

AP BIOLOGY CHAPTERS 1-3 SUMMER WORKSHEET

GENERAL DIRECTIONS: QUESTIONS 1-16 REFER TO CHAPTER 1, QUESTIONS 17-35 REFER TO CHAPTER 2, AND QUESTIONS 36-57 REFER TO CHAPTER 3

MULTIPLE CHOICE.

*Place the **letter** of the choice that best completes the statement or answers the question in the blank. **USE UPPERCASE LETTERS.***

- _____ 1. What is the correct order for the hierarchy of biological organization from the least to the most complex?
- A. molecule, cell, tissue, organelle, organ, organ system, organism, population, community, ecosystem
 - B. molecule, organelle, cell, tissue, organ, organ system, organism, population, community, ecosystem
 - C. molecule, organelle, tissue, cell, organ, organ system, organism, population, community, ecosystem
 - D. molecule, organelle, cell, tissue, organ, organ system, organism, population, ecosystem, community
- _____ 2. How does DNA (deoxyribonucleic acid) encode information?
- A. in the sequence of nucleotides.
 - B. The DNA molecule is composed of many amino acids joined together to form a functional protein.
 - C. in the number of each different nucleotide.
 - D. in the different shapes of the DNA molecules.
- _____ 3. Which of the following statements is true about chemical nutrients in an ecosystem?
- A. They depend on sunlight as their source.
 - B. They flow through the system, losing some nutrients in the process.
 - C. They recycle within the ecosystem, being constantly reused.
 - D. They exit the ecosystem in the form of heat.
- _____ 4. Which of the following attributes is common to both prokaryotic cells and eukaryotic cells?
- A. the use of DNA as the information storage molecule
 - B. membrane-enclosed organelles
 - C. generally about the same size
 - D. the use of proteins as information storage molecules
- _____ 5. No amino acid molecule by itself can speed up or catalyze reactions between other molecules; however, when amino acids are joined together to make a protein with catalytic properties, the new structure (enzymatic protein) can speed up the rate of a specific chemical reaction. What does this illustrate?
- A. polymer duality
 - B. the complexity/simplicity paradox
 - C. emergent properties
 - D. energy flow, processing, and utilization

- _____ 6. Which of the following properties or processes is **not** associated with all living things?
- A. evolutionary adaptation
 - B. energy processing
 - C. responding to the environment
 - D. movement

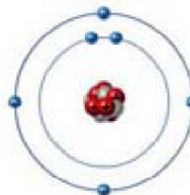
View the animation at this link

(<https://mediaplayer.pearsoncmg.com/assets/secs-bio-intro-to-experimental-design>) and then answer questions 7-14.

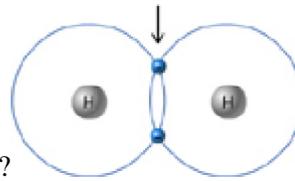
- _____ 7. Which of the following statements is **not** true of scientific experiments?
- A. They must occur under carefully controlled conditions found in a laboratory.
 - B. They yield useful results regardless of whether the hypothesis is supported or rejected.
 - C. They must be well documented.
 - D. All of the above are true.
- _____ 8. In an experiment, investigators try to control all of the variables except one—the one that tests the hypothesis. Which of the following reasons is the primary rationale for controlling variables in an experiment?
- A. To enable investigators to repeat the test
 - B. To create a control group
 - C. To eliminate alternative explanations for the results of an experiment
 - D. To guarantee that the scientist can carefully observe all reactions and process all experimental data
- _____ 9. Which of the following statements could not be supported or rejected by a scientific experiment?
- A. Grass is green because it contains chlorophyll.
 - B. The first living cell on Earth came from outer space
 - C. College students think football is more fun to watch than baseball.
 - D. Corn seedlings grow more quickly when people talk to them.
- _____ 10. Which of the following statements is **true** of a hypothesis?
- A. A hypothesis can be proved.
 - B. A hypothesis must always be written in “if” “then” form.
 - C. A hypothesis can be supported or rejected through experimentation.
 - D. The goal of scientific research is to prove the stated hypothesis.
- _____ 11. Which of the following variables did Pasteur change in his experiment to test the hypothesis of spontaneous generation?
- A. The length of time that the broth was boiled
 - B. The length of time that the flasks were allowed to sit before being sampled for organisms
 - C. The broth used in each flask
 - D. The shape of the flask

- ___ 12. In Pasteur's experiment to test the hypothesis of spontaneous generation, why did he boil the broth in both flasks?
- A. To attract dust particles to each flask
 - B. To kill any existing organisms in the broth
 - C. To expose the broth to a source of organisms
 - D. To provide nutrients to stimulate the growth of microorganisms
- ___ 13. Suppose the sub-hypothesis that wing waving alone reduces predation by jumping spiders was supported by the Zonosemata experiment. What results would have supported that sub-hypothesis?
- A. Zonosemata flies with housefly wings are attacked less frequently.
 - B. Untreated Zonosemata flies are attacked less frequently.
 - C. Houseflies with Zonosemata wings are attacked less frequently.
 - D. Zonosemata flies with their own wings cut and reglued are attacked less frequently.
- ___ 14. Suppose that Zonosemata flies whose own wings had been clipped and reattached were attacked more frequently than untreated Zonosemata flies. How would this result have affected the reliability of the other experimental results?
- A. All results for the experimental groups using Zonosemata flies would be invalid.
 - B. The reliability of the experimental results would not change.
 - C. All results for the experimental groups using houseflies would be invalid.
 - D. All results for the experimental groups involving wing surgery would be invalid.
- ___ 15. A common form of regulation in which accumulation of an end product of a process slows that process is called
- A. negative feedback.
 - B. feedback inhibition.
 - C. positive feedback.
 - D. emergent properties.
- ___ 16. Competition is central to the theory of natural selection. Why does competition occur?
- A. Females must choose among possible mates.
 - B. Organisms typically produce too many offspring, and resources are limited.
 - C. Organisms are naturally antagonistic.
 - D. Males must defend their territories.
- ___ 17. Changing the number of _____ would change an atom into an atom of a different element.
- A. bonds formed by an atom
 - B. neutrons in an atom
 - C. electrons circling the nucleus of an atom
 - D. protons in an atom
- ___ 18. Electrons are held in an atom by attraction to what particle or location?
- A. Attraction to the other electrons in the atom
 - B. Attraction to the positively charged protons in the nucleus
 - C. Attraction to the lowest electron shell
 - D. Attraction to the magnetic neutrons in the nucleus

- ___ 19. Different atomic forms of an element contain the same number of protons but a different number of neutrons. What are these different atomic forms called?
- A. isotopes
 - B. radioactive atoms
 - C. ions
 - D. isomers
- ___ 20. Radioactive isotopes can be used in studies of metabolic pathways because
- A. they are more reactive.
 - B. their half-life allows a researcher to time an experiment.
 - C. their location or quantity can be experimentally determined because of their radioactivity.
 - D. their extra neutrons produce different colors that can be traced throughout the body.
- ___ 21. To fill the valence shell, an electrically neutral, unbonded atom with atomic number 8 must add ___ electrons.
- A. 1
 - B. 2
 - C. 3
 - D. 8
- ___ 22. Atoms whose outer electron shells contain eight electrons tend to
- A. be stable and chemically nonreactive, or inert.
 - B. be isotopes and very radioactive.
 - C. be unstable and chemically very reactive.
 - D. form covalent bonds in aqueous solutions.

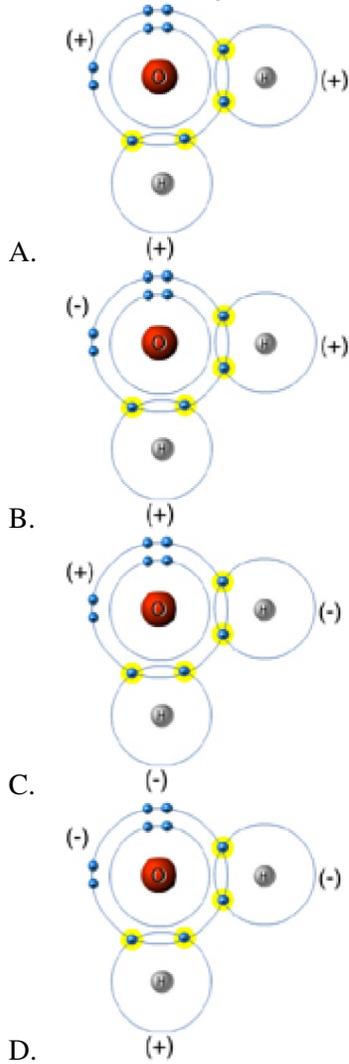


- ___ 23. This atom can form up to ___ single covalent bond(s).
- A. 1
 - B. 2
 - C. 3
 - D. 4
- ___ 24. Covalent bonds hold atoms together because they
- A. fill shells without giving atoms much charge.
 - B. bring electrons closer to neutrons.
 - C. use forces between nuclei as well as forces between electrons.
 - D. do all of the above.

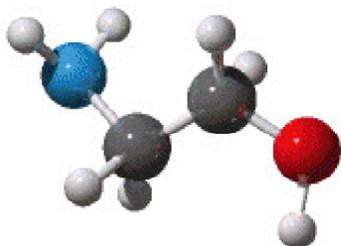


- ___ 25. What type of bond is joining the two hydrogen atoms?
- A. hydrogen
 - B. ionic
 - C. covalent
 - D. hydrophobic

- ___ 26. Which of these figures correctly illustrates the nature of the bonding of H_2O ?



___ 27. Without making or breaking bonds, the pictured molecule can change its shape because



- A. some atoms make longer bonds than others.
- B. electrons can move from one bond to another.
- C. proximity of other atoms alters bond angles.
- D. rotation can occur around single bonds.

___ 28. An ionic bond involves

- A. the unequal sharing of an electron pair.
- B. an attraction between ions of opposite charge.
- C. no atoms other than sodium and chlorine.
- D. the sharing of a single pair of electrons.

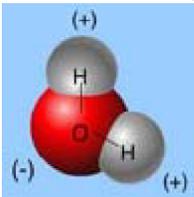
___ 29. An atom's atomic number is 7. Its valence is most likely

- A. 7
- B. 5
- C. 3
- D. 1

___ 30. What happens when two atoms form a chemical bond?

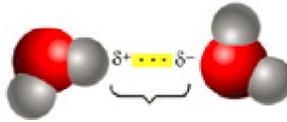
- A. A chemical bond forms when two atoms transfer or share outer electrons to complete their outer shells.
- B. A chemical bond forms when two atoms transfer or share protons to achieve a stable nucleus.
- C. Two atoms fuse together to form a chemical bond.
- D. All of the above are true.

___ 31. In this molecule, what type of bond is found between the oxygen and hydrogens?



- A. hydrogen
- B. ionic
- C. polar covalent
- D. nonpolar covalent

- ___ 32. Which statement about weak bonds is correct?
- A. Weak bonds are less important to living things than strong covalent bonds.
 - B. Weak bonds are transient and easily reversible.
 - C. Weak chemical bonds form only between atoms of similar electronegativity.
 - D. Weak bonds are not important in the formation of emergent properties.



- ___ 33. The brackets are indicating a(n) ___ bond.
- A. hydrogen
 - B. single (nonpolar) covalent
 - C. polar covalent
 - D. ionic
- ___ 34. Chemical equilibrium is reached when
- A. all of the reactants are converted to products.
 - B. the rate at which matter is destroyed and the rate at which it is created offset each other.
 - C. the reverse reaction begins to occur.
 - D. the forward and reverse reactions occur at the same rate so that the concentrations of reactants and products remain the same.
- ___ 35. The tendency of an atom to pull electrons toward itself is referred to as its
- A. electronegativity.
 - B. polarity.
 - C. ionic potential.
 - D. covalency.
- ___ 36. Each water molecule is joined to ___ other water molecules by ___ bonds.
- A. four ... polar covalent
 - B. two ... hydrogen
 - C. four ... hydrogen
 - D. three ... ionic
- ___ 37. The unequal sharing of electrons within a water molecule makes the water molecule
- A. ionic.
 - B. polar.
 - C. change easily from a liquid to gaseous form.
 - D. have a low surface tension.
- ___ 38. The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule. What is this attraction called?
- A. a hydrophilic bond
 - B. a covalent bond
 - C. a hydrophobic bond
 - D. a hydrogen bond

- ___ 39. Why does ice float in liquid water?
- A. The liquid water molecules have more kinetic energy and thus support the ice.
 - B. Ice always has air bubbles that keep it afloat.
 - C. Hydrogen bonds stabilize and keep the molecules of ice farther apart than the water molecules of liquid water.
 - D. The crystalline lattice of ice causes it to be denser than liquid water.
- ___ 40. Which type of bonds must be broken for water to vaporize?
- A. ionic bonds
 - B. hydrogen bonds
 - C. nonpolar covalent bonds
 - D. polar covalent bonds
- ___ 41. Select the statement that best describes a buffer.
- A. A buffer causes acidic solutions to become alkaline, and alkaline solutions to become acidic.
 - B. A buffer prevents the pH of a solution from changing when an acid or base is added.
 - C. A buffer resists change in pH by accepting hydrogen ions when acids are added to the solution and donating hydrogen ions when bases are added.
 - D. Buffered solutions are always neutral, with a pH of 7.
- ___ 42. Hydrophobic substances such as vegetable oil are
- A. nonpolar substances that repel water molecules.
 - B. nonpolar substances that have an attraction for water molecules.
 - C. polar substances that have an affinity for water.
 - D. charged molecules that hydrogen-bond with water molecules.
- ___ 43. Which property of water allows dogs to cool themselves by panting?
- A. the formation of covalent bonds between water molecules
 - B. water's high heat of vaporization
 - C. water's change in density when it condenses
 - D. water's high surface tension
- ___ 44. Climates tend to be moderate near large bodies of water because
- A. a large amount of solar heat is absorbed during the gradual rise in temperature of the water.
 - B. water releases heat to the environment as it cools.
 - C. a great deal of heat is absorbed and released as hydrogen bonds break or form.
 - D. all of the above.
- ___ 45. Why is water such an excellent solvent?
- A. As a polar molecule, it can surround and dissolve ionic and polar molecules.
 - B. It forms ionic bonds with ions, hydrogen bonds with polar molecules, and hydrophobic interactions with nonpolar molecules.
 - C. It has a high specific heat and a high heat of vaporization.
 - D. It is wet and has a great deal of surface tension.

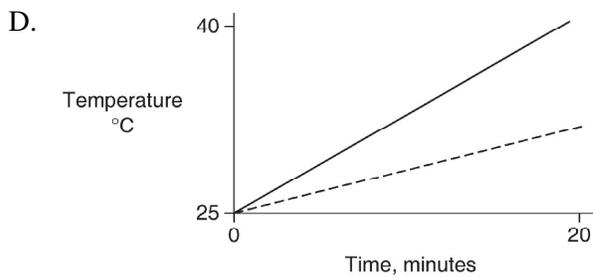
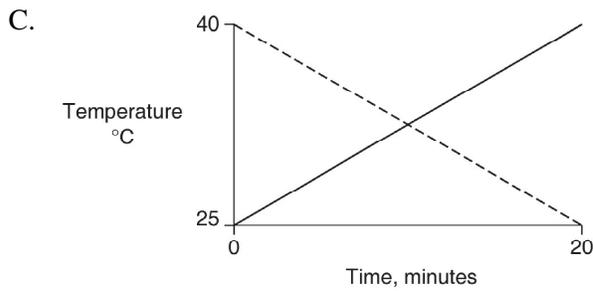
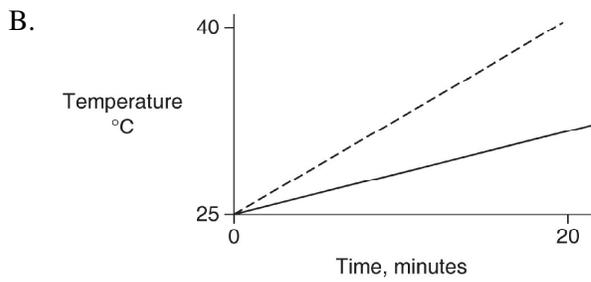
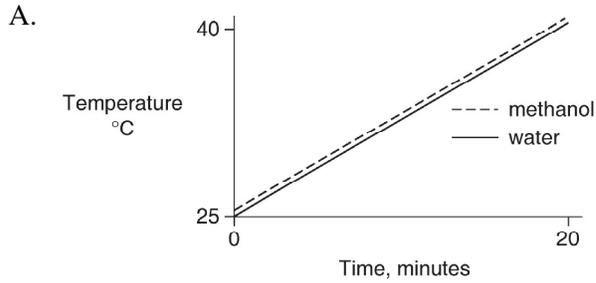
- ___ 46. What accounts for the movement of water up the vessels of a tall tree?
- A. cohesion
 - B. adhesion
 - C. hydrophilic cell walls
 - D. all of the above

- ___ 47. Why isn't this insect drowning?

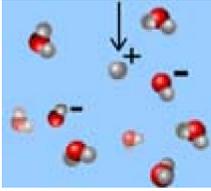


- A. The insect is swimming.
 - B. Surface tension.
 - C. The insect is flying just above the water surface.
 - D. The insect is very light.
- ___ 48. Because organisms are made primarily of water, they resist rapid temperature changes. This useful quality is based on water's
- A. ability to form colloids.
 - B. cohesion.
 - C. high specific heat.
 - D. lower density in the solid phase.
- ___ 49. Many of water's emergent properties, such as its cohesion, its high specific heat, and its high heat of vaporization, result from the fact that water molecules
- A. are attracted to each other by partial negative and positive charges on the oxygen and hydrogen atoms, respectively.
 - B. tend to repel each other.
 - C. are very small.
 - D. are in constant motion.
- ___ 50. In the past century, the average temperature of the oceans has increased by 0.74°C . Is this evidence of global warming?
- A. No, the rise in temperature is too small to be significant.
 - B. No, global warming affects air temperature, not water temperature.
 - C. Yes, because of the high specific heat of water and the huge volume of water in the oceans, a small rise in temperature would reflect a large amount of heat absorbed by the oceans.
 - D. Yes, the decreased rate of calcification is directly related to this temperature increase.
- ___ 51. In a neutral solution the concentration of
- A. hydrogen ions is equal to the concentration of hydroxide ions.
 - B. water molecules is less than the concentration of hydrogen ions.
 - C. hydrogen ions is greater than the concentration of hydroxide ions.
 - D. hydrogen ions is less than the concentration of hydroxide ions.

52. Identical heat lamps are arranged to shine on identical containers of water and methanol (wood alcohol), so that each liquid absorbs the same amount of energy minute by minute. The covalent bonds of methanol molecules are non-polar, so there are no hydrogen bonds among methanol molecules. Which of the following graphs correctly describes what will happen to the temperature of the water and the methanol?

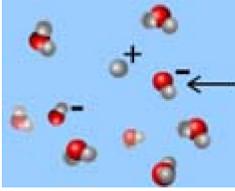


___ 53. What is the arrow pointing to?



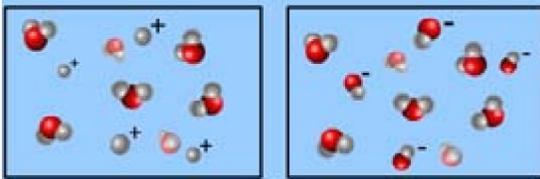
- A. hydrogen ion
- B. electron
- C. hydroxide ion
- D. hydronium ion

___ 54. What is the arrow pointing to?



- A. water
- B. hydrogen ion
- C. proton
- D. hydroxide ion

___ 55. How does the pH of the solution on the right compare with that of the solution on the left?



- A. The solution on the right is acidic relative to the solution on the left.
- B. Both of these solutions are equally acidic.
- C. The solution on the right is basic relative to the solution on the left.
- D. The solution on the right is neutral relative to the solution on the left.

___ 56. A pH of 6 is how many times more acidic than a pH of 9?

- A. 3
- B. 30
- C. 100
- D. 1000

___ 57. How does the way a buffer stabilizes pH during addition of acid differ from the way the same buffer stabilizes pH during addition of base?

- A. In one case the buffer is strong; in the other case it's weak.
- B. The same buffer can't work for both acid and base.
- C. It's the same reaction running backward or forward.
- D. In one case it adds H+; in the other case it adds OH-.

SHORT ANSWER.

Answer the following questions in the spaces provided.

58. What is the difference between a hypothesis and a scientific theory?

59. Explain what is meant by the term emergent properties?

60. Explain why it is important to understand the correlation between structure and function in biology. Use an example in your explanation.

61. Four hypotheses are listed below. Some are suitable for scientific testing and some are not. Identify which hypotheses are **not** testable by the scientific method. Explain your choice(s).

1. *Increasing numbers of deformities such as the extra limbs that have been noted in many frog populations in North America are caused by infection by trematodes (parasitic flatworms).*
2. *People with strong religious beliefs live more meaningful lives.*
3. *Humans and chimpanzees diverged from a common ancestor that lived 5–7 million years ago.*
4. *People are more likely to survive cancer if they have a positive attitude.*

62. What is meant by the valence of an atom? How is valence related to the chemical behavior of an atom?
