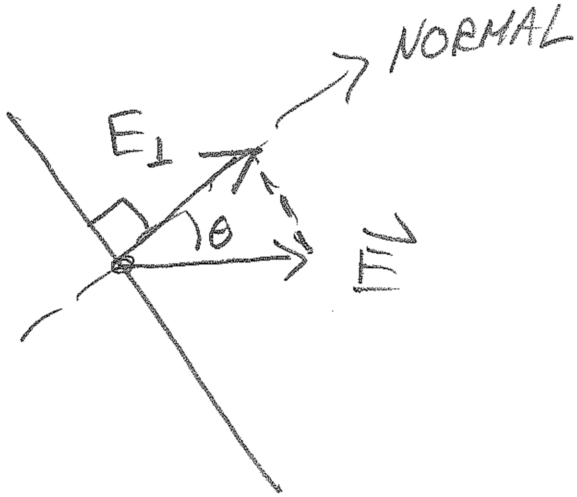
CH 22 see pre-lec 22 masteringphysics.com

see Fig 22.6 - side views

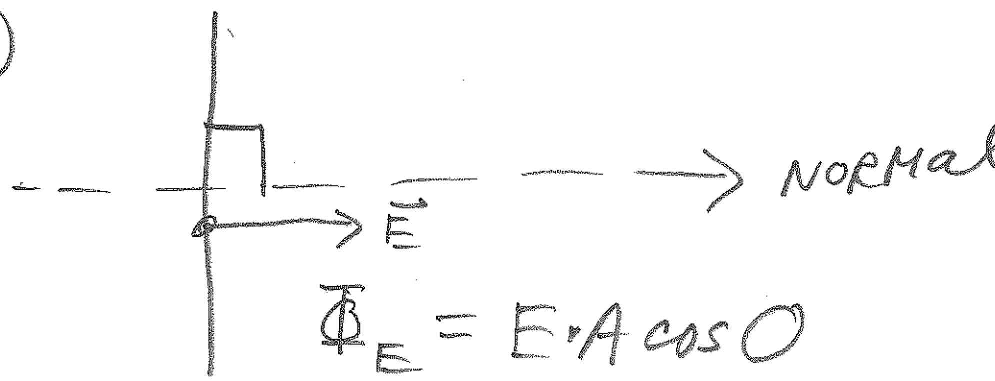


$$\Phi_E \equiv E_\perp \cdot A = E\cos\theta \cdot A$$

$$\boxed{\Phi_E = E \cdot A \cdot \cos\theta}$$ preferred form.

FIG 22.6:

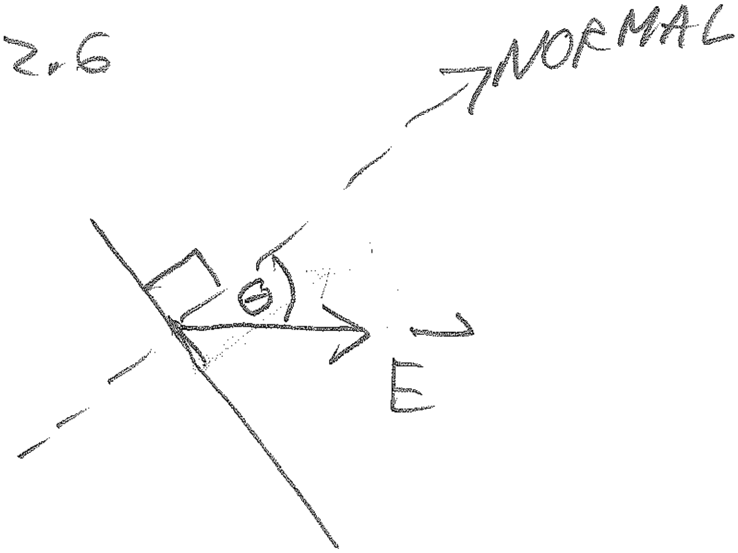
(a)



$$\Phi_E = E \cdot A \cos 0$$
$$= EA$$

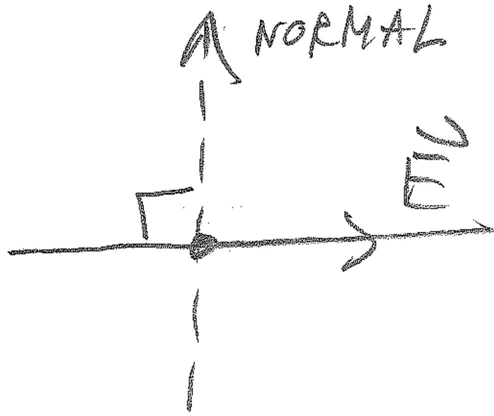
FIG. 22.6

(b.)



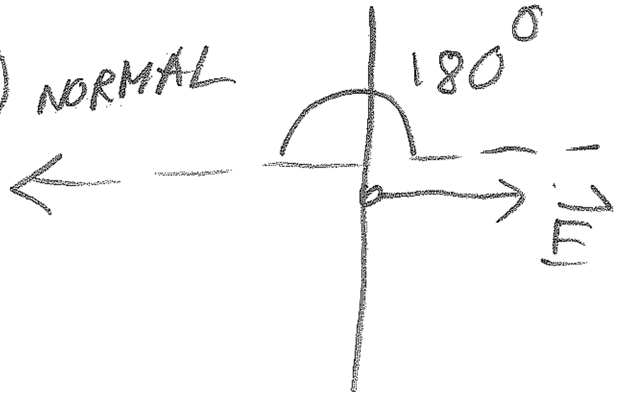
$$\Phi_E = E \cdot A \cos \theta < EA$$

(c.)



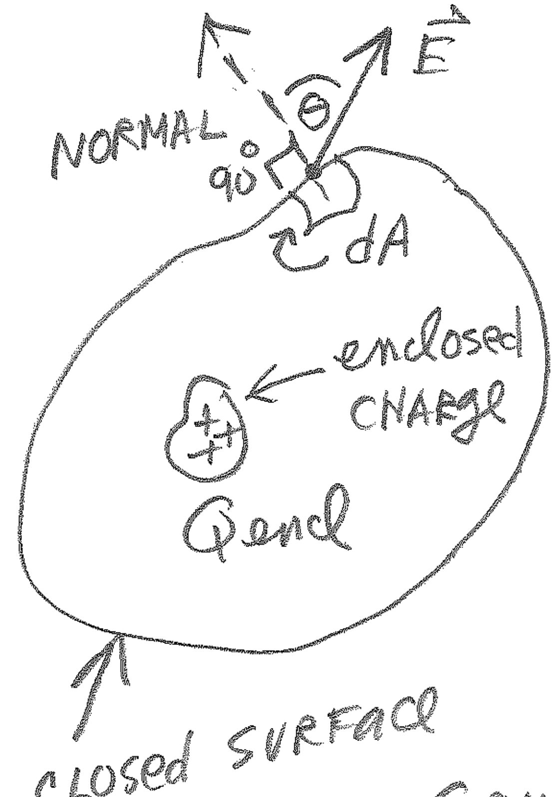
$$\Phi_E = E A \cos 90 = 0$$

my (d.)



$$\Phi_E = E A \cdot \cos 180^\circ$$
$$= EA \cdot (-1) = -EA.$$

Gauss's LAW sec 22.3



$d\Phi_E = E\,dA\cos\theta$

dA = differential area.

Gauss' LAW:

$$\Phi_E = \oint_{\text{closed surface}} E \cdot dA\cos\theta = \frac{Q_{encl}}{\varepsilon_0}$$

NOTE: NORMAL line is OUTWARD from closed surface.

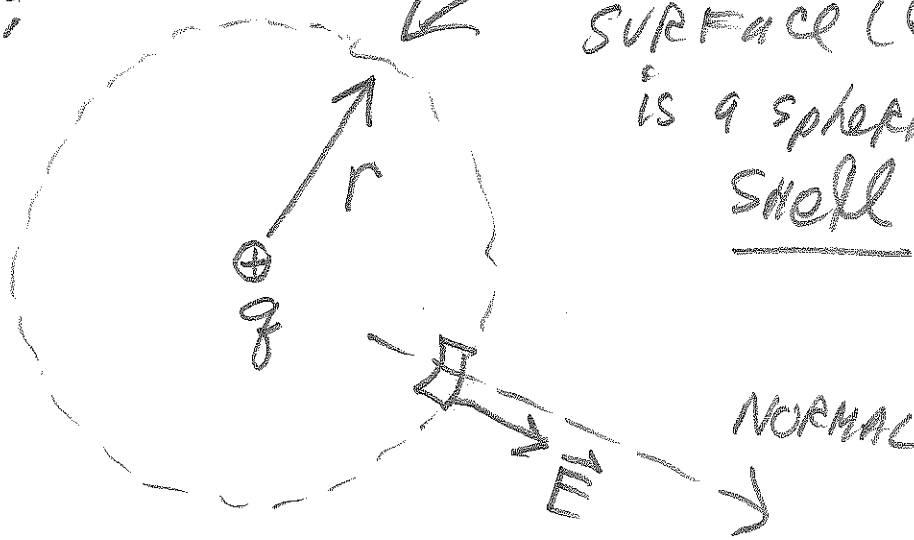
APPLICATIONS:

(A) PAGE 735: point CHARGE

FIND $\vec{E}$ for a point charge q.

q AT center:

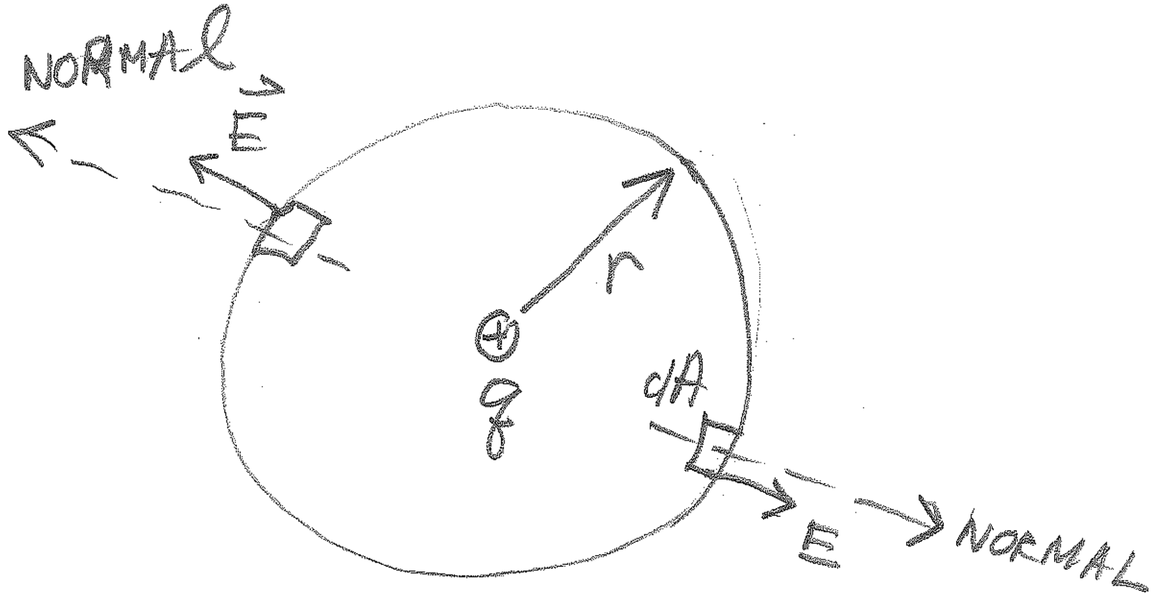
GAUSSIAN SURFACE (GS) is a spherical shell.



NOTE: (i) E = CONSTANT $= |\vec{E}|$ on G.S.

(ii) $\vec{E}$ is PARALLEL TO NORMAL: $d\Phi_E = E\,dA\cos 0$
$= E\,dA$

Point charge:



$$\oint_{G.S.} E\,dA\cos\theta = \frac{q_{encl}}{\varepsilon_0}$$

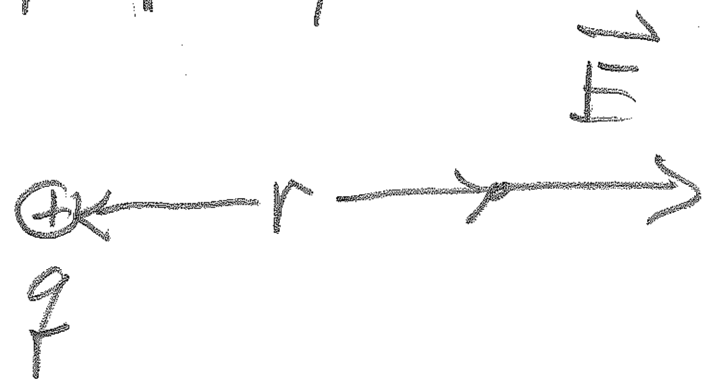
$$\oint E\,dA = \frac{q}{\varepsilon_0}$$

$$E \cdot \oint dA = \frac{q}{\varepsilon_0}$$

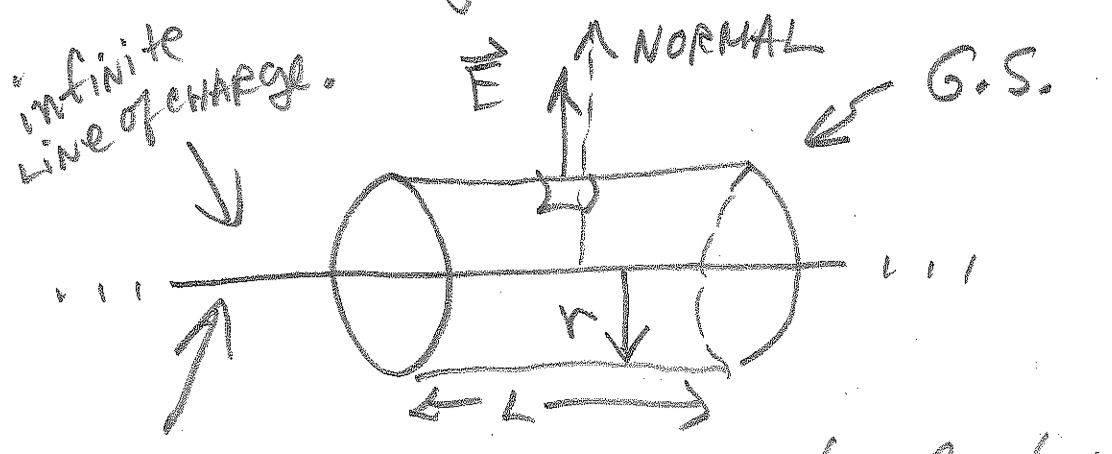
$$E \cdot (4\pi r^2) = \frac{q}{\varepsilon_0}$$

$$E = \frac{q}{4\pi\varepsilon_0 r^2} = \frac{Kq}{r^2}$$ like ch21!

$$E = |\vec{E}| = \frac{kq}{r^2}$$



(B.) FIELD of a line of CHARGE: EXAMPLE 22.6



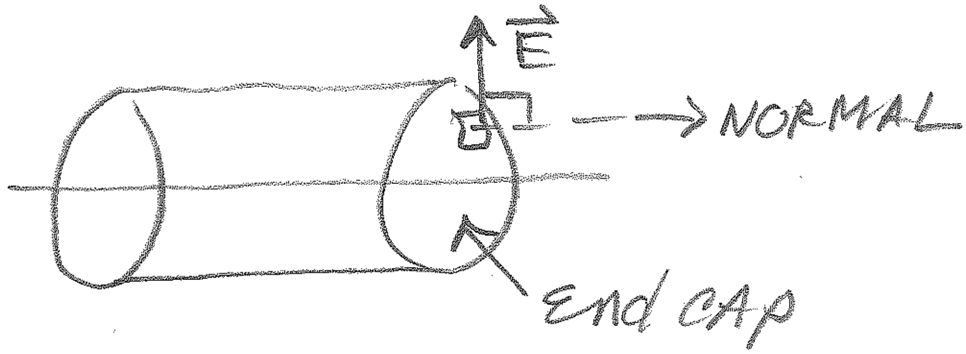
$\lambda > 0$ G.S. = closed cylinder

$$\oint E\,dA\cos\theta = \frac{\lambda \cdot L}{\varepsilon_0}, \quad \lambda L = Q_{encl}$$

$$\int_{\substack{\text{CURVY} \\ \text{PART (SIDE)}}} E\,dA\cos\theta = \frac{\lambda \cdot L}{\varepsilon_0}$$

<u>NOTE:</u> $\int E\,dA\cos 90^\circ = 0$

End caps

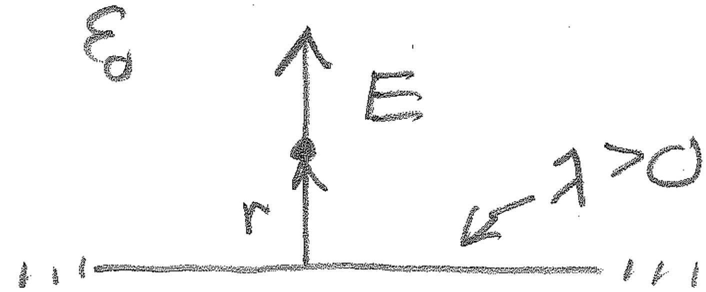


$$\int_{\text{curvy side}} E\,dA = \frac{\lambda \cdot L}{\varepsilon_0}$$

$$E \int_{\text{curvy}} dA = \frac{\lambda L}{\varepsilon_0}$$ since E = <u>CONSTANT</u> on curvy side

$$E \cdot (2\pi r \cdot L) = \frac{\lambda L}{\varepsilon_0}$$

$$\boxed{E = \frac{\lambda}{2\pi \varepsilon_0 r}}$$



See Example 21.10 as $a \to \infty$.