

Name: _____

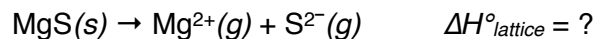
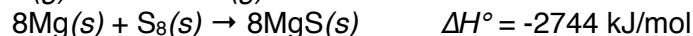
Lab Section #: _____

Please mark your answers on the scantron sheet using a #2 pencil and also mark your answers on the exam itself.

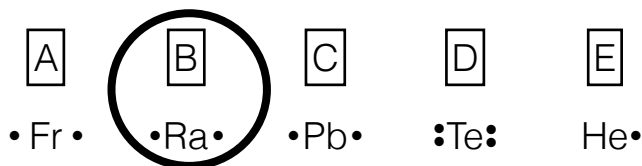
Mark Test From "A" on your scantron.

- Which of the following is an ionic compound?
 - KI**
 - NH₃
 - I₂
 - H₂S
 - CCl₄
- Of these substances, in which are the atoms held together by metallic bonding?
 - CO₂(g)
 - Si(s)
 - Br₂(l)
 - S₈(s)
 - Cr(s)**
- Which statement below best describes the location of the electrons involved in a covalent bond?
 - The electrons are delocalized evenly, everywhere, between all the atoms in the substance.
 - The electrons have a higher probability of being found directly between adjacent nuclei.**
 - The electrons form a straight line bridging the adjacent nuclei.
 - The electrons are removed from one atom and found exclusive around the adjacent atom.
 - The electrons are on the far sides of the nuclei, which touch to form a covalent bond.
- What is the molecular formula of the ionic compound formed by barium and nitrogen?
 - BaN
 - BaN₂
 - Ba₂N₃
 - Ba₂N
 - Ba₃N₂**
- The lattice energy for ionic crystals increases as the charge on the ions _____ and the size of the ions _____.
 - increases, increases
 - increases, decreases**
 - decreases, increases
 - decreases, decreases
 - None of these choices is generally correct.

6. Calculate the lattice energy of magnesium sulfide from the data given below.

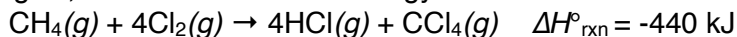


- a) -3406 kJ/mol
 b) -2720. kJ/mol
 c) 2720. kJ/mol
d) 3406 kJ/mol
 e) None of these choices are correct.
7. The diameter of a chloride ion is 362 pm, and the diameter of a potassium ion is 276 pm. What is the distance between the nuclei of adjacent chloride and potassium ions in solid potassium chloride?
 a) 1276 pm
 b) 638 pm
c) 319 pm
 d) 181 pm
 e) 138 pm
8. Select the element whose Lewis symbol is correctly represented.



9. The melting point of MgO is 2852°C, whereas SO₂ has a melting point of -97.6°C. If quartz (SiO₂) is a solid with a melting point of 1550°C, the bonding in quartz is best described as:
 a) lattice energy
 b) network attractions
 c) ionic bonding
d) network covalent bonding
 e) metallic bonding
10. Which of the atoms listed below is the most electronegative?
 a) Rb
 b) Li
 c) As
 d) Al
e) N

11. The reaction between methane and chlorine gas is exothermic and produces carbon tetrachloride and hydrogen chloride gasses. Given the reaction, its enthalpy, and the respective bond energies, determine the bond energy of the Cl – Cl bond.

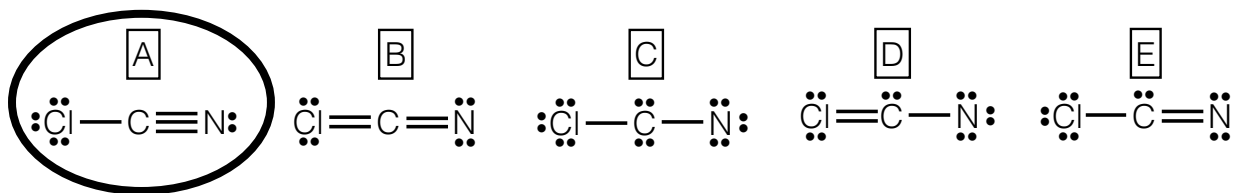


Bond energies:

C – H = 413 kJ/mol; C – Cl = 339 kJ/mol; C – C = 347 kJ/mol; H – Cl = 427 kJ/mol

- a) 60.8 kJ/mol
 b) 330 kJ/mol
c) 243 kJ/mol
 d) 972 kJ/mol
 e) 156 kJ/mol
12. Which is the strongest bond of those listed below?
 a) H – Cl
b) H – F
 c) H – Br
 d) H – At
 e) H – I

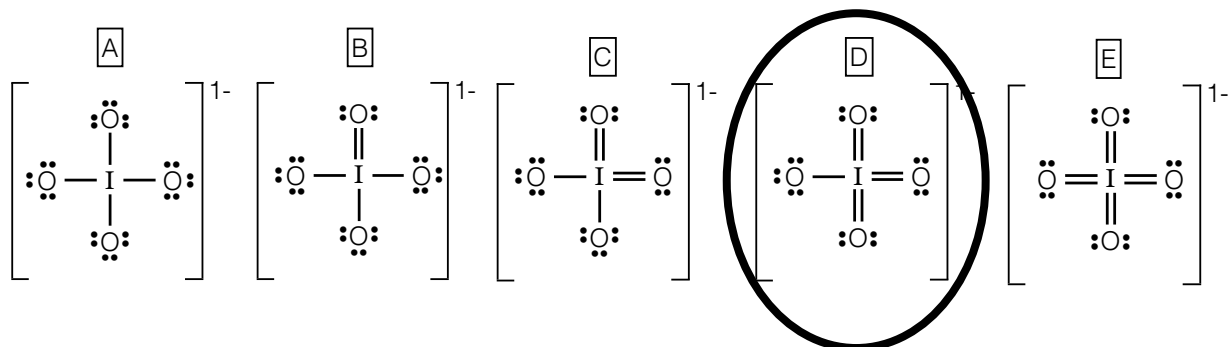
13. Select the best Lewis structure for ClCN.



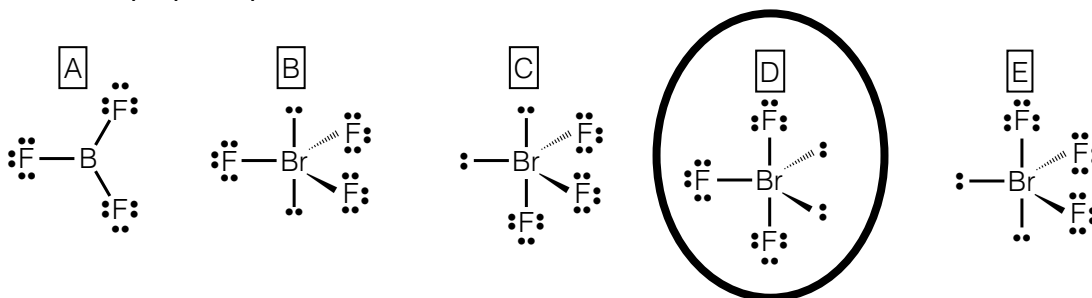
14. Which of the molecules below is not an example of an expanded octet?

- a) SO_4^{2-}
 b) ClO_3^-
 c) XeF_4
d) PCl_3
 e) PO_4^{3-}

15. Select the Lewis structure in which the formal charges on the atoms in periodate (IO_4^-) are best minimized.

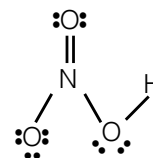


16. Which is the proper representation of bromine trifluoride?



17. What is the formal charge of the nitrogen atom in nitric acid (HNO_3)?

- a) -2
- b) -1
- c) 0
- d) +1**
- e) +2



18. Which molecule below does not have a resonance structure?

- a) O_3
- b) ClO_4^-
- c) PO_4^{3-}
- d) CO_2**
- e) SO_3^{2-}

19. Of the bond angles listed below, which is not a bond angle between chlorine atoms, predicted by the VSEPR structure, on PCl_5 ?

- a) 90°
- b) 109.5°**
- c) 120°
- d) 180°
- e) All these bond angles are found in PCl_5 .

20. Which of the molecules listed below has a square planar structure?

- a) NH_4^+
- b) XeF_4**
- c) SO_4^{2-}
- d) XeO_2F_2
- e) IF_4^+

21. Which one of the molecules below is not correctly paired with its predicted VSEPR structure?

- a) SO_4^{2-} : tetrahedral
- b) IF_4^+ : see-saw
- c) CO_3^{2-} : trigonal planar
- d) H_2O : linear**
- e) SF_6 : octahedral

22. Which one of the molecules listed below does not have a central atom with sp^3 hybridization?
- BCl₃**
 - NH₃
 - H₃O⁺
 - PCl₃
 - CH₄
23. What is the hybridization of the carbon atom in thiocyanate (SCN⁻)?
- sp**
 - sp^2
 - sp^3
 - sp^3d
 - The carbon atom is not hybridized
24. Which of the following will result in the least, or no, disruption to the ideal bond angles around a central atom?
- A lone pair of electrons.
 - A double bond to oxygen.
 - A double bond to sulfur.
 - A single bond to hydrogen.**
 - Nothing disrupts bond angles.
25. Which one of the molecules below exhibits *molecular* polarity?
- NH₄⁺
 - CO₂
 - SO₄²⁻
 - OCN⁻**
 - BF₃
26. Which statement pertaining to sigma bonds is incorrect?
- Methane (CH₄) contains four sigma bonds.
 - Sigma bonds have very high electron density along the axis of the bond.
 - Sigma bonds form from the direct overlap of any two orbitals on adjacent atoms.
 - All bonds between atoms contain sigma bonds.
 - Double bonds are the result of a pair of sigma bonds between the same two atoms.**
27. How many sigma and pi bonds are there in a molecule of SO₃?
- Three sigma bonds and zero pi bonds.
 - Two sigma bonds and one pi bond.
 - One sigma bond and two pi bonds.
 - Three sigma bonds and three pi bonds.**
 - Four sigma bonds and two pi bonds.

Use the molecular orbital diagram below to assist in answering the next three questions.

28. Using the MO diagram, determine the bond order for the BN (boronitride) molecule?

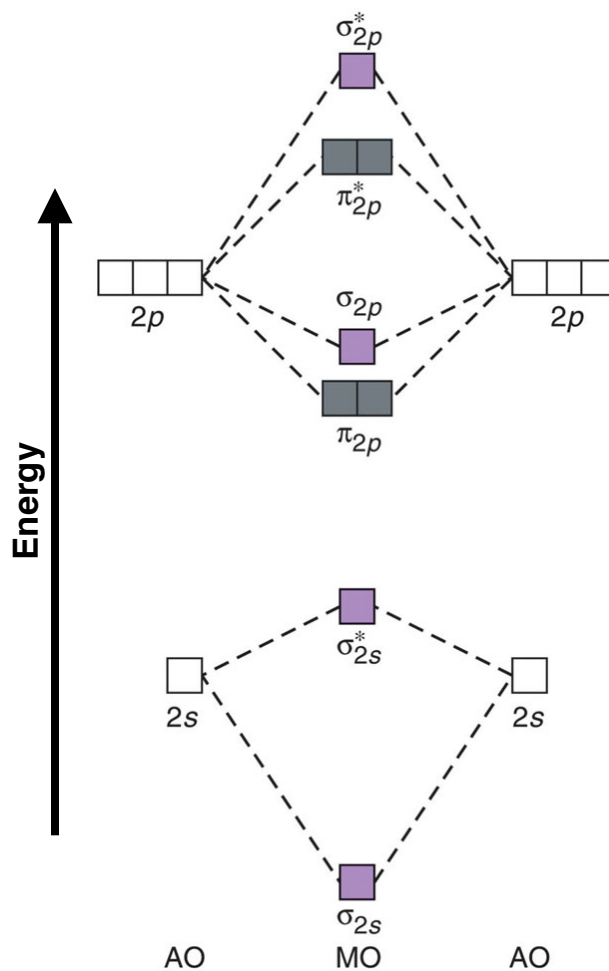
- a) 0
- b) 1
- c) 1.5
- d) 2**
- e) 3

29. Which one of the following diatomic molecules is paramagnetic?

- a) N_2
- b) CN^-
- c) BN
- d) C_2
- e) B_2**

30. How many electrons does the diatomic ion N_2^- have in anti-bonding molecular orbitals?

- a) 0
- b) 1
- c) 2
- d) 3**
- e) 4



The following problems are extra credit. You will not be penalized for wrong answers.

31. What is the hybridization of the iodine atom in IF_4^+ ?

- a) sp
- b) sp^2
- c) sp^3
- d) **sp^3d**
- e) sp^3d^2

32. In the figure below the curved line represents the potential energy of the bond in a molecule of H_2 . Which point on the figure (represented by the letters) shows the optimal length of the H – H bond?

