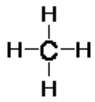
***** ANSWER KEY *****

Student Name: **Grade:** 09

Test Name: November Chemistry for All: Unit 4 - Introduction to Bonding **Version:** 1

1.



Based upon the structural formula for methane, CH_4, what can be determined about this molecule's polarity?

(a) Methane is a polar molecule.

✔ (b) Methane is a non-polar molecule.

(c) Methane is both polar and non-polar

(d) Methane is neither polar or non-polar.

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: non-polar.

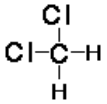
Standard:

MI_CHEM_HS-0912-C4-4x-b

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C4: PROPERTIES OF MATTER
    - Topic C4.4x Molecular Polarity
      - C4.4b Identify if a molecule is polar or nonpolar given a structural formula for the compound.

2. Based upon the structural formula for dichloromethane, CH_2Cl_2,what



can be determined about this molecule's polarity?

- ✔ (a) This molecule is polar.
- (b) This molecule is non-polar.
- (c) This molecule is both polar and non-polar.
- (d) This molecule is neither polar or non-polar.

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: polar.

Standard:

MI_CHEM_HS-0912-C4-4x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C4: PROPERTIES OF MATTER
Topic C4.4x Molecular Polarity
C4.4b Identify if a molecule is polar or nonpolar given a structural formula for the compound.

3.

Based upon the structural formula for ammonia, NH_3, what can be determined about this molecule's polarity?

- ✔ (a) This molecule is polar.
- (b) This molecule is non-polar.
- (c) This molecule is both polar and non-polar.
- (d) This molecule is neither polar or non-polar.

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: polar.

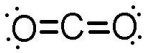
Standard:

MI_CHEM_HS-0912-C4-4x-b

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C4: PROPERTIES OF MATTER
    - Topic C4.4x Molecular Polarity
      - C4.4b Identify if a molecule is polar or nonpolar given a structural formula for the compound.

4.



Based upon the structural formula for carbon dioxide, CO_2, what can be determined about this molecule's polarity?

(a) This molecule is polar.
✔ (b) This molecule is non-polar.
(c) This molecule is both polar and non-polar.
(d) This molecule is neither polar or non-polar.

Explanation:

(a) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: non-polar.

Standard:

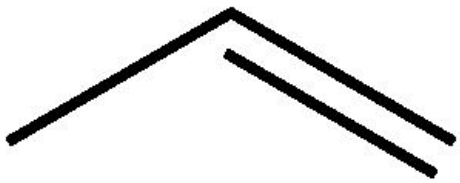
MI_CHEM_HS-0912-C4-4x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C4: PROPERTIES OF MATTER
Topic C4.4x Molecular Polarity
C4.4b Identify if a molecule is polar or nonpolar given a structural formula for the compound.

5. How many double bonds are found in the structural formula of propene, C_3H_6?

(a) 0
✔ (b) 1
(c) 2
(d) 3

Explanation:

(a)



Rubric:

1 point for correct number of carbons, 1 point for placement of hydrogens

Standard:

MI_CHEM_HS-0912-C5-8-A
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8A Draw structural formulas for up to ten carbon chains of simple hydrocarbons.

6. How many carbons atoms are necessary when drawing the structural formula for the molecule, ***octane***?

(a) 6
✔ (b) 8
(c) 16
(d) 18

Explanation:

(a)

Rubric:

1 point for correct number of carbons, 1 point for having all single bonds

Standard:

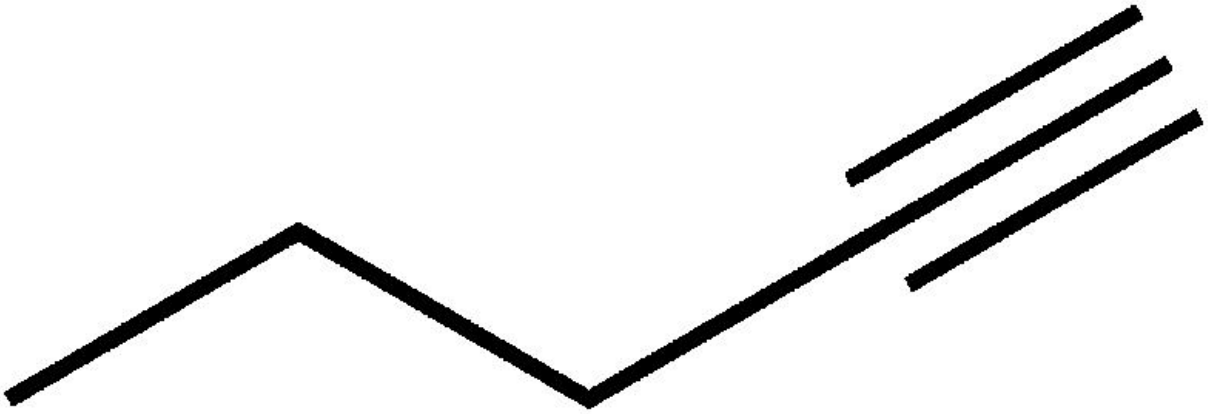
MI_CHEM_HS-0912-C5-8-A
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8A Draw structural formulas for up to ten carbon chains of simple hydrocarbons.

7. The structure for 1-pentyne, C_5H_8, would include:

(a) all single bonds
(b) a double bond
✔ (c) a triple bond
(d) a quadruble bond

Explanation:

(a)



Rubric:

1 point for correct number of carbons, 1 point for triple bond, 1 point for correct placement of triple bond

Standard:

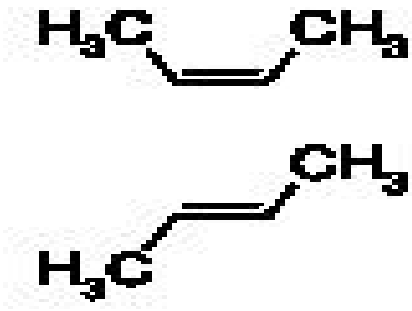
MI_CHEM_HS-0912-C5-8-A
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8A Draw structural formulas for up to ten carbon chains of simple hydrocarbons.

8. The double bond found in the structure of 2-butene, C_4H_8, is between which two carbons?

(a) 1st and 2nd carbon
✔ (b) 2nd and 3rd carbon
(c) 1st and 3rd carbon
(d) 2nd and 4th carbon

Explanation:

(a)



either picture is acceptable

Rubric:

1 point for the correct number of carbons, 1 point for double bond, 1 point for correct placement of double bond

Standard:

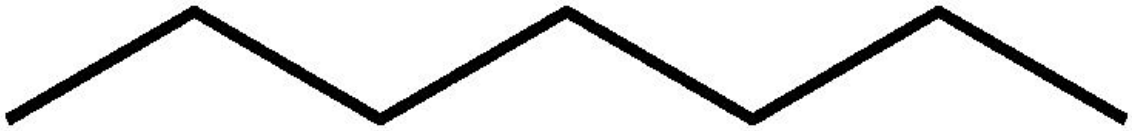
MI_CHEM_HS-0912-C5-8-A
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8A Draw structural formulas for up to ten carbon chains of simple hydrocarbons.

9. The molecule heptane, C_7H_x, contains how many hydrogens in its structure?

(a) 7
(b) 14
✔ (c) 16
(d) 30

Explanation:

(a)



Rubric:

1 point for correct number of carbons, 1 point for having all single bonds.

Standard:

MI_CHEM_HS-0912-C5-8-A
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8A Draw structural formulas for up to ten carbon chains of simple hydrocarbons.

10. During the chemical reaction for the decomposition of water the oxygen atoms separate from the hydrogen atoms. As this happens,

(a) energy is released as the distance between the oxygen and hydrogen atoms increases.

✔ (b) energy is absorbed as the distance between the oxygen and hydrogen atoms increases.

(c) energy is released as the distance between the oxygen and hydrogen decreases.

(d) energy is absorbed as the distance between the oxygen and hydrogen decreases.

Explanation:

(a) does not recognize that it takes energy to break bonds.

(b) **Difficulty:** Average, a well prepared student should be able to answer this question.

Suggested Resource: Potential Energy for the Formation of an Hydrogen Bond graph.

Correct answer: b, this is a direct reference to the Potential Energy for Hydrogen graph.

(c) does not recognize that it takes energy to break bonds and does not recognize that the atoms are moving apart.

(d) does not recognize that the atoms are moving apart.

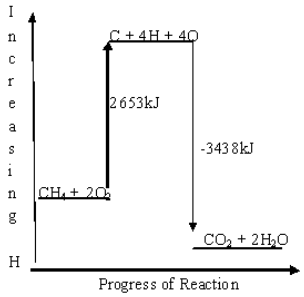
Standard:

MI_CHEM_HS-0912-C2-1x-b

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C2: FORMS OF ENERGY
    - Topic C2.1x Chemical Potential Energy
      - C2.1b Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).

11. Using the reaction enthalpy diagram showing the combustion of methane, what can be determined about this chemical reaction?



(a) The reaction is endothermic.

✔ (b) The reaction is exothermic.

(c) The reaction is both endothermic and exothermic.

(d) The reaction is neither endothermic or exothermic.

Explanation:

(a) **Difficulty:** High, this question should challenge the above average student.

Correct answer: should recognize the input of energy to break the bonds of methane and oxygen forming the intermediate, then the release of energy in the in moving from the intermediate state to the products. The specific energies involved should be noted, and the energy of reaction calculated. The balanced chemical equation should be provided.

Standard:

MI_CHEM_HS-0912-C2-1x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C2: FORMS OF ENERGY
Topic C2.1x Chemical Potential Energy
C2.1b Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).

12. What is happening to the strength of the intermolecular forces as water is melting?

- ✔ (a) decreases
- (b) increases
- (c) stays the same
- (d) varies

Explanation:

(a) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: The enthalpy diagram should indicate an endothermic process with liquid water at a higher energy level than the solid. It should be indicated that the intermolecular forces (hydrogen bonds), although constant are being overcome by the heat energy being put into the system, so that the water molecules transition from being unable to move past each other to being so able.

Standard:

MI_CHEM_HS-0912-C2-1x-b

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C2: FORMS OF ENERGY
    - Topic C2.1x Chemical Potential Energy
      - C2.1b Describe energy changes associated with chemical reactions in terms of bonds broken and formed (including intermolecular forces).

13. As the number of bonds between two atoms increases, what can be said about the strength of the bond and the length of the bond?

(a) the strength of the bond increases and the length of the bond increases.
(b) the strength of the bond decreases and the length of the bond decreases
(c) The strength of the bond decreases and length of the bond increases.
✔ (d) the strength of the bond increases and the length of the bond decreases.

Explanation:

(a) incorrect association between bond order and bond length.
(b) incorrect association between bond order and bond strength
(c) incorrect association between bond order and both strength and length.
(d) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: d, a direct observation of the trend in bond strength and length for a given pair of atoms with respect to bond order.

Standard:

MI_CHEM_HS-0912-C3-2x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C3: ENERGY TRANSFER AND CONSERVATION
Topic C3.2x Enthalpy
C3.2b Describe the relative strength of single, double, and triple covalent bonds between nitrogen atoms.

14. What is known about the strength of the C-O bond in the molecules carbon monoxide and carbon dioxide?

✔ (a) The carbon oxygen bond of carbon monoxide is stronger than that of carbon dioxide because carbon monoxide contains a triple bond.

(b) The carbon oxygen bond of carbon monoxide is weaker than that of carbon dioxide because carbon monoxide has a triple bond.

(c) The carbon oxygen bond of carbon monoxide is stronger because the carbon oxygen bond is longer than the carbon oxygen bond of carbon dioxide.

(d) The carbon oxygen bond of carbon monoxide is weaker than that of carbon dioxide, because it is shorter than the carbon oxygen bonds of carbon dioxide.

Explanation:

(a) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: a, the Lewis structure for indicates that carbon monoxide has a higher order carbon oxygen bond, an therefore is stronger than that of carbon dioxide.

(b) incorrect relationship in bond order.

(c) incorrect relationship between bond order and length.

(d) incorrect relationship between bond length and strength.

Standard:

MI_CHEM_HS-0912-C3-2x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C3: ENERGY TRANSFER AND CONSERVATION
Topic C3.2x Enthalpy
C3.2b Describe the relative strength of single, double, and triple covalent bonds between nitrogen atoms.

15. Compared to the single bond between carbons of alkanes the double bond between the carbons of alkenes is

(a) longer and stronger.
(b) longer and weaker.
✔ (c) shorter and stronger.
(d) shorter and weaker.

Explanation:

(a) incorrect association between bond strength and length.
(b) incorrect association between bond order and both length and strength.
(c) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: c, a direct observation of the trend in bond strength and length for a given pair of atoms with respect to bond order.

(d) incorrect association between bond order and strength.

Standard:

MI_CHEM_HS-0912-C3-2x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C3: ENERGY TRANSFER AND CONSERVATION
Topic C3.2x Enthalpy
C3.2b Describe the relative strength of single, double, and triple covalent bonds between nitrogen atoms.

16. A triple bond between nitrogen atoms is

(a) weaker and shorter than a single bond between nitrogen atoms.
(b) weaker and longer than a single bond between nitrogen atoms.
✔ (c) stronger and shorter than a single bond between nitrogen atoms.
(d) stronger and longer than a single bond between nitrogen atoms.

Explanation:

(a) incorrect association between bond order and strength
(b) incorrect association between bond order and both length and strength.
(c) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: c, a direct observation of the trend in bon strength and length for a given pair of atoms with respect to bond order.

(d) incorrect association between bond order and length.

Standard:

MI_CHEM_HS-0912-C3-2x-b
MI HSCEs Science - Chemistry
09-12
STANDARD C3: ENERGY TRANSFER AND CONSERVATION
Topic C3.2x Enthalpy
C3.2b Describe the relative strength of single, double, and triple covalent bonds between nitrogen atoms.

17. The diatomic form of nitrogen makes up more than seventy percent of the earth's atmosphere. In spite of this most plants are unable to use nitrogen directly from the atmosphere. What about the chemical structure of N_2 would be a reason for this finding?

(a) The weakness of the triple bond found between the two nitrogen atoms.

✔ (b) The strength of the triple bond found between the two nitrogen atoms.

(c) The uncertainity of the strength of the triple bonds between the two nitrogen atoms.

(d) The inability of the two nitrogens atoms to create a triple bond.

Explanation:

(a) **Difficulty:** High, this question should challenge the above average student.

Correct answer: answer should include the correct Lewis structure for nitrogen, and recognize that separating this molecule into atomic nitrogen would require a considerable amount of energy, thus making it difficult to incorporate into biological molecules from its atmospheric form.

Standard:

MI_CHEM_HS-0912-C3-2x-b

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C3: ENERGY TRANSFER AND CONSERVATION
    - Topic C3.2x Enthalpy
      - C3.2b Describe the relative strength of single, double, and triple covalent bonds between nitrogen atoms.

18. During the decomposition of the ozone molecule, O_3, into oxygen (O_2) and a free radical ($O\cdot$), what is known about the chemical bonds and energy?

✔ (a) Bonds are being broken and it requires energy to break bonds.
(b) Bonds are being broken and energy is lost.
(c) Bonds are being formed and it takes energy to form bonds.
(d) Bonds are being fromed and energy is lost.

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

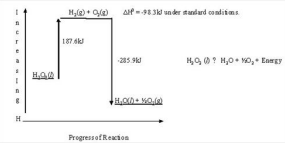
Correct answer: a, a direct regurgitation of the content expectation. Also it should be relatively intuitive that bonds are breaking and that energy is being exerted to do this.

(b) misidentifies what the question is about.
(c) fails to recognize that bonds are breaking, not forming.
(d) misidentifies the process taking place.

Standard:

MI_CHEM_HS-0912-C3-3x-c
MI HSCEs Science - Chemistry
09-12
STANDARD C3: ENERGY TRANSFER AND CONSERVATION
Topic C3.3x Bond Energy
C3.3c Explain why it is necessary for a molecule to absorb energy in order to break a chemical bond.

19. According to the enthalpy diagram for the decomposition of hydrogen peroxide, what is known about the energy in the first part of this reaction in which hydrogen peroxide breaks down into hyrogen gas and oxygen gas?



(a) Energy is released in order to break the hydrogen peroxide bonds.

✔ (b) Energy is absorbed to break the hydrogen peroxide bonds.

(c) Nothing is known about the energy for the decomposition of hydrogen peroxide.

(d) Energy is gained and then lost to produce the hydrogen and oxygen gas in the first step.

Explanation:

(a) recognizes the higher energy state, but fails to relate this to a less stable condition.

(b) misreads the graph or does not recognize the intermediate.

(c) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: c, the student has to read the enthalpy diagram correctly, and recognize that the intermediate is at a higher energy state, then relate this to the stability of this condition.

(d) misreads graph and does not understand potential energy stability relationship.

Standard:

MI_CHEM_HS-0912-C3-3x-c

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C3: ENERGY TRANSFER AND CONSERVATION
    - Topic C3.3x Bond Energy
      - C3.3c Explain why it is necessary for a molecule to absorb energy in order to break a chemical bond.

20. As two atoms of hydrogen move toward each other there is an attraction between the unlike charges of the two atoms, and a repulsion between like charges of the two atoms. Eventually the attraction just balances the repulsion, at this distance

(a) moving the atoms closer together will cause a decline in the potential energy of the system.

(b) moving the atoms farther apart will cause a decline in the potential energy of the system.

(c) moving the atoms closer together or further apart has no affect on the systems potential energy.

✔ (d) the system is at its lowest potential energy, and any change in atom position will require energy.

Explanation:

(a) misunderstands that it will take energy to move the atoms closer together.

(b) misunderstands that it will take energy to move the atoms further apart.

(c) completely misunderstands the dynamic of bond formation.

(d) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: d the student recognizes the dynamic that allows the stability for the creation of a covalent bond.

Standard:

MI_CHEM_HS-0912-C3-3x-c

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C3: ENERGY TRANSFER AND CONSERVATION
    - Topic C3.3x Bond Energy
      - C3.3c Explain why it is necessary for a molecule to absorb energy in order to break a chemical bond.

21. A decomposition reaction is conducted in a test tube, a student notes that the test tube is warm, this is because a decomposition reaction

(a) absorbs heat to break bonds.
(b) loses heat to break bonds.
✔ (c) absorbs heat to form bonds.
(d) loseds heat to form bonds.

Explanation:

(a) **Difficulty:** High, this question may challenge the above average student.

Note: This question draws on background information in the course. This material should be reviewed as another way of understanding the content expectation in this unit.

Correct answer: The Lewis structure of the water will have noble gas electron configurations for each of the atoms in the molecule. The electron configurations for the products will be on a form other than a noble gas, indicating an unstable condition. It will take energy to transition from the more to a less stable condition.

Standard:

MI_CHEM_HS-0912-C3-3x-c
MI HSCEs Science - Chemistry
- 09-12
  - STANDARD C3: ENERGY TRANSFER AND CONSERVATION
    - Topic C3.3x Bond Energy
      - C3.3c Explain why it is necessary for a molecule to absorb energy in order to break a chemical bond.

22. When a small amount of an unknown substance in the solid and liquid phases are placed in separated containers, what will be observed?

(a) The solid will fill the container and take the shape of the container, where as a liquid will not fill the container and take the shape of the container.

(b) The solid will not full the container and will take the shape of the container, where as a liquid will not fill the container and will take the shape of the container.

(c) The solid will not fill the container or take on the container's shape, where as a liquid will fill the container and will take on the container's shape.

✔ (d) The solid will not fill the container or take on the container's shape, where as a liquid will not fill the container and will take on the container's shape

Explanation:

(a) incorrect description of the solid

(b) incorrect description of the solid.

(c) incorrect description of a liquid.

(d) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: d, a direct observation of the demonstration of phase changes.

Standard:

MI_CHEM_HS-0912-C4-4x-a

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C4: PROPERTIES OF MATTER
    - Topic C4.4x Molecular Polarity
      - C4.4a Explain why at room temperature different compounds can exist in different phases.

23. A solid is different from a liquid in that

(a) the particles of a solid are in contact with each other and can move past each other, and those of a liquid are not in contact with each other and can move past each other.

✔ (b) the particles of a solid are in contact with each other and cannot move past each other, and those of a liquid are in contact with each other and can move past each other.

(c) the particles of a solid not in contact with each other and cannot move past each other, and those of a liquid are in contact with each other and can move past each other.

(d) the particles of a solid are in contact with each other and cannot move past each other, and those of a liquid are not in contact with each other and can move past each other.

Explanation:

(a) incorrect description of solid and liquid particle behavior.

(b) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: b, behavioral characteristics of solid and liquid particles, inferred from macroscopic observation.

(c) incorrect description of solid particle behavior.

(d) incorrect description of liquid particle behavior.

Standard:

MI_CHEM_HS-0912-C4-4x-a

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C4: PROPERTIES OF MATTER
    - Topic C4.4x Molecular Polarity
      - C4.4a Explain why at room temperature different compounds can exist in different phases.

24. At room temperature and pressure, carbon dioxide (atomic mass: 46.005amu/CO_2) is a gas, where as water (atomic mass: 18.015amu/H_2O) is a liquid. The reason that the more massive carbon dioxide is a gas while water is a liquid is

(a) There is a stronger attraction between the polar carbon dioxide molecules than exists between the non-polar molecules of water.

(b) There is a stronger attraction between the non-polar carbon dioxide molecules than exists between the polar molecules of water.

✔ (c) There is less attraction between the non-polar molecules of carbon dioxide than exists between the polar molecules of water.

(d) There is less attraction between the polar molecules of carbon dioxided than exists between the non-polar molecules of water.

Explanation:

(a) incorrect description of carbon dioxide and water.

(b) incorrect interpretation of the effects of polarity.

(c) **Difficulty:** High, this question may challenge the above average student.

Correct answer: c, Lower intermolecular attraction results in volatility.

(d) incorrect description of water's polarity.

Standard:

MI_CHEM_HS-0912-C4-4x-a
MI HSCEs Science - Chemistry
09-12
STANDARD C4: PROPERTIES OF MATTER
Topic C4.4x Molecular Polarity
C4.4a Explain why at room temperature different compounds can exist in different phases.

25. Three substances, one solid, one liquid and one gas exist in a lab at room temperature,which of the following phases has the weakest intermolecular (attractive) forces?

(a) solids
(b) liquids
✔ (c) gases
(d) cannot be known

Explanation:

(a) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: should include a description of the structure of an ionic crystal lattice, and describe how the attraction between unlike charged ions results in the particles being held together and unable to move past each other.

Standard:

MI_CHEM_HS-0912-C4-4x-a
MI HSCEs Science - Chemistry
09-12
STANDARD C4: PROPERTIES OF MATTER
Topic C4.4x Molecular Polarity
C4.4a Explain why at room temperature different compounds can exist in different phases.

26. Methane, CH_4 is a gas at room temperature and pressure, while CH_2Cl_2, dichloromethane is a liquid under the same conditions. What explains the different in the states of these two compounds?

(a) Methane is non-polar and therfore has stronger attractive forces.
(b) Dicloromethane is non-polar therefore has stronger attractive forces.
(c) Methane is polar and therefore has stronger attractive forces.
✔ (d) Dichoromethane is polar and therefore has stronger attractive forces.

Explanation:

(a) **Difficulty:** High, this question may challenge the above average student.

Correct answer: should recognize both molecules as tetrahedral, but with methane being non-polar and dichloromethane polar. The greater attraction between the polar molecules of dichloromethane creates a condition where the molecules stay in contact with each other, but still are able to move past each other.

Standard:

MI_CHEM_HS-0912-C4-4x-a
MI HSCEs Science - Chemistry
09-12
STANDARD C4: PROPERTIES OF MATTER
Topic C4.4x Molecular Polarity
C4.4a Explain why at room temperature different compounds can exist in different phases.

27. Isomers are

(a) molecules that have the same structural formula but different chemical formula.

✔ (b) molecules that have the same chemical formula but different structural formulas.

(c) molecules that that have the same structural formula but a different number of bonds between at least one pair of carbons.

(d) molecules that have the same chemical formula but a different number of bonds between at least one pair of carbons.

Explanation:

(a) confuses structural formula and molecular formula.

(b) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: b, a direct statement of the definition if isomer.

(c) incorrect statement about structural formula and number of bonds.

(d) incorrect statement about number of bonds.

Standard:

MI_CHEM_HS-0912-C5-8-B

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C5: CHANGES IN MATTER
    - Topic C5.8 Carbon Chemistry
      - C5.8B Draw isomers for simple hydrocarbons.

28. Octane, C_8H_{18}, is known to have many isomers. What can be said about the different isomers of octane?

(a) The physical properties will be the same, but the chemical properties will be different.

(b) The chemical properties will be the same, but the physical properties will be different.

(c) Both the physical and chemical properties of the isomers will be the same.

✔ (d) Both the physical and chemical properties of the isomers will be different.

Explanation:

(a) incorrect statement about physical properties.

(b) incorrect statement about chemical properties.

(c) incorrect statement about physical and chemical properties.

(d) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: d, different isomers of a given type (chemical formula) have different properties.

Standard:

MI_CHEM_HS-0912-C5-8-B
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8B Draw isomers for simple hydrocarbons.

29. Which phrase below would correctly complete, "Isomers have _____".?

I. the same number of atoms.
II. the same number of bonds.
III. the same empirical formula.

(a) Statement I only
(b) Statements I and II
(c) Statements II and III
✔ (d) Statements I, II and III

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: n-1-butyne & n-2-butyne.

Standard:

MI_CHEM_HS-0912-C5-8-B
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8B Draw isomers for simple hydrocarbons.

30. How many structual isomers exist for the molecule, C_5H_{12}?

(a) 1
(b) 2
✔ (c) 3
(d) 4

Explanation:

(a) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: n-pentane, 2-methylbutane & 2,2-dimethylpropane

Standard:

MI_CHEM_HS-0912-C5-8-B
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8B Draw isomers for simple hydrocarbons.

31. The five structural isomers of C_5H_{10}, must contain how many double bonds?

(a) 0
✔ (b) 1
(c) 2
(d) 3

Explanation:

(a) **Difficulty:** High, this question may challenge the above average student.

Correct answer: n-1-pentene, 2-methyl-1-butene, 3-methyl-1-butene, n-2-pentene & 1-metthyl-2-butene.

Standard:

MI_CHEM_HS-0912-C5-8-B
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8B Draw isomers for simple hydrocarbons.

32. A polymer is

- ✔ (a) a large molecule composed of repeating structural units connected by covalent chemical bonds.
- (b) the portion of the large molecule made up of repeating structural units that repeats.
- (c) the portion of a molecule that terminates the production of a repeating molecule.
- (d) a catalyst that allows for the synthesis of multiple bonds of alkenes.

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: a, a direct statement of the definition of polymer.

(b) confuses monomer and polymer.

(c) confuses polymer with end codon

(d) completely off subject.

Standard:

MI_CHEM_HS-0912-C5-8-C

MI HSCEs Science - Chemistry

09-12

STANDARD C5: CHANGES IN MATTER

Topic C5.8 Carbon Chemistry

C5.8C Recognize that proteins, starches, and other large biological molecules are polymers.

33. The monomer that makes up a protein is a(n)

(a) fatty acid.
✔ (b) amino acid.
(c) cellulose.
(d) monosaccharide

Explanation:

(a) refers to a portion of a lipid molecule.
(b) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: b, taken directly from the definition of protein.
(c) refers to a portion of the plant cell wall.
(d) refers to the monomer of starches.

Standard:

MI_CHEM_HS-0912-C5-8-C
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8C Recognize that proteins, starches, and other large biological molecules are polymers.

34. A common monomer known to make up starches is a(n)

(a) fatty acid.
(b) amino acid.
(c) cellulose.
✔ (d) glucose

Explanation:

(a) refers to a portion of a lipid molecule.
(b) refers to the monomer of proteins.
(c) refers to a portion of the plant cell wall.
(d) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: d, taken directly from the definition of starch.

Standard:

MI_CHEM_HS-0912-C5-8-C
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8C Recognize that proteins, starches, and other large biological molecules are polymers.

35. The knowledge and use of synthetic or lab produced polyers began:

✔ (a) just over 100 years ago.
(b) since before recorded history.
(c) since discovery of plastics.
(d) since the discovery of biological polymers.

Explanation:

(a) refers to the time since polymers have been synthesized.
(b) **Difficulty:** Low, all students should be able to answer this question correctly.

Correct answer: b, the uses of polymers have been illustrated in archeological digs.

(c) assumes only plastics are polymers.
(d) assumes polymers must be synthesized to be used.

Standard:

MI_CHEM_HS-0912-C5-8-C
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8C Recognize that proteins, starches, and other large biological molecules are polymers.

36. Polymers are created:

(a) only synthetically in a lab.
(b) only biologically in nature.
(c) neither synthetically in a lab or biologically in nature.
✔ (d) both synthetically in a lab and biologically in nature.

Explanation:

(a) **Difficulty:** Low, all students should be able to answer this question correctly.

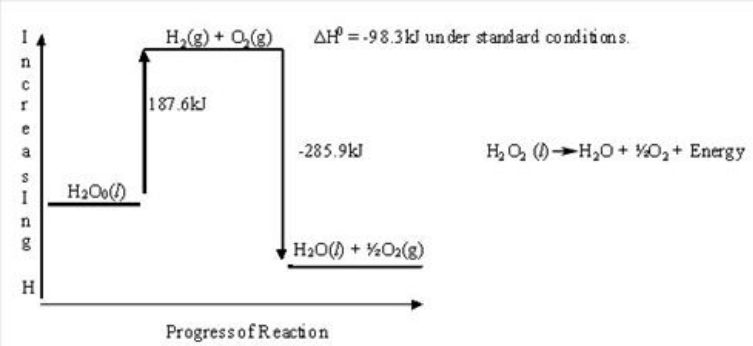
Correct answer: a, taken directly from one of the assignments.
(b) refers to polymers use by man.
(c) assumes only plastics are polymers.
(d) assumes only biological polymers are dealt with.

Standard:

MI_CHEM_HS-0912-C5-8-C
MI HSCEs Science - Chemistry
09-12
STANDARD C5: CHANGES IN MATTER
Topic C5.8 Carbon Chemistry
C5.8C Recognize that proteins, starches, and other large biological molecules are polymers.

Instructions for questions 37 through 38.

Use the following enthalpy diagram for the decomposition of hydrogen peroxide to answer the following two questions.



37. The transition or intermediate step for the decompostion of hydrogen peroxide (H_2O_2) to hydrogen and oxygen gas results in a system that has a

(a) higher potential energy and is therefore more stable.

(b) lower potential energy and is therefore more stable.

✔ (c) higher potential energy and is therefore less stable.

(d) lower potential energy and is therefore less stable.

Explanation:

(a) recognizes the higher energy state, but fails to relate this to a less stable condition.

(b) misreads the graph or does not recognize the intermediate.

(c) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: c, the student has to read the enthalpy diagram correctly, and recognize that the intermediate is at a higher energy state, then relate this to the stability of this condition.

(d) misreads graph and does not understand potential energy stability relationship.

Standard:

MI_CHEM_HS-0912-C2-1x-a

MI HSCEs Science - Chemistry

09-12

STANDARD C2: FORMS OF ENERGY

Topic C2.1x Chemical Potential Energy

C2.1a Explain the changes in potential energy (due to electrostatic interactions) as a chemical bond forms and use this to explain why bond breaking always requires energy.

38. The final products for the decompostion of hydrogen peroxide results in a system that has a

(a) higher potential energy and is therefore more stable.
✔ (b) lower potential energy and is therefore more stable.
(c) higher potential energy and is therefore less stable.
(d) lower potential energy and is therefore less stable.

Explanation:

(a) misreads the graph, and misunderstands the dynamic between potential energy and stability.
(b) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: b, the student has read the enthalpy diagram correctly, and recognizes the product is at a lower energy state, then relates this to the stability of this condition.

(c) misreads graph or does not recognize product.
(d) does not recognize dynamic between potential energy and stability.

Standard:

MI_CHEM_HS-0912-C2-1x-a
MI HSCEs Science - Chemistry
09-12
STANDARD C2: FORMS OF ENERGY
Topic C2.1x Chemical Potential Energy
C2.1a Explain the changes in potential energy (due to electrostatic interactions) as a chemical bond forms and use this to explain why bond breaking always requires energy.

39. As two atoms of hydrogen move toward each other there is an attraction between the unlike charges of the two atoms, and a repulsion between like charges of the two atoms. Eventually the attraction just balances the repulsion, at this distance

(a) moving the atoms closer together will cause a decline in the potential energy of the system.

(b) moving the atoms farther apart will cause a decline in the potential energy of the system.

(c) moving the atoms closer together or further apart has no affect on the systems potential energy.

✔ (d) the system is at its lowest potential energy, and any change in atom position will require energy.

Explanation:

(a) misunderstands that it will take energy to move the atoms closer together.

(b) misunderstands that it will take energy to move the atoms further apart.

(c) completely misunderstands the dynamic of bond formation.

(d) **Difficulty:** Average, a well prepared student should be able to answer this question.

Correct answer: d the student recognizes the dynamic that allows the stability for the creation of a covalent bond.

Standard:

MI_CHEM_HS-0912-C2-1x-a

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C2: FORMS OF ENERGY
    - Topic C2.1x Chemical Potential Energy
      - C2.1a Explain the changes in potential energy (due to electrostatic interactions) as a chemical bond forms and use this to explain why bond breaking always requires energy.

40. The combustion of methane proceeds as follows: $CH_4(g) + 2O_2(g) \Rightarrow CO_2(g) + 2H_2O(g)$ + Energy. Use the table of bond energies to determine the amount of energy released in the complete combustion of one mole of methane.

(a) 6090kJ/Mol CH_4

✔ (b) -808kJ/Mol CH_4

(c) 808kJ/Mol CH_4

(d) -354kJ/Mol CH_4

Explanation:

(a) no distinction between endothermic and exothermic processes.

(b) **Difficulty:** High, this question should challenge the above average student.

Resources needed: a table of bond energies.

Correct answer: b the student recognizes bond breaking as an endothermic process and bond formation as an exothermic process, chooses the correct bond types from the bond energies chart, uses the coefficients in the balanced chemical equation correctly, and performs the calculation successfully.

(c) reverses endothermic and exothermic processes.

(d) ignores coefficients of balanced chemical equation.

Standard:

MI_CHEM_HS-0912-C2-1x-a

MI HSCEs Science - Chemistry

- 09-12
  - STANDARD C2: FORMS OF ENERGY
    - Topic C2.1x Chemical Potential Energy
      - C2.1a Explain the changes in potential energy (due to electrostatic interactions) as a chemical bond forms and use this to explain why bond breaking always requires energy.