KFUPM – Physics Department

PHYS102 – Chapter 24 (Instructor: Dr. Al–Shukri)

Q1. What is the external work required to bring four 3.0×10^{-9} C positive point charges from infinity and place them at the corner of a square of side 0.12 m

a. +3.7 μJ b. –3.7 μJ c. 67 μJ d. –67 μJ e. 7.4 μJ

Q2. A point charge $q_1 = +2.4$ μC is held stationary at the origin. A second point charge $q_2 = -4.3$ μC moves from $x_1 = 0.15$ m, $y_1 = 0$ to a point $x_2 = 0.25$ m, $y_2 = 0.25$ m. How much is work done by the electric force on q_2 ?

a. 0.36 J b. 0.30 J c. 0.45 J d. 0.50 J e. 0.25 J

Q3. An electron is accelerated from a speed of 3×10^6 m/s to 8×10^6 m/s. Calculate the potential through which electron has to pass to gain this acceleration?

a. 157 V b. 126 V c. 165 V d. 185 V e. 205 V

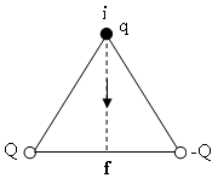
Q4. The electric potential in a certain region is described by $V(x,y,z) = 2xy - 4x^2 + 6y + 3$. Find the magnitude of the net electric field at $x = -1$ and $y = 1$?

a. 11 N/C b. 9 N/C c. 13 N/C d. 6.0 N/C e. 0

Q5. A conducting sphere with a radius of 10 cm, has a surface charge density of 4.0 μC/m^2. The electric potential, at $r = 5.0$ cm from the center of the sphere is (assume $V = 0$ at infinity):

a. 4.5×10^4 V b. 9.0×10^4 V c. 10×10^4 V
d. 35×10^4 V e. 72×10^4 V

Q6. In the **Figure** below, two particles with charges Q and −Q are fixed at the vertices of an equilateral triangle of sides a. The work required to move a particle with charge q from point **i** to point **f** is:

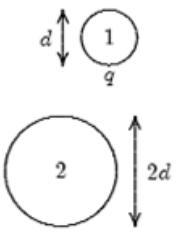


a. 0 b. kQq/a
c. $4kQq/a$ d. $2kQq/a$ e. √2kQq/a

Q7. Over a certain region of space, the electric potential is give by: $V(x,y) = 4x^2 + ay^2 + bxy$ where V is in V and x and y are in m. Find the constants a & b if the magnitude of the electric field at the point P (1.0 , 2.0) vanishes.

a. 8.5 N/C b. 12 N/C c. 0 d. 6 N/C e. 3 N/C

Q8. In the **Figure**, two conducting spheres, one having twice the diameter of the other, are separated by a distance large compared to their diameters. Initially, the smaller sphere (1) has charge q and the larger sphere (2) is uncharged. If the spheres are then connected by a long thin conducting wire:



a. 1 and 2 have the same potential
b. 2 has twice the potential of 1
c. 2 has half the potential of 1
d. 1 and 2 have the same charge
e. 1 has twice the charge of 2

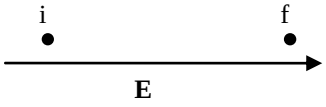
Q9. A charge $q_1 = -5.0$ μC and a charge $q_2 = 6.0$ μC are located at (8.0 cm, 0.0) and (0.0 cm, 6.0 cm) respectively in the xy plane. How much work was done, by an external agent, to bring these charges to their final positions starting from infinite separation.[Take $V = 0$ at infinity]

a. –2.7 J b. 2.7 J c. –3.4 J d. –4.5 J e. 3.4 J

Q10. A particle ($m = 9.0\times10^{-9}$ kg, $q = +8$ nC) has a kinetic energy $K = 36$ μJ at point A and moves to point B where the potential is 3.0×10^3 V greater than that at point A. What is the particle's kinetic energy at point B?

a. 12 μJ b. 60 μJ c. 24 μJ d. 36 μJ e. –24 μJ

Q11. An electron moves from point i to point f, in the direction of a uniform electric field (see the **Figure**). During this displacement:

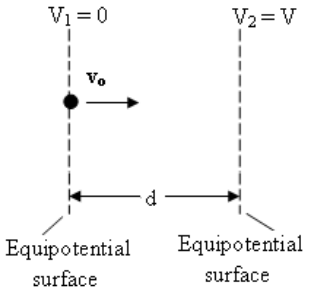


a. the work done by the field is negative and the electric potential energy of the electron-field system increases.
b. the work done by the field is positive and the electric potential energy of the electron-field system increases.
c. the work done by the field is positive and the electric potential energy of the electron-field system decreases.
d. the work done by the field is negative and the electric potential energy of the electron-field system decreases.
e. the work done by the field is positive and the electric potential energy of the electron-field system does not change.

Q12. A particle with a charge of 5.5×10^{-8} C is fixed at the origin. A particle with a charge of -2.3×10^{-8} C is moved from $x = 3.5$ cm on the x-axis to $y = 4.3$ cm on the y-axis. The change in potential energy of the two-particle system is

a. $+6.0\times10^{-5}$ J b. -3.1×10^{-3} J c. $+3.1\times10^{-3}$ J
d. -6.0×10^{-5} J e. 0

Q13. The **Figure** shows a particle of mass m and charge $-q$ moving between two equipotential surfaces V_1 and V_2 which are separated by a distance d. If the speed of the particle at surface V_1 is v_o, what is the change in the kinetic energy of the particle when it moves from surface V_1 to surface V_2?



a. qV b. $-qV$
c. $(\frac{1}{2})mv_o^2$ d. $-(\frac{1}{2})mv_o^2$
e. $qV - (\frac{1}{2})mv_o^2$

Q14. What is the velocity of an alpha particle (containing 2 protons and 2 neutrons) if it is accelerated from rest through a voltage of 100 kV ?

a. 3.1×10^6 m/s b. 1.1×10^6 m/s c. 2.1×10^6 m/s
d. 1.6×10^6 m/s e. 2.6×10^6 m/s