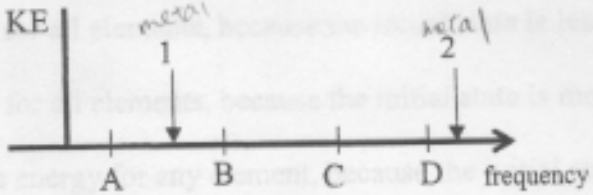
Name Yuan, Nance

Points 1 and 2 represent the work functions in frequency units of two different metals on the plot of photo-electron kinetic energy vs. photon frequency for a photoelectric effect experiment. Use the photon frequencies labeled A, B, C and D to answer the following four questions.



1.) Which photon ejects an electron with the greatest kinetic energy from metal 1?

A) A B) B C) C D) D E) none

2.) Which photon will not eject an electron from either metal?

A) A B) B C) C D) D E) none

3.) Which photon ejects an electron from metal 2?

A) A B) B C) C D) D E) none

4.) What is the wavelength (nm) of photon A if the frequency at point 'A' is 3.0×10^{14} Hz (in the infrared region of the electromagnetic spectrum)?

A) 1000 B) 1500 C) 2200 D) 3300 E) 4200

$\lambda = \frac{c}{\nu}$

$\lambda = \frac{3\times10^{8}\ m/s}{3.0\times10^{14}\ /s} \times \frac{10^{9}\ nm}{1\ m}$

Continue with the next question:

Consider the electronic energy levels of the He^{+} ion for the following three questions.

5.) What is the ground state energy in units of R_∞ (Rydbergs)?

A) -9 B) -4 C) 0 D) 4 E) 16

$E_n = \frac{-Z^2}{n^2} R_\infty$

$-4R_\infty$

6.) What wavelength photon is required to excite this ion from its ground state to first excited state (nm)?

A) 1.00 B) 3.14 C) 13.5 D) 18.8 E) 30.4

$E = -4R_\infty\left(\frac{1}{4} - 1\right)$

$E = 3R_\infty : \frac{hc}{\lambda}$

$\lambda = \frac{hc}{3R_\infty} \times \frac{10^{9}}{1\ m}$

$\lambda = \frac{(6.626\times10^{-34}\ J\cdot s)(3\times10^{8}\ m/s)}{3(2.179\times10^{-18}\ J)} \times \frac{10^{9}}{1\ m}$

7.) What is the ionization energy of the ion in units of R_∞?

A) -9 B) -4 C) 0 D) 4 E) 16

$-4R_\infty(0-1)$

Continue with the next question:

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8.) Which atomic orbital has the greatest number of radial nodes? n-1 total nodes, l angular nodes

A) 1s B) 2s C) 3s D) 3p E) 4d

0 1 2 1 1

9.) The process of removing an electron from a neutral element in the gas phase...

A) requires energy for all elements, because the initial state is less stable than the final state.
B) requires energy for all elements, because the initial state is more stable than the final state.
C) does not require energy for any element, because the initial state is the same energy as the final state.
D) requires energy for some elements, because sometimes the initial state is more stable than the final state.

10.) Which of the following is a reasonable electronic configuration for neutral Tin (Sn)?

A) $[Kr]4s^2 3d^{10} 4p^2$
B) $[Kr]5s^2 5d^{10} 5p^2$
C) $[Kr]5s^2 4d^{10} 5p^3$
D) $[Kr]5s^2 4d^{12} 5p^0$
E) $[Kr]5s^2 4d^{10} 5p^2$

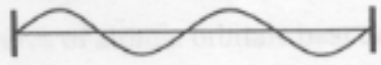
11.) In an atom of any element, the 2s orbital is:

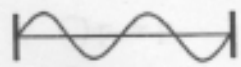
A) always at the same energy as the 2p orbital.
B) always at lower energy than the 2p orbital.
C) only at the same energy as the 2p orbital for atoms with more than one electron.
D) only at lower energy than the 2p orbital for atoms with more than one electron.

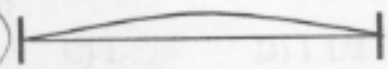
12.) Which wave form for a particle trapped in a 1-dimensional box has the lowest energy?

A) 

B) 

C) 

D) 

E) 

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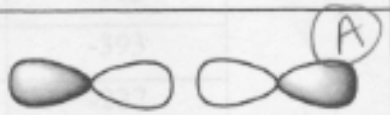
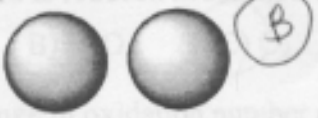
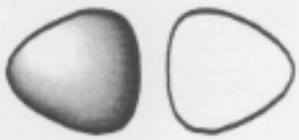
For the following five questions match the atomic orbitals with the molecular orbital formed by their sum:

Question	Atomic Orbitals			Molecular Orbitals
13.)			A	
14.)			B	
15.)			C	
16.)			D	
17.)			E	

18.) Which of the molecular orbitals in the preceding table would have the lowest energy?

more nodes = higher E

A) A B) B C) C D) D E) E

Continue with the next question:

19.) Which of the following mixtures of atomic orbitals best describes a π bonding orbital in O_2 (the internuclear axis is 'z')?

A) s + s B) s - s C) $p_z + p_z$ D) $p_x + p_y$ E) $p_x + p_x$

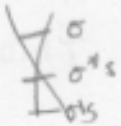
20.) Which of the following mixtures of atomic orbitals best describes the σ bonding orbitals in HeH^+?

A) s + s B) s -s C) $p_z + p_z$ D) $p_x - p_z$ E) $p_x + p_y$

5 e⁻

21.) What is the bond order of Li_2^+.

A) 0 B) 1/2 C) 1 D) 1 1/2 E) 2



1 2σ

1 - 0