

ASU BIO 100 EXAM 3 PRACTICE QUESTIONS

1. Explain the functions of each system of the body: digestive, cardiovascular (respiratory and circulatory), immune, skeletal/muscular, endocrine, reproductive, and nervous.

Answer: The human body is a complex organism composed of several interconnected systems, each with its own unique functions. Here's an overview of the functions of the major systems:

- a. Digestive System: Processes and absorbs nutrients from food, while eliminating waste.
- b. Cardiovascular System: Transports blood, oxygen, and nutrients throughout the body. Immune System: Protects the body from infections and diseases.
- c. Skeletal and Muscular System: Supports the body's structure and enables movement.
- d. Endocrine System: Regulates bodily functions through hormone secretion.
- e. Reproductive System: Facilitates reproduction and sexual development.
- f. Nervous System: Controls and coordinates bodily functions, enabling thought, sensation, and movement.

2. Compare and contrast how positive and negative feedback mechanisms are used to maintain homeostasis. Use these concepts to describe:

- The maintenance of blood glucose levels

Positive Feedback:

Amplifies change from the set point.

Less common.

Can lead to extreme outcomes.

Negative feedback:

uses insulin to lower high glucose levels and glucagon to raise low levels, maintaining stability.

- The release of platelets to form blood clots.

Positive feedback encourages more platelets to form clots when vessels are damaged, stopping bleeding.

Negative Feedback:

Reverses change to maintain the set point.

Common in homeostasis.

Provides stability.

3. What does it mean if an organism is an ectotherm? Endotherm? Give an example of each.

Answer: Ectotherm:

An organism that relies on external sources to regulate body temperature.

Example: A snake basking in the sun to warm up its body temperature.

Endotherm:

An organism capable of internally regulating and maintaining its body temperature.

Example: A mammal like a human that can generate and retain heat to keep a constant body temperature.

4. Herbivorous mammals tend to have extremely long digestive systems, especially the intestines; omnivores have intermediate length intestines; and carnivores have extremely short intestines. What might be a logical explanation for this pattern?

Answer: This pattern is related to the type of diet each group consumes. Herbivores require longer intestines to extract nutrients from plant material, which is often harder to digest.

Carnivores can digest animal tissue more efficiently and thus have shorter intestines. Omnivores have intermediate lengths because they consume a mix of both plant and animal material, requiring a balance in digestive system length.

5. Why do strict vegetarians (vegans) have to be more careful of their choices of food than do vegetarians that also eat cheese, eggs, and dairy products?

Answer: Strict vegetarians (vegans) need to be more careful with their food choices because they avoid all animal-derived products, including cheese, eggs, and dairy. This means they must pay closer attention to their diet to ensure they get essential nutrients that may be lacking in a purely plant-based diet, such as vitamin B12, calcium, and complete proteins. Vegetarians who consume cheese, eggs, and dairy have additional sources of these nutrients, making it somewhat easier to meet their dietary requirements.

6. Describe the process of breathing. In your explanation of inspiration and exhalation be sure to describe positive and negative pressure and include the actions of the diaphragm.

Answer: Breathing involves two main processes: inspiration (inhalation) and exhalation. During inspiration, the diaphragm and intercostal muscles contract, creating negative pressure to draw in air. Exhalation involves relaxation of these muscles, creating positive pressure to expel air.

7. How do vaccines work?

Answer: Vaccines work by introducing a harmless or weakened form of a pathogen (virus or bacteria) into the body. This stimulates the immune system to produce an immune response, including the creation of antibodies and memory cells. If the individual is later exposed to the actual, potentially harmful pathogen, their immune system can quickly recognize and neutralize it, preventing or reducing the severity of the disease.

8. In Southern Copperhead snake venom, you'll find a protein called a disintegrin. Disintegrins bind to a class of membrane receptors called integrins. Platelets use integrin receptors to aggregate at a site of tissue damage. What effect do you think disintegrin has on the snake's prey?

Answer: Disintegrin in Southern Copperhead snake venom likely interferes with platelet aggregation in the prey, leading to impaired blood clotting and potentially causing increased bleeding at the site of a snakebite, which can help the snake immobilize and digest its prey.

9. Anatomical designs that increase surface area are common in many body systems. Give examples of how surface area is maximized in the digestive, respiratory, and nervous systems of humans.

Answer: Digestive System: The small intestine is lined with tiny finger-like projections called villi and microvilli, which greatly increase the surface area for nutrient absorption.

Respiratory System: The lungs have numerous small air sacs called alveoli, which provide a vast surface area for efficient gas exchange between air and blood.

Nervous System: The brain's surface has convoluted folds and deep grooves called gyri and sulci, respectively, to increase the surface area for higher cognitive functions and information processing.

10. What is the role of the lungs with respect to blood circulation and gas exchange? How does this relate to the function of the heart?

Answer: The lungs play a vital role in oxygenating blood and removing carbon dioxide. During inhalation, oxygen is taken into the lungs and diffuses into the bloodstream, while carbon dioxide is released. This oxygenated blood is then pumped by the heart to the body's tissues. The heart's role is to circulate the oxygenated blood to the rest of the body, ensuring that cells receive the oxygen they need for energy production and removing waste carbon dioxide. The heart and lungs work together to support this critical gas exchange and blood circulation process.

11. Explain the immune's systems different lines of defense.

Answer: The immune system has three lines of defense: First Line of Defense: External Barriers such as Skin, mucous membranes, and secretions act as physical and chemical barriers to prevent pathogens from entering the body.

Second Line of Defense: Non-Specific Immune Response

If pathogens breach the first line of defense, the body's nonspecific defenses, including inflammation, fever, and white blood cells, work to combat a wide range of invaders.

Third Line of Defense: Specific Immune Response

When non-specific defenses are insufficient, the adaptive immune response is triggered. It involves specialized immune cells, such as T cells and B cells, that target specific pathogens and create memory to provide long-term immunity.

These lines of defense work together to protect the body from infections and maintain health.

- 12.** Why is your immune system usually more effective at fighting off infection the second time you are exposed to a pathogen?

Answer: The immune system is more effective upon re-exposure to a pathogen because memory cells (memory B and T cells) have been created during the initial infection. These memory cells recognize the pathogen quickly and initiate a faster and stronger immune response, leading to a quicker elimination of the pathogen and reduced symptoms of the disease.

- 13.** Breastfeeding has an additional effect in many women. The hormones important for producing milk and causing milk to be released in reaction to suckling also inhibit the pituitary gland from releasing the hormones needed for initiating ovulation in the ovaries. What might be a logical adaptive significance of this hormone feedback system?

Answer: The adaptive significance of this hormone feedback system is to promote birth spacing and maternal-child bonding. By inhibiting ovulation during breastfeeding, the mother is less likely to become pregnant again immediately after childbirth. This allows her body to recover, and it ensures that the current child receives the necessary care and nutrition without competition from a new sibling. It also supports the bonding between mother and child, as breastfeeding promotes physical closeness and emotional connection. This mechanism contributes to the overall health and well-being of both mother and child.

- 14.** Both the nervous system and the endocrine system are used to convey messages throughout the body and coordinate organs, systems, and behavior. Compare and contrast how these two systems function.

Answer: Nervous System:

Uses electrical impulses (action potentials) to transmit messages quickly.

Has a rapid but short-lived response.

Involves neurons and neurotransmitters for signaling.

Controls voluntary and involuntary actions.

Highly specific in targeting individual cells or muscle fibers.

Endocrine System:

Uses hormones as chemical messengers to transmit messages more slowly through the bloodstream.

Has a slower but longer-lasting response.

Involves endocrine glands such as the pituitary, thyroid, and adrenal glands.

Regulates various physiological processes, including growth, metabolism, and reproduction.

Acts on target cells with specific receptors, affecting multiple cells simultaneously.

Both systems play crucial roles in maintaining homeostasis and coordinating bodily functions, but they differ in the speed of transmission, duration of effect, and the mechanisms used for communication.

- 15.** In the genetic disorder phenylketonuria (PKU), a single reaction is blocked in a normal metabolic pathway sequence and the amino acid phenylalanine cannot be converted to the next chemical step. Phenylalanine, an essential amino acid, builds up in the body and high levels affect the nervous system and may lead to mental retardation. What would be a logical treatment for this disorder?

Answer: A logical treatment for phenylketonuria (PKU) is a strict dietary restriction of phenylalanine intake. Patients with PKU need to follow a low-phenylalanine diet, which involves avoiding high-phenylalanine foods, such as certain proteins. They would also typically take a special formula or supplement designed to provide the necessary nutrients without phenylalanine. Early detection through newborn screening and dietary management can prevent the buildup of phenylalanine, reducing the risk of neurological damage and mental retardation in individuals with PKU.

- 16.** A small area of the temporal lobe of our cerebral cortex is dedicated to learning faces and recognizing small changes in facial muscles that enable us to “read others’ minds.” What might be the most logical evolutionary argument for this adaptation?

Answer: The evolution of a specialized area for recognizing facial expressions likely enhanced social interaction, cooperation, and communication, contributing to the survival and reproductive success of early humans.

- 17.** Emphysema can be a serious disease, but it damages not only your lungs but often the heart. Why does a respiratory disease also affect the circulatory system?

Answer: Emphysema impairs the exchange of oxygen and carbon dioxide in the lungs, leading to reduced oxygen levels in the bloodstream. This low oxygen triggers the heart to work harder, leading to an increased heart rate and blood pressure. Over time, this strain on the heart can lead to heart problems and affect the circulatory system.

- 18.** Where is blood produced in the body?

Answer: Blood is primarily produced in the bone marrow, which is found in the cavities of bones, such as the ribs, sternum, pelvis, and long bones like the femur.

- 19.** You have become a member of a hot shot Criminal Investigative Team in the Phoenix police department. You are asked to lead your first murder investigation, but the only clues are old blood spots of the victim found near his body and blood on the clothes of a suspect. Because the main suspect is about ready to leave the country, you are asked to at least provide preliminary evidence that the blood found on his shirt could match that found at the crime scene so an arrest warrant can be issued quickly. You amaze your colleagues by simply looking through a microscope and determining from the nuclei of the red blood cells on the suspect's shirt that, based on this evidence, he is unlikely to be guilty. How could you be so sure of this conclusion?

Answer: The presence of nuclei in red blood cells (RBCs) would indicate that the blood on the suspect's shirt is likely from a bone marrow sample or a fresh source. In a murder investigation, old blood at the crime scene would contain RBCs without nuclei as they lose them over time. Therefore, the mismatch in the condition of the RBCs suggests that the suspect's blood is not likely to be from the crime scene, and he is unlikely to be guilty.

- 20.** What is a good way to measure your Basal Metabolic Rate (BMR)?

Answer: One common and accurate way to estimate your Basal Metabolic Rate (BMR) is to use the Harris-Benedict Equation. There are two different equations for estimating BMR:

For Men: $BMR = 88.362 + (13.397 \times \text{weight in kg}) + (4.799 \times \text{height in cm}) - (5.677 \times \text{age in years})$

For Women: $BMR = 447.593 + (9.247 \times \text{weight in kg}) + (3.098 \times \text{height in cm}) - (4.330 \times \text{age in years})$

21. Some athletes use "blood doping," adding additional red blood cells to the blood, to achieve a competitive edge. What will these extra red blood cells do?

Answer: Extra red blood cells in blood doping enhance oxygen delivery to muscles, improving an athlete's endurance and performance.

22. What are the caloric values for each gram of muscle, fat, and carbohydrates?

Answer: Muscle: Approximately 4 calories per gram.

Fat: Approximately 9 calories per gram.

Carbohydrates: Approximately 4 calories per gram.

LAB REVIEW QUESTIONS

23. Before going up and visiting Xor, we had three hypotheses for her disorientation, and you were able to test all of them. Which one appeared to be the correct one?

- a. Hypoglycemia (low blood sugar)
- b. Hypoxia (low oxygen)
- c. Hypertension (high blood pressure)

Answer: Hypoxia (low oxygen)

24. When you figured out what was wrong, what action did you take to help Xor?

- a. We set an IV with sugar solution
- b. We administered oxygen
- c. We injected a vasodilator

Answer: We injected a vasodilator

25. What would happen if the blood pressure in the brain drops?

- a. The brain will not get enough oxygen
- b. The brain will shrink due to lack of hydro pressure
- c. The brain will eventually implode and the megaraffe will die

Answer: The brain will not get enough oxygen

26. As you recall from the homeostatic system for blood pressure in megaraffes, there are sensors, effectors and integrators. The integrator is the medulla oblongata which sits in the brain, the part that will not work with low blood pressure. We controlled high blood pressure with a vasodilator, reducing the resistance in the blood vessels. What should we do when there is low blood pressure?

- a. We must manipulate the other effector - the heart
- b. We must manipulate the integrator - the medulla oblongata
- c. We must apply a vasoconstrictor to the blood vessels
- d. All of these may in theory work

Answer: We must manipulate the integrator - the medulla oblongata

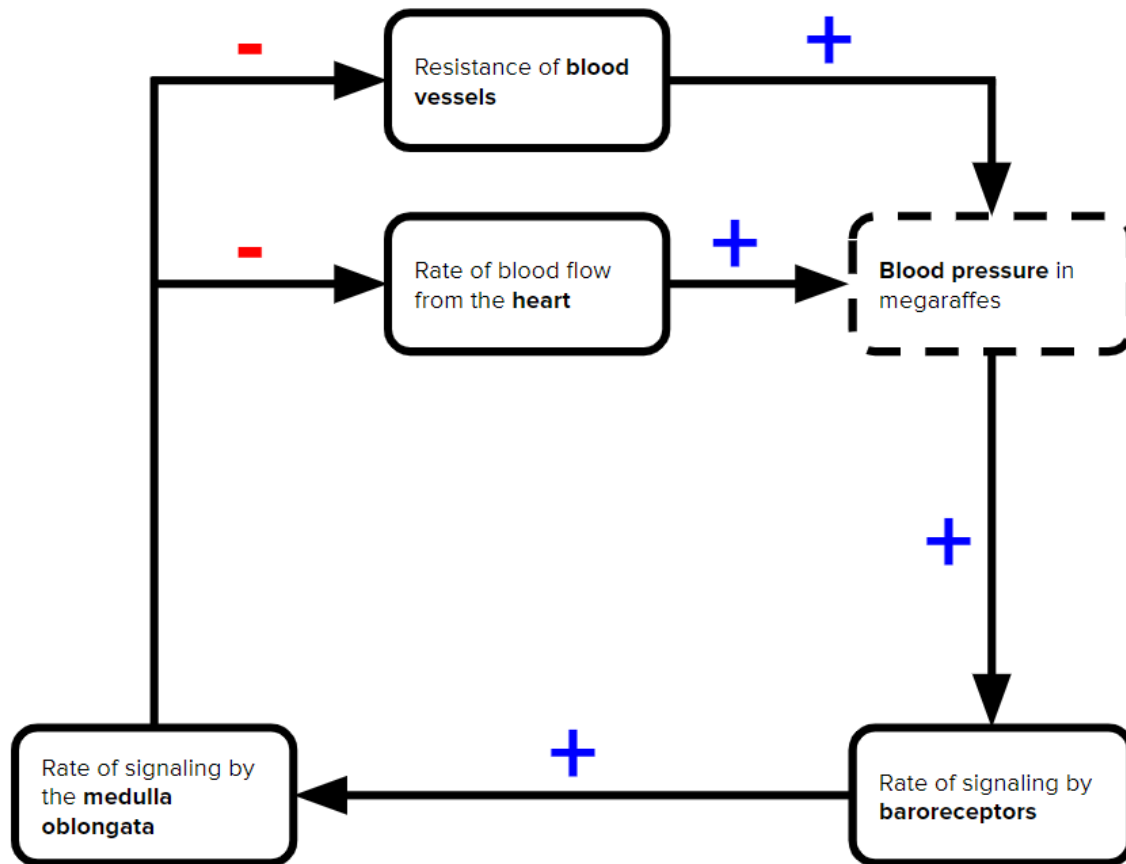
- 27.** When a homeostatic system deviates from the set point or the set range, two possible mechanisms typically set in, one of them with the purpose of bringing the system back to within the set range. What is this mechanism called?
- a. Regulating mechanism
 - b. Positive feedback
 - c. Constructive feedback
 - d. Negative feedback

Answer: Negative feedback

- 28.** Based on the path model below, what is the effector(s) in this homeostatic system?
- a. Baroreceptors and medulla oblongata
 - b. Medulla oblongata
 - c. Heart
 - d. Heart and blood vessels

Answer: Heart and blood vessels

HOMEOSTATIC SYSTEM: BLOOD PRESSURE IN MEGARAFFES



29. As the gravity fluctuates, you will alternately inject two drugs to keep Xor's blood pressure in the healthy range. It will raise her blood pressure. One drug, the beta agonist, will **activate** beta receptors inside the heart tissue. Use the path model to predict the effect of this drug: It will
- Cause the heart to beat stronger and faster
 - Cause the heart to beat weaker and slower
 - Cause an effect
 - None of the above

Answer: Cause the heart to beat stronger and faster

30. The other drug, a beta antagonist, will **block** beta receptors (you may have heard about beta blockers?). This drug will:

- a. Cause the heart to beat stronger and faster
- b. Cause the heart to beat weaker and slower
- c. Raise Xor's blood pressure
- d. Lower Xor's blood pressure
- e. Cause the heart to beat weaker and faster, and lower Xor's blood pressure

Answer: Cause the heart to beat weaker and faster, and lower Xor's blood pressure

31. What would be a good prediction for Xor's homeostatic recovery state?

- a. If Xor is only injected with an antagonist then she will recover quickly
- b. If Xor is not treated with the right medication then she will be fine
- c. If gravity equalizes then Xor's blood pressure should stabilize on its own
- d. If gravity equalizes then Xor will not be able to recover and will die

Answer: If gravity equalizes then Xor's blood pressure should stabilize on its own