

Part A: Multiple Choice – Choose the best answer to each question. (20 marks)

→ public hair, voice drop

1. Secondary sex characteristics are
 - a) present in the embryo.
 - b) develop at puberty.
 - c) the testis in the male and the ovary in the female.
 - d) the internal accessory organs and external genitalia.

2. Which of these process or phases in the monthly reproductive cycle of the human female occur at the same time?
 - a) maximal LH secretion and menses
 - b) early follicular development and the secretory phase of the uterus
 - c) regression of the corpus luteum and an increase in ovarian progesterone secretion
 - d) proliferation stage of the uterus and increased estrogen production

↳ preg prep

3. Which of the following statements about fertilization in humans is FALSE?
 - a) It usually occurs in the uterine tube.
 - b) The oocyte must be fertilized to complete meiosis.
 - c) The sperm cell must digest a path for itself through the zona pellucida.
 - d) The sperm's outer acrosomal membrane fuses with the plasma membrane of the oocyte.

4. LH in the male stimulates
 - a) the development of seminiferous tubules.
 - b) spermatogenesis.
 - c) testosterone production.
 - d) both a and b.

5. Which of the following does not add a secretion that makes a major contribution to semen?
 - a) prostate
 - b) bulbourethral glands
 - c) vas deferens
 - d) seminal vesicles

6. If the crossed-extensor reflex is functioning properly, which of the following is NOT part of the reflex response when a person steps on a sharp object with the right foot?
- a) sensory input through the dorsal root on the right side of the spinal cord
 - b) contraction of the right flexor and relaxation of the left extensor to withdraw the right foot
 - c) double reciprocal innervation of muscles
 - d) input from the central nervous system
7. The connective tissue sheath that surrounds a muscle fascicle is the
- a) perimysium.
 - b) endomysium.
 - c) epimysium.
 - d) hypomysium.
8. Which of these events occurs during the latent phase of muscle contraction?
- a) cross-bridge movement
 - b) active transport of Ca^{2+} into the sarcoplasmic reticulum
 - c) Ca^{2+} binding to troponin
 - d) ATP broken down to ADP
9. A weight lifter attempts to lift a weight from the floor, but the weight is so heavy that he is unable to move it. The type of muscle contraction the weight lifter is using is mostly
- a) isometric.
 - b) isostatic.
 - c) concentric.
 - d) eccentric.
10. Which of these conditions would one expect to find within the leg muscle cells of a world-class marathon runner?
- a) myoglobin-poor
 - b) numerous mitochondria
 - c) large deposits of glycogen
 - d) both b and c
11. The blood contained in a ventricle during isovolumetric contraction is
- a) the end-systolic volume.
 - b) the end-diastolic volume.
 - c) the stroke volume.
 - d) none of these; the ventricle is empty then.

12. While the AV valves are open during a normal cardiac cycle, the pressure in the left ventricle is

- a) greater than the pressure in the aorta.
- b) less than the pressure in the aorta.
- c) the same as the pressure in the left atrium.
- d) less than the pressure in the left atrium.

13. Select the correct statement about cardiac output.

- a) A slow heart rate increases end diastolic volume, stroke volume and force of contraction.
- b) Decreased venous return will result in increased end diastolic volume.
- c) If a semilunar valve were partially obstructed, the end systolic volume in the affected ventricle would be decreased.
- d) Stroke volume increases if end diastolic volume decreases.

14. People with allergies commonly take antihistamines with decongestants to relieve their symptoms. The package warns that individuals who are being treated for high blood pressure should not take the medication. Which of the following statements could help to explain the risk involved with taking these drugs while having high blood pressure?

- a) The antihistamine suppresses the immune system.
- b) The drugs have a positive chronotropic effect.
- c) The decongestant component decreases the function of the myocardial slow Ca^{2+} channels.
- d) The drugs cause vasodilation.

15. Norepinephrine acts on the heart by

- a) decreasing heart contractility.
- b) causing a decrease in stroke volume.
- c) blocking the action of calcium.
- d) causing threshold to be reached more quickly.

16. Which of the following processes provides a long-term response to changes in blood pressure?

- a) neural controls
- b) baroreceptor-initiated reflexes
- c) chemoreceptor-initiated reflexes
- d) renal regulation

17. If an artery that supplies blood to a lung lobe were blocked but ventilation to the lobe were unaffected, how would alveolar gas partial pressures change?

- a) Both P_{O_2} and P_{CO_2} would increase.
- b) Both P_{O_2} and P_{CO_2} would decrease.
- c) P_{O_2} would increase and P_{CO_2} would decrease.
- d) P_{O_2} would decrease and P_{CO_2} would increase.

18. At sea level, atmospheric P_{O_2} is 159 mmHg, while the alveolar P_{O_2} is 105 mmHg. Which one of the following is the BEST explanation for this difference?

- a) Due to the short amount of time blood spends in the lungs, atmospheric gases do not fully equilibrate with arterial gases.
- b) The barriers to diffusion formed by the alveolar epithelium and the capillary endothelium prevents full equilibration of atmospheric and alveolar gases.
- c) The P_{H_2O} and P_{CO_2} in the alveolus are much higher than in the atmosphere.
- d) The hydrophobic nature of oxygen prevents large amounts from dissolving in blood.

19. Most of the CO_2 that diffuses from the blood into an alveolus comes from

- a) dissolved gas.
- b) carbaminohaemoglobin.
- c) carboxyhaemoglobin.
- d) carbonic acid.

20. The chloride shift

- a) promotes the transport of carbon dioxide in the blood.
- b) occurs when Cl^- replace HCO_3^- within red blood cells.
- c) occurs only in the lungs.
- d) both a and b

Part B: Short Answer (20 marks)

15

1. Suppose you want to produce a birth control pill for men. On the basis of what you know about the male hormones, what would be the mechanism of action for the pill? Discuss any possible side effects. (4 marks)

The mechanism of the action for the pill would be to inhibit testosterone, because ~~testosterone is converted into estradiol (accumulating in the system)~~. Therefore, the pill would inhibit LH production due to its correlation to the seminiferous tubules, which help in the production of testosterone.

LH →
inhibits

~~FSH~~ FSH will be affected by the lack of LH production, so much inhibin would not be required

0.5

2. Explain why it is important that the corpus luteum remain functional following implantation. (2 marks)

It's important that the corpus luteum remain functional following implantation because if the secondary oocyte is not fertilized by a sperm the corpus luteum can regress and then menstruation can occur. The stratum functional would be thick and spongy at this point, and so the endometrium layers will start to shed.

0.5

3. Design an experiment to test the following hypothesis: Muscle A has the same number of motor units as muscle B. Assume you could stimulate the nerves that innervate skeletal muscles with an electronic stimulator and monitor the tension produced by the muscles. (4 marks)

Person 1 → Muscle A
Person 2 → Muscle B

A gait analysis can be performed, and the probes of the instrument can be connected to specific areas of the body (preferably close to the specific muscle being analyzed). The energy consumption and speed of the activity can be analyzed to see any performance differences. Importantly, if the potential differences in the specific muscle of person A & B were analyzed then the graph characteristics should be similar.

4. During an experiment in a physiology laboratory, a student named Cee Saw was placed on a table that could be tilted. The instructor asked the students to predict what would happen to Cee Saw's heart rate if the table were tilted so that her head was lower than her feet. Some students predicted an increase in heart rate, and others claimed it would decrease. Explain why either prediction might be true. (4 marks)

There could be an increase in heart rate because when your head is lower than your feet all the blood will flow down to your head.

In the systemic circulation the blood must distribute oxygen to body tissues all over the body and the left aorta has a high resistance to blood flow. ∴ the heart must pump faster (put in extra work) to distribute the oxygenated blood. However, the heart rate could decrease because in the pulmonary circulation the deoxygenated blood is only travelling to the lungs to allow the oxygen to transpire to the blood cells easily, requiring less work from the heart.

5. Consider a man in good health with a 650 mL tidal volume and a respiratory rate of 11 breaths per minute. Report his minute respiratory volume in liters per minute. Assuming his anatomical dead space is 185 mL, calculate his alveolar ventilation rate in litres per minute. Show calculations. (2 marks)

$$650 \text{ mL} = 0.650 \text{ L}$$

11 breath/min

$$\left(\frac{0.650 \text{ L}}{22\%} \right) \left(11 \frac{\text{breath}}{\text{min}} \right)$$

6. You and a physiology classmate are trapped in an overturned ship. To escape, you must swim under water a long distance. You suggest that you hyperventilate before making the escape attempt. Your classmate responds that it would be a waste of time because the pulmonary capillaries are already 100% saturated with oxygen. What do you decide to do and why? (4 marks)

I decide to hyperventilate because during ventilation the thoracic cavity has the capability of ~~hold~~ holding the most ~~oxygen~~ volume. Therefore, when you hyperventilate you are maximizing your chances of ~~maintain~~ keeping in a lot of oxygen in your lungs (while contracted) w/ 100% saturation in the pulmonary capillaries.