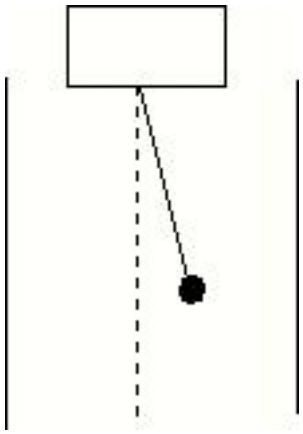
Workshop module 3 - Physics 114, Spring 2015

1. If the electric field is zero in a region of space, which of the following is always true:
    a. the potential is zero
    b. the potential is constant
    c. the potential is negative
    d. the potential depends on the size of the region of space

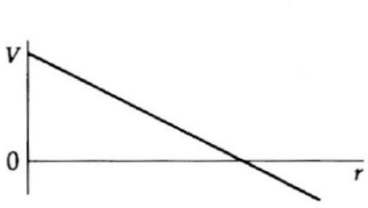
    Why?

2. A small sphere with a mass of 3.20 g hangs by a thread between two parallel vertical plates 6.00 cm apart. The charge on the sphere is $q = 7 \times 10^{-6}$ C. What potential difference between the plates will cause the thread to assume an angle of 20.0 degrees with the vertical.

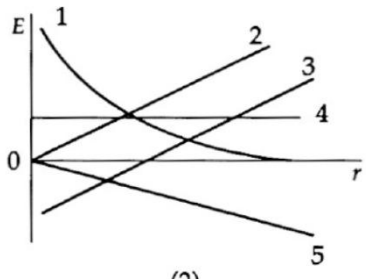


3. The electrostatic potential as a function of distance along a certain line in space is shown in graph (1). Which of the curves in graph (2) is most likely to represent the electric field as a function of distance along the same line?

    a) 1
    b) 2
    c) 3
    d) 4
    e) 5



(1)



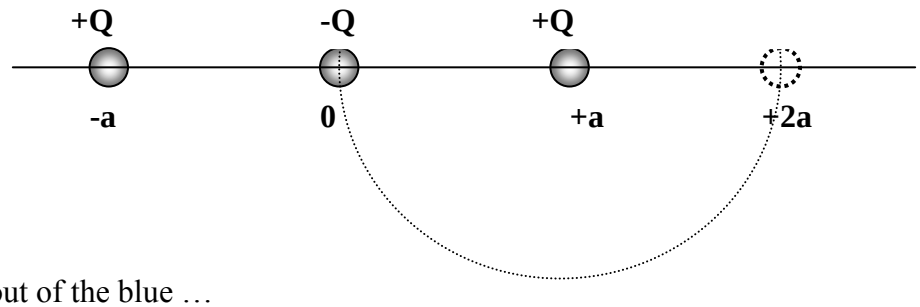
(2)

4. A positive point charge +Q is located at x = -a.

(a) How much work is required to bring a second equal positive point charge +Q from infinity to x = +a?

(b) With the two equal positive point charges at x = -a and x = +a, how much work is required to bring a third charge -Q from infinity to the origin?

(c) How much work is required to move the charge -Q from the origin to the point x = 2a along the semicircular path shown in the sketch below?



5. Here's one out of the blue …

The source of a star's energy is thermonuclear fusion taking place in the core of the star. Estimate the temperature at the center of a star when nuclear fusion reactions begin. (*Hints: Fusion is when two protons (or nuclei) bond together due to the strong nuclear force which has an effective range of about 10^{-15} m. Assume fusion takes place if two protons approach each other within 10^{-15} m. Imagine that the protons exist as a gas. Also recall that the average kinetic energy of a particle of mass m in a gas at absolute temperature T is (3/2)kT, where k is the Boltzmann constant=1.38×10^{-23} J/K)*

6. Choose the diagram that corresponds to lines of constant potential around an electric dipole where the electric charges that make up the dipole are given by the positions of the large black dots. Justify your answer briefly to the right of the drawing.