Name:_____Class: _____ Date: _____

CHAPTER 4 REVIEW

Arrangement of Electrons in Atoms

SECTION 1

SHORT ANSWER Answer the following questions in the space provided.

1. In what way does the photoelectric effect support the particle theory of light?

_____

_____

_____

2. What is the difference between the ground state and the excited state of an atom?

_____

_____

3. Under what circumstances can an atom emit a photon?

_____

_____

4. How can the energy levels of the atom be determined by measuring the light emitted from an atom?

_____

_____

_____

_____

_____

_____

5. Why does electromagnetic radiation in the ultraviolet region represent a larger energy transition than does radiation in the infrared region?

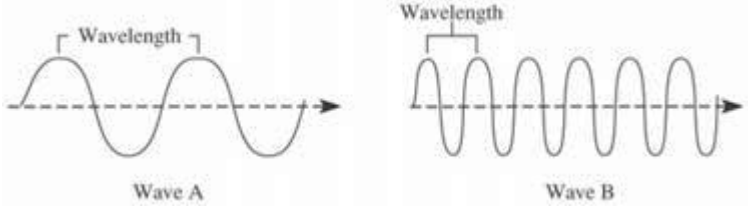
_____

_____

_____

SECTION 1 *continued*

6. Which of the waves shown below has the higher frequency? (The scale is the same for each drawing.) Explain your answer.



_____

_____

_____

7. How many different photons of radiation were emitted from excited helium atoms to form the spectrum shown below? Explain your answer.

Spectrum for helium

_____

_____

_____

_____

_____

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

8. _____ What is the frequency of light that has a wavelength of 310 nm?

9. _____ What is the wavelength of electromagnetic radiation if its frequency is 3.2×10^{-2} Hz?

Name:_____Class: _____ Date: _____

CHAPTER 4 REVIEW

Arrangement of Electrons in Atoms

SECTION 2

SHORT ANSWER Answer the following questions in the space provided.

1. _____ How many quantum numbers are used to describe the properties of electrons in atomic orbitals?
   (a) 1 (c) 3
   (b) 2 (d) 4

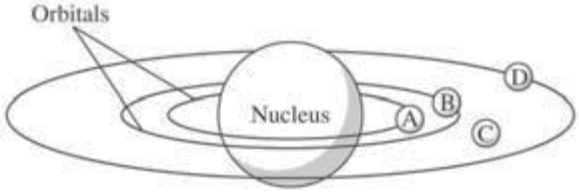
2. _____ A spherical electron cloud surrounding an atomic nucleus would best represent
   (a) an *s* orbital. (c) a combination of two different *p* orbitals.
   (b) a *p* orbital. (d) a combination of an s and a *p* orbital.

3. _____ How many electrons can an energy level of $n = 4$ hold?
   (a) 32 (c) 8
   (b) 24 (d) 6

4. _____ How many electrons can an energy level of $n = 2$ hold?
   (a) 32 (c) 8
   (b) 24 (d) 6

5. _____ Compared with an electron for which $n = 2$, an electron for which $n = 4$ has more
   (a) spin. (c) energy.
   (b) particle nature. (d) wave nature.

6. _____ According to Bohr, which is the point in the figure below where electrons cannot reside?
   (a) point A (c) point C
   (b) point B (d) point D



7. _____ According to the quantum theory, point D in the above figure represents
   (a) the fixed position of an electron.
   (b) the farthest position from the nucleus that an electron can achieve.
   (c) a position where an electron probably exists.
   (d) a position where an electron cannot exist.

SECTION 2 *continued*

8. How did de Broglie conclude that electrons have a wave nature?

9. Identify each of the four quantum numbers and the properties to which they refer.

10. How did the Heisenberg uncertainty principle contribute to the idea that electrons occupy "clouds," or "orbitals"?

11. Complete the following table:

Principal quantum number, *n*	**Number of sublevels**	**Types of orbitals**
1	1	*s*
2	2	*s, p*
3	3	*s,p,d*
4	4	*s,p,d,f*

Name:_____Class: _____ Date: _____

CHAPTER 4 REVIEW

Arrangement of Electrons in Atoms

SECTION 3

SHORT ANSWER Answer the following questions in the space provided.

1. State the Pauli exclusion principle, and use it to explain why electrons in the same orbital must have opposite spin states.

_____

_____

_____

_____

_____

2. Explain the conditions under which the following orbital notation for helium is possible:

$\underline{\uparrow}_{1s}$ $\underline{\uparrow}_{2s}$

_____

_____

Write the ground-state electron configuration and orbital notation for each of the following atoms:

3. Phosphorus

4. Nitrogen

5. Potassium

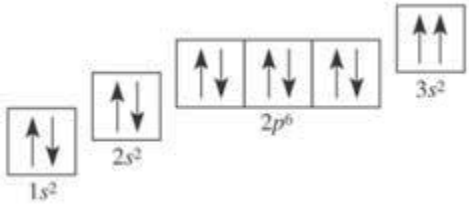
SECTION 3 *continued*

6. Aluminum

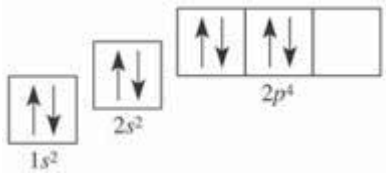
7. Argon

8. Boron

9. Which guideline, Hund's rule or the Pauli exclusion principle, is violated in the following orbital diagrams?



a. _____



b. _____