

Name: _____
Chemistry 112
Final Exam

Section I . New Material Each questions worth 20 points- You may NOT skip any questions from this section.

1A. What is the frequency of an X-ray with a 0.167 nm wavelength?

$$c = \lambda\nu, 2.998 \times 10^8 \text{ m/s} = 0.167 \text{ nm} \cdot \frac{1 \times 10^{-9} \text{ m}}{\text{nm}} \times \nu$$

$$\nu = 2.998 \times 10^8 \text{ m/s} \div 0.167 \times 10^{-9} \text{ m}$$

$$\nu = 1.80 \times 10^{18} \text{ s}^{-1} (\text{Hz})$$

1B. What is the energy of a single photon of light with a 0.167 nm wavelength?

$$E = h\nu$$

$$E = 6.626 \times 10^{-34} \text{ J} \cdot \text{s} \times 1.80 \times 10^{18} \text{ s}^{-1}$$

$$= 1.19 \times 10^{-15} \text{ J}$$

1C. What is the energy of 1 mole of photons of light with a 0.167 nm wavelength?

$$E = E_{1 \text{ photon}} \times 6.022 \times 10^{23} \text{ photons/mol}$$

$$= 7.16 \times 10^8 \text{ J or } 716 \text{ MJ}$$

2. Which of the following sets of quantum numbers is not allowed? For each incorrect set state why it is incorrect.

A. $n = 5, l = -4, m_l = 2, m_s = +1/2$

Not allowed: l cannot be < 0

B. $n = 3, l = 3, m_l = 0, m_s = -1/2$

Not allowed: l must be $n-1$ or less

C. $n = 2, l = 3, m_l = 2, m_s = -1/2$

Not allowed: l must be $n-1$ or less

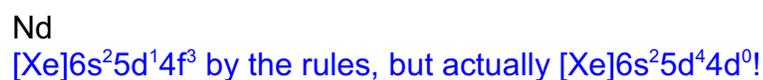
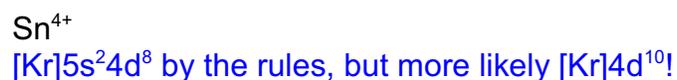
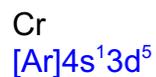
D. $n = 2, l = 1, m_l = 1, m_s = +1/2$

Allowed

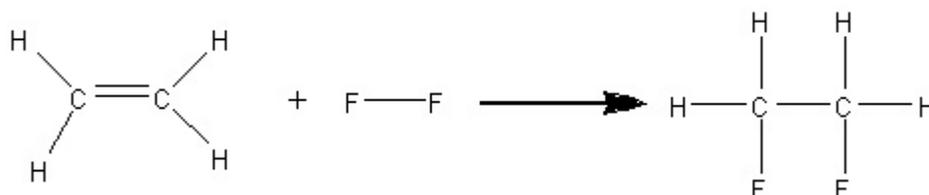
E. $n = 2, l = 1, m_l = -1, m_s = -1$

Not allowed m_s must be $+ \text{ or } - 1/2$

3. What is the electron configuration of the following atoms or ions



4. The ΔH_{RXN} for the following reaction is -535 kJ/mol.

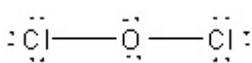
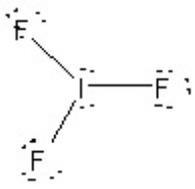
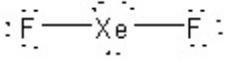
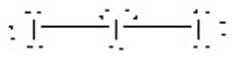


Given the bond energies below, calculate the bond energy of the F-F bond.

Bond	Energy (kJ/mole)
C-H	413
C-C	347
C=C	614
C-F	485

$$\begin{aligned}
 E &= \text{sum of bonds broken} - \text{sum of bonds formed} \\
 &= [4(\text{C-H}) + \text{C}=\text{C} + \text{F-F}] - [4(\text{C-H}) + \text{C-C} + 2(\text{C-F})] \\
 -535 &= [4(413) + 614 + X] - [4(413) + 347 + 2(485)] \\
 -535 &= 1652 + 614 + X - 1652 - 347 - 970 \\
 X &= -535 - 614 + 347 + 970 = 168 \text{ kJ}
 \end{aligned}$$

5 For each compound below give the Lewis Structure, Electron Geometry, Molecular Geometry, Polar Bonds and is a polar molecule.

Lewis Structure	e ⁻ Geometry	Molecular Geometry	Bonds	Polar Molecule
OCl_2 	Tetrahedral	V-shape	Polar	Polar
IF_3 	Trigonal bipyramid	Trigonal planar	Polar	Non-polar
XeF_2 	Trigonal bipyramid	Linear	Polar	Non-polar
I_3^- 	Trigonal bipyramid	Linear	Non-polar	Non-polar

Section II Old Material

You may skip TWO question from this section. (All questions worth 20 points. If you do all 7 questions I will throw out the worst one(s).)