(6)

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Online - E field & Equipotential

(9)

p 527 – Problems

46) $m = .40\,kg$ cart at rest .50m from fixed $q = +2.0\times10^{-4}C$
$q = +4.0\times10^{-5}C$ when released cart moves away

a) How fast going when very far away

$$E_o = E_f$$
$$U_{eo} = \cancel{U_{ef}}^{\,0} + K$$
$$\frac{kqq}{r_o} = \frac{1}{2}mv^2 \qquad v = \sqrt{\frac{2kqq}{mr_o}}$$

(1)

$$v = \sqrt{\frac{2(8.99\times10^9\ Nm^2/C^2)(4.0\times10^{-5}C)(2.0\times10^{-4}C)}{.40kg\,(.50m)}}$$

$$v = 26.8\ m/s$$

b) How fast going when 2m apart?

$$E_o = E_f$$
$$U_{eo} = U_{ef} + K$$
$$\frac{kqq}{r_o} = \frac{kqq}{r_f} + \frac{1}{2}mv^2$$

(1)

$$kqq\left(\frac{1}{r_o} - \frac{1}{r_f}\right) = \frac{1}{2}mv^2$$

$$v = \sqrt{\frac{2kqq}{m}\left(\frac{1}{r_o} - \frac{1}{r_f}\right)}$$

$$= \sqrt{\frac{2(8.99\times10^9\ \frac{Nm^2}{C^2})(4\times10^{-5}C)}{(2\times10^{-4}C)\ .40kg}\left(\frac{1}{.50m} - \frac{1}{2m}\right)}$$

$$v = 23.2\ m/s$$

52) Two protons initially at rest
$m = 1.67 \times 10^{-27}\,kg$ $r_o = 1.0 \times 10^{-14}\,m$
$q = +e = +1.60 \times 10^{-19}\,C$ when released they fly apart

a) $r_f = 1.0 \times 10^{-10}\,m$ $\quad \Delta U_e = U_f - U_o$
$\Delta U = ?$

$$= \frac{kqq}{r_f} - \frac{kqq}{r_o}$$

$$= kq^2\left(\frac{1}{r_f} - \frac{1}{r_o}\right) = 8.99 \times 10^9 \frac{N m^2}{C^2}\,(1.60 \times 10^{-19}\,C)^2 \left/ \left(\frac{1}{1 \times 10^{-10}\,m} - \frac{1}{1 \times 10^{-14}\,m}\right)\right.$$

(1)

$$\Delta U_e = -2.3 \times 10^{-14}\,J$$

b) $U_e \rightarrow K$ completely (share equally)

$$W = \Delta K$$

$$\tfrac{1}{2}\Delta U = \tfrac{1}{2} m v^2 \qquad v = \sqrt{\frac{\Delta U}{m}}$$

$$v = \sqrt{\frac{2.3 \times 10^{-14}\,J}{1.67 \times 10^{-27}\,kg}} = 3.7 \times 10^6\,m/s$$

p568 - Multiple Choice

4) Two identical + charges are located distance d. Where is both E + V zero?

(1) a) distance d from both b) exactly between
c) Both (d) Neither correct

- Concepts

15) A) What does it mean if V is 10V?

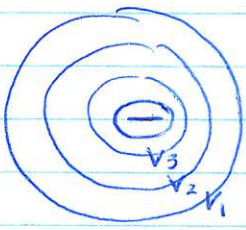
- 10 J of energy required to bring 1C in from ∞
- If we place 1C at that point the system electric field-object would have U of 10J w/ respect to zero level

(1) B) What does it mean if potential diff is 10V?

- The electric potential energy of system (field-object) will change by 10 J when 1C is moved between
- The work done by external agent to move a unit charge from one pt to another is ±10J

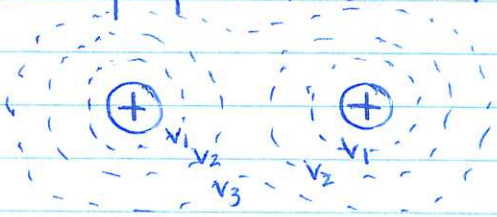
24) A) Choose correct pic of equipotential for ⊕ $V_1 > V_2 > V_3$

B) Choose equipotential for ⊖ $V_1 > V_2 > V_3$



(1)

C) Choose equipotential for 2⊕ $V_1 > V_2 > V_3$



D) Choose equipotential for large − Sheet $V_1 > V_2 > V_3$

25) Equal ⊕ & ⊖ Charge Mid point?

(1)

- E field is non zero
- V is zero

p570 – Problem

45) Earth $q = -5.7 \times 10^5 C$

a) E at surface? $r = 6.37 \times 10^6 m$

$$E = \frac{kq}{r^2}$$

$$E = \frac{(8.99 \times 10^9 Nm^2/C^2)(5.7 \times 10^5 C)}{(6.37 \times 10^6 m)^2}$$

$$E = 126\ N/C$$

(1)

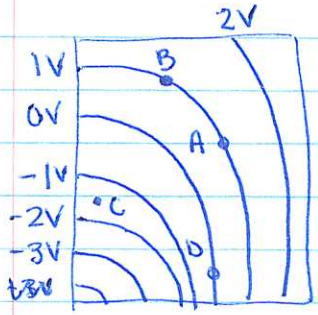
b) E inside? $E = 0\ N/C$

c) V at surface?

$$V = \frac{kq}{r} = \frac{8.99 \times 10^9 \frac{Nm^2}{C^2}(5.7 \times 10^5 C)}{6.37 \times 10^6 m}$$

$$V = 8.04 \times 10^8\ V$$

– Online Efield & Equipotential



(1)

A) Work to move 1C A→B

$$W = q\Delta V^{0} \quad W = 0\ J$$

B) Work to move 1C A→D

$$W = q\Delta V = (1C)(1V) = 1\ J$$

C) The magnitude of E at pt C is....

- greater than magnitude of E_B (equipotential lines closer)