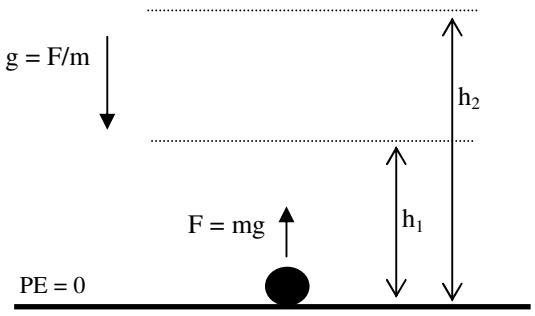
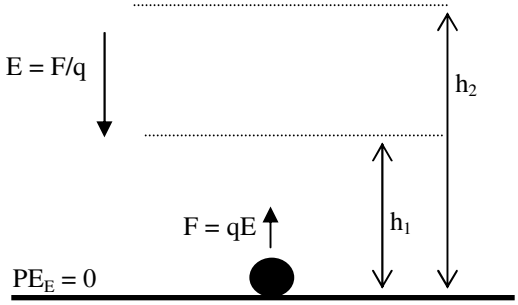
Electric Potential (Voltage)

taken from "Physics, A Laboratory Textbook", 2nd ed., Carr & Simon,1984





Zero gravitational PE is shown	Zero electrical PE is shown (PE_E)
The magnitude of the gravitational field is the force per unit mass	The magnitude of the electric field is the force per unit charge
The direction of the gravitational field is the direction the test mass will go if released	The direction of the electric field is the direction that a test charge will go if released
To lift the test mass in the uniform gravitational field (w\o acceleration), a force = mg must be applied.	To lift the test charge in the uniform electric field (w\o acceleration), a force = qE must be applied.
The work needed to lift the mass to h_1 and h_2, respectively, is just the gravitational PE at these levels $W_1 = Fh_1 = mgh_1 = PE_1$ $W_2 = Fh_2 = mgh_2 = PE_2$	The work needed to lift the charge to h_1 and h_2, respectively, is just the electrical PE at these levels $W_1 = Fh_1 = qEh_1 = PE_{E\ 1}$ $W_2 = Fh_2 = qEh_2 = PE_{E\ 2}$
The amount of work needed to go from level 1 to level 2 is just the change in PE $W_{1\to2} = mg\Delta h = \Delta PE$	The amount of work needed to go from level 1 to level 2 is just the change in PE_E $W_{1\to2} = qE\Delta h = \Delta PE_E$
Investigators seeking to find the work done in going from 1 to 2 will get different answers, depending on the mass they use. Can resolve this problem by defining Gravitational Potential Difference (no instrument exist to measure) $G_{12} = W_{1\to2}/m = g\Delta h = \Delta PE/m$	Investigators seeking to find the work done in going from 1 to 2 will get different answers, depending on the charge they use. Can resolve this problem by defining Electrical Potential Difference (Voltage! measured with a voltmeter) $V_{12} = W_{1\to2}/q = E\Delta h = \Delta PE_E/q$
Gravitational field strength can now be determined by $g = G_{12}/\Delta h$	Electric field strength can now be determined by $E = V_{12}/\Delta h$