### 3 • Atomic Structure

1. Which electron is, on average, close to the nucleus: an electron in a 2s orbital or an electron in a 3s orbital?

2. Which electron is, on average, further from the nucleus: an electron in a 3p orbital or an electron in a 4p orbital?

3. Which of these orbitals do not exist?
   - 1s
   - 1p
   - 7d
   - 9s
   - 3f
   - 4f
   - 2d

4. As you move across the continuous spectrum from red to violet, what happens to...
   - A. wavelength?
   - B. frequency?

5. What frequency of visible light has the most energy?

6. What frequency on the EMS has the lowest energy?

7. What radiation on the EMS has the shortest wavelength?

8. A beam of microwaves has a frequency of $1.0 \times 10^9$ Hz. A radar beam has a frequency of $5.0 \times 10^{11}$ Hz. Which type of radiation...
   - A. Has the longer wavelength?
   - B. is nearer to visible light in the EMS?
   - C. is closer to X-rays in frequency value?

9. On the EMS, what happens to the energy of a wave when the wavelength decreases?
   - A. What happens to the energy when the frequency increases?
   - B. What happens to the frequency when the wavelength increases?

10. What type of relationship do wavelength and energy have with each other? Is it a direct or an inverse relationship?
    - A. What about energy and frequency?
    - B. What about frequency and wavelength?

11. Describe what is happening on the subatomic level when we see fireworks that are...
    - A. blue?
    - B. red?