

What are the two postulates of special relativity?

At what speeds do relativistic corrections to classical physics really become important?

Explain length contraction. Include a figure with two frames (rod in each frame) to help clarify your words.

Explain time dilation. Include a figure with two frames (light clock in each frame) to help clarify your words.

What is meant by the phrase “simultaneity is not absolute”? Provide an example showing two frames with pictures.

Explain why special relativity implies a particle with mass can never exceed the speed of light.

Explain what is meant by the ultraviolet catastrophe.

Include a sketch of intensity versus wavelength to help explain your answer.

What hypothesis was used to predict a curve of intensity versus wavelength in good agreement with experimental results? Include a figure to help clarify your explanation.

What was the historical importance of this hypothesis?

Why was Einstein’s model for the photoelectric effect important from a historical perspective?

Conceptually explain the photoelectric effect experiment with figures and words. Be sure to include explanations of the terms stopping potential, cut-off frequency, work function.

Explain the historical importance of the photoelectric effect.

Compare experimental observations from the photoelectric effect to what is predicted by assuming light is a wave.

Explain the discrepancies between wave physics predictions and experimental observations for the photoelectric effect.

Suppose a photon interacts with an electron in a graphite target. What does classical wave theory predict for the wavelength of the scattered photon? How does this compare with what is actually observed in experiments?

What assumption about light was made by Compton to accurately predict the wavelength change for a photon scattered off an electron?

Which two conservation laws are used to derive Compton scattering? Include a diagram showing Compton scattering and clarify how the conservation laws relate to that figure.

True or False: relativity is required to accurately model wavelength changes associated with Compton scattering.

Explain the historical importance of the Compton scattering experiment.

Describe at least two different early models of the atom and state why those models fail to explain the atomic spectrum of hydrogen.

Why was the Bohr model important from a historical perspective?

State the assumptions used by the Bohr model used to derive the energy levels of the hydrogen atom.

Derive the energy levels and atomic radii of the hydrogen atom using the Bohr model.

Give an example of an experiment that could be used to measure the de Broglie wavelength of an electron.

Explain the historical significance of the de Broglie wavelength concept.

State a version of the Heisenberg uncertainty principle and explain the meaning of each  $\Delta$  term in the equation.

Explain what is meant by the term wave packet.

What is the historical importance of the Heisenberg uncertainty principle? Clarify by explaining how the uncertainty principle can be applied to wave packets.