Solutions Manual for Anatomy and Physiology 2nd Edition by Betts, Desaix, Johnson, Johnson, Korol, Kruse

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INSTRUCTOR ANSWER GUIDE

Anatomy and Physiology 2e.

Anatomy & Physiology 2e
Unit 1: Levels of Organization
Chapter 1: An Introduction to the Human Body

Interactive Link Questions

1. View this animation (http://openstaxcollege.org/l/metabolic) to learn more about metabolic processes. What kind of catabolism occurs in the heart?

Answer
Fatty acid catabolism.

2. Water concentration in the body is critical for proper functioning. A person's body retains very tight control on water levels without conscious control by the person. Watch this video (http://openstaxcollege.org/l/H2Ocon) to learn more about water concentration in the body. Which organ has primary control over the amount of water in the body?

Answer
The kidneys.

3. A CT or CAT scan relies on a circling scanner that revolves around the patient's body. Watch this video (http://openstaxcollege.org/l/CATscan) to learn more about CT and CAT scans. What type of radiation does a CT scanner use?

Answer
X-rays.

4. A patient undergoing an MRI is surrounded by a tube-shaped scanner. Watch this video (http://openstaxcollege.org/l/MRI) to learn more about MRIs. What is the function of magnets in an MRI?

Answer
The magnets induce tissue to emit radio signals that can show differences between different types of tissue.

5. PET relies on radioactive substances administered several minutes before the scan. Watch this video (http://openstaxcollege.org/l/PET) to learn more about PET. How is PET used in chemotherapy?

Answer
PET scans can indicate how patients are responding to chemotherapy

Review Questions

6. Which of the following specialties might focus on studying all of the structures of the ankle and foot?

Answer
C. regional anatomy

7. A scientist wants to study how the body uses foods and fluids during a marathon run. This scientist is most likely a(n) _____.

Answer
A. exercise physiologist

8. The smallest independently functioning biological unit of an organism is a(n) _____.

Answer
A. cell

9. A collection of similar tissues that performs a specific function is an _____.

Answer
A. organ

10. The body system responsible for structural support and movement is the _____.

Answer
D. skeletal system

11. Metabolism can be defined as the _____.

Answer
D. sum of all chemical reactions in an organism

12. Adenosine triphosphate (ATP) is an important molecule because it _____.

Answer
C. stores energy for use by body cells

13. Cancer cells can be characterized as "generic" cells that perform no specialized body function. Thus cancer cells lack _____.

Answer
A. differentiation

14. Humans have the most urgent need for a continuous supply of _____.

Answer
C. oxygen

15. Which of the following statements about nutrients is true?

Answer
A. All classes of nutrients are essential to human survival.

16. C.J. is stuck in a car during a bitterly cold blizzard. CJ's body responds to the cold by _____.

Answer
C. breaking down stored energy

17. After you eat lunch, nerve cells in your stomach respond to the distension (the stimulus) resulting from the food. They relay this information to _____.

Answer
A. a control center

18. Stimulation of the heat-loss center causes _____.

Answer
C. sweat glands to increase their output

19. Which of the following is an example of a normal physiologic process that uses a positive feedback loop?

Answer
B. childbirth

20. What is the position of the body when it is in the "normal anatomical position?"

Answer
D. None of the above

21. To make a banana split, you halve a banana into two long, thin, right and left sides along the _____.

Answer
C. midsagittal plane

22. The lumbar region is _____.

Answer
D. superior to the popliteal region

23. The heart is within the _____.

Answer

B. mediastinum

24. In 1901, Wilhelm Röntgen was the first person to win the Nobel Prize for physics. For what discovery did he win?

Answer
D. X-rays

25. Which of the following imaging techniques would be best to use to study the uptake of nutrients by rapidly multiplying cancer cells?

Answer
C. PET

26. Which of the following imaging studies can be used most safely during pregnancy?

Answer
C. ultrasound

27. What are two major disadvantages of MRI scans?

Answer
B. high cost and the need for shielding from the magnetic signals

Critical Thinking Questions

28. Name at least three reasons to study anatomy and physiology.

Answer
An understanding of anatomy and physiology is essential for any career in the health professions. It can also help you make choices that promote your health, respond appropriately to signs of illness, make sense of health-related news, and help you in your roles as a parent, spouse, partner, friend, colleague, and caregiver.

29. For whom would an appreciation of the structural characteristics of the human heart come more easily: an alien who lands on Earth, abducts a human, and dissects his heart, or an anatomy and physiology student performing a dissection of the heart on her very first day of class? Why?

Answer
A student would more readily appreciate the structures revealed in the dissection. Even though the student has not yet studied the workings of the heart and blood vessels in her class, she has experienced her heart beating every moment of her life, has probably felt her pulse, and likely has at least a basic understanding of the role of the heart in pumping blood throughout her body. This understanding of the heart's function (physiology) would support her study of the heart's form (anatomy).

30. Name the six levels of organization of the human body

Answer
Chemical, cellular, tissue, organ, organ system, organism.

31. The ovaries and the testes are a part of which body system? Can these organs be members of more than one organ system? Why or why not?

Answer
The ovaries and the testes are parts of the reproductive system. But they also secrete hormones, as does the endocrine system, therefore ovaries and testes function within both the endocrine and reproductive systems.

32. Explain why the smell of smoke when you are sitting at a campfire does not trigger alarm, but the smell of smoke in your residence hall does.

Answer

When you are sitting at a campfire, your sense of smell adapts to the smell of smoke. Only if that smell were to suddenly and dramatically intensify would you be likely to notice and respond. In contrast, the smell of even a trace of smoke would be new and highly unusual in your residence hall, and would be perceived as danger.

33. Identify three different ways that growth can occur in the human body.

Answer

Growth can occur by increasing the number of existing cells, increasing the size of existing cells, or increasing the amount of non-cellular material around cells.

34. When you open a bottle of sparkling water, the carbon dioxide gas in the bottle form bubbles. If the bottle is left open, the water will eventually "go flat." Explain these phenomena in terms of atmospheric pressure.

Answer

In a sealed bottle of sparkling water, carbon dioxide gas is kept dissolved in the water under a very high pressure. When you open the bottle, the pressure of the gas above the liquid changes from artificially high to normal atmospheric pressure. The dissolved carbon dioxide gas expands, and rises in bubbles to the surface. When a bottle of sparkling water is left open, it eventually goes flat because its gases continue to move out of solution until the pressure in the water is approximately equal to atmospheric pressure.

35. On his midsummer trek through the desert, Josh ran out of water. Why is this particularly dangerous?

Answer

The primary way that the body responds to high environmental heat is by sweating; however, sweating requires water, which comes from body fluids, including blood plasma. If Josh becomes dehydrated, he will be unable to sweat adequately to cool his body, and he will be at risk for heat stroke as his blood pressure drops too much from the loss of water from the blood plasma.

36. Identify the four components of a negative feedback loop and explain what would happen if secretion of a body chemical controlled by a negative feedback system became too great.

Answer

The four components of a negative feedback loop are: stimulus, sensor, control center, and effector. If too great a quantity of the chemical were excreted, sensors would activate a control center, which would in turn activate an effector. In this case, the effector (the secreting cells) would be adjusted downward.

37. What regulatory processes would your body use if you were trapped by a blizzard in an unheated, uninsulated cabin in the woods?

Answer

Any prolonged exposure to extreme cold would activate the brain's heat-gain center. This would reduce blood flow to your skin, and shunt blood returning from your limbs away from the digits and into a network of deep veins. Your brain's heat-gain center would also increase your muscle contraction, causing you to shiver. This increases the energy consumption of skeletal muscle and generates more heat. Your body would also produce thyroid hormone and epinephrine, chemicals that promote increased metabolism and heat production.

38. In which direction would an MRI scanner move to produce sequential images of the body in the frontal plane, and in which direction would an MRI scanner move to produce sequential images of the body in the sagittal plane?

Answer

If the body were supine or prone, the MRI scanner would move from top to bottom to produce frontal sections, which would divide the body into anterior and posterior portions, as in “cutting” a deck of cards. Again, if the body were supine or prone, to produce sagittal sections, the scanner would move from left to right or from right to left to divide the body lengthwise into left and right portions.

39. If a bullet were to penetrate a lung, which three anterior thoracic body cavities would it enter, and which layer of the serous membrane would it encounter first?

Answer

The bullet would enter the ventral, thoracic, and pleural cavities, and it would encounter the parietal layer of serous membrane first.

40. Which medical imaging technique is most dangerous to use repeatedly, and why?

Answer

CT scanning subjects patients to much higher levels of radiation than X-rays, and should not be performed repeatedly.

41. Explain why ultrasound imaging is the technique of choice for studying fetal growth and development.

Answer

Ultrasonography does not expose a mother or fetus to radiation, to radiopharmaceuticals, or to magnetic fields. At this time, there are no known medical risks of ultrasonography.

Anatomy & Physiology 2e
Unit 1: Levels of Organization
Chapter 2: The Chemical Level of Organization

Interactive Link Questions

1. Visit this website (http://openstaxcollege.org/l/ptable) to view the periodic table. In the periodic table of the elements, elements in a single column have the same number of electrons that can participate in a chemical reaction. These electrons are known as "valence electrons." For example, the elements in the first column all have a single valence electron—an electron that can be "donated" in a chemical reaction with another atom. What is the meaning of a mass number shown in parentheses?

Answer
The mass number is the total number of protons and neutrons in the nucleus of an atom.

2. Visit this website (http://openstaxcollege.org/l/electenergy) to learn about electrical energy and the attraction/repulsion of charges. What happens to the charged electroscope when a conductor is moved between its plastic sheets, and why?

Answer
The plastic sheets jump to the nail (the conductor), because the conductor takes on electrons from the electroscope, reducing the repellant force of the two sheets.

3. Watch this video (http://openstaxcollege.org/l/disaccharide) to observe the formation of a disaccharide. What happens when water encounters a glycosidic bond?

Answer
The water hydrolyses, or breaks, the glycosidic bond, forming two monosaccharides.

Review Questions

4. Together, just four elements make up more than 95 percent of the body's mass. These include _____.

Answer
D. oxygen, carbon, hydrogen, and nitrogen

5. The smallest unit of an element that still retains the distinctive behavior of that element is an _____.

Answer
B. atom

6. The characteristic that gives an element its distinctive properties is its number of _____.

Answer
A. protons

7. On the periodic table of the elements, mercury (Hg) has an atomic number of 80 and a mass number of 200.59. It has seven stable isotopes. The most abundant of these probably have _____.

Answer
C. more than 80 neutrons each

8. Nitrogen has an atomic number of seven. How many electron shells does it likely have?

Answer
B. two

9. Which of the following is a molecule, but not a compound?

Answer
C. H_2

10. A molecule of ammonia contains one atom of nitrogen and three atoms of hydrogen. These are linked with _____.

Answer
C. polar covalent bonds

11. When an atom donates an electron to another atom, it becomes

Answer
A. an ion

12. A substance formed of crystals of equal numbers of cations and anions held together by ionic bonds is called a(n) _____.

Answer
B. salt

13. Which of the following statements about chemical bonds is true?

Answer
A. Ionic bonds are stronger than covalent bonds.

14. The energy stored in a foot of snow on a steep roof is _____.

Answer
A. potential energy

15. The bonding of calcium, phosphorus, and other elements produces mineral crystals that are found in bone. This is an example of a(n) _____ reaction.

Answer
B. synthesis

16. $AB \rightarrow A + B$ is a general notation for a(n) _____ reaction.

Answer
C. decomposition

17. _____ reactions release energy.

Answer
D. Catabolic, exergonic, and decomposition

18. Which of the following combinations of atoms is most likely to result in a chemical reaction?

Answer
A. hydrogen and hydrogen

19. Chewing a bite of bread mixes it with saliva and facilitates its chemical breakdown. This is most likely due to the fact that _____.

Answer
D. saliva contains enzymes

20. CH_4 is methane. This compound is _____.

Answer
B. organic

21. Which of the following is most likely to be found evenly distributed in water in a homogeneous solution?

Answer
A. sodium ions and chloride ions

22. Jenny mixes up a batch of pancake batter, then stirs in some chocolate chips. As she is waiting for the first few pancakes to cook, she notices the chocolate chips sinking to the bottom of the clear glass mixing bowl. The chocolate-chip batter is an example of a _____.

Answer
D. suspension

23. A substance dissociates into K^+ and Cl^- in solution. The substance is a(n) _____.

Answer
C. salt

24. Ty is three years old and as a result of a "stomach bug" has been vomiting for about 24 hours. His blood pH is 7.48. What does this mean?

Answer
B. Ty's blood is slightly alkaline.

25. $C_6 H_{12} O_6$ is the chemical formula for a _____.

Answer
C. hexose monosaccharide

26. What organic compound do brain cells primarily rely on for fuel?

Answer
A. glucose

27. Which of the following is a functional group that is part of a building block of proteins?

Answer
C. amino

28. A pentose sugar is a part of the monomer used to build which type of macromolecule?

Answer
B. nucleic acids

29. A phospholipid _____.

Answer
A. has both polar and nonpolar regions

30. In DNA, nucleotide bonding forms a compound with a characteristic shape known as a(n) _____.

Answer
D. double helix

31. Uracil _____.

Answer
D. all of the above (contains nitrogen, is a pyrimidine, is found in RNA)

32. The ability of an enzyme's active sites to bind only substrates of compatible shape and charge is known as _____.

Answer
B. specificity

Critical Thinking Questions

33. The most abundant elements in the foods and beverages you consume are oxygen, carbon, hydrogen, and nitrogen. Why might having these elements in consumables be useful?

Answer
These four elements—oxygen, carbon, hydrogen, and nitrogen—together make up more than 95 percent of the mass of the human body, and the body cannot make elements, so it is helpful to have them in consumables.

34. Oxygen, whose atomic number is eight, has three stable isotopes: ^{16}O, ^{17}O, and ^{18}O. Explain what this means in terms of the number of protons and neutrons.

Answer
Oxygen has eight protons. In its most abundant stable form, it has eight neutrons, too, for a mass number of 16. In contrast, ^{17}O has nine neutrons, and ^{18}O has 10 neutrons.

35. Magnesium is an important element in the human body, especially in bones. Magnesium's atomic number is 12. Is it stable or reactive? Why? If it were to react with another atom, would it be more likely to accept or to donate one or more electrons?

Answer
Magnesium's 12 electrons are distributed as follows: two in the first shell, eight in the second shell, and two in its valence shell. According to the octet rule, magnesium is unstable (reactive) because its valence shell has just two electrons. It is therefore likely to participate in chemical reactions in which it donates two electrons.

36. Explain why CH_4 is one of the most common molecules found in nature. Are the bonds between the atoms ionic or covalent?

Answer
A carbon atom has four electrons in its valence shell. According to the octet rule, it will readily participate in chemical reactions that result in its valence shell having eight electrons. Hydrogen, with one electron, will complete its valence shell with two. Electron sharing between an atom of carbon and four atoms of hydrogen meets the requirements of all atoms. The bonds are covalent because the electrons are shared: although hydrogen often participates in ionic bonds, carbon does not because it is highly unlikely to donate or accept four electrons.

37. In a hurry one day, you merely rinse your lunch dishes with water. As you are drying your salad bowl, you notice that it still has an oily film. Why was the water alone not effective in cleaning the bowl?

Answer
Water is a polar molecule. It has a region of weakly positive charge and a region of weakly negative charge. These regions are attracted to ions as well as to other polar molecules. Oils are nonpolar, and are repelled by water.

38. Could two atoms of oxygen engage in ionic bonding? Why or why not?

Answer
Identical atoms have identical electronegativity and cannot form ionic bonds. Oxygen, for example, has six electrons in its valence shell. Neither donating nor accepting the valence shell electrons of the other will result in the oxygen atoms completing their valence shells. Two atoms of the same element always form covalent bonds.

39. $AB + CD \rightarrow AD + BE$ Is this a legitimate example of an exchange reaction? Why or why not?

Answer
It is not. An exchange reaction might be $AB + CD \rightarrow AC + BD$ or $AB + CD \rightarrow AD + BC$. In all chemical reactions, including exchange reactions, the components of the reactants are identical to the components of the products. A component present among the reactants cannot disappear, nor can a component not present in the reactants suddenly appear in the products.

40. When you do a load of laundry, why do you not just drop a bar of soap into the washing machine? In other words, why is laundry detergent sold as a liquid or powder?

Answer
Recall that the greater the surface area of the reactants, the more quickly and easily they will interact. It takes energy to separate particles of a substance. Powder and liquid laundry detergents, with relatively more surface area per unit, can quickly dissolve into their reactive components when added to the water.

41. The pH of lemon juice is 2, and the pH of orange juice is 4. Which of these is more acidic, and by how much? What does this mean?

Answer
Lemon juice is one hundred times more acidic than orange juice. This means that lemon juice has a one hundred-fold greater concentration of hydrogen ions.

42. During a party, Eli loses a bet and is forced to drink a bottle of lemon juice. Not long thereafter, he begins complaining of having difficulty breathing, and his friends take him to the local emergency room. There, he is given an intravenous solution of bicarbonate. Why?

Answer
Lemon juice, like any acid, releases hydrogen ions in solution. As excessive H^+ enters the digestive tract and is absorbed into blood, Eli's blood pH falls below 7.35. Recall that bicarbonate is a buffer, a weak base that accepts hydrogen ions. By administering bicarbonate intravenously, the emergency department physician helps raise Eli's blood pH back toward neutral.

43. If the disaccharide maltose is formed from two glucose monosaccharides, which are hexose sugars, how many atoms of carbon, hydrogen, and oxygen does maltose contain and why?

Answer
Maltose contains 12 atoms of carbon, but only 22 atoms of hydrogen and 11 atoms of oxygen, because a molecule of water is removed during its formation via dehydration synthesis.

44. Once dietary fats are digested and absorbed, why can they not be released directly into the bloodstream?

Answer
All lipids are hydrophobic and unable to dissolve in the watery environment of blood. They are packaged into lipoproteins, whose outer protein envelope enables them to transport fats in the bloodstream.

Anatomy & Physiology 2e
Unit 1: Levels of Organization
Chapter 3: The Cellular Level of Organization

Interactive Link Questions

1. Visit this link (http://openstaxcollege.org/l/diffusion) to see diffusion and how it is propelled by the kinetic energy of molecules in solution. How does temperature affect diffusion rate, and why?

Answer
Higher temperatures speed up diffusion because molecules have more kinetic energy at higher temperatures.

2. Watch this video (http://openstaxcollege.org/l/endomembrane1) to learn about the endomembrane system, which includes the rough and smooth ER and the Golgi body as well as lysosomes and vesicles. What is the primary role of the endomembrane system?

Answer
Processing, packaging, and moving materials manufactured by the cell.

3. Watch this video (http://openstaxcollege.org/l/DNArep) to learn about DNA replication. DNA replication proceeds simultaneously at several sites on the same molecule. What separates the base pair at the start of DNA replication?

Answer
an enzyme

4. Watch this video (http://openstaxcollege.org/l/ribosome) to learn about ribosomes. The ribosome binds to the mRNA molecule to start translation of its code into a protein. What happens to the small and large ribosomal subunits at the end of translation?

Answer
They separate and move and are free to join translation of other segments of mRNA.

5. Visit this link (http://openstaxcollege.org/l/mitosis) to learn about mitosis. Mitosis results in two identical diploid cells. What structures form during prophase?

Answer
the spindle

Review Questions

6. Because they are embedded within the membrane, ion channels are examples of _____.

Answer
B. integral proteins

7. The diffusion of substances within a solution tends to move those substances _____ their _____ gradient.

Answer
D. down; concentration

8. Ion pumps and phagocytosis are both examples of _____.

Answer
C. active transport

9. Choose the answer that best completes the following analogy: Diffusion is to _____ as endocytosis is to _____.

Answer
B. osmosis; pinocytosis