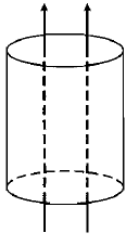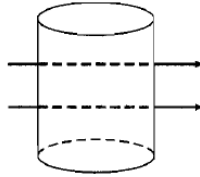For each of the closed cylinders shown below, are the electric fluxes through the top, the side wall, and the bottom positive (+), negative (-), or zero (0)? Is the net flux +, -, or 0? (Arrows represent electric field lines.)
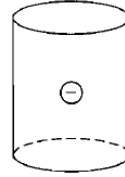
a.

$\Phi_{top} =$ _____

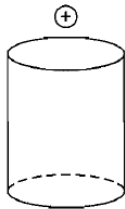$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

b.

$\Phi_{top} =$ _____

$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

c.

$\Phi_{top} =$ _____

$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

d.

$\Phi_{top} =$ _____

$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

e.

$\Phi_{top} =$ _____

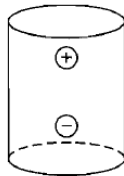$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

f.

$\Phi_{top} =$ _____

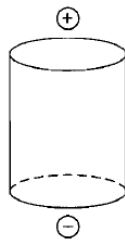$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

g.

+ wire

$\Phi_{top} =$ _____

$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

h.

+ plane

$\Phi_{top} =$ _____

$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

i.

+ plane
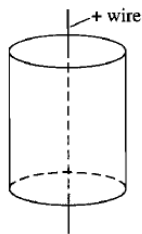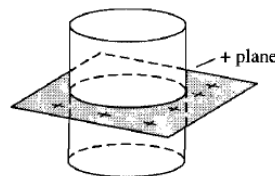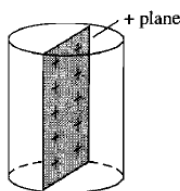
$\Phi_{top} =$ _____

$\Phi_{wall} =$ _____

$\Phi_{bot} =$ _____

$\Phi_{net} =$ _____

Calculate the net electric flux through the surfaces indicated.

a)

E = 10 N/C to right

2 cm

1 cm

60°

b)

E = 10 N/C to right

1 cm

2 cm

60°

E is approx. uniform across square

c) +1 μC

50 cm

1 cm by 1 cm square

d) +1 μC

50 cm

1 cm by 1 cm square

e) +1 μC

half spherical shell (R = 10 cm) with charge at center

f) +1 μC

whole spherical shell (R = 10 cm) with charge at center

g) +1 μC

whole spherical shell (R = 10 cm) with charge inside but off-center

h) +1 μC
+1 μC
−1 μC
−1 μC

whole spherical shell (R = 10 cm) all charges inside but off-center

i) +1 μC

50 cm

whole spherical shell (R = 10 cm) containing no charges

Consider this equation: $\Phi_E = \oint \vec{E} \cdot d\vec{A} = \dfrac{q_{enc}}{\varepsilon_0}$

(a) Explain the equation in words.

(b) Provide a name for each parameter and indicate its units (dimensions).

Φ_E

E

A

q_{in}

(c) What does the dot product do here?

(d) A thin spherical shell of radius 0.750 m surrounds a collection of charged particles, but the sphere itself is not charged. The electric field everywhere at the location of the shell is measured to be 890 N/C and points radially toward the center of the sphere. Find the net charge contained in the space inside the spherical shell.

A charge of 170 µC is at the center of a cube of side length 80.0 cm.

(a) Find the total flux through the whole surface of the cube.
(b) Find the flux through each face of the cube.
(c) Speaking qualitatively, how would your answers above change if the charge were not at the cube's center?
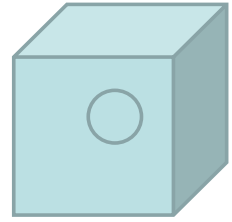
A solid sphere 2.0 cm in radius carries a uniform volume charge density. The electric field 1.0 cm from the sphere's center has a magnitude of 39,000 N/C and points outward from the sphere's center.

(a) What total charge is contained in the sphere?
(b) At what other distance does the electric field have a magnitude of 39,000 N/C?

Wolfson, Volume II, 2nd Edition, Problem 21.25

Type equation here.

Wolfson, Volume II, 2nd Edition, Problem 21.29

Wolfson, Volume II, 2nd Edition, Problem 21.46

Wolfson, Volume II, 2nd Edition, Problem 21.48