

Chem 130
Electronic Structure Practice Questions

1) Arrange the following forms of electromagnetic radiation

infrared x-rays orange visible light microwave blue visible light

in order of:

- a) decreasing wavelength
 - b) decreasing frequency
 - c) increasing energy
- 2) What experimental evidence led Bohr to propose a model for the hydrogen atom with quantized energy levels?
- 3) In the Bohr model, what is the maximum number of electrons for the $n = 6$ shell?
- 4) How many distinct orbitals are contained in each of the following subshells? What is the maximum number of electrons in each of these subshells?

a) 3s b) 2p c) 4f d) 3d

5) Write the electron configuration for each element, using the full notation for Al, As, Sr, and Ni and the noble gas shorthand for I.

Al As Sr Ni I

6) Using the noble gas shorthand, write electron configurations for the following elements:

I Hf Pb

7) Rank the following in elements in order of a) increasing atomic radius b) decreasing metallic character and c) increasing ionization energy

Ge O Sr C Sn Cs

8) For each of the following elements, tell how many valence electrons the element has and draw the Lewis dot structure for the element. Then, write the symbol for the ion that each of the elements would tend to form. (e.g. Zn tends to form Zn^{+2})

Ba N I Cs Se

Answers

- 1)
 a) decreasing wavelength → microwave, infrared, orange, blue, x-rays
 b) decreasing frequency → x-rays, blue, orange, infrared, microwave
 c) increasing energy → microwave, infrared, orange, blue, x-rays

- 2)
 When light from excited hydrogen gas is passed through a prism or a grating, discrete lines of color appear, NOT a continuous spectrum (rainbow) of color.

*** a line spectrum, not a continuous spectrum ***

3) $2n^2 = 2(6^2) = 2(36) = 72$ electrons max.

- 4)
- | | | | |
|------------------|------------------|-------------------|-------------------|
| a) 3s | b) 2p | c) 4f | d) 3d |
| 1 orbital | 3 orbitals | 7 orbitals | 5 orbitals |
| 2 electrons max. | 6 electrons max. | 14 electrons max. | 10 electrons max. |

- 5)
 Al: $1s^2 2s^2 2p^6 3s^2 3p^1$
 As: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$
 Sr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$
 Ni: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
 I: $[\text{Kr}] 5s^2 4d^{10} 5p^5$

- 6)
 I: $[\text{Kr}] 5s^2 4d^{10} 5p^5$
 Hf: $[\text{Xe}] 6s^2 4f^{14} 5d^2$
 Pb: $[\text{Xe}] 6s^2 4f^{14} 5d^{10} 6p^2$

- 7)
 Increasing radius: O < C < Ge < Sn < Sr < Cs
 Decreasing metallic character: Cs > Sr > Sn > Ge > C > O
 Increasing I.E.: Cs < Sr < Sn < Ge < C < O

- 8) For each of the following elements, tell how many valence electrons the element has and draw the Lewis dot structure for the element. Then, write the symbol for the ion that each of the elements would tend to form. (e.g. Zn tends to form Zn^{+2})

Ba	N	I	Cs	Se
2 valence electrons	5 valence electrons	7 valence electrons	1 valence electron	6 valence electrons
·Ba·	: $\ddot{\text{N}}$ ·	: $\ddot{\text{I}}$ ·	Cs·	: $\ddot{\text{Se}}$ ·
Ba^{+2}	N^{-3}	I^{-1}	Cs^{+1}	Se^{-2}