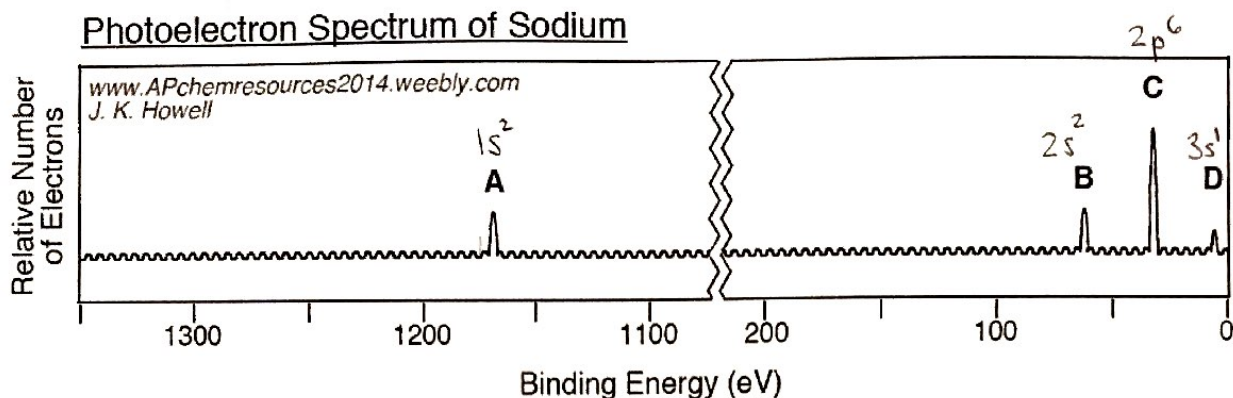


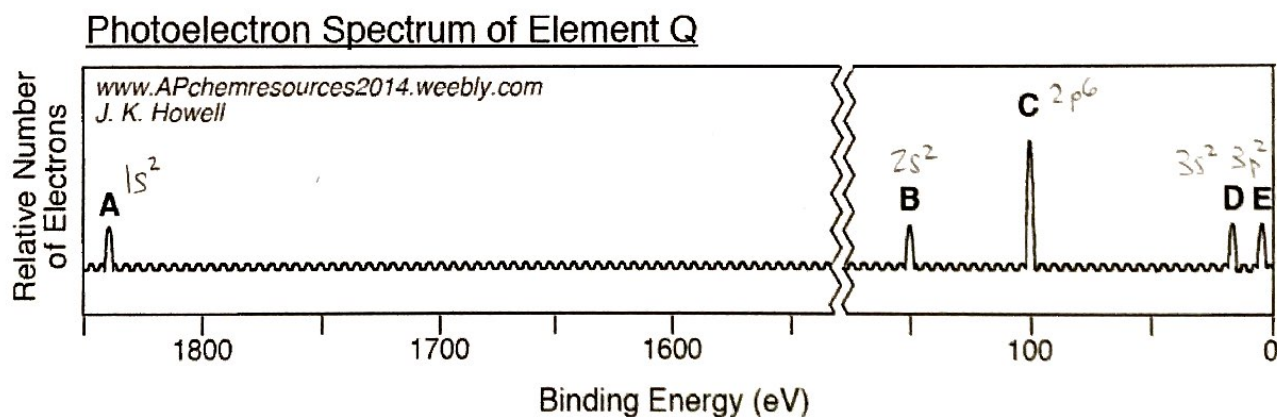
Questions 7 – 9 refer to the complete photoelectron spectrum of sodium shown below:



7. Label the identity of each peak with principal quantum number,  $n$  (energy level), subshell ( $s$ ,  $p$ ,  $d$ , or  $f$ ) and a superscript representing the number of electrons found in the subshell.
8. Which peak (A-D) in the photoelectron spectrum of sodium represents an orbital containing 6 electrons? C
9. Which peak (A-D) in the photoelectron spectrum of sodium shows electrons closest to the nucleus? A

### Multiple Choice Practice

Questions 10 – 13 refer to the complete photoelectron spectrum shown below:

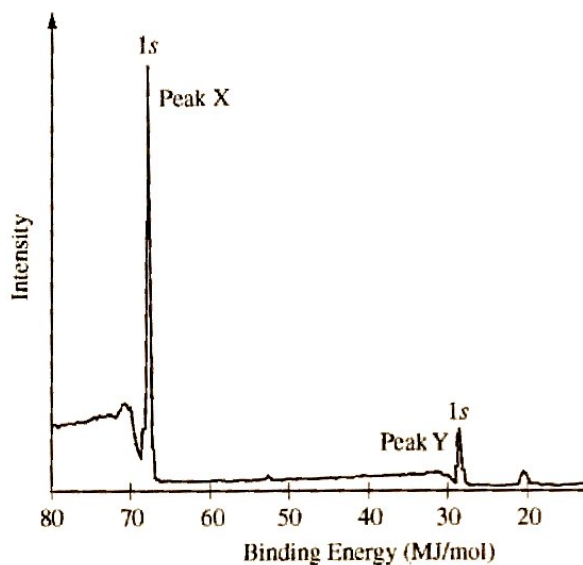


10. The electrons that feel the strongest effective nuclear charge are given by which peak?
  - (a) A
  - b. B
  - c. E
  - d. all electrons in this spectrum experience the same effective nuclear charge
11. Which peaks in the photoelectron spectrum represent valence electrons of element Q?
  - a. A only
  - b. B and C
  - (c) D and E
  - d. E only
12. Which peaks in the photoelectron spectrum of Q are given by the binding energy of  $p$  orbital electrons?
  - a. C only
  - b. D only
  - (c) C and E
  - d. B, C, and D
13. What is the identity of element Q?
  - a. carbon
  - b. oxygen
  - c. magnesium
  - (d) silicon

5 p<sup>+</sup>                      8 p<sup>+</sup>                      26

14. When a given sample was analyzed, it was determined to contain only atoms of boron and oxygen. The portion of the PES spectrum showing only the 1s peaks is provided. Which peak belongs to boron and why?

- a. Peak X, because B is less electronegative than O.
- b. Peak X, because B has a larger atomic radius than O.
- c. Peak Y, because B has a smaller nuclear charge than O.
- d. Peak Y, because B has a greater first ionization energy than O.

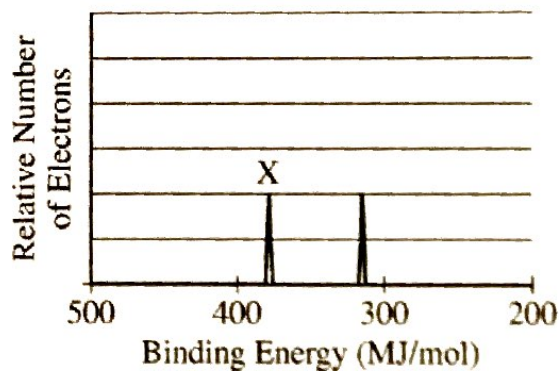


15. Atoms of four elements are examined: carbon, nitrogen, neon and sulfur. Which element would have a photoelectron spectrum in which the peak representing electrons with the lowest ionization energy would be three times higher than all other peaks?

- a. Carbon
- b. Nitrogen
- c. Neon
- d. Sulfur

16. The PES spectra of the 1s electrons for two isoelectronic species, Sr<sup>2+</sup> and Kr, is shown to the right. Which species resulted in peak X, and why?

- a. Kr, because it has a completely filled valence shell.
- b. Kr, because it has a smaller radius than Sr<sup>2+</sup>.
- c. Sr<sup>2+</sup>, because it has a greater mass than Kr.
- d. Sr<sup>2+</sup>, because it has more protons than Kr.



17. An atom of oxygen is in an excited state. When an electron in this atom moves from the third to the second energy level, energy is:

- a. emitted by the nucleus
- b.  emitted by the electron
- c. absorbed by the nucleus
- d. absorbed by the electron