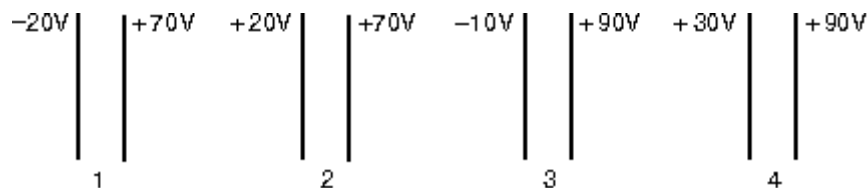


## Physics 108L: Lab Worksheet #2

### Electric Potential

1. The diagram shows four pairs of large parallel conducting plates. The value of the electric potential is given for each plate. **Rank** the pairs according to the magnitude of the **electric field** between the plates, *least to greatest*.



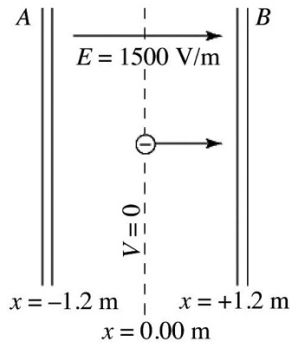
- A) 1, 2, 3, 4  
B) 4, 3, 2, 1  
C) 2, 3, 1, 4  
D) 2, 4, 1, 3  
E) 3, 2, 4, 1

2. An alpha particle is a nucleus of helium. It has twice the charge and four times the mass of the proton. When they were very far away from each other, but headed toward directly each other, a proton and an alpha particle each had an initial speed of  $0.0030c$ , where  $c$  is the speed of light. What is their distance of closest approach? *Hint:* There are *two* conserved quantities. Make use of both of them. ( $c = 3.00 \times 10^8$  m/s,  $k = 1/4\pi\epsilon_0 = 8.99 \times 10^9$  N  $\cdot$  m<sup>2</sup>/C<sup>2</sup>,  $e = 1.60 \times 10^{-19}$  C,

$m_{\text{proton}} = 1.67 \times 10^{-27}$  kg)

3. Two point charges,  $Q$  and  $-3Q$ , are located on the  $x$ -axis a distance  $d$  apart, with  $-3Q$  to the right of  $Q$ . Find the location of ALL the points on the  $x$ -axis (not counting infinity) at which the potential (relative to infinity) due to this pair of charges is equal to zero.

4. Two large conducting parallel plates  $A$  and  $B$  are separated by  $2.4\text{ m}$ . A uniform field of  $1500\text{ V/m}$ , in the positive  $x$ -direction, is produced by charges on the plates. The center plane at  $x = 0.00\text{ m}$  is an equipotential surface on which  $V = 0$ . An electron is projected from  $x = 0.00\text{ m}$ , with an initial velocity of  $1.0 \times 10^7\text{ m/s}$  perpendicular to the plates in the positive  $x$ -direction, as shown in the figure. What is the kinetic energy of the electron as it reaches plate  $A$ ? ( $e = 1.60 \times 10^{-19}\text{ C}$ ,  $m_e = 9.11 \times 10^{-31}\text{ kg}$ )



5. Two conducting spheres are far apart. The smaller sphere carries a total charge of  $Q$ . The larger sphere has a radius that is twice that of the smaller and is neutral. After the two spheres are connected by a conducting wire, the charges on the smaller and larger spheres, respectively, are:
6. Consider the configuration below, a charge  $q$  at the center of a conducting shell in the region  $a < r < b$  with a net charge of  $-2q$ . If the potential at infinity is zero find the electric potential everywhere: (a)  $r \geq b$ ; (b)  $a \leq r \leq b$ ; (c)  $r \leq a$ .

