

## Problems with classical mechanics (a study guide)

Classical Mechanics and Quantum Mechanics are 2 ways of looking at our physical world.

According to classical mechanics:

1. Particles can have precise motion, that is we can determine position and velocity exactly
2. Particles can occupy any energy state, that is any motion can be changed into any other motion

### Basic ideas which show the failure of the classical model

#### 1. *Black body radiation*

What is a black body?

Sketch a graph of energy density vs. wavelength for an ideal “black body” emitter

State the equation which relates the temperature of a black body to the energy maximum wavelength.

The power emitted per unit area can be determined from the Stefan-Boltzmann Law. State this equation.

Who tried to interpret the black-body radiation emission? What is the ultraviolet catastrophe?

How did Planck conceptually solve the classical difficulties of black-body radiation?

*2. Heat capacities*

Summarize in words the difficulty of classical physics with heat capacities.

*3. The photoelectric effect*

What is the photoelectric effect?

What are the problems interpreting this with classical physics?

Who is responsible for the correct interpretation and what is this interpretation? Give the equation.

#### 4. *Diffraction of electrons*

What was discovered about electrons that contributed to the downfall of classical mechanics?

Who discovered this property of electrons?

#### 5. *Atomic and molecular spectra*

Explain how atomic and molecular spectra contribute to problems with classical mechanics.