WS 21.3 Quantum Mechanics

1. Light acts as both a wave and a particle.

a. Give an example in which light acts like a wave.

b. Give an example in which light acts like a particle.

2. Heisenberg’s uncertainty principle states that it is impossible to simultaneously measure both the position and the momentum of an object with complete certainty. Explain why this uncertainty is a big concern when conducting measurements on a small object, such as an electron, but is not a consideration when measuring the position and momentum of a large object, such as an athlete. (Hint: Consider the amount of uncertainty relative to the size of the measured value.)

3. Calculate the de Broglie wavelength for the following objects:

a. a 1550 kg car moving at 29.1 m/s

b. a 90 800 kg ship moving at 13.5 m/s

c. a 75 kg person moving at 10.5 m/s

d. an 8.2 kg baby crawling at 2.2 m/s

4. In terms of the uncertainty principle, how was the quantum mechanical model of the atom an improvement over Bohr’s model?