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| 1. Order the intermolecular forces (dipole-dipole, London dispersion, ionic, and hydrogen-bonding) from weakest to strongest .   |  |  |  | | --- | --- | --- | |  | a. | dipole-dipole, London dispersion, ionic, and hydrogen-bonding | |  | b. | London dispersion, dipole-dipole, hydrogen-bonding, and ionic | |  | c. | hydrogen-bonding, dipole-dipole, London dispersion, and ionic | |  | d. | dipole-dipole, ionic, London dispersion, and hydrogen-bonding | |  | e. | London dispersion, ionic, dipole-dipole, and hydrogen-bonding |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 2. Hydrogen bonds account for which of the following observation?   |  |  |  | | --- | --- | --- | |  | a. | Hydrogen naturally exists as a diatomic molecule. | |  | b. | Hydrogen is easily combustible with oxygen. | |  | c. | Water molecules are bent or "V-shaped." | |  | d. | Air is more dense than hydrogen gas. | |  | e. | For its molar mass, water has a high boiling point. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonds | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 3. Which of the following would you expect to have the highest boiling point?   |  |  |  | | --- | --- | --- | |  | a. | F2 | |  | b. | Cl2 | |  | c. | Br2 | |  | d. | I2 | |  | e. | All of the above have the same boiling point. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 4. Which of the following should have the lowest boiling point?   |  |  |  | | --- | --- | --- | |  | a. | Na2S | |  | b. | HF | |  | c. | NH3 | |  | d. | N2 | |  | e. | H2O |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 5. Which of the species below would you expect to show the least hydrogen bonding?   |  |  |  | | --- | --- | --- | |  | a. | NH3 | |  | b. | H2O | |  | c. | HF | |  | d. | CH4 | |  | e. | all the same |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonds | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 6. The molecules in a sample of solid SO2 are attracted to each other by a combination of   |  |  |  | | --- | --- | --- | |  | a. | London forces and H-bonding | |  | b. | H-bonding and ionic bonding | |  | c. | covalent bonding and dipole-dipole interactions | |  | d. | London forces and dipole-dipole interactions | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 7. In which of the following groups of substances would dispersion forces be the only *significant* factors in determining boiling points?   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | I. | Cl2 | II. | HF | III. | Ne | IV. | KNO2 | V. | CCl4 |  |  |  |  | | --- | --- | --- | |  | a. | I, III, V | |  | b. | I, II, III | |  | c. | II, IV | |  | d. | II, V | |  | e. | III, IV, V |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | London forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 8. The elements of group 5A, the nitrogen family, form compounds with hydrogen having the boiling points listed below:           SbH3 –17°C,  AsH3 –55°C,  PH3 –87°C,  NH3 –33°C The first three compounds illustrate a trend where the boiling point decreases as the mass decreases; however, ammonia (NH3) does not follow the trend because of   |  |  |  | | --- | --- | --- | |  | a. | dipole-dipole attraction | |  | b. | metallic bonding | |  | c. | hydrogen bonding | |  | d. | London dispersion forces | |  | e. | ionic bonding |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 9. Which substance involves no bonding forces except London dispersion forces?   |  |  |  | | --- | --- | --- | |  | a. | NaCl(*l*) | |  | b. | HF(*l*) | |  | c. | N2(*s*) | |  | d. | H2O(*l*) | |  | e. | K(*s*) |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | London forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 10. In general, the density of a compound as a gas is closer in value to that of the compound as a liquid than the density of the compound as a liquid is in value to that of the compound as a solid.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 11. Second row hydrides generally have higher than expected boiling points for their position on the periodic table.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 12. The bonds between hydrogen and oxygen within a water molecule can be characterized as \_\_\_\_\_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | hydrogen bonds | |  | b. | London dispersion forces | |  | c. | intermolecular forces | |  | d. | intramolecular forces | |  | e. | dispersion forces |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonds | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 13. When a water molecule forms a hydrogen bond with another water molecule, which atoms are involved in the interaction?   |  |  |  | | --- | --- | --- | |  | a. | a hydrogen from one molecule and a hydrogen from the other molecule | |  | b. | a hydrogen from one molecule and an oxygen from the other molecule | |  | c. | an oxygen from one molecule and an oxygen from the other molecule | |  | d. | an oxygen and a hydrogen from the same molecule | |  | e. | two hydrogens from one molecule and one hydrogen from the other molecule |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonding | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 14. Which of the following is the correct order of boiling points for KNO3, CH3OH, C2H6, Ne?   |  |  |  | | --- | --- | --- | |  | a. | Ne < CH3OH < C2H6 < KNO3 | |  | b. | KNO3 < CH3OH < C2H6 < Ne | |  | c. | Ne < C2H6 < KNO3 < CH3OH | |  | d. | Ne < C2H6 < CH3OH < KNO3 | |  | e. | C2H6 < Ne < CH3OH < KNO3 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| Consider the representations below to answer the next three questions. (I)  (II)  (III) |

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| 15. How many of the following statements are correct concerning drawing I?   |  |  | | --- | --- | | I. | Each molecule induces a dipole onto the next molecule in close proximity. | | II. | The phenomenon shown is relatively weak and short-lived. | | III. | C8H18 contains this type of interaction. | | IV. | The forces that exist in this example are London dispersion forces. |  |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 10-2 | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | London forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 16. Which drawing *best* represents the interactions in a sample of HF?   |  |  |  | | --- | --- | --- | |  | a. | I | |  | b. | II | |  | c. | III | |  | d. | I, II | |  | e. | all of the above |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 10-2 | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonding | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 17. Which of the following statements are incorrect concerning drawing III?   |  |  |  | | --- | --- | --- | |  | a. | Electrostatic interactions exist between the molecules. | |  | b. | The molecules find the best compromise between attraction and repulsion. | |  | c. | These molecules exhibit ionic bonding. | |  | d. | OCS exhibits this type of interaction. | |  | e. | Two of the above statements are incorrect. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 10-2 | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 18. The freezing point of helium is –270°C. The freezing point of xenon is –112°C. Both of these are in the noble gas family. Which of the following statements is supported by these data?   |  |  |  | | --- | --- | --- | |  | a. | Helium and xenon form highly polar molecules. | |  | b. | As the molecular weight of the noble gas increases, the freezing point decreases. | |  | c. | The London dispersion forces between the helium molecules are greater than the London dispersion between the xenon molecules. | |  | d. | The London dispersion forces between the helium molecules are less than the London dispersion forces between the xenon molecules. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 19. Which best explains the following trend?   |  |  | | --- | --- | | Element | b.p. (K) | | He | 4 | | Ne | 25 | | Ar | 95 | | Kr | 125 | | Xe | 170 |  |  |  |  | | --- | --- | --- | |  | a. | London dispersion forces | |  | b. | dipole-dipole interaction | |  | c. | hydrogen bonding | |  | d. | Le Chatelier's principle | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | London forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 20. Intermolecular forces are weaker than intramolecular bonds.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 21. Hydrogen bonding is a type of London dispersion force.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonding | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 22. Methane (CH4) exhibits stronger hydrogen bond interactions than ammonia (NH3).   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonding | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 23. Which of the following compounds has the lowest viscosity?   |  |  |  | | --- | --- | --- | |  | a. | CCl4(*l*) | |  | b. | N2(*g*) | |  | c. | H2O(*l*) | |  | d. | CH3-(CH2)25-CH3(*l*) | |  | e. | HCl(*g*) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | viscosity | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 24. Which of the following statements about liquids is true?   |  |  |  | | --- | --- | --- | |  | a. | Droplet formation occurs because of the higher stability associated with increased surface area. | |  | b. | Substances that can form hydrogen bonds will display lower melting points than predicted from periodic trends. | |  | c. | London dispersion forces arise from a distortion of the electron clouds within a molecule or atom. | |  | d. | Liquid rise within a capillary tube because of the small size lowers the effective atmospheric pressure over the surface of the liquid. | |  | e. | The boiling point of a solution is dependent solely on the atmospheric pressure over the solution. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 25. What is responsible for capillary action, a property of liquids?   |  |  |  | | --- | --- | --- | |  | a. | surface tension | |  | b. | cohesive forces | |  | c. | adhesive forces | |  | d. | viscosity | |  | e. | two of these |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 26. When a nonpolar liquid displays a convex meniscus, which of the following explains this behavior?   |  |  |  | | --- | --- | --- | |  | a. | It has a low surface tension, and therefore clings to the glass. | |  | b. | The cohesive forces are stronger than the adhesive forces to the glass. | |  | c. | The adhesive forces to the glass are stronger than the cohesive forces. | |  | d. | The liquid's viscosity is low. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 27. Liquids with large intermolecular forces tend to have high surface tension.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | surface tension | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 28. The unit cell in this two-dimensional crystal contains \_\_\_\_\_\_\_\_\_\_ Xs and \_\_\_\_\_\_\_\_\_\_ Os.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | X |  | X |  | X |  | X |  | |  | O |  | O |  | O |  | O | | X |  | X |  | X |  | X |  | |  | O |  | O |  | O |  | O | | X |  | X |  | X |  | X |  | |  | O |  | O |  | O |  | O |  |  |  |  | | --- | --- | --- | |  | a. | 1,1 | |  | b. | 2,1 | |  | c. | 1,2 | |  | d. | 4,1 | |  | e. | 1,4 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystal lattice | crystalline solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/3/2017 4:14 AM | |

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| 29. Which of the following is paired incorrectly?   |  |  |  | | --- | --- | --- | |  | a. | crystalline solids—highly regular arrangement of their components | |  | b. | amorphous solids—considerable disorder in their structures | |  | c. | unit cell—the smallest repeating unit of the lattice | |  | d. | gold metal—simple cubic unit cell | |  | e. | glass—amorphous solid |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 30. Table salt and table sugar are both crystalline solids.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 31. Atomic solids generally have low melting points.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 32. A crystal was analyzed with x-rays having 1.50 Å wavelength. A reflection was produced at θ = 23.1°. Assuming *n* = 1, what is the distance between the layers of atoms in the crystal?   |  |  |  | | --- | --- | --- | |  | a. | 7.65 Å | |  | b. | 3.82 Å | |  | c. | 0.523 Å | |  | d. | 0.815 Å | |  | e. | 1.91 Å |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | x-ray diffraction | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 33. A crystal was analyzed with x-rays having 2.54 Å wavelength. The angle of first-order diffraction (*n* = 1) was 18.6°. What would be the angle for second-order diffraction (*n* = 2)?   |  |  |  | | --- | --- | --- | |  | a. | 37.2 Å | |  | b. | 39.6 Å | |  | c. | 9.18 Å | |  | d. | 15.9 Å | |  | e. | 4.57 Å |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | x-ray diffraction | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| The molar volume of a certain form of solid lead is 18 cm3/mol. Assuming cubic closest packed structure, determine the following: |

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| 34. The number of Pb atoms per unit cell.   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 4 | |  | d. | 6 | |  | e. | 10 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 10-1 | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 35. The volume of a single cell.   |  |  |  | | --- | --- | --- | |  | a. | 1.20 × 102 pm3 | |  | b. | 1.20 × 104 pm3 | |  | c. | 1.20 × 106 pm3 | |  | d. | 1.20 × 108 pm3 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 10-1 | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 36. The radius of a Pb atom.   |  |  |  | | --- | --- | --- | |  | a. | 1.74 pm | |  | b. | 17.4 pm | |  | c. | 174 pm | |  | d. | 1740 pm | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 10-1 | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 37. Cubic closest packing is another name for \_\_\_\_\_\_\_\_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | simple cubic packing | |  | b. | body-centered cubic packing | |  | c. | face-centered cubic packing | |  | d. | hexagonal closest packing | |  | e. | more than one of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 38. Which one of the following statements about solid Cu (face-centered cubic unit cell) is incorrect?   |  |  |  | | --- | --- | --- | |  | a. | It will conduct electricity. | |  | b. | There are two atoms per unit cell. | |  | c. | The number of atoms surrounding each Cu atom is 12. | |  | d. | The solid has a cubic closest-packed structure. | |  | e. | The length of a face diagonal is four times the Cu radius. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 39. In any cubic lattice an atom lying on an edge of a unit cell is shared equally by how many unit cells?   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 1 | |  | c. | 4 | |  | d. | 8 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 40. Which of the following statements is (are) *false?*   |  |  | | --- | --- | | I. | The layering in a hexagonal closest-packed structure is *aba*. | | II. | A body-centered cubic unit cell has four atoms per unit cell. | | III. | For unit cells having the same edge length, a simple cubic structure would have a smaller density than a body-centered cube. | | IV. | Atoms in a solid consisting of only one element would have six nearest neighbors if the crystal structure were a simple cubic array. |  |  |  |  | | --- | --- | --- | |  | a. | I | |  | b. | II | |  | c. | II, III | |  | d. | I, IV | |  | e. | II, III, IV |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 41. Aluminum metal crystallizes in a face-centered cubic structure. The relationship between the radius of an Al atom (*r*) and the length of an edge of the unit cell (*E*) is:   |  |  |  | | --- | --- | --- | |  | a. | *r* = *E*/2 | |  | b. |  | |  | c. |  | |  | d. | *r* = 2*E* | |  | e. |  |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 42. Chromium metal crystallizes as a body-centered cubic lattice. If the atomic radius of Cr is 1.25 angstroms, what is the density of Cr metal in g/cm3?   |  |  |  | | --- | --- | --- | |  | a. | 5.52 | |  | b. | 7.18 | |  | c. | 14.4 | |  | d. | 2.76 | |  | e. | 3.59 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 43. You are given a small bar of an unknown metal, M. You find the density of the metal to be 10.5 g/cm3. An X-ray diffraction experiment measures the edge of the unit cell as 409 pm. Assuming that the metal crystallizes in a face-centered cubic lattice, what is M most likely to be?   |  |  |  | | --- | --- | --- | |  | a. | Ag | |  | b. | Rh | |  | c. | Pt | |  | d. | Pb | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 44. Silver chloride crystallizes with the sodium chloride (rock salt) structure. The length of a unit cell edge is 555 pm. What is the density of AgCl?   |  |  |  | | --- | --- | --- | |  | a. | 5.57 g/cm3 | |  | b. | 4.19 g/cm3 | |  | c. | 2.79 g/cm3 | |  | d. | 2.10 g/cm3 | |  | e. | 1.39 g/cm3 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 45. A metal crystallizes in a body-centered unit cell with an edge length of 2.00 × 102 pm. Assume the atoms in the cell touch along the cube diagonal. The percentage of empty volume in the unit cell will be:   |  |  |  | | --- | --- | --- | |  | a. | 0% | |  | b. | 26.0% | |  | c. | 32.0% | |  | d. | 68.0% | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 46. A metal crystallizes with a face-centered cubic lattice. The edge of the unit cell is 417 pm. The diameter of the metal atom is:   |  |  |  | | --- | --- | --- | |  | a. | 147 pm | |  | b. | 209 pm | |  | c. | 295 pm | |  | d. | 417 pm | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 47. If equal, rigid spheres are arranged in a simple cubic lattice in the usual way (i.e., in such a way that they touch each other), what fraction of the corresponding solid will be empty space? [The volume of a sphere is (4/3)π*r*3, with π = 3.14.]   |  |  |  | | --- | --- | --- | |  | a. | 0.52 | |  | b. | 0.32 | |  | c. | 0.68 | |  | d. | 0.48 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 48. Which substance can be described as cations bonded together by mobile electrons?   |  |  |  | | --- | --- | --- | |  | a. | Ag(*s*) | |  | b. | S8(*s*) | |  | c. | Kr(*l*) | |  | d. | KCl(*s*) | |  | e. | HCl(*l*) |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 49. Steel is considered to be a(n) \_\_\_\_\_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | interstitial alloy | |  | b. | ionic solid | |  | c. | molecular solid | |  | d. | substitutional alloy | |  | e. | two of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 50. Which of the following statements about steel is *false?*   |  |  |  | | --- | --- | --- | |  | a. | It contains carbon atoms in the holes of its iron crystals. | |  | b. | The presence of carbon-iron bonds in the alloy make steel harder and stronger than pure iron. | |  | c. | Pure iron is relatively soft and ductile because it lacks directional bonding. | |  | d. | The amount of carbon directly affects the properties of steel. | |  | e. | All of these are true. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 51. What is the *simplest* formula of a solid containing A, B, and C atoms in a cubic lattice in which the A atoms occupy the corners, the B atoms the body-center position, and the C atoms the faces of the unit cell?   |  |  |  | | --- | --- | --- | |  | a. | ABC | |  | b. | ABC3 | |  | c. | ABC6 | |  | d. | A8BC6 | |  | e. | A4BC3 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 52. A solid material consists of an array of A atoms with Z atoms located in the spaces in the lattice. This solid would be classified as   |  |  |  | | --- | --- | --- | |  | a. | an amalgam | |  | b. | an interstitial alloy | |  | c. | a substitutional alloy | |  | d. | a semiconductor | |  | e. | ceramic |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 53. The net number of spheres in the face-centered cubic unit cell is 4.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 54. Steel is a substitutional alloy.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 55. Which of the following statements is true about *p*-type silicon?   |  |  |  | | --- | --- | --- | |  | a. | It is produced by doping Si with P or As. | |  | b. | Protons are the mobile charge carriers. | |  | c. | It does not conduct electricity as well as pure Si. | |  | d. | All are true. | |  | e. | None is true. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | semiconductor | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 56. Doping Se with B would produce a(n) \_\_\_\_\_\_\_\_\_\_ semiconductor with \_\_\_\_\_\_\_\_\_\_ conductivity compared to pure Se.   |  |  |  | | --- | --- | --- | |  | a. | *p*-type, increased | |  | b. | *n*-type, decreased | |  | c. | *n*-type, increased | |  | d. | *p*-type, decreased | |  | e. | intrinsic, identical |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | semiconductor | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 2/9/2017 11:57 PM | |

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| 57. A material is made from Al, Ga, and As. The mole fraction of each element is 0.25, 0.26, and 0.49, respectively. This material would be   |  |  |  | | --- | --- | --- | |  | a. | a metallic conductor because Al is present | |  | b. | an insulator | |  | c. | a *p*-type semiconductor | |  | d. | an *n*-type semiconductor | |  | e. | none of the above |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | semiconductor | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 58. Which of the compounds below is an example of a network solid?   |  |  |  | | --- | --- | --- | |  | a. | S8(*s*) | |  | b. | SiO2(*s*) | |  | c. | MgO(*s*) | |  | d. | NaCl(*s*) | |  | e. | C25H52(*s*) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | covalent network solid | general chemistry | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 59. Which of the compounds below is *not* an example of a molecular solid?   |  |  |  | | --- | --- | --- | |  | a. | I2(*s*) | |  | b. | SiO2(*s*) | |  | c. | CO2(*s*) | |  | d. | H2O(*s*) | |  | e. | C25H52(*s*) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | molecular solid | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 60. Ice is a molecular solid.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.6 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | molecular solid | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 61. Which of these statements is incorrect?   |  |  |  | | --- | --- | --- | |  | a. | Molecular solids have high melting points. | |  | b. | The binding forces in a molecular solid include London dispersion forces. | |  | c. | Ionic solids have high melting points. | |  | d. | Ionic solids are insulators. | |  | e. | All of the statements (A-D) are correct. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 62. At room temperature, CsF is expected to be   |  |  |  | | --- | --- | --- | |  | a. | a gas | |  | b. | a conducting solid | |  | c. | a liquid | |  | d. | a brittle solid | |  | e. | a soft solid |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | properties of solids | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 63. A solid crystal of NaCl is   |  |  |  | | --- | --- | --- | |  | a. | soft, low melting, a good electrical conductor | |  | b. | hard, high melting, a good electrical conductor | |  | c. | soft, low melting, a poor electrical conductor | |  | d. | hard, high melting, a poor electrical conductor | |  | e. | soft, high melting, a poor electrical conductor |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | properties of solids | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 64. Solid MgO has the same crystal structure as NaCl. How many oxide ions surround each Mg2+ ion as nearest neighbors in MgO?   |  |  |  | | --- | --- | --- | |  | a. | 4 | |  | b. | 6 | |  | c. | 8 | |  | d. | 12 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | ionic solid | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 65. Which of the following has the highest melting temperature?   |  |  |  | | --- | --- | --- | |  | a. | H2O | |  | b. | CO2 | |  | c. | S8 | |  | d. | MgF2 | |  | e. | P4 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | melting point | phases | properties of solids | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 66. A certain solid substance that is very hard, has a high melting point, and is nonconducting unless melted is most likely to be:   |  |  |  | | --- | --- | --- | |  | a. | I2 | |  | b. | NaCl | |  | c. | CO2 | |  | d. | H2O | |  | e. | Cu |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 67. Which of these statements is false?   |  |  |  | | --- | --- | --- | |  | a. | Diamond is a covalent crystal. | |  | b. | The size of the unit cell of Li and Cs is the same. | |  | c. | Molecular crystals usually have low melting points. | |  | d. | Metallic crystals are usually good electrical conductors. | |  | e. | None of the statements is false. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 68. An ionic crystalline solid, MX2, has a cubic unit cell. Which of the following arrangements of the ions is consistent with the stoichiometry of the compound?   |  |  |  | | --- | --- | --- | |  | a. | M2+ ions at the corners and at each face, 8 X– ions at the tetrahedral centers | |  | b. | M2+ ions at each face, X– ions at the corners | |  | c. | M2+ ions at the corners, X– ions at the faces, and 2 X– ions at the tetrahedralcenters | |  | d. | 4 M2+ ions at the body centers, X– ions at the corners and at the faces | |  | e. | M2+ ions at the corners and at the faces, 4 X– ions at the octahedral centers |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | ionic solid | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 69. Lithium chloride crystallizes in a face-centered cubic structure. The unit cell length is 5.14 × 10–8 cm. The chloride ions are touching each other along the face diagonal of the unit cell. The lithium ions fit into the holes between the chloride ions. What is the mass of LiCl in a unit cell?   |  |  |  | | --- | --- | --- | |  | a. | 7.04 × 10–23 g | |  | b. | 1.41 × 10–22 g | |  | c. | 2.82 × 10–22 g | |  | d. | 4.22 × 10–22 g | |  | e. | 5.63 × 10–22 g |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | ionic solid | phases | solid | structures of crystalline solids | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 2/10/2017 1:21 AM | |

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| 70. How would you expect the melting point of CCl4 to compare to that of NaCl?   |  |  |  | | --- | --- | --- | |  | a. | It should be lower because NaCl forms an extended ionic crystal lattice, whereas CCl4 is a covalently-bonded small molecule. | |  | b. | It should be similar since they are both ionic solids. | |  | c. | It should be higher because the bonds are stronger due to the higher charge on C (+4). | |  | d. | It should be higher because CCl4 is larger than NaCl. | |  | e. | It is not possible to say anything about their melting points without more information. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | melting point | phases | properties of solids | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 71. In the unit cell of sphalerite, Zn2+ ions occupy half the tetrahedral holes in a face-centered cubic lattice of S2– ions. The number of formula units of ZnS in the unit cell is:   |  |  |  | | --- | --- | --- | |  | a. | 6 | |  | b. | 4 | |  | c. | 3 | |  | d. | 2 | |  | e. | 1 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 72. The unit cell in a certain lattice consists of a cube formed by an anion at each corner, an anion in the center, and a cation at the center of each face. The unit cell contains a net:   |  |  |  | | --- | --- | --- | |  | a. | 5 anions and 6 cations | |  | b. | 5 anions and 3 cations | |  | c. | 2 anions and 3 cations | |  | d. | 3 anions and 4 cations | |  | e. | 2 anions and 2 cations |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | crystalline solids | cubic unit cell | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 73. Which of the following statements about the closest packing of spheres in binary ionic solids is *false*?   |  |  |  | | --- | --- | --- | |  | a. | The packing is done in a way that minimizes repulsions among ions with like charges. | |  | b. | The packing arrangement maximizes electrostatic attractions among oppositely charged ions. | |  | c. | For spheres of a given diameter, tetrahedral holes are larger than octahedral holes. | |  | d. | Trigonal holes are so small that they are never occupied. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 74. An atom in an octahedral hole is surrounded by \_\_\_\_ atoms.   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 6 | |  | e. | 8 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 75. A salt, MY, crystallizes in a body-centered cubic structure with a Y– anion at each cube corner and an M+ cation at the cube center. Assuming that the Y– anions touch each other and the M+ cation at the center, and the radius of Y– is 1.50 × 102 pm, the radius of M+ is:   |  |  |  | | --- | --- | --- | |  | a. | 62.0 pm | |  | b. | 110. pm | |  | c. | 124 pm | |  | d. | 220. pm | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculations with unit cell dimensions | Chemistry | general chemistry | phases | solid | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 76. Sodium oxide (Na2O) crystallizes in a structure in which the O2– ions are in a face-centered cubic lattice and the Na+ ions are in tetrahedral holes. The number of Na+ ions in the unit cell is:   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 4 | |  | c. | 6 | |  | d. | 8 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | ionic solid | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 77. A certain metal fluoride crystallizes in such a way that the fluoride ions occupy simple cubic lattice sites, while the metal atoms occupy the body centers of half the cubes. The formula for the metal fluoride is:   |  |  |  | | --- | --- | --- | |  | a. | MF2 | |  | b. | M2F | |  | c. | MF | |  | d. | MF8 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | ionic solid | phases | solid | structures of crystalline solids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 78. Which of the following is most likely to be a solid at room temperature?   |  |  |  | | --- | --- | --- | |  | a. | Na2S | |  | b. | HF | |  | c. | NH3 | |  | d. | N2 | |  | e. | H2O |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 79. On the basis of your knowledge of bonding in liquids and solids, which of the following has the lowest melting temperature?   |  |  |  | | --- | --- | --- | |  | a. | NaCl | |  | b. | Na | |  | c. | Cl2 | |  | d. | SiO2 | |  | e. | More information is needed. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 80. Which of the following substances would you expect to have the lowest boiling point?   |  |  |  | | --- | --- | --- | |  | a. | diamond | |  | b. | methane, CH4 | |  | c. | sodium nitrate, NaNO3 | |  | d. | glycerine, C3H5(OH)3 | |  | e. | copper |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | classification of solids | general chemistry | phases | solid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 81. On a relative basis, the weaker the intermolecular forces in a substance,   |  |  |  | | --- | --- | --- | |  | a. | the greater its heat of vaporization | |  | b. | the more it deviates from ideal gas behavior | |  | c. | the greater its vapor pressure at a particular temperature | |  | d. | the higher its melting point | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 82. At normal atmospheric pressure and a temperature of 0°C, which phase(s) of H2O can exist?   |  |  |  | | --- | --- | --- | |  | a. | ice and water | |  | b. | ice and water vapor | |  | c. | water only | |  | d. | water vapor only | |  | e. | ice only |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | melting point | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 83. The process of evaporation happens when which of the following occurs?   |  |  |  | | --- | --- | --- | |  | a. | A solid becomes a liquid. | |  | b. | A liquid becomes a solid. | |  | c. | A liquid becomes a gas. | |  | d. | A gas becomes a liquid. | |  | e. | A solid becomes a gas. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 84. Which of the following processes must exist in equilibrium with the evaporation process when a measurement of vapor pressure is made?   |  |  |  | | --- | --- | --- | |  | a. | fusion | |  | b. | vaporization | |  | c. | sublimation | |  | d. | boiling | |  | e. | condensation |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 85. Assume 12,500 J of energy is added to 2.0 moles (36 grams) of H2O as an ice sample at 0°C. The molar heat of fusion is 6.02 kJ/mol. The specific heat of liquid water is 4.18 J/g °C. The molar heat of vaporization is 40.6 kJ/mol. The resulting sample contains which of the following?   |  |  |  | | --- | --- | --- | |  | a. | only ice | |  | b. | ice and water | |  | c. | only water | |  | d. | water and water vapor | |  | e. | only water vapor |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | Clausius-Clapeyron equation | general chemistry | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 86. You are given the following boiling point data. Which one of the liquids would you expect to have the highest vapor pressure at room temperature?   |  |  |  | | --- | --- | --- | |  | a. | water, H2O                                                  100°C | |  | b. | methanol, CH3OH                                   64.96°C | |  | c. | ethanol, CH3CH2OH                                 78.5°C | |  | d. | diethyl ether, CH3CH2–O–CH2CH3 34.5°C | |  | e. | ethylene glycol, HO–CH2–CH2–OH          198°C |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/6/2017 5:55 AM | |

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| 87. Given below are the temperatures at which two different liquid compounds with the same empirical formula have a vapor pressure of 400 torr.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  |  |  | Compound | T (°C) | |  |  |  | dimethyl ether, CH3–O–CH3 | –37.8 | |  |  |  | ethanol, CH3CH2OH | 63.5 | |  |  | Which of the following statements (a–d) is *false*? | |  |  |  |  |  | | --- | --- | --- | |  | a. | Increasing the temperature will increase the vapor pressure of both liquids. | |  | b. | Intermolecular attractive forces are stronger in (liquid) ethanol than in (liquid) dimethyl ether. | |  | c. | The normal boiling point of dimethyl ether will be higher than the normal boiling point of ethanol. | |  | d. | The reason that the temperature at which the vapor pressure is 400 torr is higher for ethanol (than for dimethyl ether) is that there is strong hydrogen bonding in ethanol. | |  | e. | None of these is false. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/3/2017 5:42 AM | |

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| 88. Given the graph below, what is the boiling point of chloroform at standard pressure?   |  |  |  | | --- | --- | --- | |  | a. | 77°C | |  | b. | 34°C | |  | c. | 98°C | |  | d. | 60°C | |  | e. | The graph does not give that information. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 89. A liquid placed in a closed container will evaporate until equilibrium is reached. At equilibrium, which of the statements (A-D) is *false?*   |  |  |  | | --- | --- | --- | |  | a. | The partial pressure exerted by the vapor molecules is called the vapor pressure of the liquid. | |  | b. | Liquid molecules are still evaporating. | |  | c. | The number of vapor molecules remains essentially constant. | |  | d. | The boundary (meniscus) between liquid and vapor disappears. | |  | e. | All of these are true. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 90. Which one of the following decreases as the strength of the attractive intermolecular forces increases?   |  |  |  | | --- | --- | --- | |  | a. | the heat of vaporization | |  | b. | the normal boiling temperature | |  | c. | the extent of deviations from the ideal gas law | |  | d. | the sublimation temperature of a solid | |  | e. | the vapor pressure of a liquid |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 91. Knowing that Δ*H*vap for water is 40.7 kJ/mol, calculate *P*vap of water at 65°C.   |  |  |  | | --- | --- | --- | |  | a. | 3.9 torr | |  | b. | 559 torr | |  | c. | 14.5 torr | |  | d. | 759 torr | |  | e. | 195 torr |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | Clausius-Clapeyron equation | general chemistry | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/3/2017 5:58 AM | |

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| 92. Water sits in an open beaker. Assuming constant temperature and pressure, the rate of evaporation decreases as the water evaporates.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 93. Water sits in an open beaker. Assuming constant temperature and pressure, the vapor pressure of the water decreases as the water evaporates.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 94. Generally the vapor pressure of a liquid is related to:   |  |  | | --- | --- | | I. | the amount of liquid | | II. | atmospheric pressure | | III. | temperature | | IV. | intermolecular forces |  |  |  |  | | --- | --- | --- | |  | a. | I, III | |  | b. | II, III, IV | |  | c. | I, III, IV | |  | d. | III, IV | |  | e. | I, II, III, IV |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 95. In which of the following processes will energy be evolved as heat?   |  |  |  | | --- | --- | --- | |  | a. | sublimation | |  | b. | crystallization | |  | c. | vaporization | |  | d. | melting | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 96. When one mole of benzene is vaporized at a constant pressure of 1.00 atm and at its boiling point of 353.0 K, 30.01 kJ of energy (heat) is absorbed and the volume change is +28.90 L. What is Δ*E* for this process? (1 L·atm = 101.3 J)   |  |  |  | | --- | --- | --- | |  | a. | 30.01 kJ | |  | b. | 58.91 kJ | |  | c. | 32.94 kJ | |  | d. | 1.11 kJ | |  | e. | 27.08 kJ |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | Clausius-Clapeyron equation | general chemistry | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 97. When one mole of benzene is vaporized at a constant pressure of 1.00 atm and at its boiling point of 353.0 K, 30.38 kJ of energy (heat) is absorbed and the volume change is +28.90 L. What is Δ*H* for this process? (1 L·atm = 101.3 J)   |  |  |  | | --- | --- | --- | |  | a. | 27.45 kJ | |  | b. | 33.31 kJ | |  | c. | 1.48 kJ | |  | d. | 30.38 kJ | |  | e. | 59.28 kJ |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | Clausius-Clapeyron equation | general chemistry | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 98. The normal boiling point of liquid X is less than that of Y, which is less than that of Z. Which of the following is the correct order of increasing vapor pressure of the three liquids at STP?   |  |  |  | | --- | --- | --- | |  | a. | X, Y, Z | |  | b. | Z, Y, X | |  | c. | Y, X, Z | |  | d. | X, Z, Y | |  | e. | Y, Z, X |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 99. The vapor pressure of water at 100.0°C is   |  |  |  | | --- | --- | --- | |  | a. | 85 torr | |  | b. | 760 torr | |  | c. | 175 torr | |  | d. | 1 torr | |  | e. | More information is needed. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase | phase transitions | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 100. How much energy is needed to convert 55.4 grams of ice at 0.00°C to water at 75.0°C?      specific heat (ice) = 2.10 J/g°C      specific heat (water) = 4.18 J/g°C      heat of fusion = 333 J/g      heat of vaporization = 2258 J/g   |  |  |  | | --- | --- | --- | |  | a. | 17.4 kJ | |  | b. | 1.99 kJ | |  | c. | 27.2 kJ | |  | d. | 35.8 kJ | |  | e. | 142 kJ |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phase transition enthalpy change | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 101. The vapor pressure of water at 80°C is   |  |  |  | | --- | --- | --- | |  | a. | 0.48 atm | |  | b. | 1.00 atm | |  | c. | 1.20 atm | |  | d. | 2.00 atm | |  | e. | 5.00 atm |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 102. Which of the following has the highest boiling point?   |  |  |  | | --- | --- | --- | |  | a. | chalk (calcium carbonate) | |  | b. | ice (water) | |  | c. | window cleaner (ammonia) | |  | d. | motor oil (hydrocarbon chains) | |  | e. | helium gas inside a party balloon |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 103. How many grams of ice would be melted by the energy obtained as 16.1 g of steam is condensed at 100°C and cooled to 0°C?      specific heat (ice) = 2.10 J/g°C      specific heat (water) = 4.18 J/g°C      heat of fusion = 333 J/g      heat of vaporization = 2258 J/g   |  |  |  | | --- | --- | --- | |  | a. | 43.1 kg | |  | b. | 36.4 kg | |  | c. | 129 g | |  | d. | 6.73 kg | |  | e. | 20 g |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phase transition enthalpy change | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 104. The heat of combustion of bituminous coal is 2.50 × 104 J/g. What quantity of the coal is required to produce the energy to convert 118.9 pounds of ice at 0.00°C to steam at 100.°C?       specific heat (ice) = 2.10 J/g°C       specific heat (water) = 4.18 J/g°C       heat of fusion = 333 J/g       heat of vaporization = 2258 J/g   |  |  |  | | --- | --- | --- | |  | a. | 6.49 kg | |  | b. | 0.718 kg | |  | c. | 0.90 kg | |  | d. | 4.87 kg | |  | e. | 1.62 kg |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phase transition enthalpy change | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/3/2017 6:24 AM | |

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| 105. The process of changing from a vapor to a liquid is vaporization.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 106. A certain substance, *X*, has a triple-point temperature of 20°C at a pressure of 2.0 atm. Which one of the statements (A-D) cannot possibly be true?   |  |  |  | | --- | --- | --- | |  | a. | *X* can exist as a liquid above 20°C. | |  | b. | *X* can exist as a solid above 20°C. | |  | c. | Liquid *X* can exist as a stable phase at 25°C, 1 atm. | |  | d. | Both liquid and solid *X* have the same vapor pressure at 20°C. | |  | e. | All of the statements (A-D) could be true. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | triple point | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 107. Which statement regarding water is true?   |  |  |  | | --- | --- | --- | |  | a. | Energy must be given off in order to break down the crystal lattice of ice to a liquid. | |  | b. | Hydrogen bonds are stronger than covalent bonds. | |  | c. | Liquid water is less dense than solid water. | |  | d. | Only covalent bonds are broken when ice melts. | |  | e. | All of the statements (A–D) are false. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 108. The triple point of iodine is at 90 torr and 115°C. This means that liquid I2   |  |  |  | | --- | --- | --- | |  | a. | is more dense than I2(s) | |  | b. | cannot exist above 115°C | |  | c. | cannot exist at 1 atmosphere pressure | |  | d. | cannot have a vapor pressure less than 90 torr | |  | e. | can exist at pressure of 10 torr |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | triple point | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 109. The triple point of CO2 is at 5.2 atm and –57°C. Under atmospheric conditions present in a typical Boulder, Colorado, laboratory (*P* = 630 torr, *T* = 23°C), solid CO2 will:   |  |  |  | | --- | --- | --- | |  | a. | remain solid | |  | b. | boil | |  | c. | melt | |  | d. | sublime | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | triple point | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 110. Choose the correct statement about the diagram below.   |  |  |  | | --- | --- | --- | |  | a. | The diagram is qualitatively correct for water. | |  | b. | The diagram shows that the melting point of the solid increases with increasing pressure. | |  | c. | The diagram shows the triple point above 1 atm pressure. | |  | d. | The diagram could represent the phase diagram of CO2. | |  | e. | None of the above statements is correct. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 111. Below is a phase diagram for compound *Q*. You wish to purify a sample of *Q* that was collected at *P* = 1.0 atm and *T* = 100 K by subliming it. In order to sublime the sample, you should:   |  |  |  | | --- | --- | --- | |  | a. | Increase *P* to 1.5 atm and then increase *T* to 300 K. | |  | b. | Increase *T* to 300 K, keeping *P* = 1.0 atm. | |  | c. | Lower *P* to 0.5 atm and then increase *T* to 200 K. | |  | d. | Increase *T* to 300 K and then lower *P* to 0.5 atm. | |  | e. | Abandon the attempt to sublime *Q*. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 112. Shown below is a phase diagram for compound *Y*. At 25°C and 1 atm *Y* will exist as a:   |  |  |  | | --- | --- | --- | |  | a. | solid | |  | b. | liquid | |  | c. | gas | |  | d. | gas/liquid at equilibrium | |  | e. | gas/solid at equilibrium |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 113. Below is a phase diagram for compound *Y*. The normal melting point of *Y* is most likely:   |  |  |  | | --- | --- | --- | |  | a. | 47°C | |  | b. | 21°C | |  | c. | 63°C | |  | d. | 18°C | |  | e. | 0°C |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 114. Shown below is a phase diagram for compound *Y*.  How will the melting point of *Y* change with increased pressure?   |  |  |  | | --- | --- | --- | |  | a. | increase | |  | b. | decrease | |  | c. | remain the same | |  | d. | not enough information given | |  | e. | increase and then decrease |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 115. Based on the phase diagram shown below, which of the following statements are correct?   |  |  | | --- | --- | | I. | Sublimation occurs at a point in the transformation that occurs along a straight line from point A to point F. | | II. | C and E represent points where the gas and liquid phases are in equilibrium. | | III. | Δ*H*vap can be measured at point B. | | IV. | Molecules at point D have a greater average kinetic energy than those at point F. | | V. | The temperature at point E is called the critical temperature of the compound. |  |  |  |  | | --- | --- | --- | |  | a. | II, V | |  | b. | I, III, IV | |  | c. | I, II, III | |  | d. | II, IV, V | |  | e. | I, II, IV |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/6/2017 5:52 AM | |

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| 116. A certain substance has the phase diagram shown below. At which of the following values of *T* and *P* is the substance a pure liquid?   |  |  |  | | --- | --- | --- | |  | a. | *T* = 8°C, *P* = 1 atm | |  | b. | *T* = 10°C, *P* = 0.5 atm | |  | c. | *T* = 70°C, *P* = 1.2 atm | |  | d. | *T* = 80°C, *P* = 1 atm | |  | e. | *T* = 10°C, *P* = 1 atm |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 117. A sample consisting of CO2(*g*) and CO2(*s*) at equilibrium at –78°C and 1 atm pressure is heated to –30°C and the pressure is increased to 8 atm. Based on the phase diagram below, what will happen?   |  |  |  | | --- | --- | --- | |  | a. | At equilibrium, only CO2(*g*) will be present. | |  | b. | All of the CO2 will be converted to CO2(*l*). | |  | c. | At equilibrium, CO2(*g*) and CO2(*l*) will be present. | |  | d. | The melting point of the CO2(*s*) will decrease. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 118. Given the phase diagram below, which of the following statements (A–D) is *false*?   |  |  |  | | --- | --- | --- | |  | a. | The solid has a higher density than the liquid. | |  | b. | At some (constant) temperature, the gaseous substance can be compressed into a solid and then into a liquid in this order. | |  | c. | When phase A is compressed at constant temperature at point X, no change is observed. | |  | d. | When heated at 1 atm, this substance will first melt, then boil. | |  | e. | None of the above statements is false. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 119. The density of the solid phase of a substance is 0.90 g/cm3 and the density of the liquid phase is 1.0 g/cm3. A large increase in pressure will   |  |  |  | | --- | --- | --- | |  | a. | lower the freezing point | |  | b. | raise the freezing point | |  | c. | lower the boiling point | |  | d. | raise the triple point | |  | e. | lower the triple point |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 120. Make a sketch to show the hydrogen bonding between two acetic acid molecules (HC2H3O2).   |  |  | | --- | --- | | *ANSWER:* | See Sec. 10.1 of Zumdahl, *Chemistry* | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonding | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 121. If you have 10.0 moles of BH3 and 5.0 moles of HF, which amount exhibits the most hydrogen bonding? Explain. Check question   |  |  | | --- | --- | | *ANSWER:* | HF; Hydrogen bonding only occurs between molecules where hydrogen is bonded to nitrogen, oxygen, or fluorine. Even though more BH3 is present, it does not exhibit any hydrogen bonding at all.  See Sec. 10.1 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 122. The particularly strong dipole-dipole interaction between hydrogen in one molecule and nitrogen in another molecule is known as a \_\_\_\_\_\_\_\_\_\_.   |  |  | | --- | --- | | *ANSWER:* | hydrogen bond | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonding | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 123. The relatively weak forces that exist among noble gas atoms are \_\_\_\_\_\_\_\_\_\_.   |  |  | | --- | --- | | *ANSWER:* | London dispersion forces | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | London forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 124. The meniscus of mercury curves downward at the edges. Explain using the concepts of cohesion and adhesion.   |  |  | | --- | --- | | *ANSWER:* | In mercury the cohesive forces within the liquid are stronger than the adhesive forces toward glass.  See Sec. 10.2 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 125. The resistance of a liquid to an increase in its surface area is the \_\_\_\_\_\_\_\_\_\_ of the liquid.   |  |  | | --- | --- | | *ANSWER:* | surface tension | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | surface tension | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 126. The structures of crystalline solids are most commonly determined by \_\_\_\_\_\_\_\_\_\_.   |  |  | | --- | --- | | *ANSWER:* | x-ray diffraction | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.3 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phases | solid | x-ray diffraction | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 127. In a(n) \_\_\_\_\_\_\_\_\_\_ alloy some of the host metal atoms are replaced by other metal atoms of similar size.   |  |  | | --- | --- | | *ANSWER:* | substitutional | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.4 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 128. Iodine moves directly from solid to gas in a process called \_\_\_\_\_\_\_\_\_\_.   |  |  | | --- | --- | | *ANSWER:* | sublimation | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 129. Explain why water boils at a lower temperature up in the mountains versus at sea level. Include at least one microscopic drawing in your explanation.   |  |  | | --- | --- | | *ANSWER:* | The boiling point of a liquid is the temperature at which the vapor pressure of the liquid is exactly the same as the pressure of the atmosphere around it. Water boils at a lower temperature up in the mountains because at high altitudes the atmospheric pressure is lower (see pictures A and B). Boiling occurs when the water is hot enough to have the same vapor pressure as the surrounding air pressure, so that it can form bubbles. Since the air pressure is lower at high altitudes, the water does not have to get as hot for boiling to occur. It will take more heat for water at sea level to attain the same pressure as the surrounding air since the atmospheric pressure is higher (see picture B).                      Picture A                       Picture B                (high altitudes)                   (low altitudes)   See Sec. 10.8 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transitions | phases | vapor pressure | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 130. 100. g of ice at 0°C is added to 300.0 g of water at 60°C. Assuming no transfer of heat to the surroundings, what is the temperature of the liquid water after all the ice has melted and equilibrium is reached?      specific heat (ice) = 2.10 J/g°C      specific heat (water) = 4.18 J/g°C      heat of fusion = 333 J/g      heat of vaporization = 2258 J/g   |  |  | | --- | --- | | *ANSWER:* | 25.0°C  100.g (333 J/g) + 100.g(Tf–0°C)(4.18 J/g°C) = –300.0g(Tf–60°C)(4.18 J/g°C) 33300 + 418Tf = –1254Tf + 75240    (using underline to track sig figs) 1672Tf = 41940;   Tf = 25°C | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase transition enthalpy change | phase transitions | phases | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 131. For each of the following pairs of substances, select the one expected to have the higher melting point:  I.    H2O, H2S                II.   HCl, NaCl                    III.    CH4, C3H8   |  |  |  | | --- | --- | --- | |  | a. | H2O, HCl, C3H8 | |  | b. | H2O, NaCl, C3H8 | |  | c. | H2O, NaCl, CH4 | |  | d. | H2S, HCl, CH4 | |  | e. | H2S, NaCl, CH4 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 2/10/2017 4:40 AM | |

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| 132. For each of the following pairs of substances, select the one expected to have the lower melting point:  I.  H2O, H2S                      II.  HCl, NaCl                                 III.  CH4, C3H8   |  |  |  | | --- | --- | --- | |  | a. | H2O, HCl, C3H8 | |  | b. | H2O, NaCl, C3H8 | |  | c. | H2O, HCl, CH4 | |  | d. | H2S, HCl, CH4 | |  | e. | H2S, NaCl, CH4 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 2/10/2017 6:28 AM | |

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| 133. Which of the following compounds is expected to have the HIGHEST boiling point?   |  |  |  | | --- | --- | --- | |  | a. | CH3OCH3 | |  | b. | CH3CH2OH | |  | c. | CH3CH2CH2CH3 | |  | d. | CH3CH2CH3 | |  | e. | CH3Cl |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonds | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 134. Which of the following compounds is expected to have the HIGHEST melting point?   |  |  |  | | --- | --- | --- | |  | a. | CH3OCH3 | |  | b. | CH3CH2OH | |  | c. | CH3CH2CH2CH3 | |  | d. | CH3CH2CH3 | |  | e. | CH3Cl |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | hydrogen bonds | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 135. Which of the following compounds is expected to have the LOWEST melting point?   |  |  |  | | --- | --- | --- | |  | a. | CH3OCH3 | |  | b. | CH3CH2OH | |  | c. | CH3CH2CH2CH3 | |  | d. | CH3CH2CH3 | |  | e. | CH3Cl |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 136. Which of the following compounds is expected to have the LOWEST boiling point?   |  |  |  | | --- | --- | --- | |  | a. | CH3OCH3 | |  | b. | CH3CH2OH | |  | c. | CH3CH2CH2CH3 | |  | d. | CH3CH2CH3 | |  | e. | CH3Cl |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 137. The measure of resistance to flow of a liquid is   |  |  |  | | --- | --- | --- | |  | a. | van der Waals forces | |  | b. | vapor pressure | |  | c. | London forces | |  | d. | surface tension | |  | e. | viscosity |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | liquid | phases | properties of liquids | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 138. Which of the following would be expected to have the lowest heat of vaporization?   |  |  |  | | --- | --- | --- | |  | a. | H2O | |  | b. | NH3 | |  | c. | PH3 | |  | d. | AsH3 | |  | e. | CH4 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 139. Which of the following is indicative of the existence of strong intermolecular forces of attraction in a liquid?   |  |  |  | | --- | --- | --- | |  | a. | a very low boiling point | |  | b. | a very low viscosity | |  | c. | a very low vapor pressure | |  | d. | a very low heat of vaporization | |  | e. | a very low freezing point |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | liquid | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 140. Which of the following intermolecular forces exist in all solid substances?   |  |  |  | | --- | --- | --- | |  | a. | Dispersion forces | |  | b. | Dipole-dipole forces | |  | c. | Covalent bonding | |  | d. | Hydrogen bonding | |  | e. | Ion-induced dipole forces |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 141. Consider the compounds CH3OH, CCl4, and CH3Br.  For each compound, list the strongest intermolecular force that operates within a sample of that compound.   |  |  |  | | --- | --- | --- | |  | a. | H-bonding is the strongest intermolecular force in CH3OH, dispersion is the strongest intermolecular force in CCl4, and dipole-dipole is the strongest intermolecular force in CH3Br | |  | b. | Dispersion is the strongest intermolecular force in CH3OH, dispersion is the strongest intermolecular force in CCl4, and dispersion is the strongest intermolecular force in CH3Br. | |  | c. | Ion-dipole is the strongest intermolecular force in CH3OH, Ion-dipole is the strongest intermolecular force in CCl4, and dipole-dipole is the strongest intermolecular force in CH3Br. | |  | d. | Dipole-induced dipole is the strongest intermolecular force in CH3OH, dispersion is the strongest intermolecular force in CCl4, and dipole-dipole is the strongest intermolecular force in CH3Br. | |  | e. | Ion-induced dipole is the strongest intermolecular force in CH3OH, dispersion is the strongest intermolecular force in CCl4, and H-bonding is the strongest intermolecular force in CH3Br. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | intermolecular forces | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 142. In a standard phase diagram that plots temperature versus pressure, which one of the following statements is TRUE?   |  |  |  | | --- | --- | --- | |  | a. | Three phases coexist at equilibrium at any point along one of the lines that separate regions (areas) on the phase diagram. | |  | b. | Two phases coexist at equilibrium at the triple point on the phase diagram. | |  | c. | The gas-solid line ends at a critical point on the phase diagram, beyond which evaporation cannot occur. | |  | d. | The gas-liquid line ends at the critical point on the phase diagram, beyond which a gas cannot be compressed to form a liquid. | |  | e. | In fact, all the above statements are false |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 10.9 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | phase diagram | phase transitions | phases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:26 PM | | *DATE MODIFIED:* | 3/4/2016 4:26 PM | |

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| 143. Graphs A and B compare the vapor pressures of two compounds in four groups, Groups 1-4, at various temperatures. The **skeletal structures** of the compounds in each of these Groups are shown below.  ​  ​  Which compound in each Group would be represented by **graph A**?  **Group 1            Group 2              Group 3                  Group 4**   |  |  |  | | --- | --- | --- | |  | a. | compound I      compound IV       compound V          compound VII | |  | b. | compound II     compound III       compound VI        compound VIII | |  | c. | compound I      compound III       compound VI        compound VIII | |  | d. | compound II     compound III       compound VI        compound VII | |  | e. | compound I       compound IV      compound V          compound VIII |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *DATE CREATED:* | 3/7/2017 12:41 AM | | *DATE MODIFIED:* | 3/7/2017 12:52 AM | |

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| 144. Which has the **greater** polarizability in Groups I-IV?  ​  **Group I**:  Br - or I-  ​  **Group II**:  H2O or H2Se  ​  **Group III**:  CCl4 or CF4  ​  **Group IV**: CH2 = CH2 or CH3-CH3  ​  **Group I            Group II              Group III                   Group IV**   |  |  |  | | --- | --- | --- | |  | a. | Br -                     H2O                       CF4 CH3-CH3 | |  | b. | I-H2Se                      CCl4 CH2 = CH2 | |  | c. | Br -H2Se                      CCl4CH2 = CH2 | |  | d. | I-                         H2O                       CF4                           CH3-CH3 | |  | e. | I-H2Se                      CCl4 CH3-CH3 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *DATE CREATED:* | 3/7/2017 12:59 AM | | *DATE MODIFIED:* | 3/7/2017 1:05 AM | |

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| 145. Which of the following pair of molecules could form hydrogen bonds between them?   |  |  |  | | --- | --- | --- | |  | a. | CH3OH and HBr | |  | b. | C2H6 and HOCH2CH2OH | |  | c. | (CH3)2NH and (CH3)3N | |  | d. | FCH2CH2F and HCl | |  | e. | Na+ and H2O |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *DATE CREATED:* | 3/7/2017 1:05 AM | | *DATE MODIFIED:* | 3/7/2017 1:07 AM | |

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| 146. A hydrogen bond is normally depicted between molecules using ------------.  ​  In which of the following diagrams, I-IV, is a hydrogen bond **correctly** shown between molecules?   |  |  |  | | --- | --- | --- | |  | a. | I and II only | |  | b. | III only | |  | c. | III and IV only | |  | d. | IV only | |  | e. | I-IV |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *DATE CREATED:* | 3/7/2017 1:51 AM | | *DATE MODIFIED:* | 3/7/2017 1:59 AM | |

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| 147. A hydrogen bond is normally depicted between molecules using ------------.  ​  In which of the following diagrams, I-IV, is a hydrogen bond **incorrectly** shown between molecules?   |  |  |  | | --- | --- | --- | |  | a. | III only | |  | b. | II only | |  | c. | II and IV only | |  | d. | I - IV | |  | e. | I and III only |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *DATE CREATED:* | 3/7/2017 1:59 AM | | *DATE MODIFIED:* | 3/7/2017 2:05 AM | |

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| 148. The following graphs of vapor pressure versus temperature were plotted for C2H6, CH3OH and CH4. Which of the following plots, A, B or C, is the correct plot for C2H6?  ​   |  |  | | --- | --- | | *ANSWER:* | B | | *POINTS:* | 1 | | *QUESTION TYPE:* | Objective Short Answer | | *HAS VARIABLES:* | False | | *DATE CREATED:* | 3/7/2017 2:24 AM | | *DATE MODIFIED:* | 3/7/2017 2:26 AM | |