

Chem 111

10:10a section

Evening Exam #2v1 Fixed

This exam is composed of 25. 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.

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

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

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

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

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

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

1. Which radiation below has the longest wavelength (don't use your calculator!)?

1) blue light ($6.8 \times 10^{14} \text{ Hz}$)

4) microwaves ($2.4 \times 10^9 \text{ Hz}$)

2) green light ($6.0 \times 10^{14} \text{ Hz}$)

5) x-rays ($5.0 \times 10^{18} \text{ Hz}$)

3) red light ($4.5 \times 10^{14} \text{ Hz}$)

(4) It has the lowest frequency. Remember that $\lambda = c/\nu$

From OWL Unit 7-1b (and from last exam)

2. A local AM radio station broadcasts at an energy of 5.55×10^{-7} . Are the units of this number likely:

1) kJ/mole

2) kJ/atom

3) kJ/photon

4) kJ/song played

(1) From lecture. I stressed that it was important to have a feel for the magnitudes of energies – molecule (photon) vs mole.

3. Calculate the frequency at which the above radio station is broadcasting.

1) 1.39 MHz

2) 838 KHz

3) 1.39 KHz

4) 838 Mhz

5) Cant' tell

$$\text{(1) } \nu = \frac{E}{h} = \frac{5.55 \times 10^{-7} \text{ kJ mol}^{-1} \cdot 10^3 \text{ J}}{6.626 \times 10^{-34} \text{ J s}} \cdot \frac{1}{6.02 \times 10^{23} \text{ mol}^{-1}} = 1.39 \times 10^6 \text{ s}^{-1} = 1.39 \text{ MHz}$$

From OWL Unit 7-2c and Unit 7-3c

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

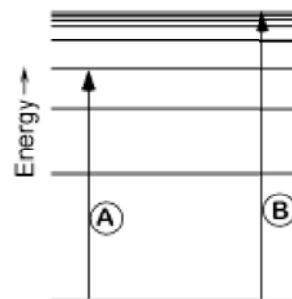
1) emission

2) absorption

3) ionization

4) electron capture

(2) From OWL Unit 7-4c



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

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

(3) From OWL Unit 7-4c

6. 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 | |

(5) From OWL Unit 7-7b

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 | |

(1) From OWL Unit 7-7b

8. The magnetic quantum number m_l specifies:

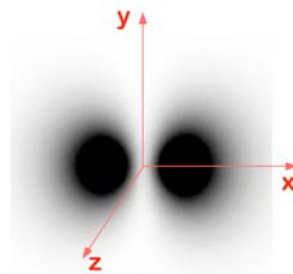
- | | |
|-------------------------------------|------------------------|
| 1) subshell orbital shape | 2) orbital orientation |
| 3) transition probability | 4) orbital karma |
| 5) energy and distance from nucleus | |

(2) From OWL Unit 7-7b

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

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

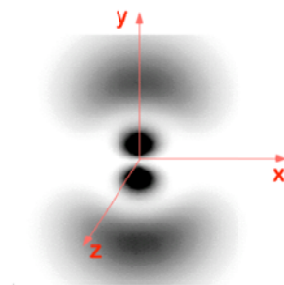
(2) From OWL Unit 7-8c



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

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

(5) From OWL Unit 7-8c



11. The correct spectroscopic notation for phosphorous (P) is:

- 1) $1s^22s^22p^63s^23p^2$ 2) $1s^22s^22p^63s^23p^3$
3) $1s^22s^22p^63s^23p^4$ 4) $1s^22s^22p^63s^23p^5$
5) $1s^22s^22p^63s^23p^6$

(2) From OWL Unit 8-5b

12. The correct spectroscopic notation for phosphorous ion (P^{2-}) is:

- 1) $1s^22s^22p^63s^23p^2$ 2) $1s^22s^22p^63s^23p^3$
3) $1s^22s^22p^63s^23p^4$ 4) $1s^22s^22p^63s^23p^5$
5) $1s^22s^22p^63s^23p^6$

(4) From OWL Unit 8-7c

13. 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

(1) From OWL Unit 8-7d

14. If an element with the valence configuration $4s^13d^5$ loses 2 electron(s), these electron(s) 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

(3) From OWL Unit 8-7d

15. Which of the following elements has the greatest difference between the first and second ionization energies?

- 1) C 2) Li 3) N 4) Be 5) F

(2) See Study Questions 67-68 & 72, Chapter 8 of K&T

16. Which molecule below does not exist?

- 1) BeF_3 2) CaF_2 3) MgO 4) KCl 5) $BeCl_2$

(1) See Study Question 33, Chapter 9 of K&T – think about ionization required to make ionic compounds (Chapt 9.3)

17. Which of the following correctly compares atomic sizes?

- 1) $Ne < Li < B < C < N$ 2) $Ne < O < N < C < Be$
3) $Li < B < C < N < Ne$ 4) $O < N < C < Be < Ne$
5) none of the above

(2) From OWL Unit 8-8c

22. Draw the Lewis structure for NO_2^-

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 | |

(3) From OWL units 9-1d and 9-2b. See Study Questions 13-14, Chapter 9 of K&T

23. Draw the Lewis structure for NO_2^+

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 | |

(2) From OWL units 9-1d and 9-2b. See Study Questions 13-14, Chapter 9 of K&T

24. The CN bond in HCN is a:

- | | | | |
|----------------|----------------|----------------|---------------|
| 1) single bond | 2) double bond | 3) triple bond | 4) ionic bond |
|----------------|----------------|----------------|---------------|

(3) From OWL units 9-1d and 9-2b. See Study Questions 13-14, Chapter 9 of K&T

25. The correct designator for this course is:

- | | | | |
|-------------|-------------|---------------|--------------|
| 1) Chem 111 | 2) Chem 363 | 3) PolSci 101 | 4) Sports 01 |
|-------------|-------------|---------------|--------------|

(1)