1) A small sphere with a mass of 275.0 g is moving along the y-axis in the negative y direction when it encounters an electric field of magnitude 5.0 N/C, pointing in the positive y direction. If the sphere suddenly accelerates in the y-direction at +13.0 m/s^2, what is the charge that it carries?

A) -0.72 C B) -720 C C) 720 C D) 0.72 C

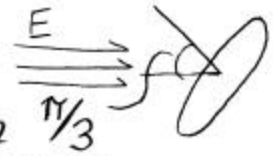
$f = ma$, $f = Eq$

$Eq = ma$

$q = \frac{ma}{E} = \frac{.2750\ kg \times (+13.0\ m/s^2)}{5.0\ N/C} = \boxed{0.72\ C}$

2) A flat disk 1.0 m in radius is oriented so as to have its surface normal make an angle $\pi/3$ radians with a uniform electric field. If the field strength is 140.0 N/C, find the electric flux through the surface.

A) $480/\pi$ N•m^2/C B) 70π N•m^2/C C) $120/\pi$ N•m^2/C D) 30π N•m^2/C

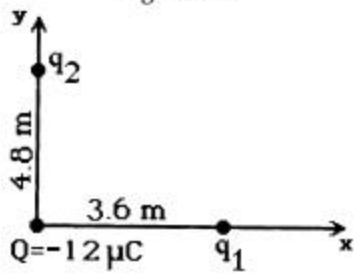


$\Phi = E \cdot A \cdot \cos\theta$

$= 140.0\ N/C \cdot \pi (1.0\ m)^2 \cos \pi/3$

$= 140\ \frac{Nm^2}{C} \cdot \frac{1}{2} \cdot \pi = \boxed{70\pi\ \frac{N m^2}{C}}$

Figure 22.3



A point charge Q = −12 μC, and two other charges, q_1 and q_2, are placed as shown. The electric force components on charge Q are F_x= +0.005 N and F_y = −0.003 N.

3) In Figure 22.3, the number of excess electrons in charge Q is closest to:

A) 7.5×10^{13} B) 6.5×10^{13} C) 9.5×10^{13} D) 8.5×10^{13} E) 5.5×10^{13}

4) In Figure 22.3, charge q_1, in nC, is closest to:

A) −200 B) +200 C) +600 D) −400 E) +400

5) In Figure 22.3, charge q_2, in nC, is closest to:

A) −480 B) +640 C) +480 D) +320 E) −640

---

3) $Q = -12\mu C = -12 \times 10^{-6} C$

$$n_e = \frac{Q}{-e} = \frac{-12 \times 10^{-6} C}{1.6 \times 10^{-19} C} = \boxed{7.5 \times 10^{13}}$$

4) $F_x = 0.005 N \quad Q = -12\mu C$

$$F_x = \frac{k_e |Q| |q_1|}{(3.6 m)^2}$$

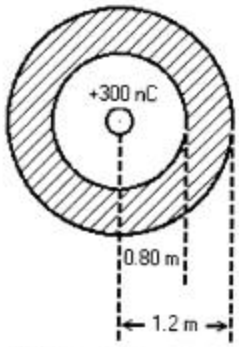
$$q_1 = \frac{F_x (3.6m)^2}{k_e |Q|} = \frac{0.005 N \cdot (3.6m)^2}{9 \times 10^9 N m^2/C^2 \cdot 12 \times 10^{-6} C} = \boxed{6 \times 10^{-7} C = 600 nC}$$

force is attractive so q_1 is positively charged.

5 $$q_2 = -\frac{F_y (4.8m)^2}{k_e |Q|} = \frac{0.003 N \cdot (4.8m)^2}{9 \times 10^9 \frac{N m^2}{C} \cdot 12 \times 10^{-6} C} = \boxed{-640 nC}$$

force is repulsive so q_2 is **negative**

Figure 23.5



A hollow conducting sphere has radii of 0.80 m and 1.20 m. The sphere carries a charge of -500 nc. A point charge of +300 nC is present at the center.

6) In Figure 23.5, the charge on the outer spherical surface, in nC, is closest to:
A) -200 B) -800 C) -500 D) -300 E) zero

7) In Figure 23.5, the radial component of the electric field at a point which is 0.90 m from the center is closest to:
A) +2000 N/C B) +3000 N/C C) zero D) -2000 N/C E) -3000 N/C

It is easiest to do 7 first

7) $r = 0.90\text{m}$ is inside the conductor

therefore $\boxed{E = 0}$

6) We know all charge on a conductor is on the surface, so we can draw a spherical Gaussian surface at $r = 0.90\text{m}$. $\Phi = E \cdot A \cdot \cos\theta = 0$ since $E = 0$ there (#7). By Gauss's Law we know the total charge inside $r = 0.9$ (point charge + inner surface) must be 0 ($\Phi = \frac{q_{inside}}{\varepsilon_0}$), therefore the inner surface must have charge of $-300\,nC$ and outer surface $(-500 - -300)\,nC$ $\boxed{-200\,nC}$