Jordan University of Science & Technology

Department of Physics

Physics 102, 1st Exam, 2nd Semester, 1999/2000

Student Name: **Prof. Name:**

Section: **I . D. #:**

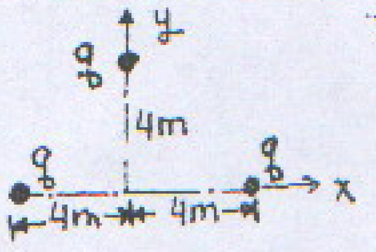
$1\mu = 10^{-6}$ $1n = 10^{-9}$ $g = 10\ m/s^2$

Electron mass $= 9.1\times10^{-31}$ kg, $e = 1.6\times10^{-19}$C $K_e = 9\times10^9\ N.m^2/C^2$.

ENTER YOUR ANSWERS IN THE FOLLOWING TABLE:

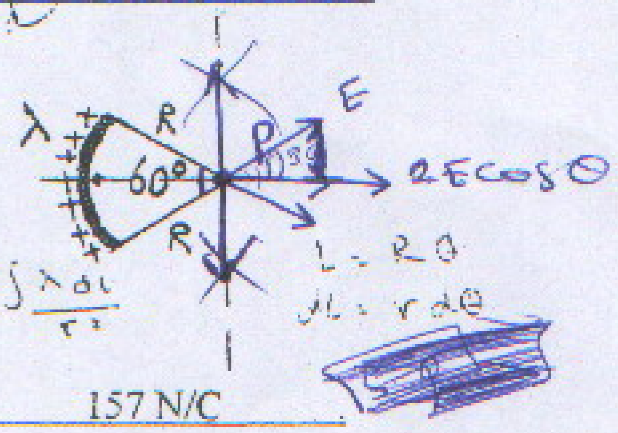
Q 1	Q 2	Q 3	Q4	Q 5	Q 6
Q 7	Q 8	Q 9	Q 10	Q 11	Q 12

(Q1) Three identical point charges, each of which has a charge $q = 3\ \mu C$, are located in the x-y plane as shown. Find the electric potential at the origin.



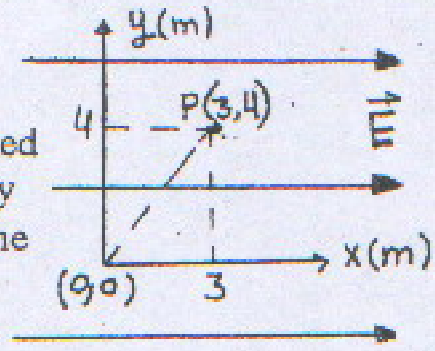
(A) 0.75×10^3 volts (B) 5.06×10^3 volts (C) 6.75×10^3 volts (D) 20.25×10^3 volts.

(Q2) A charge is uniformly distributed over a circular arc of radius $R = 6$ cm with linear charge density ($\lambda = 2$ nC/m) as shown. Find the magnitude of the electric field at the center of the circular arc (at point P).



(A) 150 N/C (B) Zero (C) 300 N/C (D) 157 N/C

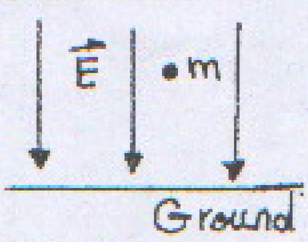
(Q3) A uniform electric field of magnitude 4×10^3 N/C is directed in the positive x-direction as shown. Find the work done by the electric field in moving a 100 μC point charge from the origin (0,0) to point P (x = 3 m , y = 4m).



$W = qE\ x$

(A) - 1.2 N.m (B) 2.0 N.m (C) - 2.0 N.m (D) 1.2 N.m

(Q4) A negatively charged particle of mass $m = 4.5\times10^{-5}$ kg is balanced in a region of a uniform electric field (E = 300 N/C) directed downwards. Find the charge on the particle.



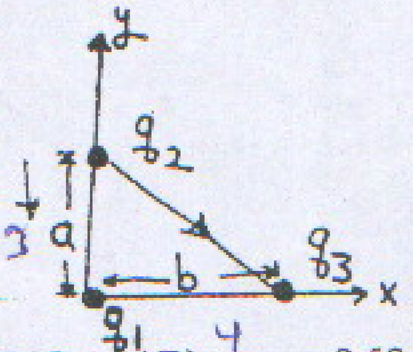
(A) - 0.15 μC (B) - 1.5 μC (C) - 1.1 μC (D) - 3.0 μC

$Eq = 4\times10^{-5}\times10$

$q = \frac{40\times10^{-5}}{300}$

$F_2 = F_{21} + F_{23}$

(Q5) Three point charges, $q_1 = -50\ \mu C$, $q_2 = 100\ \mu C$ and $q_3 = -100\ \mu C$ are located as shown. If $a = 3$ m, $b = 4$ m, what is the total force acting on q_2 ?



(A) 4.02 N (B) 7.70 N (C) 5.69 N (D) 8.58 N

(Q6) An infinite plane carrying a uniform surface charge density σ. What is the electric field at a distance x from the plane?

(A) $\pi k\sigma/x$ (B) $\pi k\sigma$ (C) $2\pi k\sigma$ (D) $\pi k\sigma x$

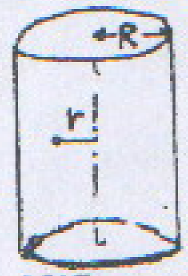
(Q7) A circular surface of radius R lies in the x-z plane is placed in a uniform electric field $\mathbf{E} = a\,\mathbf{i} + b\,\mathbf{k}$ N/C. Find the electric flux through this circular surface.

(A) $\pi R^2 a$ (B) Zero (C) $\pi R^2 (a + b)$ (D) $\pi R^2 b$

(Q8) An electron traveling with an initial velocity equal to $v_0 = 6\times10^6\,\mathbf{i}$ m/s enters a region of an electric field $\mathbf{E} = -40\,\mathbf{j}$ N/C. Find the magnitude of its velocity after one μsecond.

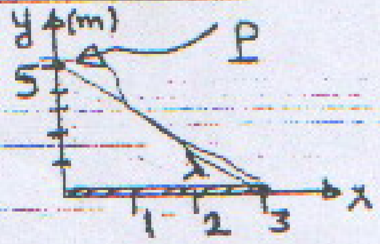
(A) 7.0×10^6 m/s (B) 6.5×10^6 m/s (C) 13.0×10^6 m/s (D) 9.2×10^6 m/s.

(Q9) An infinitely long insulating cylinder of radius R = 50 cm, has a uniform volume charge density ($\rho = 2$ nC/m^3). Find the electric field at a distance r = 20 cm from the axis of the cylinder.



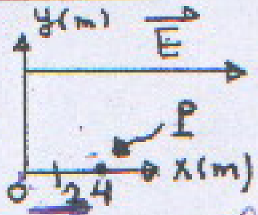
(A) 22.6 N/C (B) 141.2 N/C (C) 7.5 N/C (D) 1883.3 N/C

(Q10) A charge is uniformly distributed along the x-axis with a linear-charge-density ($\lambda = 4$ nC/m) from x = 0 to x = 3 meters as shown . Which of the following integrals is correct for the electric potential at a point P located on the y-axis at y = 5 m?



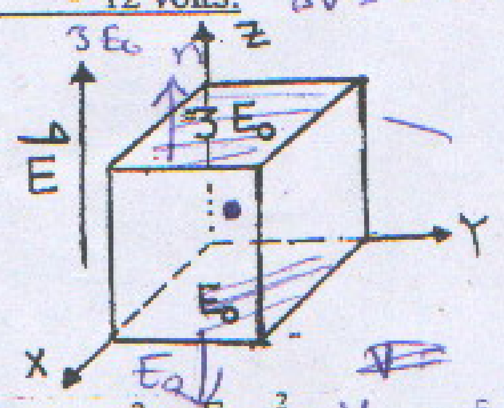
(A) $\int_0^3 \frac{36\,x\,dx}{(x^2+25)^{1/2}}$ (B) $\int_0^3 \frac{36\,dx}{(x^2+25)^{1/2}}$ (C) $\int_0^3 \frac{36\,dx}{(x^2+25)^{3/2}}$ (D) $\int_0^3 \frac{36\,dx}{(x^2+25)}$

(Q11) The electric field in space is given by $\mathbf{E} = 3x\,\mathbf{i}$ where E is measured in N/C and x in meters. The electric potential difference between the origin and a point P located at x = 4 meters ($V_P - V_0$) is:



(A) Zero (B) - 3 volts (C) - 24 volts (D) - 12 volts.

(Q12) A cube of side a is located in a region of a nonuniform electric field directed in the positive z- axis as shown. The electric field has a magnitude of $E = 3E_0$ at the top face of the cube and a magnitude of $E = E_0$ at the bottom face. Find the charge Q enclosed in the cube?



(A) $-2\varepsilon_0 E_0 a^2$ (B) Zero (C) $4\varepsilon_0 E_0 a^2$ (D) $3\varepsilon_0 E_0 a^2$

$\Phi_E = \frac{q_{ins}}{\varepsilon_0} = 3\varepsilon_0 A - \varepsilon_0 A = \frac{q_{ins}}{\varepsilon_0}$

$= 2\varepsilon_0 a^2 = q_{ins}$