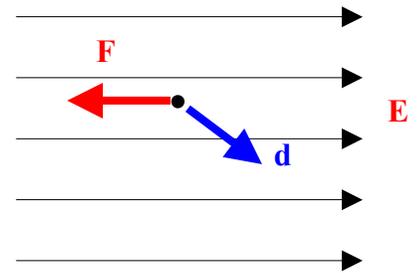


Does the potential energy increase or decrease for the electron (charge = $-e$) in the uniform electric field shown to the right with the indicated displacement?

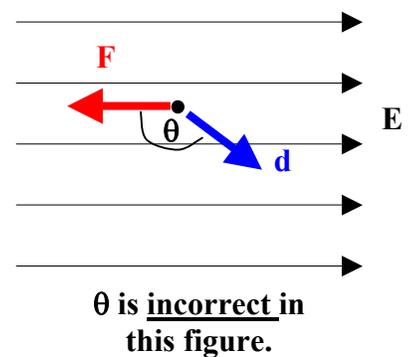


We expect that since we have a negative charge moving with the field lines (more-or-less) its potential energy will increase. That's because the electron is moving more-or-less against the electric force, F .

Let's see what we get:

$$\Delta U = -q \mathbf{E} \cdot \mathbf{d} = -q E d \cos\theta = -(-e) E d \cos\theta = e E d \cos\theta.$$

Is this positive or negative? It all depends on θ . In Friday's lecture, I labeled θ as shown in the figure. θ is clearly between 90° and 180° making $\cos\theta$ negative, thus making ΔU negative. That's wrong! Where is the mistake?



θ is the angle between E and d , not F and d !!!

If I draw θ correctly, we see that $0^\circ < \theta < 90^\circ$ making $\cos\theta$ positive, thus making ΔU positive. All is well!!!

