LM7805

Inside the regulator is a high gain amplifier, always monitoring the difference in output voltage with an internal reference supply. Like most amplifiers, it can become unstable if variations in supply voltage cause a change in output voltage. Given the battery has quite a high internal resistance, it is very likely it's voltage will vary if the load changes.  
  
You should always connect a capacitor of more than 100nF and preferably in the region of 1 to 10uF across the input terminal and ground with the wiring as short as possible. A capacitor on the output is less important but it is preferable to have one close to the output and ground pins as well. If you make the output capacitor too big, it has a detrimental effect on the regulators transient response. Between 1 and 10uF is usually a good choice.

10uF because that's what the regulator manufacturers suggest. The value isn't critical but if you make it too small you risk it being inadequate to damp oscillation. If you make it too big, at least with a single capacitor, you run the risk of the high frequency impedance of the capacitor being too high. Most cheap aluminum electrolytic capacitors have a relatively high internal inductance so while fine as reservoirs in power supplies, they become less effective at damping high frequency oscillation. You will find that in 'better' designs, there are two parallel capacitors used, one will be electrolytic to give a high value in a small space and the other will be ceramic to improve HF performance.