

Chem 111 **9:05a section** **Evening Exam #2v1**

This exam is composed of **25** questions. Go initially through the exam and answer the questions you can answer *quickly*. Then go back and try the ones that are more challenging to you and/or that require calculations.

As discussed on the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.

$$E = h\nu = \frac{hc}{\lambda}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

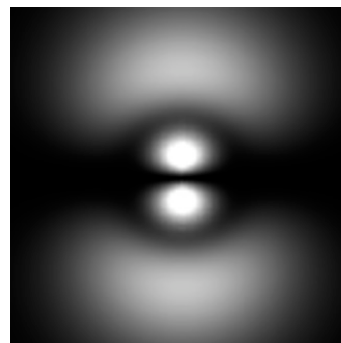
$$\text{Hz} = \text{s}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

$$c = 2.998 \times 10^8 \text{ m s}^{-1}$$

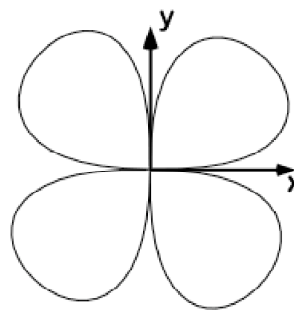
$$N = 6.022 \times 10^{23} \text{ mol}^{-1}$$

- How many valence electrons are in the O atom?
 1) 4 2) 6 3) 8 4) 16 5) 0
- Which atom(s) has/have completely filled 3s, 3p, and 3d orbitals?
 1) Ar 2) Zn 3) Kr 4) Ar & Zn 5) Kr & Zn
- Which element is represented by: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^3$
 1) Sb 2) Te 3) Br 4) As 5) Se
- The orbital depicted at right is:
 1) 1s 2) 2p 3) 3s 4) 3p 5) 4p



5. The orbital depicted at right is:

- 1) p_{xy} 2) d_{xy} 3) $d_{x^2-y^2}$ 4) d_{z^2} 5) f_{xy}



6. Which of the following quantum number sets is **not** allowed?

- 1) $n=+3$ $l=+2$ $m_l = -1$ $m_s = +1/2$ 2) $n=+2$ $l=+1$ $m_l = -1$ $m_s = +1/2$
 3) $n=+3$ $l=+1$ $m_l = -1$ $m_s = -1/2$ 4) $n=+2$ $l=0$ $m_l = -1$ $m_s = +1/2$
 5) $n=+3$ $l=0$ $m_l = 0$ $m_s = -1/2$

7. What is the maximum number of orbitals that can be identified by the set of quantum numbers $n=+3$ $l=+2$?

- 1) 7 2) 2 3) 3 4) 5 5) 10

8. Which of the following has the shortest bond length?

- 1) H_2O 2) HF 3) NH_3 4) CH_4

9. Which of the following has the highest bond energy?

- 1) B_2 2) C_2 3) N_2 4) O_2 5) F_2

10. The CO bond in the molecule CH_3OH is best described as a:
- 1) triple bond
 - 2) double bond
 - 3) single bond
 - 4) ionic bond
 - 5) the molecule doesn't exist
11. Consider the molecule SO_3^x , where x is the charge on the molecule. All three bonds are single bonds. Which value of x yields the stable molecule? (Hint: draw Lewis structures to figure this one out)
- 1) +2
 - 2) +1
 - 3) 0
 - 4) -1
 - 5) -2
12. For the SO_3^x molecule above, how many equal-energy resonance structures can you draw?
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
 - 5) 6
13. The NO bond in HNO is a:
- 1) single bond
 - 2) double bond
 - 3) triple bond
 - 4) ionic bond
14. If an element with the valence configuration $4s^23d^7$ loses 2 electron(s), these electron(s) would be removed from the following **subshell(s)**.
- 1) 4s
 - 2) 3d
 - 3) 4s and 3d
 - 4) 3p
 - 5) 4p

15. Which molecule below does not exist?

- 1) BeF_2 2) CaF_4 3) MgO 4) KCl 5) BCl_3

16. Draw a stable Lewis structure for the symmetrical molecule **hydrazine** N_2H_4 . In this structure, how many *lone pair electrons* are on *each* N?

- 1) 1 2) 2 3) 3 4) 4 5) 6

17. Draw a stable Lewis structure for the molecule **OCS**. In this structure (with C at the center), what is the bond order between C and O?

- 1) 1 2) 1.5 3) 2 4) 2.5 5) 3

18. Draw the best Lewis structure for ClF_2^+ . How many **lone pair electrons** are located on Cl?

- 1) 1 2) 2 3) 3 4) 4 5) 6

19. For the molecule ClF_2^+ , what is the electron group geometry of Cl?

- 1) linear 2) tetrahedral 3) trigonal planar
4) trigonal bipyramidal 5) octahedral

20. In the molecule NO_2^+ , the actual bond order for each NO bond is:

- 1) 1 2) 2 3) 3 4) 1.5
 5) 1 for one bond and 2 for the other

21. Draw the Lewis structure for XeF_4 . The electron group geometry is:

- 1) square planar 2) square pyramidal 3) trigonal bipyramidal
 4) octahedral 5) none of the above

Bond Dissociation Energies (kJ mol^{-1}) (gas phase)

Bond	D	Bond	D	Bond	D
H-H	436	C-C	346	N-N	163
C-H	413	C=C	610	N=N	418
N-H	391	O-O	146	C-O	358
O-H	463	O=O	498	C=O	745

22. Consider the reaction: $\text{H}_2\text{CCH}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{CH}_3(\text{g})$

What is the energy (ΔH° , in kJ mol^{-1}) for this reaction?

- 1) -480 2) -44 3) +44 4) -346 5) +346
 5) -1 for one O and 0 for the other O

