483
version

last name

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signature

McCord CH301
49970 / 49975

Exam 3

Fall 2016

Remember that the bubble sheet has the periodic table on the back.

NOTE: Please keep your Exam copy intact (all pages still stapled). You must turn in your exam copy, bubble sheet, and scratch paper.

This print-out should have 34 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 3.0 points

The best predicted shape and bond angle of SbH_3 is

1. tetrahedral; 109.5°.

2. trigonal planar; 120°.

3. trigonal pyramidal; 107°.

4. trigonal pyramidal; 109.5°.

002 3.0 points

The dominant forces between molecules (intermolecular forces) are _____ in origin.

1. gravitational

2. electrodynamic

3. electromagnetic

4. magnetic

5. electrostatic

003 3.0 points

Consider the compound ethene, C_2H_4. The bond between the two carbons that is formed above and below the internuclear axis is a __?__ bond. The atomic orbitals that combine to form this bond are __?__ orbitals.

1. π; $1p$

2. π; $2p$

3. σ; sp^2

4. π; sp^2

5. σ; sp^3

004 3.0 points

When a given molecule or ion is shown via resonance structures, the numerous structures

1. show the set of bonding extremes of which the average will better represent the actual bonding.

2. show the nature of the various vibrations possible based on the nature of the kinds of atoms and bonds.

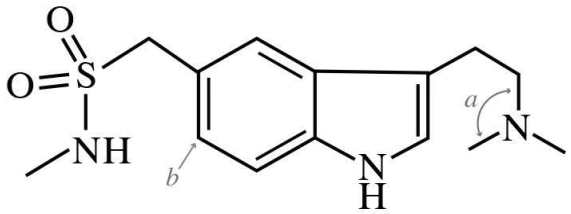
3. show how an isotope of one or more of the atoms is distributed within a molecule.

4. show the various possible geometries that a molecule or ion can assume.

5. show the various stable isomers (or kinds) of a compound.

005 (part 1 of 3) 3.0 points

Consider the line formula for the migraine medication, Imitrex.



What is the correct empirical formula for this compound?

1. $C_{12}H_{20}N_3O_2S$

2. $C_{13}H_{19}N_3O_2S$

3. $C_{14}H_{19}N_3O_2S$

4. $C_{12}H_{21}N_3O_2S$

5. $C_{14}H_{21}N_3O_2S$

6. $C_{13}H_{20}N_3O_2S$

006 (part 2 of 3) 3.0 points

Which of the following best represents the bond angle labeled a?

1. 120°

2. 180°

3. 90°

4. 109.5°

5. 107°

6. 118°

7. 178°

---

007 (part 3 of 3) 3.0 points

What is the hybridization of the atom that is labeled b?

1. sp^2

2. sp^3d

3. sp

4. sp^3

5. sp^3d^2

---

008 3.0 points

Generally if a liquid has stronger intermolecular attractions it will have
A. a higher viscosity;
B. a higher vapor pressure;
C. a higher boiling point.

1. C only

2. A, B, and C

3. A only

4. B and C only

5. None of the properties

6. A and B only

7. B only

8. A and C only

---

009 3.0 points

A substance has a melting point of 1200 K, and it conducts electricity in the melted state (liquid) but not in the solid state. What is the name of the major attractive force that holds this substance together?

1. metallic bonds

2. dipole-dipole attractions

3. ionic bonds

4. dispersion forces

5. hydrogen bonds

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010 3.0 points

What types of intermolecular interactions does ammonia (NH_3) exhibit?
I) dispersion forces
II) dipole-dipole interaction
III) hydrogen bonding
IV) covalent bonding

1. I, II, and III only

2. II only

3. I only

4. II and IV only

5. II and III only

6. I and II only

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011 3.0 points

Classify the molecule $AsCl_3$.

1. polar molecule with polar bonds

2. polar molecule with nonpolar bonds

3. nonpolar molecule with polar bonds

4. nonpolar molecule with nonpolar bonds

012 3.0 points

What is the strongest evidence for hydrogen bonding?

1. Hydrogen has an extremely low electronegativity.

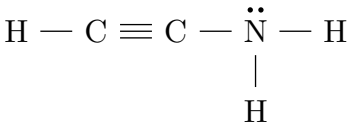
2. Hydrogen can be considered either a metal or nonmetal.

3. The boiling points of NH_3, H_2O, and HF are abnormally high compared with the rest of the hydrides in their respective periods.

4. Hydrogen is able to accept or donate electrons, so it is the most versatile atom in the periodic chart.

013 3.0 points

How many σ and π bonds are in the molecule



1. 5 σ; 2 π

2. 6 σ; 1 π

3. 7 σ; 1 π

4. 6 σ; 2 π

5. 5 σ; 1 π

014 3.0 points

Consider a solid that has a molar mass of 180.2 g/mol and a melting point of 423 K. This solid is a terrible electrical conductor, even when fully dissolved in an aqueous medium. What type of solid is this compound?

1. Metallic

2. Ionic

3. Network

4. Molecular

015 3.0 points

Why is I_2 a solid while Cl_2 is a gas even though they are both halogens?

1. I_2 is more polarizable than Cl_2.

2. I_2 is less polarizable than Cl_2.

3. I_2 has a larger dipole than Cl_2.

4. I_2 has H-bonding and Cl_2 does not.

5. I_2 has a smaller dipole than Cl_2.

016 3.0 points

Consider four molecules

I) $CHCl_3$
II) CH_4
III) CH_3Cl
IV) CCl_4

Which of these exhibit permanent dipole-dipole interactions?

1. I, III, and IV only

2. III only

3. None of these

4. I and III only

5. I only

017 3.0 points

Which of the following is expected to boil at the highest temperature?

1. C_4H_{10}

2. C_2H_6

3. CH_4

4. C_5H_{12}

5. C_3H_8

018 3.0 points

Draw the Lewis structure of xenon difluoride and give the number of lone pairs of electrons around the central atom.

1. 4

2. 2

3. 5

4. 3

5. 1

019 3.0 points

The viscosity of a liquid depends on which of the following

I. strength of intermolecular forces.
II. shape of the molecule
III. temperature

1. I and II

2. only II

3. I, II, and III

4. I and III

5. only I

6. only III

020 3.0 points

Dispersion (London) forces result from

1. the formation of a loose covalent linkage between a hydrogen atom connected to a very electronegative atom in one molecule and another very electronegative atom in a neighboring molecule.

2. the balance of attractive and repulsive forces between two polar molecules.

3. attraction between molecules in a liquid and molecules or atoms in a solid surface with which the liquid is in contact.

4. distortion of the electron cloud of an atom or molecule by the presence of nearby atoms or molecules.

5. attractive forces between a molecule at the surface of a liquid and those beneath it which are not balanced by corresponding forces from above.

021 3.0 points

Consider the polyatomic ion PCl_4^- and its three dimensional structure. What is the electronic geometry and the molecular geometry for this ion?

1. trigonal bypyramidal; tetrahedral

2. octahedral; square planar

3. octahedral; square pyramidal

4. trigonal bipyramidal; seesaw

5. tetrahedral; tetrahedral

6. trigonal bipyramidal; T-shaped

022 3.0 points

Which of the following compounds would be expected to have the longest N-O bonds?

1. they will all be the same

2. NO_3^-

3. NO_2^-

4. NO

023 3.0 points

Which of the following can be expected to exhibit the strongest hydrogen bonding in the liquid state?

1. CH_3CH_3

2. CH_3OCH_3

3. CH_4

4. CH_3OH

5. CH_3COCH_3

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024 3.0 points

Consider the molecular orbital diagram for oxygen, O_2. What is the total number of electrons that occupy the π and π^* molecular orbitals? How many of those electrons are unpaired?

1. 6 ; 4

2. 0 ; 0

3. 4 ; 2

4. 4 ; 0

5. 6 ; 0

6. 8 ; 2

7. 6 ; 2

---

025 3.0 points

Which of the following is diamagnetic?

1. N_2^+

2. N_2^-

3. N_2

4. N_2^{2-}

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026 3.0 points

The key to an effective photovoltaic material, is to have a dye that can absorb electromagnetic radiation to cause a promotion of an electron to an excited state with a minimum energy gap. That excited electron is then routed around a circuit to create a current and a voltage. Material A absorbs in the red region of the visible spectrum while material B absorbs in the blue region of the visible spectrum. Assuming the materials cost about the same amount of money to manufacture, which material would be the better choice for the solar cell?

1. Material B would be a better choice because it would have smaller HOMO LUMO gap.

2. Material B would be a better choice because it would have larger HOMO LUMO gap.

3. Material A would be a better choice because it would have smaller HOMO LUMO gap.

4. Material A would be a better choice because it would have larger HOMO LUMO gap.

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027 3.0 points

Which of the following molecules is nonpolar?

1. BF_3

2. NF_3

3. CH_3Br

4. H_2O

5. SO_2

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028 3.0 points

What are the electronic and molecular geometries of the molecule BrF_5?

1. octahedral, octahedral

2. trigonal bipyramidal, square pyramidal

3. octahedral, trigonal bipyramidal

4. trigonal bipyramidal, trigonal bipyramidal

5. ocahedral, square pyramidal

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029 3.0 points

What is the hybridization of carbon in CH_2O? C is the central atom.

1. sp

2. sp^3

3. sp^3d

4. sp^3d^2

5. sp^2

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030 1.0 points

Free Point Question. Bubble in choice 1 and get a free point (or points) on the exam.

1. This is the correct answer.

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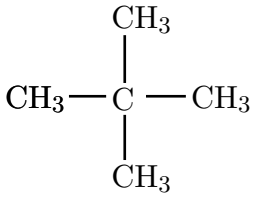
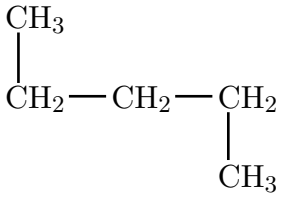
031 3.0 points

Under standard conditions, neopentane is a gas while *n*-pentane is a liquid.

neopentane



n-pentane



Given that both are non-polar and have identical chemical formulas (C_5H_12), the reason that *n*-pentane has a higher boiling point is that

1. its straight-chain structure allows the molecules to have more instantaneous dipoles interacting at close distances.

2. it has more H-bonding than the neopentane.

3. it has more C-H bonds that are slightly polar.

4. *n*-pentane has more valence electrons and therefore can form more instantaneous dipoles.

5. its straight-chain structure allows for a substantial permanent dipole.

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032 3.0 points

Antibonding orbitals

1. are responsible for high ionization energies in atoms.

2. lend instability to a molecule when populated with electrons.

3. are higher in energy than bonding orbitals and are therefore populated with electrons prior to bonding orbitals.

4. are responsible for dipole moments in molecules.

5. are lower in energy than bonding orbitals and are therefore populated with electrons prior to bonding orbitals.

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033 3.0 points

If a molecule has square planar molecular geometry, what must be its hybridization?

1. sp^3

2. sp^3d

3. sp^2

4. sp

5. sp^3d^2

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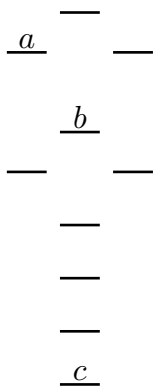
034 3.0 points

Consider the following molecular orbital diagram for a 2nd row diatomic molecule (X_2):



The labels a, b, and c are placed in three of the molecular orbitals. What are the names of these three orbitals?

1. $\pi^*_{2p}, \sigma_{2p}, \sigma^*_{2s}$

2. $\pi^*_{2p}, \sigma_{2p}, \sigma_{1s}$

3. $\pi^*_{2p}, \sigma^*_{2p}, \sigma_{1s}$

4. $\sigma^*_{2p}, \pi_{2p}, \sigma^*_{2s}$

5. $\sigma^*_{2p}, \pi_{2p}, \sigma^*_{1s}$