

Chapter 5 Review Sheet

KEY

**A. Matching**

Match each description in Column B with the correct term in Column A.

**Column A**

- B 1. hertz
- D 2. atomic orbital
- E 3. spectrum
- C 4. atomic emission spectrum
- H 5. quantum of energy
- J 6. amplitude
- I 7. wavelength
- G 8. energy level
- F 9. Aufbau principle
- A 10. frequency

**Column B**

- ~~a.~~ the number of wave cycles that pass a given point per unit of time
- ~~b.~~ the SI unit of frequency
- ~~c.~~ lines of colored light obtained by passing the light emitted by an element through a prism
- ~~d.~~ the region around an atomic nucleus where an electron is likely to be moving
- ~~e.~~ a range of colors seen when light passes through a prism
- ~~f.~~ Electrons enter orbitals of lowest energy first.
- ~~g.~~ a region outside the nucleus where there is high probability of finding an electron
- ~~h.~~ the amount of energy required to move an electron from one energy level to the next higher one
- ~~i.~~ the distance between crests of waves
- ~~j.~~ the height of a wave from the origin to the crest

**B. Multiple Choice**

Choose the best answer and write its letter on the line.

- B 1. The fourth principal energy level has 1 3 5 7  
4s 4p 4d 4f
  - a. 4 orbitals.
  - b. 16 orbitals.
  - c. 32 orbitals.
  - d. 9 orbitals.
- C 2. If the electron configuration of an element is  $1s^2 2s^2 2p^6 3s^2 3p^5$ , the element is
  - a. iron.
  - b. bromine.
  - c. chlorine.
  - d. phosphorus.
- D 3. The electron configuration of calcium is
  - a.  $1s^2 2s^2 2p^2 3s^2 3p^3 4s^2$ .
  - b.  $1s^2 2s^2 2p^{10} 3s^2 3p^4$ .
  - c.  $1s^2 2s^2 3s^2 3p^6 3d^0$ .
  - d.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ .
- A 4. The maximum number of electrons that can occupy the third principal energy level is
  - a. 18.
  - b. 32.
  - c. 2.
  - d. 8.3s 3p 3d  
2 6 8
- C 5. As the frequency of light increases, the wavelength
  - a. increases.
  - b. remains the same.
  - c. decreases.
  - d. approaches the speed of light.

## Chapter 5 Review Sheet

### C. Problems

1. Write orbital diagrams for these atoms, using arrows to represent electrons.

a. S  $1s^2 2s^2 2p^6 3s^2 3p^4$



b. Na



2. What is the frequency of radiation whose wavelength is  $2.40 \times 10^{-5}$  cm?  $2.40 \times 10^{-7}$  m

$$c = \lambda \nu$$

$$\nu = 1.25 \times 10^{15} \text{ Hz (or } s^{-1})$$

3. Identify the elements that have the following electron configurations.

a.  $1s^2 2s^2 2p^6 3s^2 3p^1$

a. Al

b.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$

b. Kr

c.  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$

c. Co

4. Consider the elements neon, bromine, and phosphorus. Which has

a. three electrons in its  $3p$  sublevel?

a. P

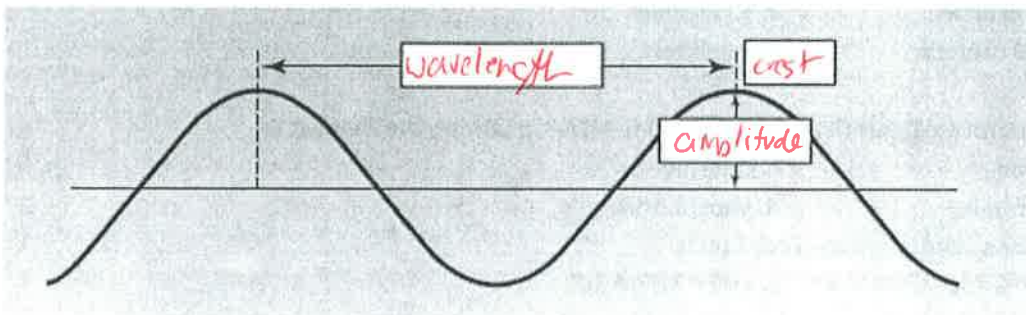
b. its highest energy level completely filled?

b. Ne

c. the highest occupied energy level?

c. Br

5. Label the parts of a wave in this drawing. Label the wavelength, the amplitude, and the crest.



6. Put the visible colors in order of increasing frequency.

red orange yellow green blue indigo violet

7. What is the frequency of an X-ray with a wavelength of  $1.15 \times 10^{-10}$  m?

$$\nu = 2.61 \times 10^{18} \text{ Hz (or } s^{-1})$$

Chapter 5 Review Sheet

8. The wavelengths of the visible spectrum range from (approximately) 400 nm to (approximately) 700 nm.

(a) Which number corresponds to the violet end and which number corresponds to the red end?

400 nm violet                      700 nm (red)

(b) Convert both wavelengths to meters.

(UV)  $4 \times 10^{-7} \text{ m}$                        $7 \times 10^{-7} \text{ m}$  (IR)

(c) Determine the frequency range for visible light.

(UV)  $\sim 7 \times 10^{14} \text{ Hz} \rightarrow \sim 4 \times 10^{14} \text{ Hz}$  (IR)

9. For each of the following electron transitions, (a) determine the frequency of light produced. (b) determine the wavelength of light produced and (c) identify the type of electromagnetic radiation: visible, infrared or ultraviolet.

To complete the table, use the equation for frequency, wavelength and speed of light, as well as Planck's equation. Refer to your answers to #8 above to determine the type of radiation.

Transition	Energy released (J)	Frequency (Hz)	Wavelength (m)	Type
$n = 6 \rightarrow n = 5$	$2.66 \times 10^{-20}$	$4.01 \times 10^{13}$	$7.48 \times 10^{-6}$	IR
$n = 5 \rightarrow n = 1$	$2.09 \times 10^{-18}$	$3.15 \times 10^{15}$	$9.52 \times 10^{-8}$	UV
$n = 4 \rightarrow n = 2$	$4.09 \times 10^{-19}$	$6.17 \times 10^{14}$	$4.86 \times 10^{-7}$	visible
$n = 3 \rightarrow n = 1$	$1.94 \times 10^{-18}$	$2.93 \times 10^{15}$	$1.02 \times 10^{-7}$	UV
$n = 6 \rightarrow n = 3$	$1.82 \times 10^{-19}$	$2.75 \times 10^{14}$	$1.09 \times 10^{-6}$	IR
$n = 5 \rightarrow n = 2$	$4.56 \times 10^{-19}$	$6.88 \times 10^{14}$	$4.36 \times 10^{-7}$	visible

$$E = hf$$

$$c = \lambda f$$