

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.

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

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

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

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

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

- Which radiation below has the longest wavelength (don't use your calculator!)?
 - blue light (6.8×10^{14} Hz)
 - green light (6.0×10^{14} Hz)
 - red light (4.5×10^{14} Hz)
 - gamma rays (2.4×10^{20} Hz)
 - x-rays (5.0×10^{18} Hz)
- A local AM radio station broadcasts at an energy of 5.55×10^{-31} . Does this number likely represent:
 - kJ/photon
 - kJ/mole
 - kJ/atom
 - kJ/song played
- Calculate the frequency at which the above radio station is broadcasting.
 - 1.39 MHz
 - 838 KHz
 - 1.39 KHz
 - 838 Mhz
 - Cant' tell

4. Consider the diagram at right. The transition labeled A described as :

- 1) emission 2) absorption
3) ionization 4) electron capture

5. In the same diagram, the energy of transition B is *best* as:

- 1) absorption energy 2) emission energy
3) ionization energy 4) electron affinity

6. The magnetic quantum number m_l specifies:

- 1) subshell orbital shape 2) orbital orientation
3) transition probability 4) orbital karma
5) energy and distance from nucleus

7. The angular momentum quantum number l specifies:

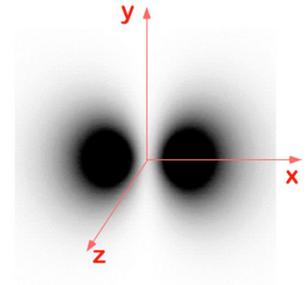
- 1) subshell orbital shape 2) orbital orientation
3) transition probability 4) orbital karma
5) energy and distance from nucleus

8. The principle quantum number n specifies:

- 1) subshell orbital shape 2) orbital orientation
3) transition probability 4) orbital karma
5) energy and distance from nucleus

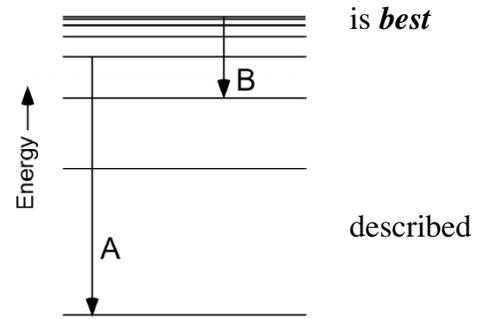
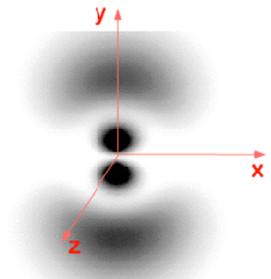
9. The orbital depicted at right is what type of orbital?

- 1) $3d_z$ 2) $2p_x$
3) $3p_x$ 4) $2p_y$ 5) $3p_y$



10. The orbital depicted at right is what type of orbital?

- 1) $3d_z$ 2) $2p_x$
3) $3p_x$ 4) $2p_y$ 5) $3p_y$



is *best*

described

11. The correct spectroscopic notation for sulfur (S) is:
- 1) $1s^2 2s^2 2p^6 3s^2 3p^2$
 - 2) $1s^2 2s^2 2p^6 3s^2 3p^3$
 - 3) $1s^2 2s^2 2p^6 3s^2 3p^4$
 - 4) $1s^2 2s^2 2p^6 3s^2 3p^5$
 - 5) $1s^2 2s^2 2p^6 3s^2 3p^6$
12. The correct spectroscopic notation for sulfur ion (S^{2-}) is:
- 1) $1s^2 2s^2 2p^6 3s^2 3p^2$
 - 2) $1s^2 2s^2 2p^6 3s^2 3p^3$
 - 3) $1s^2 2s^2 2p^6 3s^2 3p^4$
 - 4) $1s^2 2s^2 2p^6 3s^2 3p^5$
 - 5) $1s^2 2s^2 2p^6 3s^2 3p^6$
13. If an element with the valence configuration $4s^2 3d^7$ loses 3 electrons, these electron(s) would be removed from the following **subshell(s)**.
- 1) 4s
 - 2) 3d
 - 3) 4s and 3d
 - 4) 3p
 - 5) 4p
14. If an element with the valence configuration $4s^1 3d^5$ loses 1 electron, the electron would be removed from the following **subshell(s)**. Think carefully about this one!
- 1) 4s
 - 2) 3d
 - 3) 4s and 3d
 - 4) 3p
 - 5) 4p
15. Which of the following elements has the greatest difference between the second and third ionization energies?
- 1) C
 - 2) Mg
 - 3) Ar
 - 4) Na
 - 5) F
16. Which molecule below does not exist?
- 1) BeF_2
 - 2) CaF_2
 - 3) MgO_2
 - 4) KCl
 - 5) $BeCl_2$
17. Which of the following correctly compares atomic sizes?
- 1) $Ar < Na < Al < Si < P$
 - 2) $Ar < S < P < Si < Mg$
 - 3) $Na < Al < Si < P < Ar$
 - 4) $S < P < Si < Mg < Ar$
 - 5) none of the above
18. Which of the following correctly compares ionic/atomic sizes?
- 1) $Ne < O < C < Mg^{2+} < Na^+$
 - 2) $C < O < Ne < Na^+ < Mg^{2+}$
 - 3) $Mg^{2+} < Na^+ < Ne < C < O$
 - 4) $Al^{3+} < Mg^{2+} < Na^+ < O < C$
 - 5) none of the above

19. The molecule HF can be thought of as having both ionic and covalent character. Given that statement, which of the following is likely to best describe the charge on each atom?

	H	F
1)	-1.0	+1.0
2)	-0.7	+0.7
3)	0.0	0.0
4)	+0.7	-0.7
5)	+1.0	-1.0

20. Which of the following is most likely to be the correct assignment of effective nuclear charges for a 2s electron in each of the atoms below?

	B	C	N	O	F
1)	3.58	4.22	4.85	5.49	6.13
2)	6.13	5.49	4.85	4.22	3.58
3)	2.58	3.22	3.85	4.49	5.13
4)	5.13	4.49	3.85	3.22	2.58

21. The CO bond in the molecule CH₃OH is best described as a:

- | | |
|-------------------------------|----------------|
| 1) ionic bond | 2) single bond |
| 3) double bond | 4) triple bond |
| 5) the molecule doesn't exist | |

22. Draw the Lewis structure for CO₂

Your resulting molecule has a total of:

- | | |
|-----------------------------------|-----------------------------------|
| 1) Two single bonds | 2) Two double bonds |
| 3) One single and one double bond | 4) One double and one triple bond |
| 5) Two triple bonds | |

