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practice test 3 (236473)

About this Assignment

Due: **Wed Dec 1 2004 10:09 PM EST**

Current Score: **0 out of 91**

Description
practice test 3

Instructions
practice test 3

1. ZumChem5 5.AE.102. [224665] **0/1 points** Show Details

Acetylene gas, $C_2H_2(g)$, can be produced by reacting solid calcium carbide, CaC_2, with water. The products are acetylene and calcium hydroxide. What volume of wet acetylene is collected at 25℃ and 741 torr when 5.60 g calcium carbide is reacted with an excess of water? (At 25℃ the vapor pressure of water is 23.8 torr.)

4.0 ✗ 2.27 L

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2. ZumChem5 5.E.061. [224707] **0/3 points** Show Details

A piece of solid carbon dioxide, with a mass of 7.6 g, is placed in a 4.0 L otherwise empty container at 24℃. What is the pressure in the container after all the carbon dioxide vaporizes?

4.0 ✗ 1.1 atm

If 7.6 g solid carbon dioxide were placed in the same container but it already contained air at 740 torr, what would be the partial pressure of carbon dioxide, P_{CO_2}?

4.0 ✗ 1.1 atm

What would be the total pressure, P_{total}, in the container after the carbon dioxide vaporized?

4.0 ✗ 2.0 atm

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3. ZumChem5 8.CP.120. [224840] **0/4 points** Show Details

Which of the following molecules have dipole moments? (Select all that apply.)

(a)

- ☐ [x] CH_2Cl_2
- ☐ [_] CCl_4
- ☐ [x] $CHCl_3$

✗

(b)

- ☐ [x] N_2O
- ☐ [_] CO_2

✗

(c)

- ☐ [x] PH_3
- ☐ [x] NH_3

✗

For the molecules that are polar, indicate the polarity of each bond and the direction of the net dipole moment of the molecule. (Do this on paper. Your instructor may ask you to turn in this work.)

Key: paper submission

4. ZumChem5 9.E.016. [190176] **0/7 points** Show Details

Give the expected hybridization of the central atom for the following molecules or ions. (Type your answer using the format sp2 for sp^2.)

(a) PCl_2^- sp3

(b) O_3 sp2

(c) NF_3 sp3

(d) SO_3 sp2

(e) SO_3^{2-} sp3

(f) SCl_2 sp3

(g) SO_2 sp2

[PDF] Click here to view the solution for this question.

5. ZumChem5 9.E.024. [189313] **0/19 points** Show Details

For each of the following molecules or ions that contain sulfur, predict the molecular structure about each sulfur (including bond angles), and give the expected hybrid orbitals for sulfur. (Select all that apply.)

(a) SO_3

molecular structure(s)
- [ ] [_] linear
- [ ] [_] octahedral
- [ ] [_] see-saw
- [ ] [_] square planar
- [ ] [_] tetrahedral
- [x] [x] trigonal planar
- [ ] [_] trigonal pyramidal
- [ ] [_] trigonal bipyramid
- [ ] [_] V-shaped

bond angles
- [ ] [_] 90°
- [ ] [_] 109.5°
- [x] [x] 120°
- [ ] [_] 180°

hybridization
- [ ] [_] sp
- [x] [x] sp^2
- [ ] [_] sp^3
- [ ] [_] dsp^2
- [ ] [_] dsp^3
- [ ] [_] d^2sp^3

(b) SF_2

molecular structure(s)
- [ ] [_] linear
- [ ] [_] octahedral
- [ ] [_] see-saw
- [ ] [_] square planar
- [ ] [_] tetrahedral
- [ ] [_] trigonal planar
- [ ] [_] trigonal pyramidal
- [ ] [_] trigonal bipyramid
- [x] [x] V-shaped

bond angles
- [ ] [_] 90°
- [x] [x] 109.5°
- [ ] [_] 120°
- [ ] [_] 180°

hybridization
- [ ] [_] sp
- [ ] [_] sp^2
- [x] [x] sp^3
- [ ] [_] dsp^2
- [ ] [_] dsp^3
- [ ] [_] d^2sp^3

(c) SO_2

molecular structure(s)
- [ ] [_] linear
- [ ] [_] octahedral
- [ ] [_] see-saw
- [ ] [_] square planar
- [ ] [_] tetrahedral
- [ ] [_] trigonal planar
- [ ] [_] trigonal pyramidal
- [ ] [_] trigonal bipyramid
- [x] [x] V-shaped

bond angles
- [ ] [_] 90°
- [ ] [_] 109.5°
- [x] [x] 120°
- [ ] [_] 180°

hybridization
- [ ] [_] sp
- [x] [x] sp^2
- [ ] [_] sp^3
- [ ] [_] dsp^2
- [ ] [_] dsp^3

[_] d^2sp^3

✗

(d) SO_3^{2-}

molecular structure(s)
- [_] linear
- [_] octahedral
- [_] see-saw
- [_] square planar
- [_] tetrahedral
- [_] trigonal planar
- [x] trigonal pyramidal
- [_] trigonal bipyramid
- [_] V-shaped

✗

bond angles
- [_] 90°
- [x] 109.5°
- [_] 120°
- [_] 180°

✗

hybridization
- [_] *sp*
- [_] sp^2
- [x] sp^3
- [_] dsp^2
- [_] dsp^3
- [_] d^2sp^3

✗

(e) SF_6

molecular structure(s)
- [_] linear
- [x] octahedral
- [_] see-saw
- [_] square planar
- [_] tetrahedral
- [_] trigonal planar
- [_] trigonal pyramidal
- [_] trigonal bipyramid
- [_] V-shaped

✗

bond angles
- [x] 90°
- [_] 109.5°
- [_] 120°
- [x] 180°

✗

hybridization
- [_] *sp*
- [_] sp^2
- [_] sp^3
- [_] dsp^2
- [_] dsp^3
- [x] d^2sp^3

✗

(f) $F_3S\text{-}SF$

molecular structure(s)
- [_] linear
- [_] octahedral
- [x] see-saw
- [_] square planar
- [_] tetrahedral
- [_] trigonal planar
- [_] trigonal pyramidal
- [_] trigonal bipyramid
- [x] V-shaped

✗

bond angles
- [x] 90°
- [x] 109.5°
- [x] 120°
- [_] 180°

✗

hybridization
- [_] *sp*
- [_] sp^2
- [x] sp^3
- [_] dsp^2
- [x] dsp^3
- [_] d^2sp^3

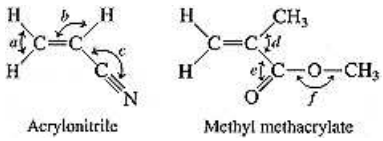
✗

Write the Lewis structure(s) for each molecule or ion. (Do this on paper. Your instructor may ask you to turn in this work.)

Key: paper submission

6. ZumChem5 9.E.028. [227668] **0/17 points** Show Details

Many important compounds in the chemical industry are derivatives of ethylene (C_2H_4). Two of them are acrylonitrile and methyl methacrylate.



Complete the Lewis structures, showing all lone pairs. (Do this on paper. Your instructor may ask you to turn in this work.)

Key: paper submission

Give approximate values for bond angles *a* through *f*.

(a) ✗ 120 °
(b) ✗ 120 °
(c) ✗ 180 °
(d) ✗ 120 °
(e) ✗ 120 °
(f) ✗ 109.5 °

Give the hybridization of all carbon atoms. (Type your answer using the format sp2 for sp^2.)

acrylonitrile
double-bonded carbons
✗ sp2
triple-bonded carbon
✗ sp

methyl methacrylate
double-bonded carbons
✗ sp2
carbon double bonded to oxygen
✗ sp2
methyl carbons
✗ sp3

In acrylonitrile, how many of the atoms in the molecule lie in the same plane?
✗ 7

How many σ bonds and how many π bonds are there in methyl methacrylate and acrylonitrile?
methyl methacrylate
σ bonds
✗ 14
π bonds
✗ 2

acrylonitrile
σ bonds
✗ 6
π bonds
✗ 3

7. ZumChem5 9.E.037. [227672] **0/12 points** Show Details

Using the molecular orbital model, write electron configurations for the following diatomic species and calculate the bond orders, BO (enter 1/2 as 0.5). How many unpaired electrons are present in each one? (Type your answers in the format (S2s)2(S2s*)2(P2p)4(S2p)2 for $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2$ where S stands for σ and P stands for π.)

O_2^+
configuration
(S2s)2(S2s*)2(S2p)2(P2p)4(P2p*)1
bond order
2.5
unpaired electrons
1

O_2
configuration
(S2s)2(S2s*)2(S2p)2(P2p)4(P2p*)2
bond order
2
unpaired electrons
2

O_2^-
configuration
(S2s)2(S2s*)2(S2p)2(P2p)4(P2p*)3
bond order
1.5
unpaired electrons
1

O_2^{2-}
configuration
(S2s)2(S2s*)2(S2p)2(P2p)4(P2p*)4
bond order
1
unpaired electrons
0

8. ZumChem5 9.E.042. [227674] **0/9 points** Show Details

Using the molecular orbital model, write electron configurations for the following diatomic species and calculate the bond orders. Which ones are paramagnetic?

(a) NO^+
electron configuration
- **(o)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2$
- **(_)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^1$
- **(_)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^2$

(b) NO
electron configuration
- **(_)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2$
- **(o)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^1$
- **(_)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^2$

(c) NO^-
electron configuration
- **(_)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2$
- **(_)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^1$
- **(o)** $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4(\sigma_{2p})^2(\pi_{2p}^*)^2$

bond order [ ] 3
paramagnetic or diamagnetic?
( ) paramagenetic
(o) diamagnetic

bond order [ ] 2.5
paramagnetic or diamagnetic?
(o) paramagenetic
( ) diamagnetic

bond order [ ] 2
paramagnetic or diamagnetic?
(o) paramagenetic
( ) diamagnetic

9. ZumChem5 9.E.049. [92521] **0/2 points** Show Details

Describe the bonding in the O_3 molecule and the NO_2^- ion using the localized electron model.

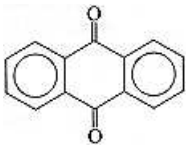
Key: O_3 and NO_2^- are isoelectronic, so we only need consider one of them since the same bonding ideas apply to both. For each of the two resonance forms, the central O atom is sp^2 hybridized with one unhybridized *p* atomic orbital. The sp^2 hybrid orbitals are used to form the two sigma bonds to the central atom. The localized electron view of the π bond utilizes unhybridized *p* atomic orbitals.

How would the molecular orbital model describe the π bonding in these two species?

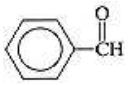
Key: The π bond resonates between the two positions in the Lewis structures. In the MO picure of the π bond, all three unhybridized *p* orbitals overlap at the same time, resulting in π electrons that are delocalized over the entire surface of the molecule.

10. ZumChem5 22.E.041. [224256] **0/4 points** Show Details

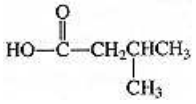
Identify each of the following compounds as a carboxylic acid, ester, ketone, aldehyde, or amine.



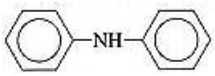
ketone



aldehyde



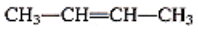
carboxylic acid



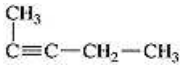
amine

11. ZumChem5 22.E.022. [224251] **0/3 points** Show Details

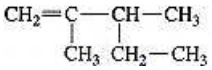
Name each of the following alkenes or alkynes.



2-butene



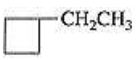
2-pentyne



2,3-dimethyl-1-pentene

12. ZumChem5 22.E.020. [224250] **0/6 points** Show Details

Name each of the following cyclic alkanes, and indicate the formula of the compound.

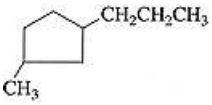


name

ethylcyclobutane

formula (Type your answer using the format CH4 for CH_4.)

C6H12

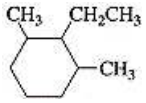


name

1-methyl-3-propylcyclopentane

formula

C9H18



name

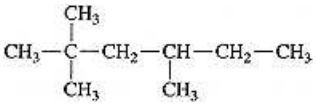
2-ethyl-1,3-dimethylcyclohexane

formula

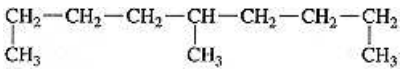
C10H20

13. ZumChem5 22.E.019. [224249] **0/4 points** Show Details

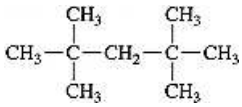
Name each of the following.



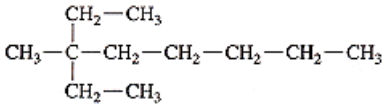
2,2,4-trimethylhexane



5-methylnonane



2,2,4,4-tetramethylpentane



3-ethyl-3-methyloctane

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