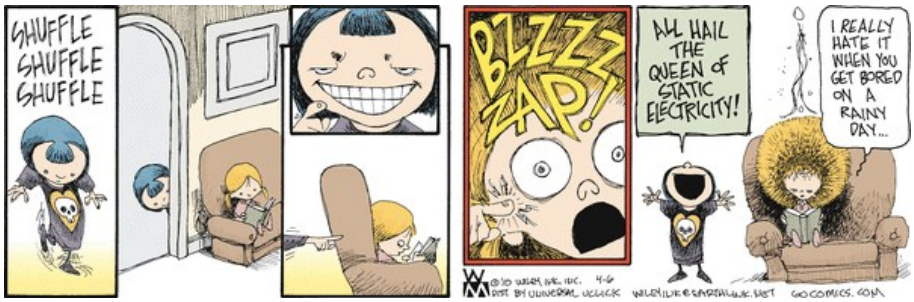
February 20, 2013 Physics 132 Prof. E. F. Redish

- **Theme Music:** **Linkin Park**
  High Voltage
- **Cartoon:** **Wiley Miller**
  Non-Sequitur



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Quiz 3

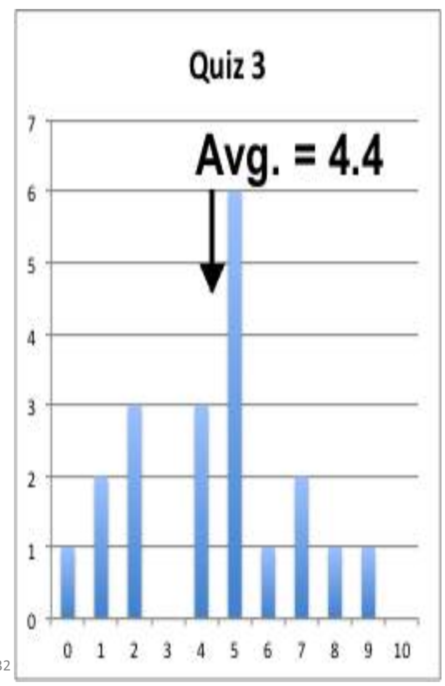
	3.1	3.3.1
A	55%	20%
B	25%	55%
C	85%	25%
D	30%	

3.2

$$\Delta S = \frac{Q_A}{T_A} + \frac{Q_B}{T_B} = \frac{-0.5\text{ J}}{350\text{ K}} + \frac{0.5\text{ J}}{250\text{ K}}$$
$$= -1.4\times10^{-3}\text{ J/K} + 2.0\times10^{-3}\text{ J/K} = +0.6\times10^{-3}\text{ J/K}$$

3.3.1

$$\frac{p(E_1)}{p(E_0)} = \frac{e^{-E_1/k_BT}}{e^{-E_0/k_BT}} = e^{-\Delta E/k_BT} = e^{-0.015/0.025} = e^{-0.6} = 0.55$$



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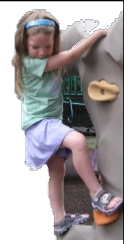
Foothold idea: Fields



- *Test particle*
  - We pay attention to what force it feels. We assume it does not have any affect on the source particles.
- *Source particles*
  - We pay attention to the forces they exert and assume they do not move.
- *Physical field*
  - We consider what force a test particle would feel if it were at a particular point in space and divide by its coupling strength to the force. This gives a vector at each point in space.

$$\vec{g} = \frac{1}{m}\vec{W}_{E\to m} \qquad \vec{E} = \frac{1}{q}\vec{F}_{\text{all charges}\to q} \qquad V = \frac{1}{q}U^{elec}_{\text{all charges}\to q}$$

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Foothold ideas: Electric potential energy and potential

- The potential energy between two charges is $U^{elec}_{12} = \frac{k_C Q_1 Q_2}{r_{12}}$
- The potential energy of many charges is $U^{elec}_{12\ldots N} = \sum_{i<j=1}^{N} \frac{k_C Q_i Q_j}{r_{ij}}$
- The potential energy added by adding a test charge *q* is

$$\Delta U^{elec}_{q} = \sum_{i=1}^{N} \frac{k_C q Q_i}{r_{iq}} = qV$$

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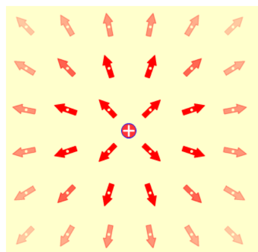
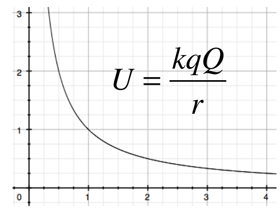
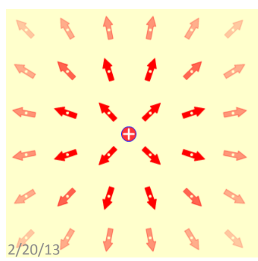
Positive test charge near a single (+) source charge

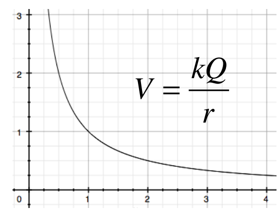


Potential energy
of a positive test charge
near a positive source.





Electric Potential
of a positive test charge
near a positive source.



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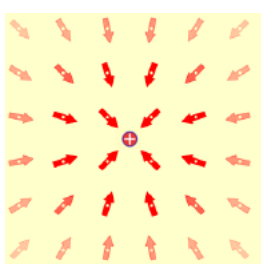
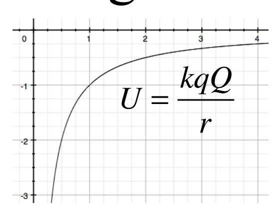
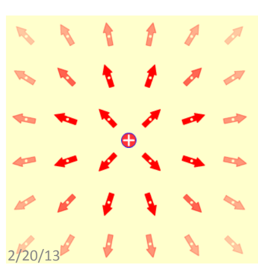
Negative test charge near a single (+) source charge

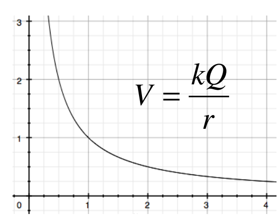


Potential energy
of a negative test charge
near a positive source.





Electric Potential
of a negative test charge
near a positive source.



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