

Lecture 7 - Electrostatic Potential

Chapter 28 - Tuesday January 30th

- Review of electrostatic potential energy
- The electrostatic potential
- Many example problems
- Equipotential surfaces

Reading: pages 635 thru 652 (chapter 28) in HRK

Read and understand the sample problems

WebAssign homework: set 3, due Sun. 4th at 11:59pm

Graded problems (Ch. 28) – Ex. 2, 12, 16, 24; Prob. 6, 13

Practice problems (Ch. 28): Ex. 29, 31, 43, 47; Prob. 15

- ***Exam 1, Feb 6th, 8:30 – 10:10 am (Chs. 25-28)***
- ***Review sessions: Thurs. 5:30 pm and Mon. 5:00 pm***

Electrostatic Potential Energy

Consider the analogy with gravitation:

$$\vec{\mathbf{F}}_E = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r_{12}^2} \hat{\mathbf{r}}_{12} \quad \vec{\mathbf{F}}_G = -G \frac{m_1 m_2}{r_{12}^2} \hat{\mathbf{r}}_{12}$$

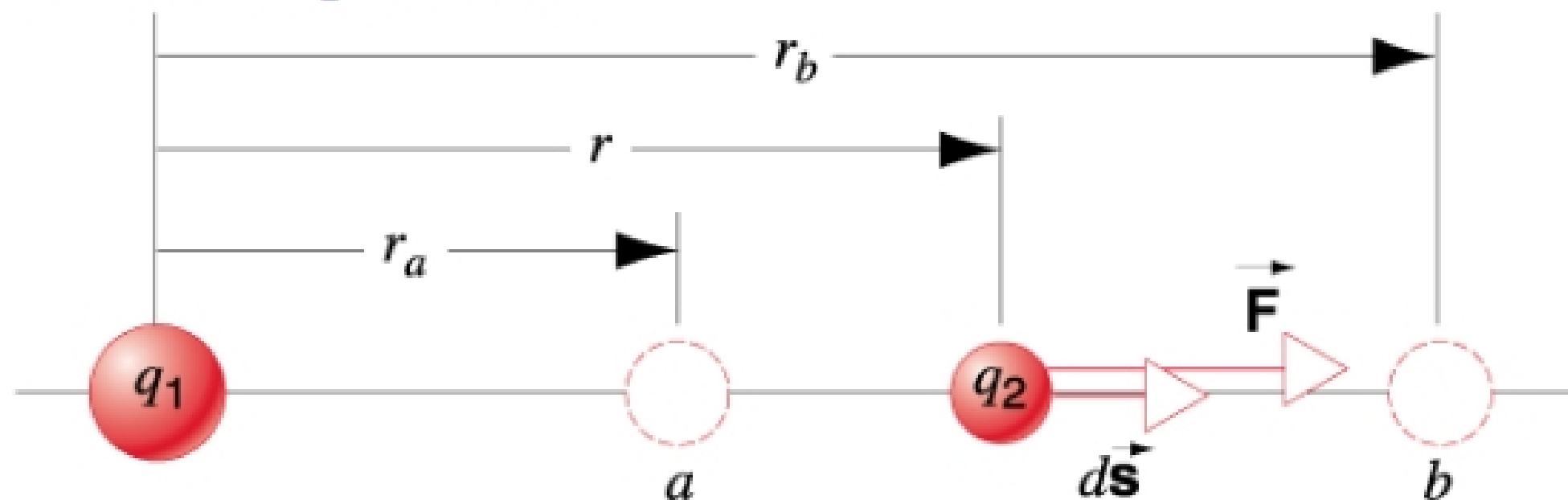
In the gravitational case, we defined differences in potential energy in the following way:

$$\Delta U = U_f - U_i = -W_{if} = -\int_i^f \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} = -Gm_1 m_2 \left(\frac{1}{r_f} - \frac{1}{r_i} \right)$$

You were, no doubt, told that gravity is a conservative force. Thus, the above result does not depend on the path taken between r_i and r_f .

Electrostatic Potential Energy

- *Thus, it should not surprise you that the electrostatic force is conservative also.*
- *It is this property that allows us to define a scalar potential energy (one cannot do this for non conservative forces).*



$$\Delta U = -\int_a^b \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} = +\frac{1}{4\pi\epsilon_0} q_1 q_2 \left(\frac{1}{r_b} - \frac{1}{r_a} \right)$$