



Chapter: Oscillations & Electrostatics

Worksheet# 7 (Sec:___)

Q1. A particle oscillates with simple harmonic motion, so that its displacement varies according to the expression $x = (5 \text{ cm}) \cos (2t + \pi/6)$ where x is in centimeters and t is in seconds. At $t = 0$ find,

- (a) the displacement of the particle, (c) its acceleration
(b) its velocity, (d) Find period and amplitude of motion.

Q2. A 20 g particle moves in simple harmonic motion with a frequency of 3 oscillations per second and an amplitude of 5 cm.

- (a) Through what total distance does the particle move during one cycle of its motion? (b) What is its maximum speed? Where does that occur?
(c) Find the maximum acceleration of the particle. Where in the motion does the maximum acceleration occur?

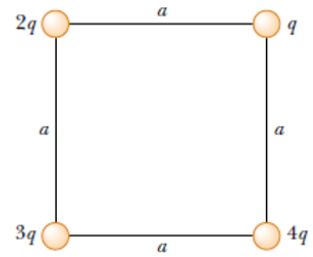
Ans: **1a.** 4.33 cm **1b.** -5 cm/s. **1c.** -17.3 cm/s² **1d.** π s & 5 cm

Ans: **2a.** 20 cm **2b.** 0.94 m/s **2c.** 17.8 m/s²

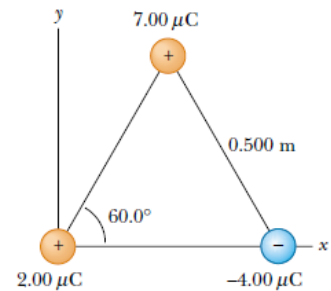
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Q3. Find the net force on charge q_1 due to the three other charges in figure. Take $q_1 = -5\mu\text{C}$, $q_2 = -8\mu\text{C}$, $q_3 = 15\mu\text{C}$ and $q_4 = -16\mu\text{C}$, $a = 5\text{cm}$. (Ans: $2.3\hat{i} - 2.4\hat{j}$)



Q4. Three-point charges are located at the corners of an equilateral triangle, as shown in Figure -2. Calculate the net electric force on the $7\mu\text{C}$ charge. (Ans:)



Q5. A point charge $q_1 = -2.5\mu\text{C}$ is at $x=0$, while $q_2 = 6\mu\text{C}$ is at $x=1\text{ m}$. At what point, besides infinity, would the net force on a positive charge q_3 be zero? (Ans: $d=1.82\text{m}$ to the left $-2.5\mu\text{C}$)

Q6. The electron and the proton in a hydrogen atom are $0.53 \times 10^{-10}\text{ m}$ apart. Compare the electrostatic and gravitational forces between them. $F_g/F_e = 4.4 \times 10^{-40}$

Q7. At what separation would the force between a proton and an electron be 1 N ? (Ans: $1.52 \times 10^{-14}\text{m}$)

Q8. A proton orbits with a speed $v = 294\text{ km/s}$ just outside a charged sphere of radius $r = 1.13\text{cm}$. Find the charge on sphere. ($p=e = 1.9 \times 10^{-19}\text{C}$ and $m = 1.67 \times 10^{-27}\text{ kg}$) (Ans: $-1.13 \times 10^{-9}\text{C}$)