBIN, WHICH IS HIGHER IN SLOW TWITCH, HELPS STORE A RESERVE OF OXYGEN IN SKELETAL MUSCLE, P.345)
    b. Size of associated motor neuron (P.345, SLOW TWITCH ARE IN SMALLER MOTOR UNITS WHICH, ACCORDING TO THE SIZE PRINCIPLE, HAVE SMALLER MOTOR NEURONS)
    c. Peak tension during tetanus (TABLE 12.1; THIS IS THE SAME AS FORCE-GENERATING CAPACITY)
    d. Order of recruitment (P.345, SMALL ARE RECRUITED FIRST)

4. As blood flows from the aorta to the right atrium:
    a. The pulse caused by the pressure wave, like mean arterial pressure, decreases continually along that pathway (FIG. 14.9, TRICKY, PULSE PRESSURE REACHES ZERO AT THE CAPILLARIES THEN DROPS NO MORE; MAP DROPS CONTINUALLY)

   b. Overall blood flow rate remains constant though resistance may change (FIG 14.11; SHOWS EXAMPLE OF HOW OVERALL BLOOD FLOW RATE (A.K.A. CARDIAC OUTPUT) CAN DECREASE DUE TO INCREASE IN RESISTANCE)
   c. Constant flow rate through an organ can be maintained even if perfusion pressure changes (P.409; THIS IS THE MYOGENIC RESPONSE)
   d. Actual blood pressure does not increase along the pathway (FIG.14.9; DUE TO SYSTOLIC VS. DIASTOLIC PRESSURE DIFFERENCES, BLOOD PRESSURE INCREASES WITH EACH BEAT IN THE ARTERIES)

5. From a state of rest to a state of exercise, blood flow to working muscles would normally increase due to:
   a. Active hyperemia (P.407; METABOLIC RATE OF SKELETAL MUSCLE INCREASES AND WILL, THEREFORE, INDUCE ACTIVE HYPEREMIA)
   b. Reactive hyperemia (P.407-08; NO BLOCKAGE EXPECTED)
   c. The myogenic response in the skeletal muscle (P.407-08; THE MYOGENIC RESPONSE WOULD KEEP THE FLOW RATE CONSTANT)
   d. Decreased vascular resistance (P.407; AS A RESULT OF ACTIVE HYPEREMIA)

6. The following only occur during diastole (assume left side of the heart) (ALL FIG 13.18):
   a. Ventricular pressure is lower than aortic pressure (TRUE, EXCEPT IN PHASE 2)
   b. Atrial pressure is higher than ventricular pressure (ONLY DURING PHASE 1 WHICH IS ONLY IN DIASTOLE)
   c. AV and semi-lunar valves are closed at the same time (ALSO HAPPENS DURING ISOVOLUMETRIC CONTRACTION, PART OF SYSTOLE)
   d. Atrium begins to contract (FIG.13.19)

7. Normal spirometry volumes/capacities for an adult male at rest suggest that (ALL, FIG. 16.16):
   a. Expiratory reserve volume plus residual volume equals inspiratory reserve volume (IRV = 3000 ml, ERV = 1000ml, RV = 1200; 3000 DOES NOT EQUAL 2200)
   b. Total lung capacity can be determined via spirometry (NO, BECAUSE RESIDUAL VOLUME ASSESSMENT REQUIRES HELIUM DILUTION, NOT PART OF SPIROMETRY)
   c. During normal unforced breathing, volume of air expired = volume of air inspired (RIGHT OFF THE FIG. 16.16)
   d. Inspiratory capacity and vital capacity differ only in the volume of air one can maximally expire at the end of a normal expiration (THEY DIFFER BY ERV WHICH IS THE MAX VOLUME OF AIR ONE CAN EXPIRE AT THE END OF A NORMAL EXPIRATION)

8. Alveoli:
   a. Contain more CO_2 just before an expiration than just after an inspiration (P.474)
   b. Contain a lower PO_2 than atmospheric air due, in part, to having 100% humidified air (P.483)

c. Just after a maximal expiration, contain air that makes up, in part, the residual volume (P.473)
d. In one minute, experience a greater increase in alveolar ventilation by doubling respiratory rate vs. doubling tidal volume (TABLE 16.1)

9. According to the hemoglobin-oxygen dissociation curve:
   a. Increased temperature increases the PO_2 required to achieve a certain level of O_2 saturation (FIG 17.10)
   b. Increased pH at the same PO_2 decreases the % O_2 saturation (FIG. 17.10, INCREASES)
   c. In venous blood under normal conditions, O_2 saturation on hemoglobin is approximately 75% (FIG 17.7, 17.8, venous blood PO_2 = 40mm, so saturation = 75%)
   d. Decreased PCO_2 increases the PO_2 necessary for 98% O_2 saturation (P.491, DECREASES THE PO_2 NECESSARY)