Estat #5

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p523 – Multiple Choice (11)

9) Two charged objects
Infinite far away V = 0
When close V is +

What is incorrect?

X · One is +, one is –

10) ~~+2q~~ +q, -2q separated by r
Slowly move closer to half r
Incorrect?

(3)

Incorrect
- X, electric Potential energy is ½
- X magnitude of electric PE is ½
- ✓ electric PE doubles
- ✓ electric PE magnitude double

11) Charged A + B separated by d

Choose A as system alone. Slowly push B closer to .3d

Correct?

a) electric potential, system energy ↑
b) electric potenial energy system ↓
(c) electric potential energs RTS
d) You do +W
e) You do -W
(f) You do zero work

p525 – Problems

24) $q_1 = -1.5C$ $\quad r_o = 500\,km$
$q_2 = -4.0C$ $\quad r_f = 100\,km$

a) Change in electric PE ★ must use sign

$$\Delta U_e = \frac{kqq}{r_f} - \frac{kqq}{r_o} = kqq\left(\frac{1}{r_f} - \frac{1}{r_o}\right)$$

(1)
$$= 8.99\times10^9 \frac{Nm^2}{C^2}(-1.5C)(-4.0C)\left(\frac{1}{100E3m} - \frac{1}{500E3m}\right)$$

$$= 432,000\,J \qquad 4.32\times10^5\,J$$

b) U_e initial?

$$U_o = \frac{kqq}{r} = \frac{8.99\times10^9 \frac{Nm^2}{C^2}(-1.5C)(-4.0C)}{500\times10^3 m}$$

(1)
$$= 108,000\,J \qquad 1.08\times10^5\,J$$

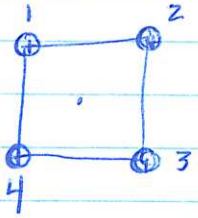
c) U_e final?

$$U_f = \frac{kqq}{r} = \frac{8.99\times10^9 \frac{Nm^2}{C^2}(-1.5C)(-4.0C)}{100\times10^3 m}$$

$$= 539,000\,J \qquad 5.39\times10^5\,J$$

43) Four object $q = +1.0 \times 10^{-4} C$ at corners of square sides 2.0m

a) $F_e = ?$ b) b)



0 N b/c symmetry cancels the force

a) b) $U_e = ?$

c) $U_e = U_{1,2} + U_{1,3} + U_{1,4} + U_{2,3} + U_{2,4} + U_{3,4}$

(2)

$$= \frac{kq^2}{r_{1,2}} + \frac{kq^2}{r_{1,3}} + \frac{kq^2}{r_{1,4}} + \frac{kq^2}{r_{2,3}} + \frac{kq^2}{r_{2,4}} + \frac{kq^2}{r_{3,4}}$$

$$= \frac{kq^2}{d} + \frac{kq^2}{d\sqrt{2}} + \frac{kq^2}{d} + \frac{kq^2}{d} + \frac{kq^2}{d\sqrt{2}} + \frac{kq^2}{d}$$

$$= \frac{kq^2}{d}\left(1 + \frac{1}{\sqrt{2}} + 1 + 1 + \frac{1}{\sqrt{2}} + 1\right) = \frac{kq^2}{d}\left(4 + \frac{2}{\sqrt{2}}\right)$$

$$= \frac{(8.99 \times 10^9 \ N m^2/c^2)(1.0 \times 10^{-4} C)^2}{2.0m}\left(4 + \frac{2}{\sqrt{2}}\right)$$

$$= 243 J$$

$4\left(\frac{kq^2}{d}\right) + 2\left(\frac{kq^2}{d\sqrt{2}}\right)$

a) a) What quantities can be determined?

- ✓ Total electric p.e. of the system consisting of 4 charged objects
- ✓ The electric force on charged object placed @ center of square

p569 – Concept

21) Describe relation b/t E + V

(1) The magnitude of the E field component in a particular direction indicates how fast the V field (electric potential) changes in that direction. The E field points in direction of decreasing V.

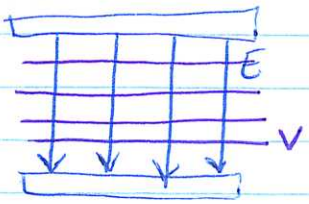
- In one dimension we have $E_x = -\Delta V/\Delta x$ (the minus sign points to decrease V)

22) A) if V is constant, what is E?

E field is zero

(1) B) If E is constant, what V look like?

- equipotential surfaces equally spaced planes ⊥ to E
- V changes at constant rate

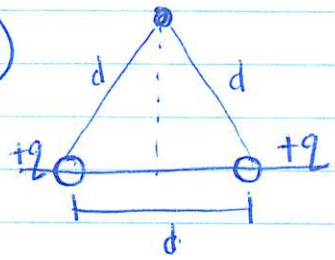


p570 - Problems

21) $q = -15C$ lightning flash
$V = 8.0 \times 10^7 V$
$\Delta U = ?$

(1)

$$\Delta U = q \Delta V$$
$$= (-15C)(8.0 \times 10^7 V)$$
$$= -1.2 \times 10^9 J$$

23) 

(1)

V at distance d from each

$$V_{total} = V_1 + V_2$$
$$= \frac{kq}{d} + \frac{kq}{d}$$
$$V_{tot} = \frac{2kq}{d}$$