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| **Modified True / False** |

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| 1. The four elements that make up more than 96% of the weight of living organisms are oxygen, carbon, hydrogen and calcium.   |  |  | | --- | --- | | *ANSWER:* | False - oxygen, carbon, hydrogen and nitrogen | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.1 - Describe the elemental composition of living organisms. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 2. Carbon dioxide is an element.   |  |  | | --- | --- | | *ANSWER:* | False - a compound | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.2 - Describe atoms, molecules, elements, and compounds. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 3. Hydrogen, atomic number 1, has 3 isotopes, 1H, 2H, 3H. 1H is comprised of one proton, one neutron and one electron.   |  |  | | --- | --- | | *ANSWER:* | False - one proton, one electron and no neutrons | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 4. Atoms with atomic numbers between lithium and neon have two energy levels.   |  |  | | --- | --- | | *ANSWER:* | True | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.2 - Illustrate the arrangement of electrons around an atomic nucleus. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 5. In the representation of hydrogen gas, H-H, the dash represents two electrons being shared equally.   |  |  | | --- | --- | | *ANSWER:* | True | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 6. Proteins in thermophiles must be stabilized by van der Waals forces, because hydrogen bonds cannot be maintained at high temperatures   |  |  | | --- | --- | | *ANSWER:* | True | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.3 - Describe van der Waals forces. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 7. Ice floats in liquid water because there are, on average, fewer hydrogen bonds between molecules in ice than water, resulting in a lower density.​   |  |  | | --- | --- | | *ANSWER:* | False - more | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 8. The polarity of water allows it to create a hydration layer that prevents salt from coming back out of solution after it has been dissolved.   |  |  | | --- | --- | | *ANSWER:* | True | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 9. Acid precipitation can have a pH as low as 3.   |  |  | | --- | --- | | *ANSWER:* | True | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.2 - Describe the pH scale. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 10. Buffers can increase the pH of a solution when acids are added.   |  |  | | --- | --- | | *ANSWER:* | False - maintain | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Modified True / False | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.3 - Discuss the role of buffers in biological systems. | | *KEYWORDS:* | Bloom’s: Understand | |

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| **Multiple Choice** |

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| 11. Four elements, including \_\_\_\_, make up more than 96% of the mass of most living organisms.   |  |  |  | | --- | --- | --- | |  | a. | ​sodium | |  | b. | ​potassium | |  | c. | ​phosphorus | |  | d. | ​nitrogen | |  | e. | ​calcium |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.1 - Describe the elemental composition of living organisms. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 12. A trace element is one found in specific organisms in \_\_\_\_ quantities and is \_\_\_\_ for normal biological functions.   |  |  |  | | --- | --- | --- | |  | a. | ​moderate; unnecessary | |  | b. | ​moderate; vital | |  | c. | ​small; unnecessary | |  | d. | ​large; unnecessary | |  | e. | small; vital​ |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.1 - Describe the elemental composition of living organisms. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 13. Prolonged iodine deficiency causes \_\_\_\_, a condition in which the thyroid gland enlarges so much that the front of the neck swells significantly.​   |  |  |  | | --- | --- | --- | |  | a. | ​gout | |  | b. | ​cancer | |  | c. | ​a goiter | |  | d. | ​anemia | |  | e. | ​granuloma |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.1 - Describe the elemental composition of living organisms. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 14. The smallest unit that retains the chemical and physical properties of an element is a(n) \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​proton | |  | b. | ​compound | |  | c. | ​molecule | |  | d. | ​neutron | |  | e. | ​atom |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.2 - Describe atoms, molecules, elements, and compounds. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 15. The substance H2O is considered to be \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​both a molecule and a compound | |  | b. | ​a compound but not a molecule | |  | c. | ​neither a molecule nor a compound | |  | d. | ​a molecule but not a compound | |  | e. | ​both a molecule and an ion |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.2 - Describe atoms, molecules, elements, and compounds. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 16. The substance O2 is considered to be \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​both a molecule and a compound | |  | b. | ​a compound but not a molecule | |  | c. | ​neither a molecule nor a compound | |  | d. | ​a molecule but not a compound | |  | e. | ​both a molecule and an ion |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.2 - Describe atoms, molecules, elements, and compounds. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 17. Diluted acetic acid, CH3COOH, is commonly called vinegar. How many atoms of hydrogen are present in one molecule of acetic acid?​   |  |  |  | | --- | --- | --- | |  | a. | ​one | |  | b. | ​two | |  | c. | ​three | |  | d. | ​four | |  | e. | ​five |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.2 - Describe atoms, molecules, elements, and compounds. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 18. Radioactive \_\_\_\_ is commonly used to treat patients with dangerously overactive thyroid glands.​   |  |  |  | | --- | --- | --- | |  | a. | ​carbon | |  | b. | ​radium | |  | c. | ​iodine | |  | d. | ​thallium | |  | e. | ​cobalt |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 19. An oxygen atom has \_\_\_\_ surrounding a nucleus composed of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​neutrons; electrons and protons | |  | b. | ​electrons; protons and neutrons | |  | c. | ​protons and electrons; neutrons | |  | d. | ​protons; neutrons and electrons | |  | e. | ​electrons and neutrons; protons |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Remember | |

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| Figure 2.1 |

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| 20. Answer the question using the accompanying figure. The mass number of the atom depicted in the figure is \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​4 | |  | b. | ​6 | |  | c. | ​8 | |  | d. | ​12 | |  | e. | ​18 |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.1 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 21. Answer the question using the accompanying figure. The atomic number of the atom depicted in the figure is \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​4 | |  | b. | ​6 | |  | c. | ​8 | |  | d. | ​12 | |  | e. | ​18 |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.1 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 22. Answer the question using the accompanying figure. The atom depicted in this figure can form \_\_\_\_ covalent bonds with another atom.​   |  |  |  | | --- | --- | --- | |  | a. | ​0 | |  | b. | ​2 | |  | c. | ​4 | |  | d. | ​3 | |  | e. | ​6 |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.1 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 23. Which of the three atomic particles are charged?​   |  |  |  | | --- | --- | --- | |  | a. | ​electrons and protons | |  | b. | ​neutrons only | |  | c. | ​protons and neutrons | |  | d. | ​electrons only | |  | e. | ​protons, neutrons, and electrons |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 24. Isotopes of the same element differ from each other in the number of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​electrons and protons | |  | b. | ​neutrons only | |  | c. | ​protons and neutrons | |  | d. | ​electrons only | |  | e. | ​protons, neutrons, and electrons |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 25. A carbon atom with six protons, seven neutrons, and six electrons has a mass number of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​6 | |  | b. | ​7 | |  | c. | ​12 | |  | d. | ​13 | |  | e. | ​19 |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 26. 14C is heavier than 12C because it has \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​two more electrons than 12C | |  | b. | ​two more neutrons than 12C | |  | c. | ​two more protons than 12C | |  | d. | ​two more protons and two more electrons than 12C | |  | e. | ​one more proton and one more neutron than 12C |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 27. When the isotope 14C undergoes radioactive decay, a neutron splits into an electron and a proton, with ejection of the electron. This decay produces an atom of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​iron | |  | b. | ​carbon | |  | c. | ​hydrogen | |  | d. | ​oxygen | |  | e. | ​nitrogen |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 28. An orbital describes the \_\_\_\_ of an electron.​   |  |  |  | | --- | --- | --- | |  | a. | ​exact location | |  | b. | ​exact path | |  | c. | ​most frequent locations | |  | d. | ​charge | |  | e. | ​chemical bonds |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.2 - Illustrate the arrangement of electrons around an atomic nucleus. | | *KEYWORDS:* | Bloom’s: Remember | |

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| Figure 2.2 |

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| 29. Answer the question using the accompanying figure. The electrons at the lowest energy level in the neon atom depicted are found in which orbital?​   |  |  |  | | --- | --- | --- | |  | a. | ​1*s* | |  | b. | ​2*s* | |  | c. | ​2*p*x | |  | d. | ​2*p*y | |  | e. | ​2*p*z |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.2 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.2 - Illustrate the arrangement of electrons around an atomic nucleus. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 30. Answer the question using the accompanying figure. All of the orbitals shown in the neon atom are completely filled with electrons. How many electrons does this neon atom have?   |  |  |  | | --- | --- | --- | |  | a. | ​5 | |  | b. | ​6 | |  | c. | ​8 | |  | d. | ​10 | |  | e. | ​16 |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.2 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.2 - Illustrate the arrangement of electrons around an atomic nucleus. | | *KEYWORDS:* | Bloom’s: Evaluate | |

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| 31. Sodium has one valence electron in its third energy level. To reach a stable energy configuration, sodium will tend to\_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​take up an electron from another atom | |  | b. | ​move its valence electron to the second energy shell | |  | c. | ​give up an electron to another atom | |  | d. | ​share its valence electron with another atom | |  | e. | ​move an electron from the second energy level to the valence shell |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.3 - Explain how electrons determine the chemical properties of atoms. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 32. Which element is most likely to share electrons with other atoms in joint orbitals?​   |  |  |  | | --- | --- | --- | |  | a. | ​chlorine (7 valence electrons) | |  | b. | ​calcium (2 valence electrons) | |  | c. | ​argon (8 valence electrons) | |  | d. | ​carbon (4 valence electrons) | |  | e. | ​potassium (1 valence electron) |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.3 - Explain how electrons determine the chemical properties of atoms. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 33. Which element is likely to be chemically unreactive?​   |  |  |  | | --- | --- | --- | |  | a. | ​chlorine (7 valence electrons) | |  | b. | ​calcium (2 valence electrons) | |  | c. | ​argon (8 valence electrons) | |  | d. | ​carbon (4 valence electrons) | |  | e. | ​potassium (1 valence electron) |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.3 - Explain how electrons determine the chemical properties of atoms. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 34. Which element is most likely to accept an electron from another atom?​   |  |  |  | | --- | --- | --- | |  | a. | ​chlorine (7 valence electrons) | |  | b. | ​calcium (2 valence electrons) | |  | c. | ​neon (8 valence electrons) | |  | d. | ​carbon (4 valence electrons) | |  | e. | ​potassium (1 valence electron) |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.3 - Explain how electrons determine the chemical properties of atoms. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 35. The attraction between Na+ cations and Cl- anions form \_\_\_\_ that hold the ions together in the compound NaCl.​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 36. Metallic ions such as Ca2+, Na+, and Fe3+ readily form \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 37. The chemical bonds that are formed when atoms share electrons equally are called \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 38. Electronegativity is the tendency of an atom to attract \_\_\_\_ to itself in a chemical bond.​   |  |  |  | | --- | --- | --- | |  | a. | ​neutrons | |  | b. | ​protons | |  | c. | ​electrons | |  | d. | ​delta forces | |  | e. | ​polar associations |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 39. The chemical linkages that exert an attractive force over the greatest distance are \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 40. Chemical bonds that are formed when one atom with a partial positive charge (created from unequal sharing of electrons) is electrically attracted to another atom with a partial negative charge (also created from unequal sharing of electrons) are called \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.2 - Discuss polar and nonpolar bonds and molecular associations. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 41. Molecules such as H-H and O=O are held together by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.2 - Discuss polar and nonpolar bonds and molecular associations. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| Figure 2.3 |

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| 42. Answer the question using the accompanying figure. The molecule shown is held together by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.3 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.2 - Discuss polar and nonpolar bonds and molecular associations. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 43. A polar covalent bond would be most likely to form between \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​atoms with different electronegativities | |  | b. | ​cations and anions | |  | c. | ​atoms with partial positive and partial negative charges | |  | d. | ​atoms with filled valence shells | |  | e. | ​atoms of the same element |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.2 - Discuss polar and nonpolar bonds and molecular associations. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 44. Which type of chemical linkage is the weakest?​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.3 - Describe van der Waals forces. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 45. Geckos are able to cling to vertical walls due to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​polar covalent bonds | |  | b. | ​van der Waals forces | |  | c. | ​ionic bonds | |  | d. | ​hydrogen bonds | |  | e. | ​nonpolar covalent bonds |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.3 - Describe van der Waals forces. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 46. In contrast to ionic bonds, covalent bonds \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​hold atoms together | |  | b. | ​have distinct, three-dimensional forms | |  | c. | ​transfer electrons from one atom to another | |  | d. | ​are rarely broken | |  | e. | ​are transient |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.4 - Explain the role of chemical bonds in chemical reactions and determining molecular shape. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 47. In a molecule of methane, CH4, each hydrogen atom shares an orbital with the carbon atom. The total number of shared electrons in CH4 is \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​1 | |  | b. | ​2 | |  | c. | ​4 | |  | d. | ​5 | |  | e. | ​8 |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.4 - Explain the role of chemical bonds in chemical reactions and determining molecular shape. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 48. In the presence of water, nonpolar associations form between molecules or regions of molecules that are \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​partially charged | |  | b. | ​hydrophobic and hydrophilic | |  | c. | ​hydrophobic | |  | d. | ​fully charged | |  | e. | ​hydrophilic |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.4 - Explain the role of chemical bonds in chemical reactions and determining molecular shape. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 49. A mixture of vegetable oil and water will separate into layers because oil is \_\_\_\_ and forms \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ​hydrophobic; nonpolar associations | |  | b. | ​hydrophilic; nonpolar associations | |  | c. | ​hydrophilic; polar associations | |  | d. | ​hydrophobic; polar associations | |  | e. | ​hydrophobic; ionic associations |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.4 - Explain the role of chemical bonds in chemical reactions and determining molecular shape. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 50. The formation and breaking of bonds between atoms requires \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​a chemical reaction | |  | b. | ​van der Walls forces | |  | c. | ​partial charges | |  | d. | ​an empty valence shell | |  | e. | ​an enzyme |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.4 - Explain the role of chemical bonds in chemical reactions and determining molecular shape. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 51. A molecule of water in the middle of a chunk of ice will usually have \_\_\_\_ hydrogen bonds with other water molecules.​   |  |  |  | | --- | --- | --- | |  | a. | ​2 | |  | b. | ​3 | |  | c. | ​3.4 | |  | d. | ​4 | |  | e. | 6​ |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 52. Which substance would have the most difficulty entering a water lattice?​   |  |  |  | | --- | --- | --- | |  | a. | ​table salt (NaCl) | |  | b. | ​a nonpolar molecule | |  | c. | ​a sodium ion | |  | d. | ​a proton (H+) | |  | e. | ​an electron |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 53. Water has an unusually high boiling point for its molecular weight because water molecules \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​are very dense | |  | b. | ​get much heavier as they are heated | |  | c. | ​are held to each other by hydrogen bonds | |  | d. | ​are held together by covalent bonds | |  | e. | ​form hydration layers |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 54. The hydrogen-bond lattice causes water to have an unusually \_\_\_\_ specific heat, an unusually \_\_\_\_ heat of vaporization and an unusually \_\_\_\_ density in solid form.​   |  |  |  | | --- | --- | --- | |  | a. | ​high; high; high | |  | b. | ​low; low; low | |  | c. | ​high; low; high | |  | d. | ​high; high; low | |  | e. | ​low; low; high |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 55. Water has an important stabilizing effect on temperature in living organisms and their environments because as water absorbs heat, much of the energy is used to \_\_\_\_ instead of raising the temperature.​   |  |  |  | | --- | --- | --- | |  | a. | ​create hydrogen bonds | |  | b. | ​create covalent bonds | |  | c. | ​break surface tension | |  | d. | ​break hydrogen bonds | |  | e. | ​create hydration layers |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| ​  Figure 2.4 |

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| 56. The water strider shown in the figure above is able to stand on water because of the \_\_\_\_ of water.   |  |  |  | | --- | --- | --- | |  | a. | ​covalent bonds | |  | b. | ​surface tension | |  | c. | ​van der Waals forces | |  | d. | ​density | |  | e. | ​hydration layer |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.4 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 57. When water molecules exposed to the air form hydrogen bonds between adjacent water molecules below and beside them, molecules in the upper layer become more resistant to separating from those underneath.  This property of water is known as \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​cohesion | |  | b. | ​adhesion | |  | c. | ​a hydration layer | |  | d. | ​a water lattice | |  | e. | ​surface tension |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 58. How many calories, as defined in chemistry, are in one calorie, which is the unit used to quantify the amount of energy in the food we eat?​   |  |  |  | | --- | --- | --- | |  | a. | ​10 | |  | b. | ​100 | |  | c. | ​1,000 | |  | d. | ​10,000 | |  | e. | ​100,000 |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 59. Multiple hydrogen bonds together stabilize proteins into a spiral structure called a \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ​water lattice | |  | b. | ​alpha helix | |  | c. | ​chemical groups | |  | d. | ​delta minus | |  | e. | ​delta plus |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Understand | |

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| ​  Figure 2.5 |

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| 60. The water lattice illustrated in the figure above forms as a result of \_\_\_\_ between water molecules.​   |  |  |  | | --- | --- | --- | |  | a. | ​covalent bonds | |  | b. | ​hydrogen bonds | |  | c. | ​nonpolar interactions | |  | d. | ​ionic bonds | |  | e. | ​van der Walls forces |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *PREFACE NAME:* | Figure 2.5 | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 61. Biological membranes are held together mainly by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​hydrogen bonds between lipid molecules | |  | b. | ​hydration layers over lipid molecules | |  | c. | ​exclusion of the nonpolar regions of lipids by water | |  | d. | ​hydrogen bonds between water molecules | |  | e. | ​surface tension at the interface between layers of water molecules |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 62. A \_\_\_\_ is formed when a \_\_\_\_ is dissolved in a \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​solution; solute; solvent | |  | b. | ​solute; solvent; solution | |  | c. | ​solution; solvent; solute | |  | d. | ​solvent; solution; solute | |  | e. | ​solvent; solute; solution |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 63. When sugar dissolves in water, water is acting as a \_\_\_\_ and the sugar molecules are acting as \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​solution; solvents | |  | b. | ​solute; solutions | |  | c. | ​solvent; solutes | |  | d. | ​solute; solvents | |  | e. | ​solvent; solutions |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 64. When salt dissolves in water, the water molecules form \_\_\_\_ around the Na+ and Cl- ions.​   |  |  |  | | --- | --- | --- | |  | a. | ​covalent bonds | |  | b. | ​hydration layers | |  | c. | ​nonpolar interactions | |  | d. | ​membranes | |  | e. | ​ionic bonds |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 65. Water has a molecular weight of 18 g per mole, and glucose has a molecular weight of 180 g per mole. Which masses of water and glucose would have an approximately equal number of molecules?​   |  |  |  | | --- | --- | --- | |  | a. | ​1 g of water and 180 g of glucose | |  | b. | ​90 g of water and 9 g of glucose | |  | c. | ​180 g of water and 1 g of glucose | |  | d. | ​9 g of water and 90 g of glucose | |  | e. | ​90 g of water and 90 g of glucose |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 66. Avogadro's number represents the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​number of grams in a mole of substance | |  | b. | ​number of moles in a gram of substance | |  | c. | ​number of atoms in one gram of substance | |  | d. | ​atomic weight of an atom divided by the weight of an atom of that element | |  | e. | ​weight of an atom of an element divided by the atomic weight of that element |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 67. Ethanol, the alcohol found in wine and beer, has the molecular formula CH3CH2OH. What is the molecular weight of ethanol if the atomic weight of C=12, H=1 and O=16?​   |  |  |  | | --- | --- | --- | |  | a. | ​29 g/mol | |  | b. | ​30 g/mol | |  | c. | ​34 g/mol | |  | d. | ​45 g/mol | |  | e. | ​46 g/mol |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 68. The most common isotope of carbon has an atomic number of 6 and a mass number of 12, while the most common isotope of oxygen has an atomic number of 8 and a mass number of 16. A molecule of CO2 made up of these common isotopes has a molecular weight of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​28 | |  | b. | ​44 | |  | c. | ​56 | |  | d. | ​14 | |  | e. | 22​ |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Analyze | |

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| 69. When added to water, a base will act as a(n) \_\_\_\_ and cause the pH of the solution to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​proton acceptor; rise | |  | b. | ​proton donor; rise | |  | c. | ​proton acceptor; fall | |  | d. | ​proton donor; fall | |  | e. | ​acid; fall |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.1 - Compare acids and bases. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 70. When added to water at neutral pH (7.0), an acid will \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​act as a proton donor, raising the pH of the solution | |  | b. | ​act as a proton acceptor, raising the pH of the solution | |  | c. | ​act as a proton donor, lowering the pH of the solution | |  | d. | ​act as a proton acceptor, lowering the pH of the solution | |  | e. | ​do nothing since the aqueous solution is neutral |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.1 - Compare acids and bases. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 71. In water, NaOH almost completely separates into Na+ and OH- ions. Thus, NaOH is \_\_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​a strong acid | |  | b. | ​a strong base | |  | c. | ​a weak acid | |  | d. | ​a weak base | |  | e. | ​neutral |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.1 - Compare acids and bases. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 72. Seawater typically is \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​highly basic | |  | b. | ​neutral | |  | c. | ​somewhat basic | |  | d. | ​somewhat acidic | |  | e. | ​highly basic |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.1 - Compare acids and bases. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 73. A pH of 6 is \_\_\_\_ times more \_\_\_\_ than a pH of 2.​   |  |  |  | | --- | --- | --- | |  | a. | ​3; acidic | |  | b. | ​4; acidic | |  | c. | ​3; basic | |  | d. | ​10,000; basic | |  | e. | ​40; basic |  |  |  | | --- | --- | | *ANSWER:* | d | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.2 - Describe the pH scale. | | *KEYWORDS:* | Bloom’s: Apply | |

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| 74. Pure water has a pH of 7.0, therefore, \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​[H+] < [OH-] | |  | b. | ​[H+] = [OH-] | |  | c. | ​[H+] = 0 | |  | d. | ​[OH-] = 0 | |  | e. | ​[H+] > [OH-] |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.2 - Describe the pH scale. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 75. Lemon juice has a pH of 2.0, therefore, \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​[H+] < [OH-] | |  | b. | ​[H+] = [OH-] | |  | c. | ​[H+] = 0 | |  | d. | ​[OH-] = 0 | |  | e. | ​[H+] > [OH-] |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.2 - Describe the pH scale. | | *KEYWORDS:* | Bloom’s: Understand | |

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| 76. Solution A has a pH of 6 and solution B has a pH of 8. Therefore, \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​A has 10 times greater H+ concentration than B. | |  | b. | ​B has 10 times greater H+ concentration than A. | |  | c. | ​A has 100 times greater H+ concentration than B. | |  | d. | ​B has 100 times greater H+ concentration than A. | |  | e. | ​A has 1,000 times greater H+ concentration than B. |  |  |  | | --- | --- | | *ANSWER:* | c | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.2 - Describe the pH scale. | |

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| 77. Without \_\_\_\_, living organisms would often experience major changes in pH in their cells.​   |  |  |  | | --- | --- | --- | |  | a. | ​buffers | |  | b. | ​acids | |  | c. | ​surface tension | |  | d. | ​nonpolar bonds | |  | e. | ​bases |  |  |  | | --- | --- | | *ANSWER:* | a | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.3 - Discuss the role of buffers in biological systems. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 78. Most pH buffers are \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​strong acids | |  | b. | ​weak acids or weak bases | |  | c. | ​weak acids | |  | d. | ​strong bases | |  | e. | ​strong acids or strong bases |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.3 - Discuss the role of buffers in biological systems. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 79. Consider the equilibrium established in the carbonic acid-bicarbonate buffer system, which maintains pH balance in mammalian blood:            H2CO3 → HCO3- + H+  During hypoventilation, breathing rate decreases, and therefore elimination of CO2 during exhalation decreases. How is optimal blood pH maintained when acid levels increase in our blood from hypoventilating?​   |  |  |  | | --- | --- | --- | |  | a. | ​excess H+ from the acid react with H2CO3 to decrease pH level | |  | b. | ​excess H+ from the acid react with H2CO3 to increase pH level | |  | c. | ​excess H+ from the acid react with H2CO3 to maintain pH level | |  | d. | ​excess H+ from the acid react with HCO3- to increase pH level | |  | e. | ​excess H+ from the acid react with HCO3- to maintain pH level |  |  |  | | --- | --- | | *ANSWER:* | e | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.3 - Discuss the role of buffers in biological systems. | | *KEYWORDS:* | Bloom’s: Evaluate | |

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| 80. High levels of carbon dioxide in the atmosphere are causing \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​the pH of the ocean to increase | |  | b. | ​the pH of the ocean to decrease | |  | c. | ​the natural buffers in the ocean to die | |  | d. | ​increased calcification of the coral reefs | |  | e. | ​increased biodiversity in coral reefs |  |  |  | | --- | --- | | *ANSWER:* | b | | *REFERENCES:* | 2.5 Water Ionization and Acids, Bases, and Buffers | | *QUESTION TYPE:* | Multiple Choice | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.5.3 - Discuss the role of buffers in biological systems. | | *KEYWORDS:* | Bloom’s: Remember | |

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| **Matching** |

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| Match each of the following terms with its correct definition.​   |  |  | | --- | --- | | a. | ​Anything that occupies space and has mass | | b. | ​A pure substance that cannot be broken down into simpler substances by ordinary chemical or physical techniques | | c. | ​An atom with the same number of protons as another atom but a different number of neutrons | | d. | ​The locations around an atomic nucleus where an electron occurs most frequently | | e. | ​A molecule whose component atoms are different from each other |  |  |  | | --- | --- | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms 2.3 Chemical Bonds and Chemical Reactions 2.2 Atomic Structure | | *QUESTION TYPE:* | Matching | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.2 - Describe atoms, molecules, elements, and compounds. DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. DYNS.RUSS.17.2.2.2 - Illustrate the arrangement of electrons around an atomic nucleus. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 81. ​element   |  |  | | --- | --- | | *ANSWER:* | b | |

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| 82. ​compound   |  |  | | --- | --- | | *ANSWER:* | e | |

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| --- | --- | --- |
| 83. ​matter   |  |  | | --- | --- | | *ANSWER:* | a | |

|  |  |  |
| --- | --- | --- |
| 84. ​orbital   |  |  | | --- | --- | | *ANSWER:* | d | |

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| --- | --- | --- |
| 85. ​isotope   |  |  | | --- | --- | | *ANSWER:* | c | |

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| For each of the following situations, choose the correct type of chemical bond. Some choices may be used more than once.​   |  |  | | --- | --- | | a. | ​ionic bonds | | b. | ​nonpolar covalent bonds | | c. | ​polar covalent bonds | | d. | ​hydrogen bonds | | e. | ​van der Waals forces |  |  |  | | --- | --- | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Matching | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.1 - Compare ionic, covalent, and hydrogen bonds. DYNS.RUSS.17.02.3.2 - Discuss polar and nonpolar bonds and molecular associations. DYNS.RUSS.17.02.3.3 - Describe van der Waals forces. DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | | *KEYWORDS:* | Bloom’s: Evaluate | |

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| 86. ​Occurs in sodium chloride (NaCl)   |  |  | | --- | --- | | *ANSWER:* | a | |

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| 87. ​The weakest of the chemical linkages listed   |  |  | | --- | --- | | *ANSWER:* | e | |

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| 88. ​Generates regions of partial positivity and partial negativity within a molecule   |  |  | | --- | --- | | *ANSWER:* | c | |

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| 89. Characteristic of molecules that contain atoms of only one kind​   |  |  | | --- | --- | | *ANSWER:* | b | |

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| 90. ​Forms when atoms gain or lose valence electrons completely   |  |  | | --- | --- | | *ANSWER:* | a | |

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| 91. ​Attraction that arises when the constant movement of electrons, by chance, produces temporary zones of partial positive and partial negative charges   |  |  | | --- | --- | | *ANSWER:* | e | |

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| 92. ​Occurs when electrons are shared unequally between two atoms   |  |  | | --- | --- | | *ANSWER:* | c | |

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| 93. ​Creates a region that is hydrophobic   |  |  | | --- | --- | | *ANSWER:* | b | |

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| 94. ​Occurs between water molecules   |  |  | | --- | --- | | *ANSWER:* | d | |

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| 95. ​Occurs in molecular oxygen (O2)   |  |  | | --- | --- | | *ANSWER:* | b | |

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| **Subjective Short Answer** |

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| 96. Why is iodine considered a trace element and what is its biological function in humans?   |  |  | | --- | --- | | *ANSWER:* | Iodine is 0.0004% of a human’s weight, compared to elements that occur at quantities greater than 0.01%. Iodine is required for proper thyroid gland function. Lack of iodine affects metabolism and growth. In the short-term iodine deficiency results in lethargy, apathy and sensitivity to cold temperatures, in the long-term, iodine deficiency causes a goiter. | | *REFERENCES:* | 2.1 The Organization of Matter: Elements and Atoms | | *QUESTION TYPE:* | Subjective Short Answer | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.1.1 - Describe the elemental composition of living organisms. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 97. Explain how radiometric dating allows scientists to determine the age of a particular fossil.   |  |  | | --- | --- | | *ANSWER:* | Radioactive isotopes decay in a very predictable way. By knowing the approximate concentration of a radioisotope that is naturally present, and determining the concentration of the radioisotope in the fossil, you can calculate the length of time that it took for the radioactive isotope to decay to the level in the fossil. | | *REFERENCES:* | 2.2 Atomic Structure | | *QUESTION TYPE:* | Subjective Short Answer | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.2.1 - Summarize the constitution and properties of atoms and their isotopes. | | *KEYWORDS:* | Bloom’s: Evaluate | |

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| 98. If van der Waals forces are weak, how can geckos utilize these forces to cling to and walk up vertical smooth surfaces?   |  |  | | --- | --- | | *ANSWER:* | The toes of geckos are covered by millions of hairs (setae). At the tip of each setae are hundreds of thousands of pads, where each pad forms a weak interaction with a smooth surface due to van der Waal forces. Collectively, these forces form strong attractive forces. | | *REFERENCES:* | 2.3 Chemical Bonds and Chemical Reactions | | *QUESTION TYPE:* | Subjective Short Answer | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.3.3 - Describe van der Waals forces. | | *KEYWORDS:* | Bloom’s: Remember | |

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| 99. Describe the difference between cohesion and adhesion, and how they, together, allow water to move upward in plants.   |  |  | | --- | --- | | *ANSWER:* | Cohesion is the resistance of a molecules to separate from each other, where adhesion is the ability of molecules to stick to surfaces. Cohesion in water is the resistance to separate due to the hydrogen-bond lattice. Adhesion in water is the ability of hydrogen bonds to form with charged and polar groups associated with surfaces. A water column in a plant is a result of cohesion – water molecules being held together – and maintained by water adhering to the walls of the water conducting tissue (xylem). | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Subjective Short Answer | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.1 - Discuss the role of the hydrogen bond lattice in determining the properties of water. | |

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| 100. The pH of your stomach is between 1 and 3. Use your knowledge of polar and nonpolar substances to explain why the acids in your stomach do not alter the pH of your blood.   |  |  | | --- | --- | | *ANSWER:* | Cells are comprised of a lipid bilayer that excludes hydrophillic substances, including acids. The cells lining the inside of the stomach prevent the acid from moving across the cell membrane into the blood stream. | | *REFERENCES:* | 2.4 Hydrogen Bonds and the Properties of Water | | *QUESTION TYPE:* | Subjective Short Answer | | *LEARNING OBJECTIVES:* | DYNS.RUSS.17.02.4.2 - Discuss how molecular polarity contributes to the properties of water. | | *KEYWORDS:* | Bloom’s: Apply | |