TAP 507-1: Standing waves - for electrons?

Electrons have a frequency too

Electrons can be modelled as having a frequency. In another context you have seen how superposition of waves in the laboratory produces standing waves. Here it is useful to put these two together, describing electrons with standing waves, with their wavelength described by de Broglie's relationship:

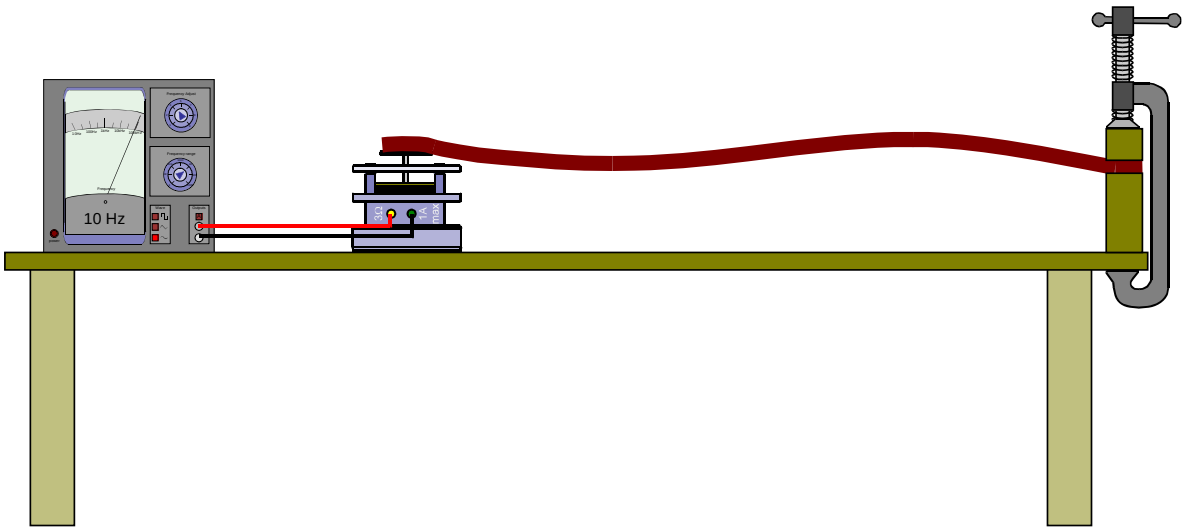
$\lambda = h / mv$.

Here you look at some consequences of this step.

You will need:

- ✓ vibration generator
- ✓ signal generator
- ✓ rubber cord
- ✓ G-clamp
- ✓ wooden blocks

Vibrating a rubber cord

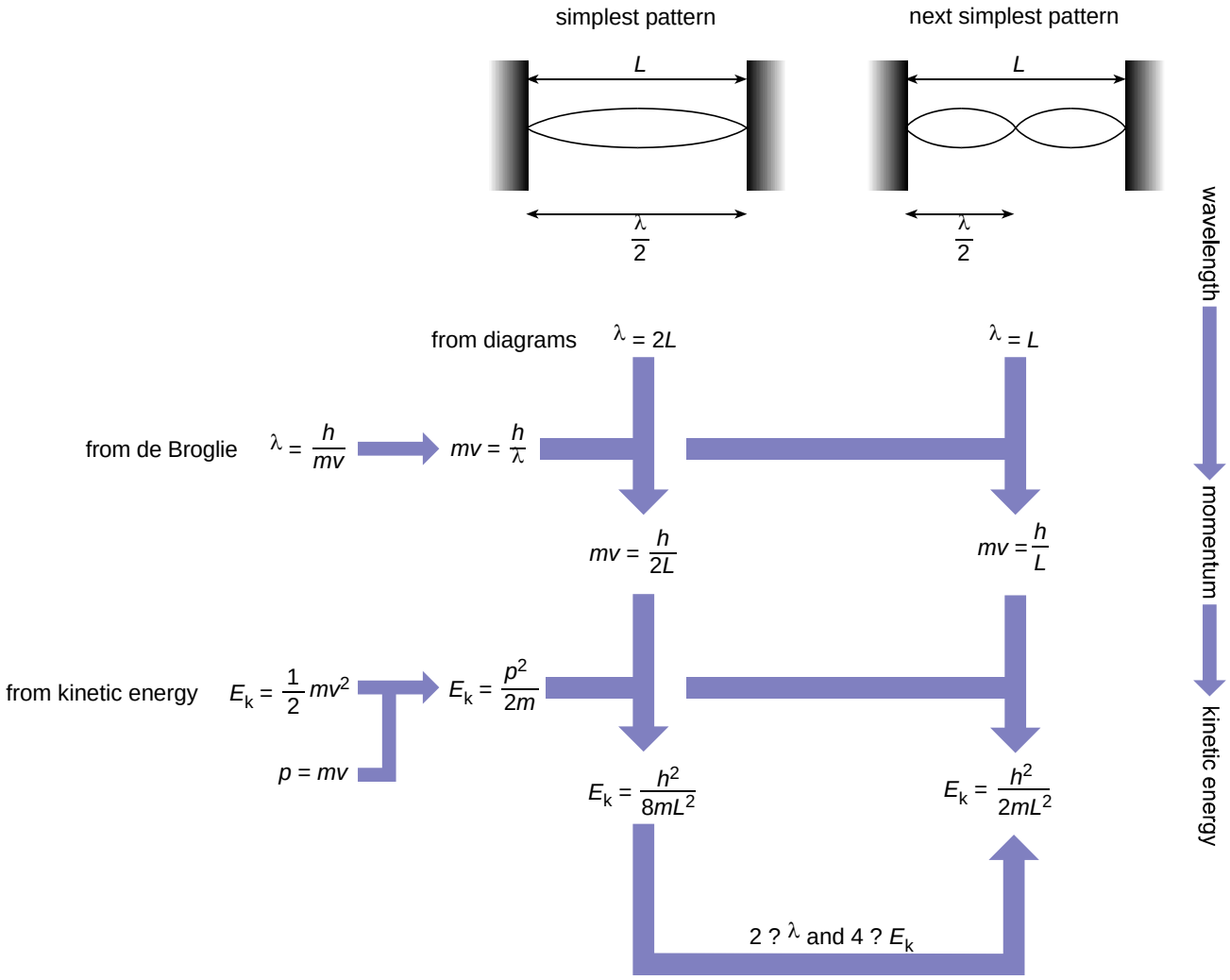


Make sure that you can get clear patterns with this apparatus. Note that only whole numbers of half wavelengths fit onto the cord.

Electrons trapped in an atom are also constrained. Describing them as waves, where the amplitude tells you the chance of find them in any one place, constrains you to draw the waves in a similar way.

Making links

Putting relationships together with these results allows you to predict that electrons will have certain allowed energy levels only.



See if you can continue the series for the next two standing wave patterns that will fit onto the cord.

You have

1. Reminded yourself about standing waves.
2. Seen some of the consequences of using standing waves to model electrons in atoms.

External reference

This activity is taken from Advancing Physics chapter 17, 140E