Name:
Score: 0 / 42 points (0%) [2 open-ended questions not graded]

C8&9Practice

Multiple Choice
Identify the choice that best completes the statement or answers the question.

___ 1. There are _____ paired and _____ unpaired electrons in the Lewis symbol for a phosphorus atom.
a. 4, 2
b. 2, 4
c. 2, 3
d. 4, 3
e. 0, 3

ANSWER: C
POINTS: 0 / 1

___ 2. Based on the octet rule, iodine most likely forms an _____ ion.
a. I^{2+}
b. I^{4+}
c. I^{4-}
d. I^{+}
e. I^{-}

ANSWER: E
POINTS: 0 / 1

___ 3. Which of the following would have to gain two electrons in order to achieve a noble gas electron configuration?

O Sr Na Se Br

a. Br
b. Sr
c. Na
d. O, Se
e. Sr, O, Se

ANSWER: D
POINTS: 0 / 1

___ 4. The electron configuration of the S^{2-} ion is _____.
a. $[Ar]3s^23p^6$

b. $[Ar]3s^2 3p^2$
c. $[Ne]3s^2 3p^2$
d. $[Ne]3s^2 3p^6$
e. $[Kr]3s^2 2p^{-6}$

ANSWER: D
POINTS: 0 / 1

___ 5. A double bond consists of _____ pairs of electrons shared between two atoms.
a. 1
b. 2
c. 3
d. 4
e. 6

ANSWER: B
POINTS: 0 / 1

___ 6. The Lewis structure of HCN (H bonded to C) shows that _____ has _____ nonbonding electron pairs.
a. C, 1
b. N, 1
c. H, 1
d. N, 2
e. C, 2

ANSWER: B
POINTS: 0 / 1

___ 7. The formal charge on carbon in the molecule below is _____.

a. 0
b. +1
c. +2
d. +3
e. -1

ANSWER: A
POINTS: 0 / 1

___ 8. How many equivalent resonance forms can be drawn for CO_3^{2-} (carbon is the central atom)?
a. 1
b. 2
c. 3
d. 4

e. 0

ANSWER: C
POINTS: 0 / 1

___ 9. Using the table of average bond energies below, the ΔH for the reaction is _____ kJ.

$C{\equiv}O\ (g) + 2H_2\ (g) \rightarrow H_3C{-}O{-}H\ (g)$

Bond:	C-O	C=O	C≡O	C-H	H-H	O-H
D (kJ/mol):	358	799	1072	413	436	463

a. +276
b. -276
c. +735
d. -735
e. -116

ANSWER: E
POINTS: 0 / 1

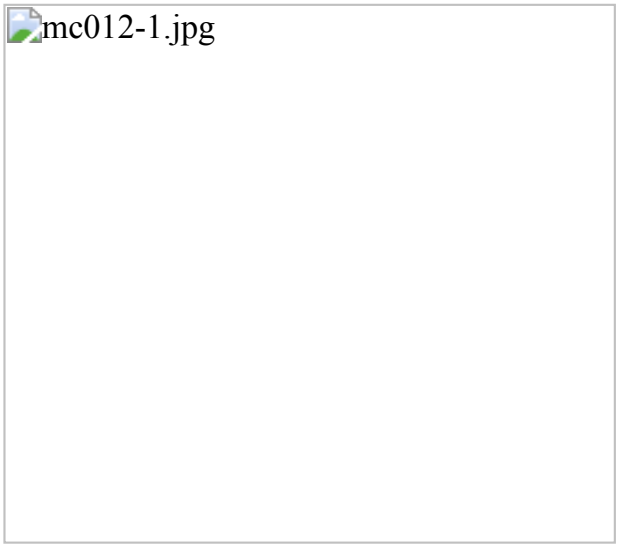
___ 10. Of the ions below, only _____ has a noble gas electron configuration.
a. S^{3-}
b. O^{2+}
c. I^{+}
d. K^{-}
e. Cl^{-}

ANSWER: E
POINTS: 0 / 1

___ 11. In ionic bond formation, the lattice energy of ions _____ as the magnitude of the ion charges _____ and the radii _____.
a. increases, decrease, increase
b. increases, increase, increase
c. decreases, increase, increase
d. increases, increase, decrease
e. increases, decrease, decrease

ANSWER: D
POINTS: 0 / 1

___ 12. The diagram below is the Born-Huber cycle for the formation of crystalline potassium fluoride.



Which energy change corresponds to the first ionization energy of potassium?
a. 2
b. 5
c. 4
d. 3
e. 6

ANSWER: D
POINTS: 0 / 1

___ 13. Of the bonds below, _____ is the least polar.
a. Na, S
b. P, S
c. C, F
d. Si, Cl
e. Na, Cl

ANSWER: B
POINTS: 0 / 1

___ 14. The Lewis structure of N_2H_2 shows _____.
a. a nitrogen-nitrogen triple bond
b. a nitrogen-nitrogen single bond
c. each nitrogen has one nonbonding electron pair
d. each nitrogen has two nonbonding electron pairs
e. each hydrogen has one nonbonding electron pair

ANSWER: C
POINTS: 0 / 1

___ 15. To convert from one resonance structure to another, _____.
a. only atoms can be moved
b. electrons and atoms can both be moved
c. only electrons can be moved

d. neither electrons nor atoms can be moved
e. electrons must be added

ANSWER: C
POINTS: 0 / 1

___ 16. A valid Lewis structure of _____ cannot be drawn without violating the octet rule.
a. NI_3
b. SO_2
c. ICl_5
d. SiF_4
e. CO_2

ANSWER: C
POINTS: 0 / 1

___ 17. Given that the average bond energies for C-H and C-Br bonds are 413 and 276 kJ/mol, respectively, the heat of atomization of bromoform ($CHBr_3$) is _____ kJ/mol.
a. 1241
b. 689
c. -689
d. 1378
e. -1378

ANSWER: A
POINTS: 0 / 1

___ 18. Of the bonds C-N, C=N, and C≡N, the C-N bond is _____.
a. strongest/shortest
b. strongest/longest
c. weakest/shortest
d. weakest/longest
e. intermediate in both strength and length

ANSWER: D
POINTS: 0 / 1

___ 19. The molecular geometry of the CS_2 molecule is _____.
a. linear
b. bent
c. tetrahedral
d. trigonal planar
e. T-shaped

ANSWER: A
POINTS: 0 / 1

___ 20. The molecular geometry of the $PHCl_2$ molecule is _____.

a. bent
b. trigonal planar
c. trigonal pyramidal
d. tetrahedral
e. T-shaped

ANSWER: C
POINTS: 0 / 1

___ 21. The F-N-F bond angle in the NF_3 molecule is slightly less than _____.

a. 90°
b. 109.5°
c. 120°
d. 180°
e. 60°

ANSWER: B
POINTS: 0 / 1

___ 22. The molecular geometry of the H_3O^+ ion is _____.

a. linear
b. tetrahedral
c. bent
d. trigonal pyramidal
e. octahedral

ANSWER: D
POINTS: 0 / 1

___ 23. The hybridization of the central atom in the XeF_4 molecule is _____.

a. sp
b. sp^2
c. sp^3
d. sp^3d
e. sp^3d^2

ANSWER: E
POINTS: 0 / 1

___ 24. The electron-domain geometry of the AsF_6^- ion is octahedral. The hybrid orbitals used by the As atom for bonding are _____ orbitals.

a. sp^2d^2
b. sp^3
c. sp^3d
d. sp^3d^2

e. sp^2

ANSWER: D
POINTS: 0 / 1

___ 25. In order to produce sp^3 hybrid orbitals, _____ s atomic orbital(s) and _____ p atomic orbital(s) must be mixed.
a. one, two
b. one, three
c. one, one
d. two, two
e. two, three

ANSWER: B
POINTS: 0 / 1

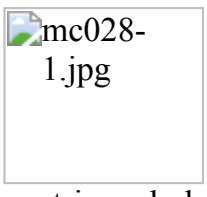
___ 26. There are _____ σ and _____ π bonds in the $H_2C=C=CH_2$ molecule.
a. 4, 2
b. 6, 4
c. 2, 2
d. 2, 6
e. 6, 2

ANSWER: E
POINTS: 0 / 1

___ 27. The basis of the VSEPR model of molecular bonding is _____.
a. regions of electron density on an atom will organize themselves so as to maximize *s*-character
b. regions of electron density in the valence shell of an atom will arrange themselves so as to maximize overlap
c. atomic orbitals of the bonding atoms must overlap for a bond to form
d. electron domains in the valence shell of an atom will arrange themselves so as to minimize repulsions
e. hybrid orbitals will form as necessary to, as closely as possible, achieve spherical symmetry

ANSWER: D
POINTS: 0 / 1

___ 28. The molecular geometry of the right-most carbon in the molecule below is _____.



a. trigonal planar

b. trigonal bipyramidal
c. tetrahedral
d. octahedral
e. T-shaped

ANSWER: A
POINTS: 0 / 1

___ 29. The bond angles marked a, b, and c in the molecule below are about _____, _____, and _____, respectively.

a. 109.5°, 109.5°, 109.5°
b. 120°, 109.5°, 120°
c. 109.5°, 109.5°, 120°
d. 90°, 180°, 90°
e. 109.5°, 109.5°, 90°

ANSWER: C
POINTS: 0 / 1

___ 30. Of the molecules below, only _____ is polar.
a. SbF_5
b. AsH_3
c. I_2
d. SF_6
e. CH_4

ANSWER: B
POINTS: 0 / 1

___ 31. Of the molecules below, only _____ is nonpolar.
a. BF_3
b. NF_3
c. IF_3
d. PBr_3
e. $BrCl_3$

ANSWER: A
POINTS: 0 / 1

___ 32. The molecular geometry of the $BeCl_2$ molecule is _____, and this molecule is

32. _____.
a. linear, nonpolar
b. linear, polar
c. bent, nonpolar
d. bent, polar
e. trigonal planar, polar

ANSWER: A
POINTS: 0 / 1

___ 33. According to valence bond theory, which orbitals overlap in the formation of the bond in HBr?
a. 1s on H and 4p on Br
b. 1s on H and 4s on Br
c. 1s on H and 3p on Br
d. 2s on H and 4p on Br
e. 2s on H and 3p on Br

ANSWER: A
POINTS: 0 / 1

___ 34. The electron-domain geometry of a carbon-centered compound is tetrahedral. The hybridization of the central carbon atom is _____.
a. sp
b. sp^2
c. sp^3
d. sp^3d
e. sp^3d^2

ANSWER: C
POINTS: 0 / 1

___ 35. Of the following, the central atom is sp^3d^2 hybridized only in _____.
a. PCl_5
b. XeF_4
c. PH_3
d. Br_3^-
e. BeF_2

ANSWER: B
POINTS: 0 / 1

___ 36. A typical triple bond _____.
a. consists of one σ bond and two π bonds
b. consists of three shared electrons

c. consists of two π bonds and one π bond
d. consists of six shared electron pairs
e. is longer than a single bond

ANSWER: A
POINTS: 0 / 1

___ 37. In a polyatomic molecule, "localized" bonding electrons are associated with _____.
a. one particular atom
b. two particular atoms
c. all of the atoms in the molecule
d. all of the π bonds in the molecule
e. two or more σ bonds in the molecule

ANSWER: B
POINTS: 0 / 1

___ 38. The carbon-carbon σ bond in ethylene, $H_2C=CH_2$, results from the overlap of _____.
a. sp hybrid orbitals
b. sp^3 hybrid orbitals
c. sp^2 hybrid orbitals
d. s atomic orbitals
e. p atomic orbitals

ANSWER: C
POINTS: 0 / 1

___ 39. The N-N bond in HNNH consists of _____.
a. one σ bond and one π bond
b. one σ bond and two π bonds
c. two σ bonds and one π bond
d. two σ bonds and two π bonds
e. one σ bond and no π bonds

ANSWER: A
POINTS: 0 / 1

___ 40. Based on molecular orbital theory, the bond orders of the H–H bonds in H_2, H_2^+, and H_2^- are _____, respectively
a. 1, 0, and 0
b. 1, 1/2, and 0
c. 1, 0, and 1/2
d. 1, 1/2, and 1/2
e. 1, 2, and 0

ANSWER: D

POINTS: 0 / 1

___ 41. A molecular orbital can accommodate a maximum of _____ electron(s).

a. one
b. two
c. four
d. six
e. twelve

ANSWER: B
POINTS: 0 / 1

___ 42. Molecular Orbital theory correctly predicts diamagnetism of fluorine gas, F_2. This is because _____.

a. the bond order in F_2 can be shown to be equal to 1.
b. there are more electrons in the bonding orbitals than in the antibonding orbitals.
c. all electrons in the MO electron configuration of F_2 are paired.
d. the energy of the π_{2p} MOs is higher than that of the σ_{2p} MO
e. the F–F bond enthalpy is very low

ANSWER: C
POINTS: 0 / 1

Free Response

43. Carbon dioxide gas is bubbled into water.

a. Write and balance a chemical equation to describe the process. Recall your strong vs. weak acid knowledge.

b. Draw the Lewis structurres for the reactants and products. Include any valid resonance structures.

c. Calculate the change in enthalpy for this reaction using bond energy values.

d. Are the C-O bonds in teh reactant stronger or weaker than those in the product? Explain. Is your explanation consistent with the sign of the enthalpy change that you calculated? Explain.

RESPONSE:
ANSWER: ?
POINTS: -- / 1

44. Consider the chemical species IF_5 and IF_4^{1+}

a. Draw the Lewis structures of each species.

b. Identify the orbital hybridization, geometry, and bond angles for each.

c. Predict which, if any, is a polar species. Justify your answer.

d. Predict the oxidation number of iodine in each species. Give another example of an ion with the same oxidation number for iodine as IF_4^{1+} has.

e. Would you expect the conversion from IF_5 to IF_4^{1+} to be endothermic or exothermic. Explain.

RESPONSE:
ANSWER: ?
POINTS: -- / 1