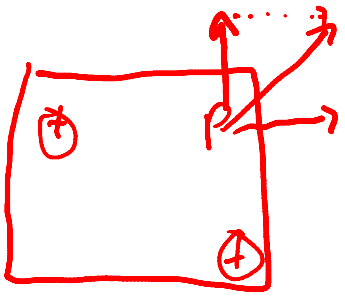
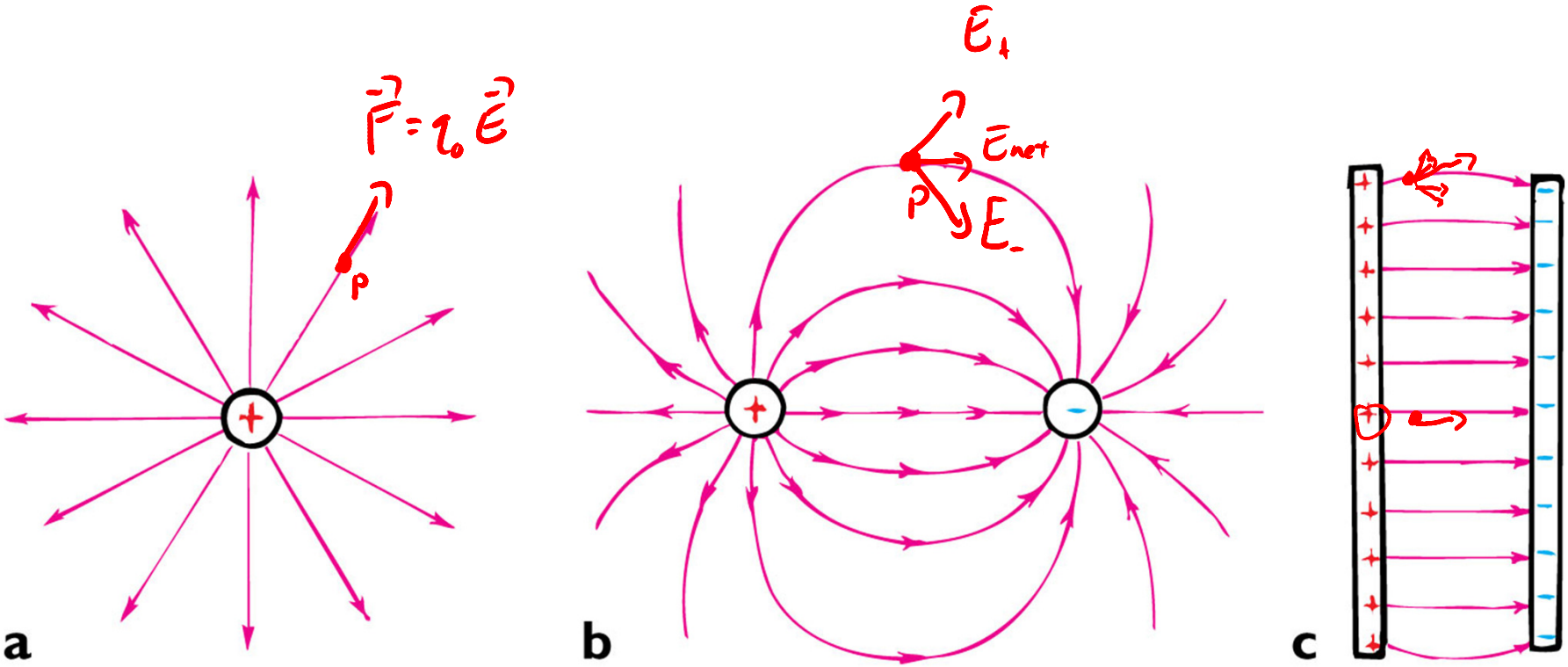
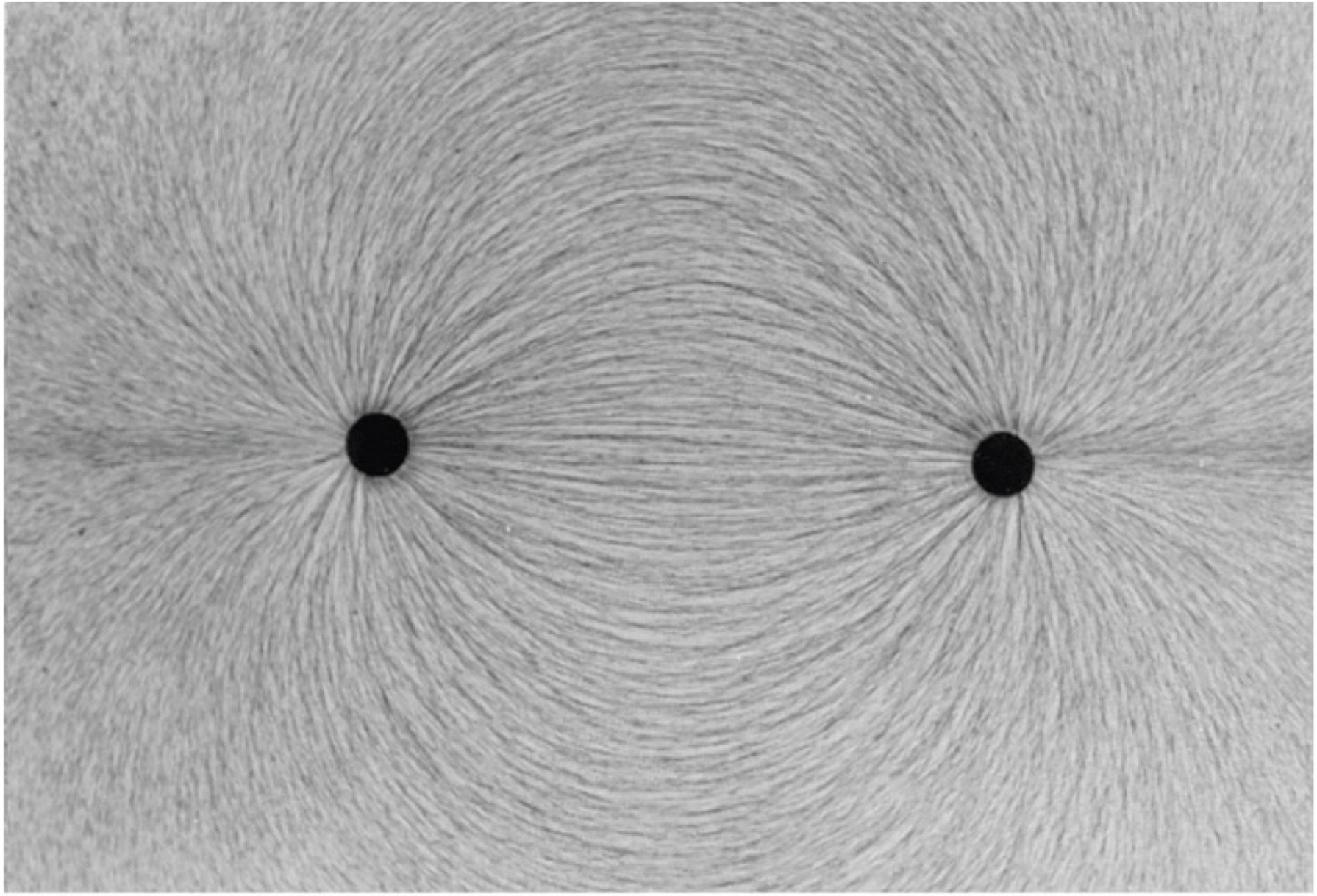
Worksheet that says “page 26” *(boxes A thru H…)*

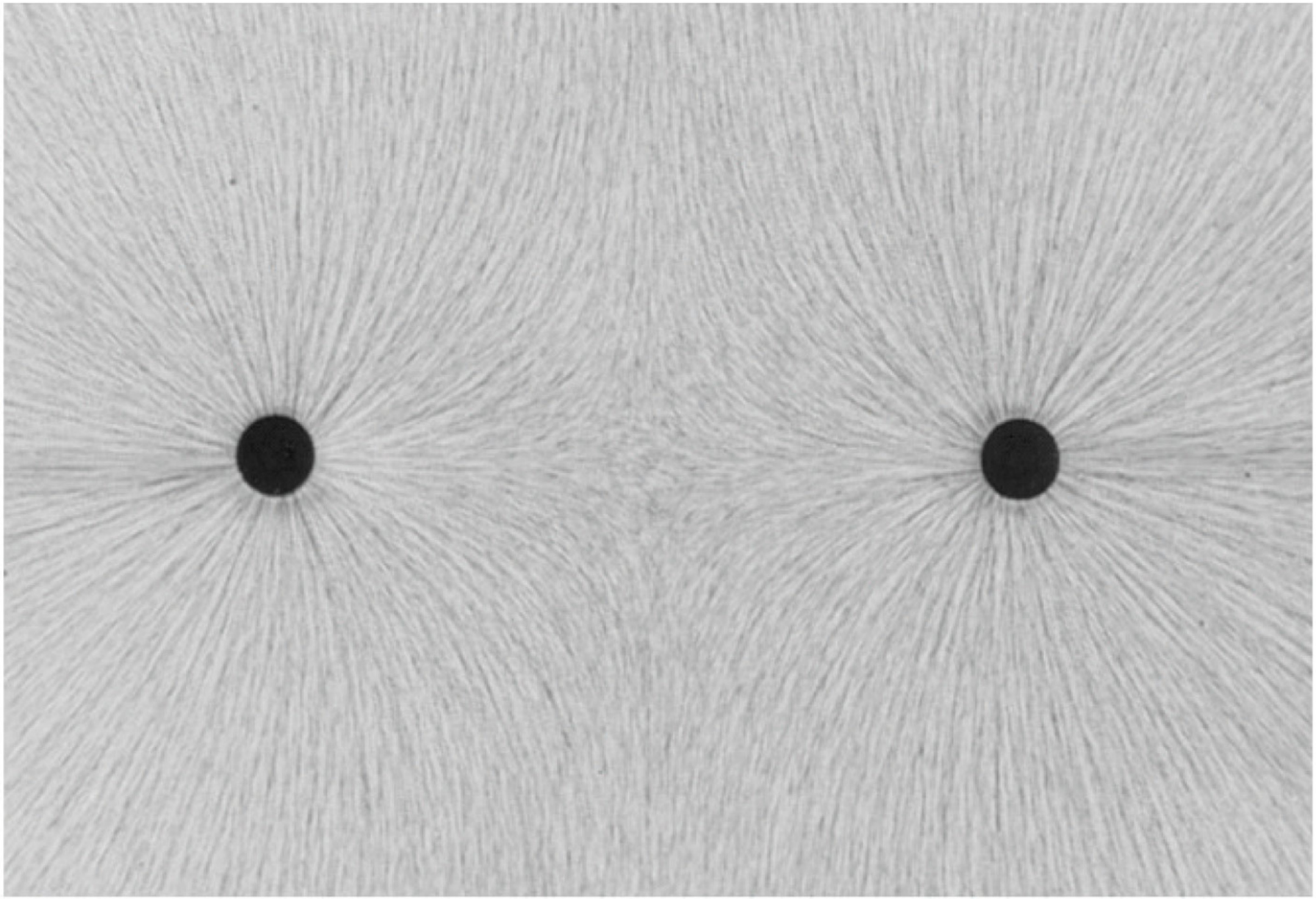




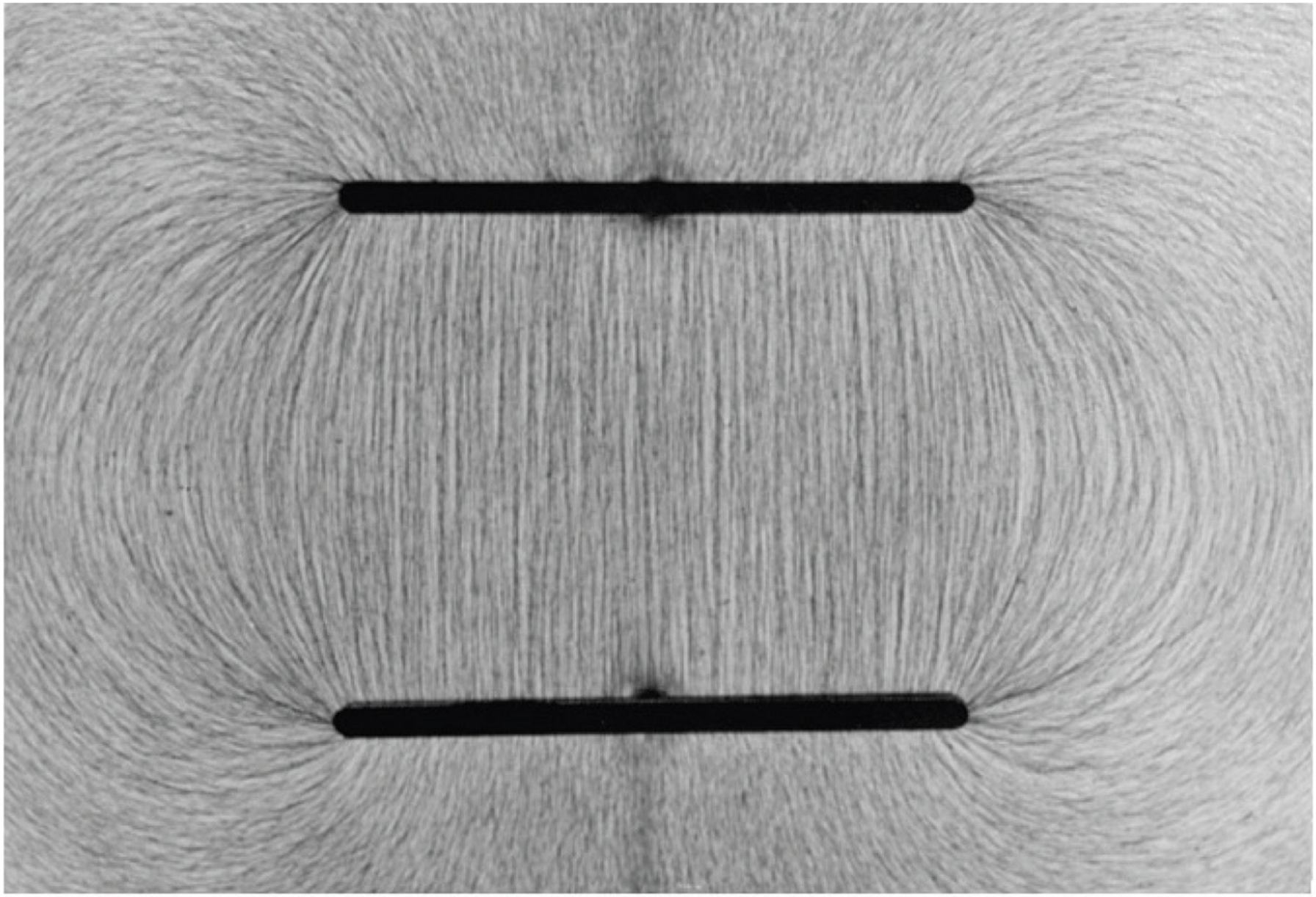
See E-field simulation link on class website



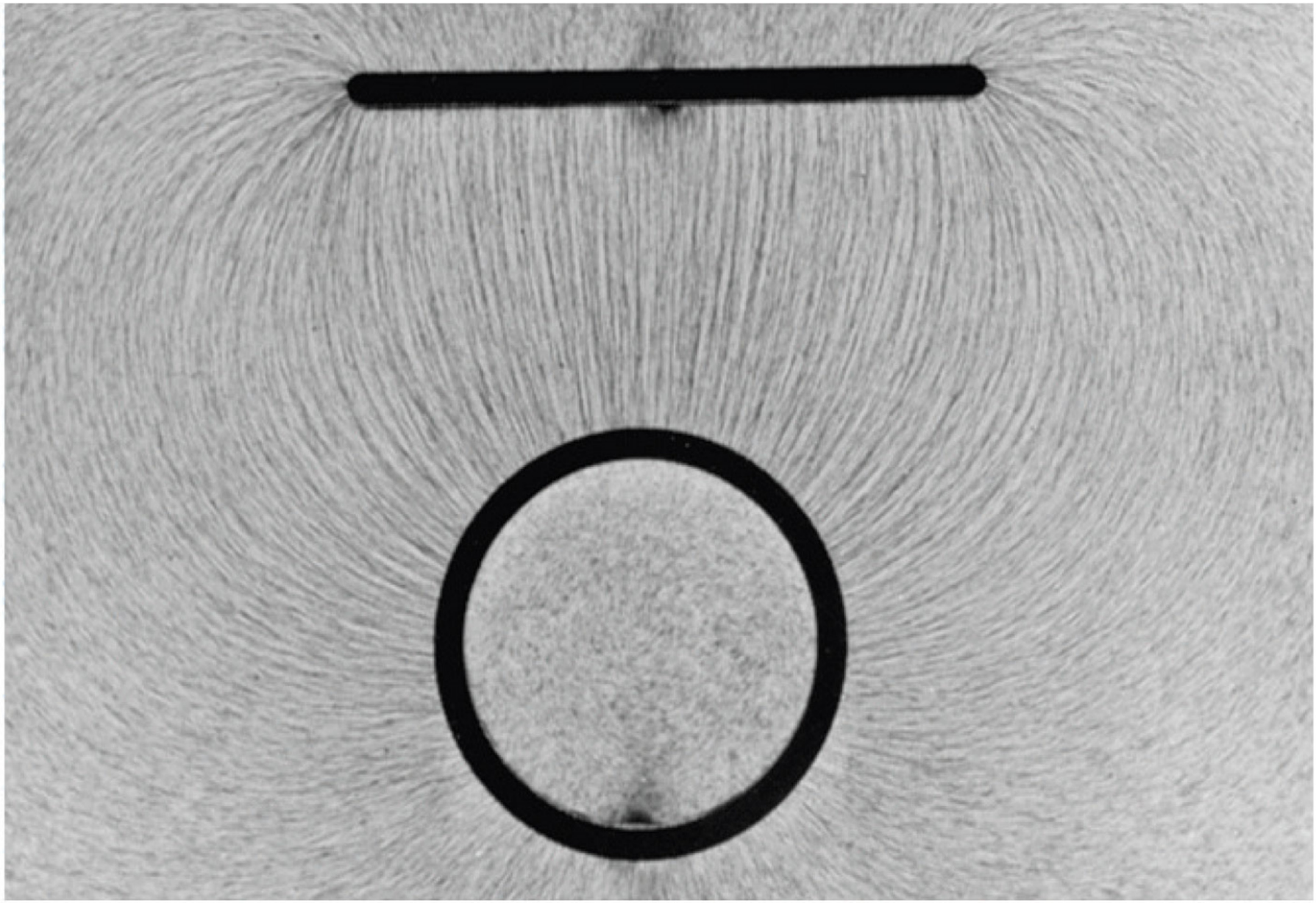
a



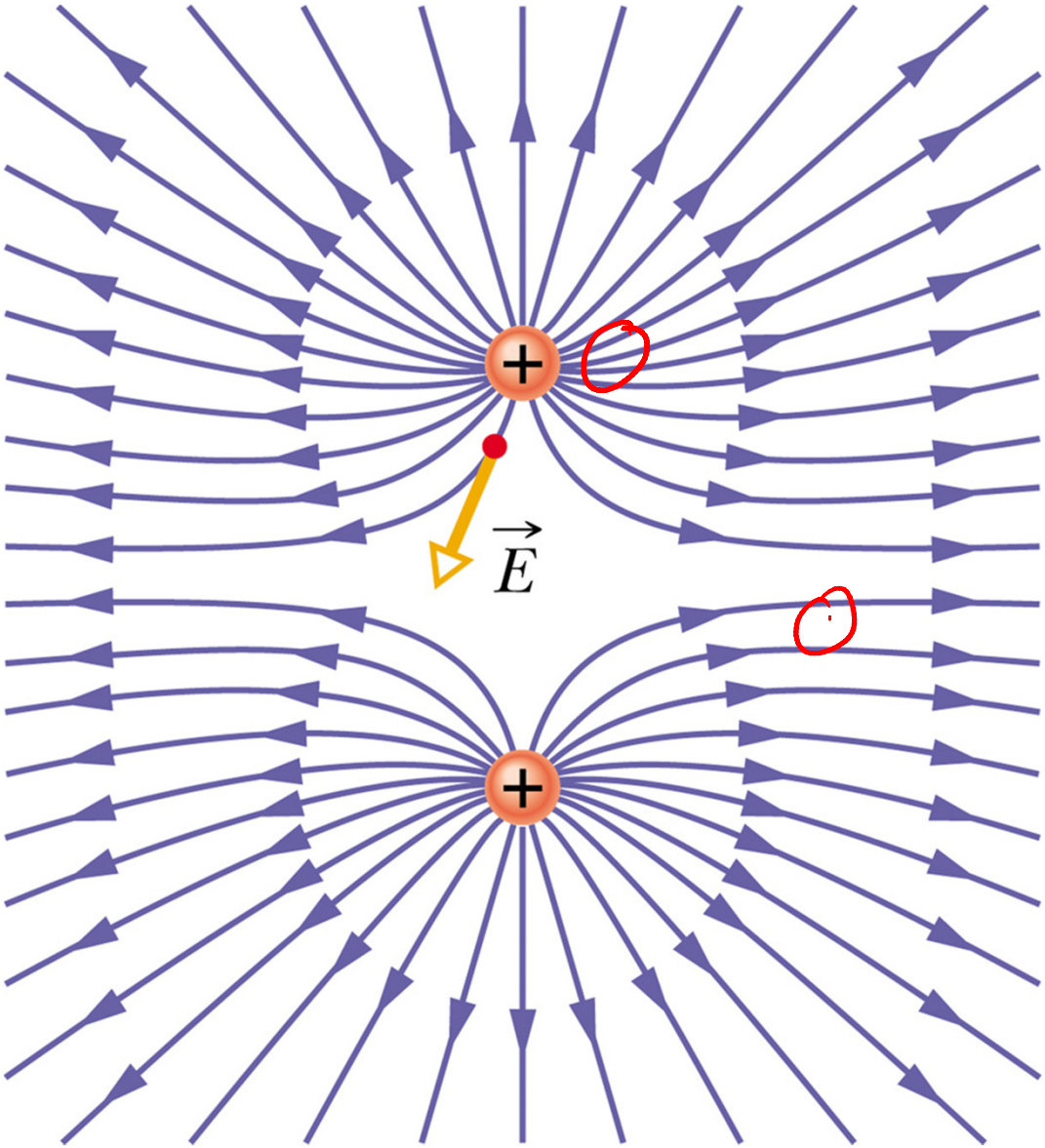
b

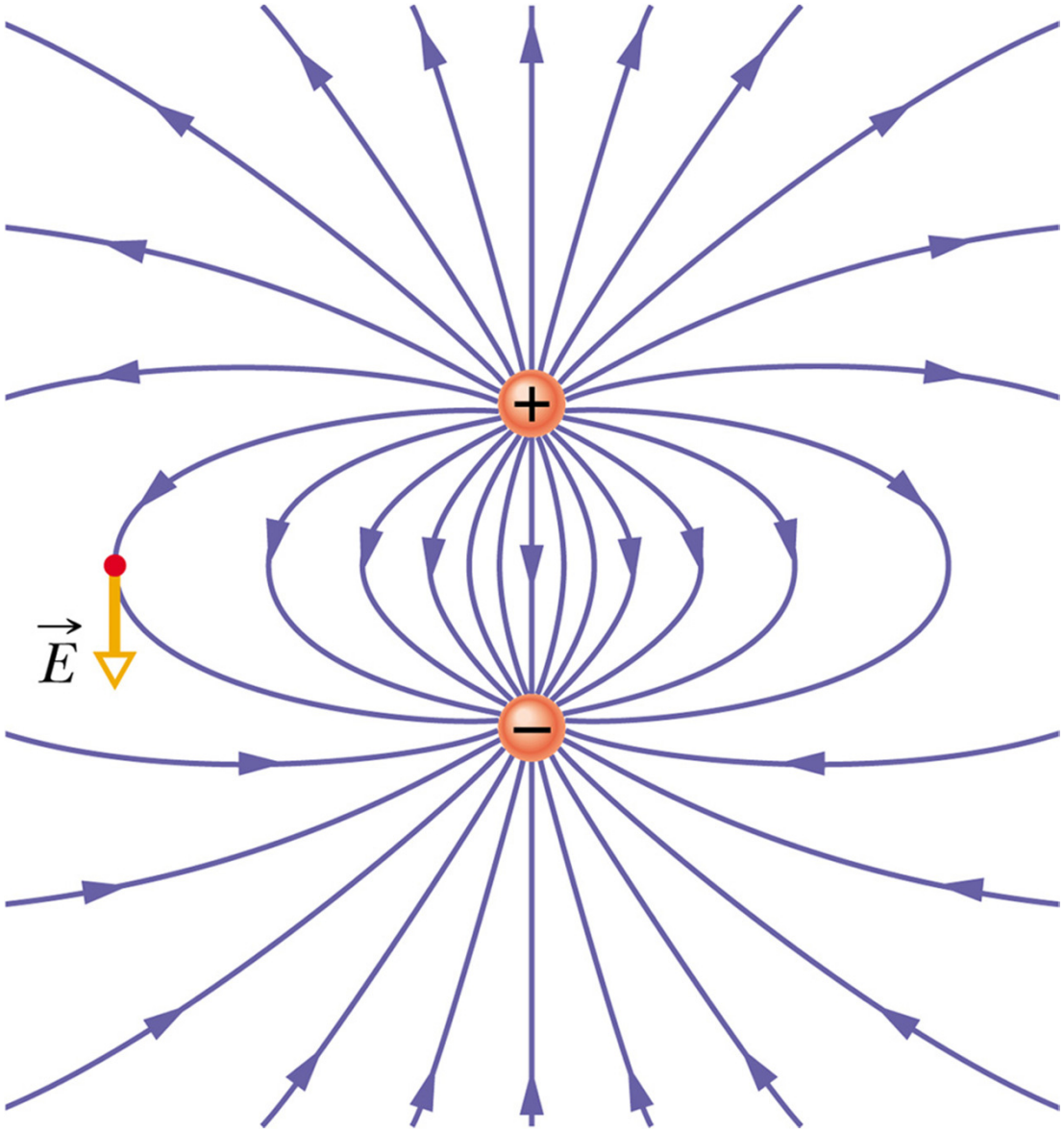


C

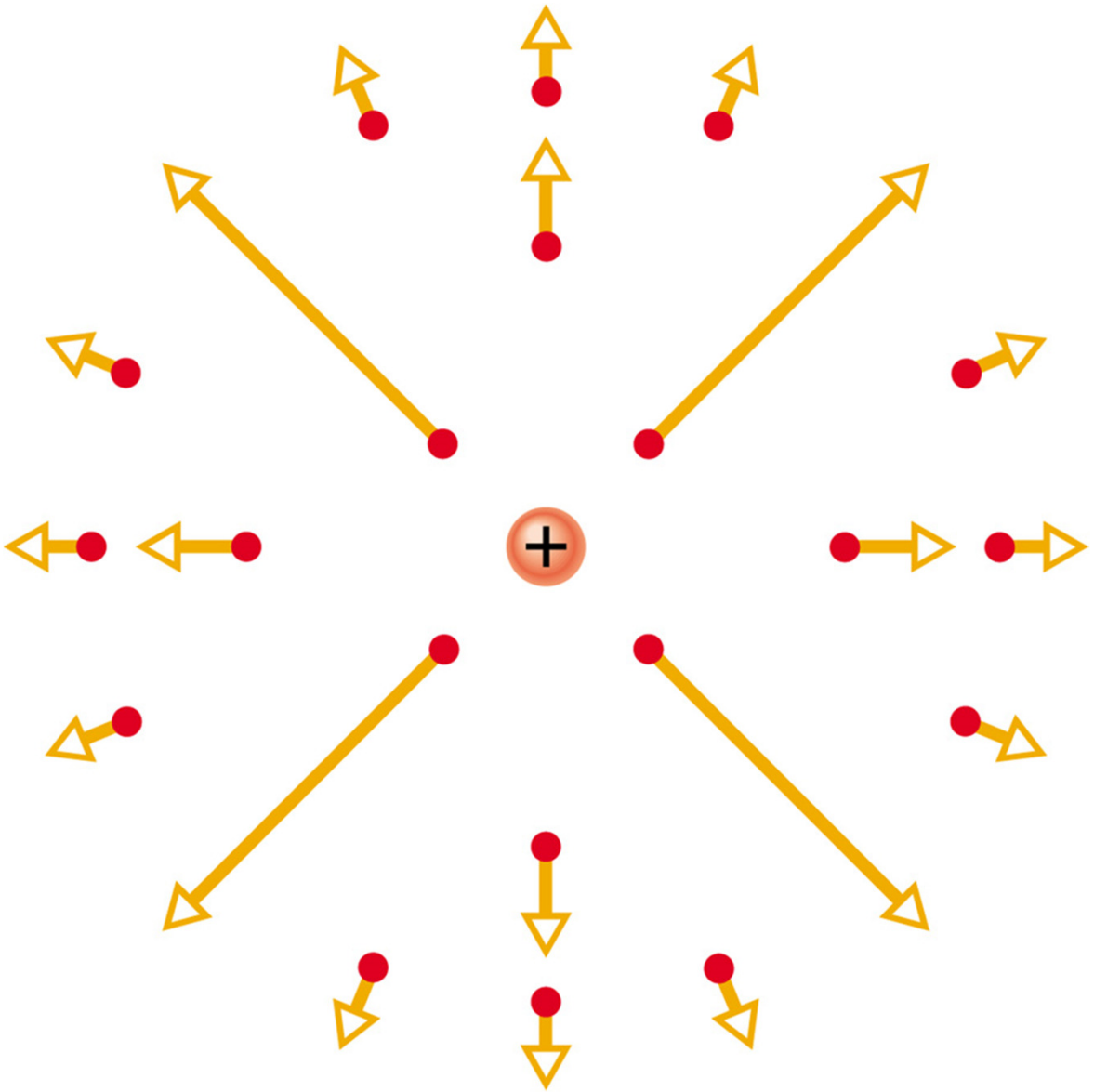


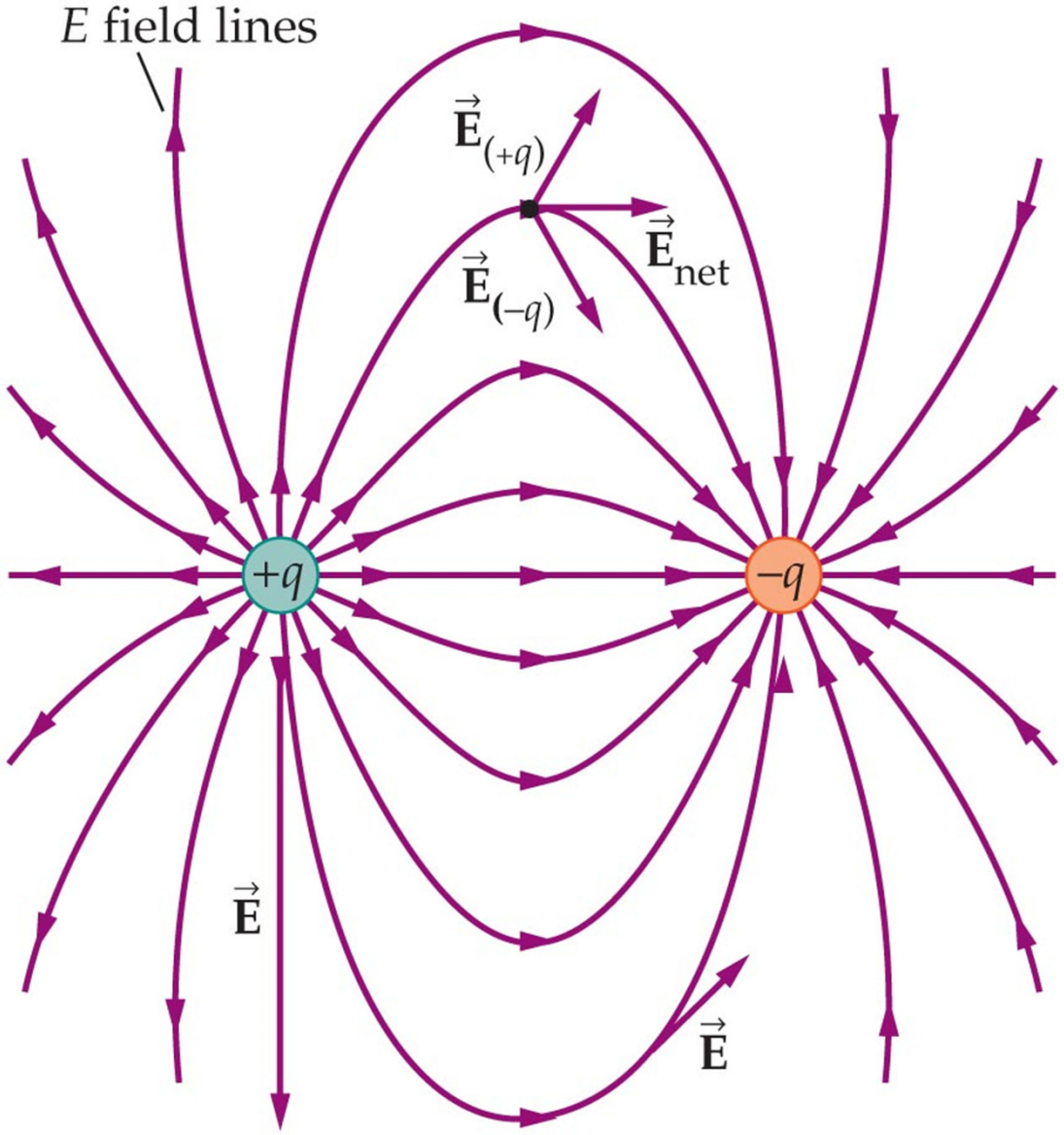
d


+
+
$\vec{E}$

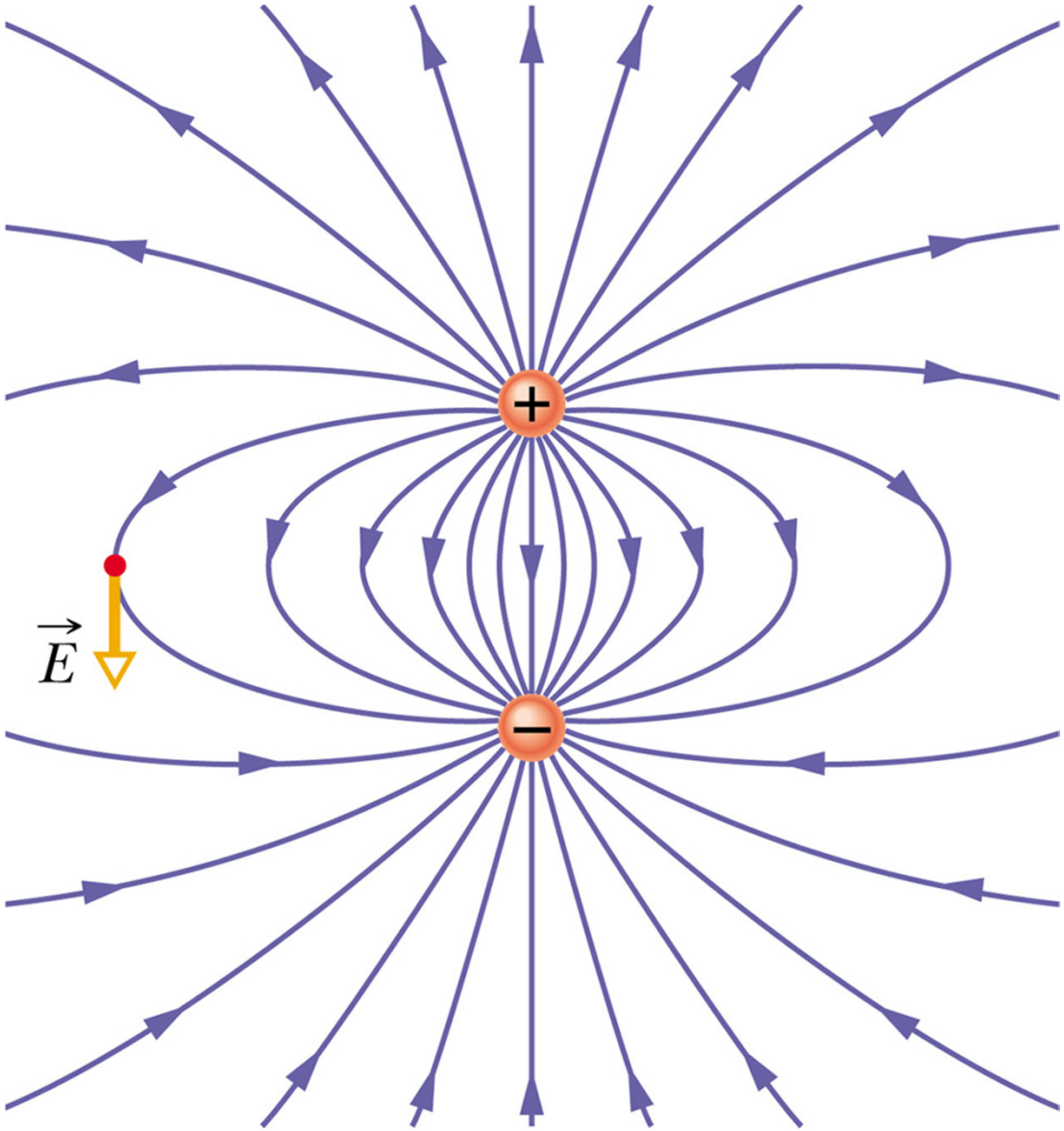

+
−
$\vec{E}$

$$\vec{E} = \frac{kQ}{r^2}\hat{r}$$





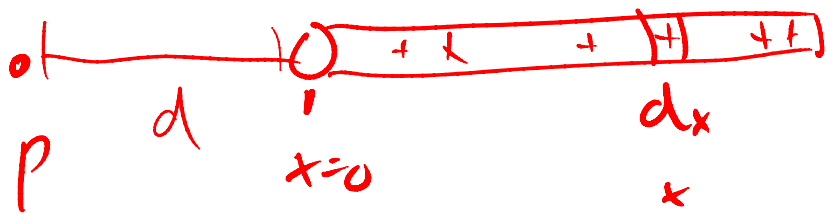
(a)


+
−
$\vec{E}$

Worksheet that says “page 27” *(picture of a rod in segments…*)

$dq = \lambda dx$

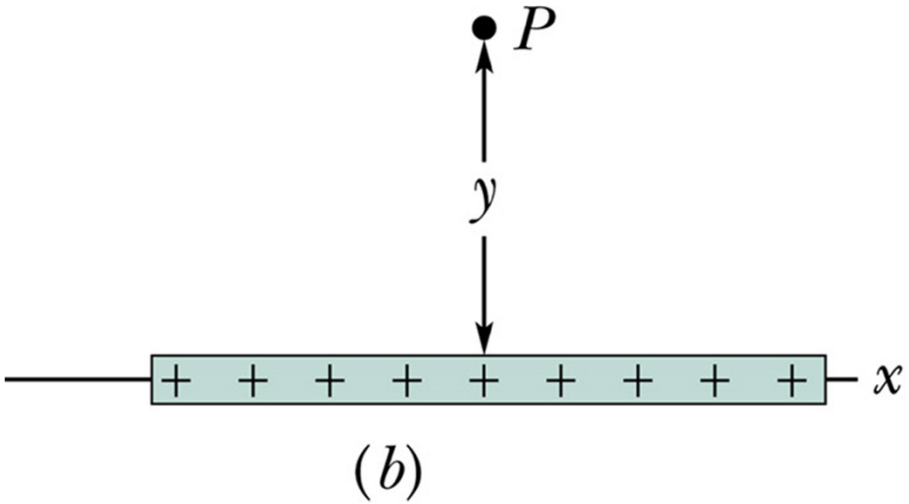
$r = d + x$



$$\lambda = \frac{Q}{L}$$

$$\lambda = f(x)$$

But what if it's not a point charge?
Real things have size.

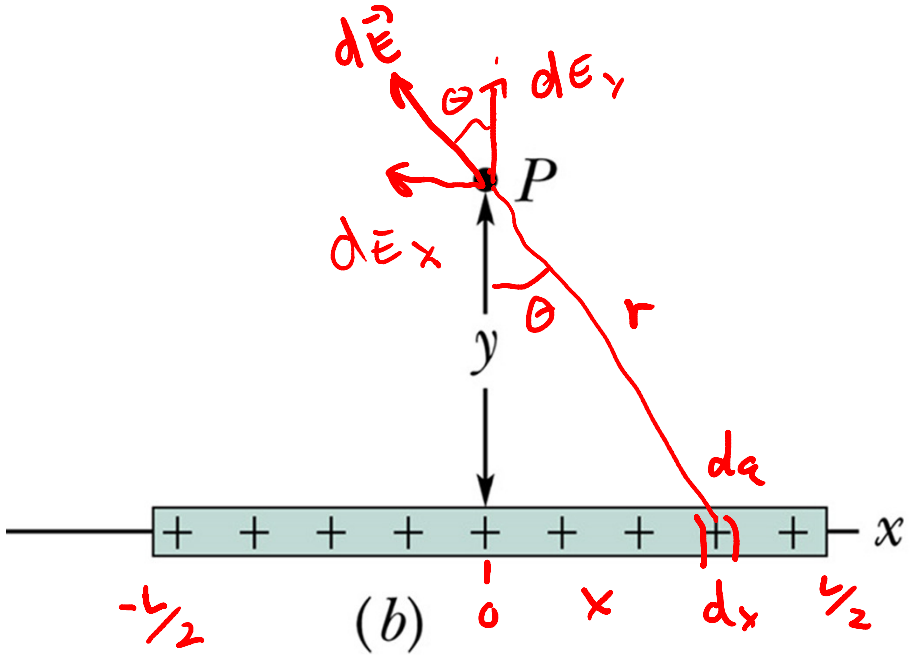


(b)

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

Spread Q over L long rod

$\lambda = Q/L \qquad dq = \lambda\, dx$



$r^2 = y^2 + x^2$

$$dE = \frac{k\, dq}{(y^2+x^2)}$$

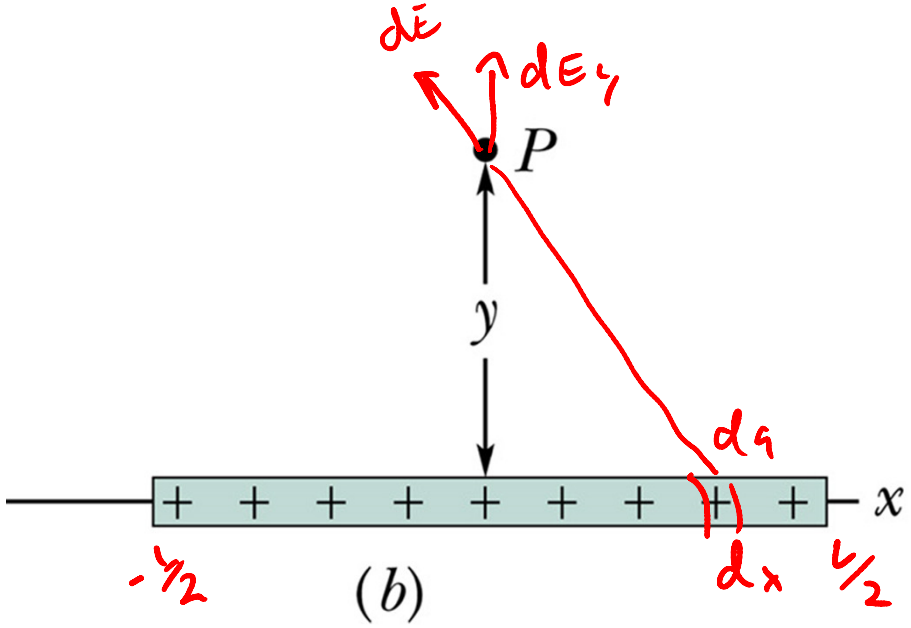
$\cos\theta = \frac{y}{r} \qquad \sin\theta = \frac{x}{r}$

$dE_y = dE\cos\theta = dE\,\frac{y}{r}$

$dE_x = -dE\sin\theta = -dE\,\frac{x}{r}$

dE_x's cancel, lets worry about E_y

$$dE_y = \frac{k\,\lambda\,dx}{r^2}\,\frac{y}{r} = \frac{k\,\lambda\,y\,dx}{(x^2+y^2)^{3/2}}$$



$$E_y = \int dE_y = \int \frac{k\,\lambda\,y\,dx}{(x^2+y^2)^{3/2}}$$

$$= k\,\lambda\,y \int \frac{dx}{(x^2+y^2)^{3/2}}$$

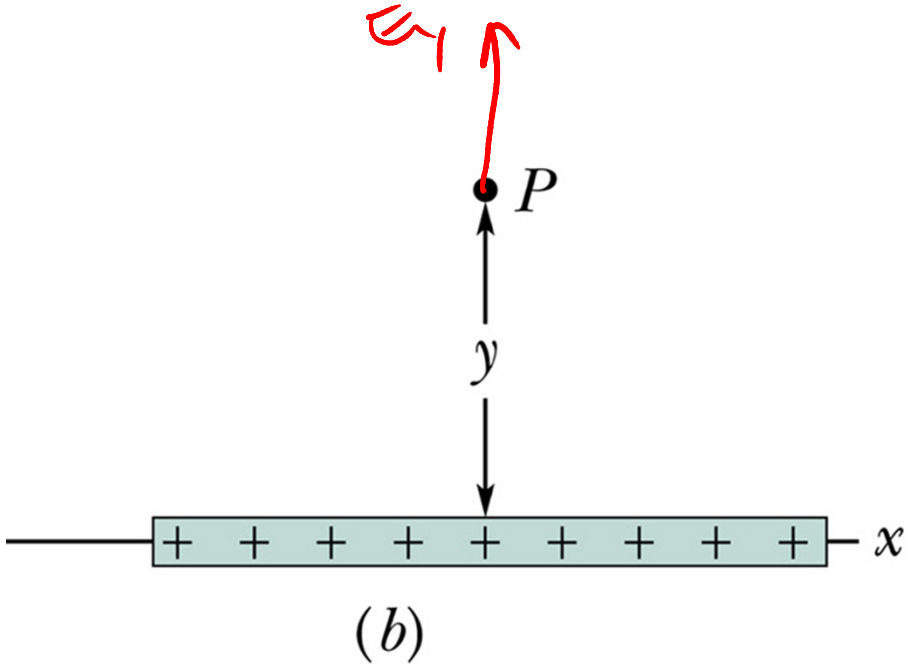
Look on page A-3

$$\int \frac{dx}{(x^2+a^2)^{3/2}} = \frac{1}{a^2}\,\frac{x}{\sqrt{x^2+a^2}}$$

$$E_y = k\,\lambda\,y \int_{-L/2}^{L/2} \frac{dx}{(x^2+y^2)^{3/2}} = k\,\lambda\,y \left| \frac{1}{y^2}\,\frac{x}{(x^2+y^2)^{1/2}} \right|_{-L/2}^{L/2}$$

$$E_y = \frac{k\,\lambda}{y}\left(\frac{L/2}{((L/2)^2+y^2)^{1/2}} + \frac{L/2}{((L/2)^2+y^2)^{1/2}} \right)$$

$$E_y = \frac{k\lambda L}{y}\left(\frac{1}{\sqrt{(L/2)^2 + y^2}}\right)$$



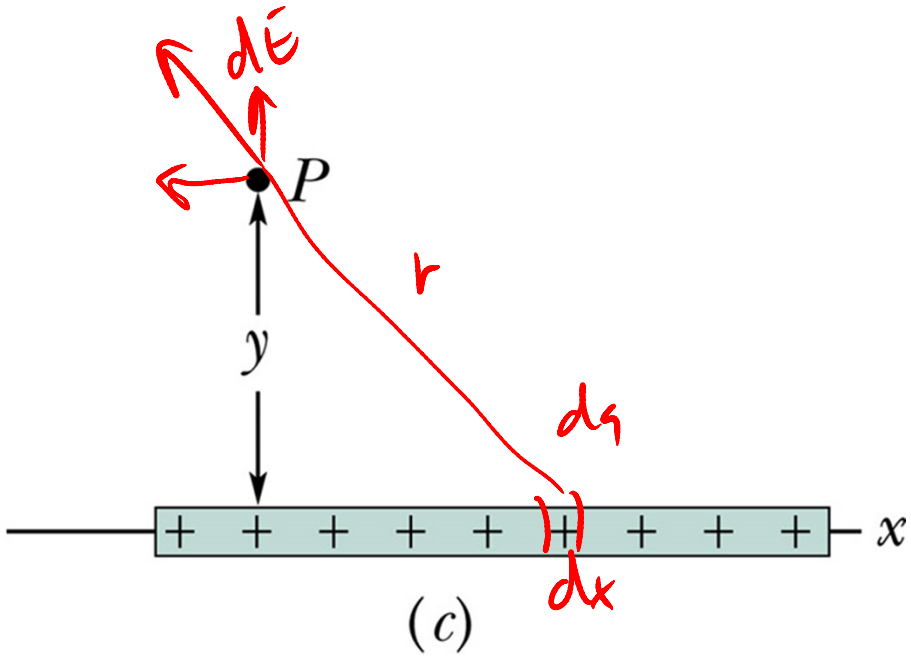
$(\lambda L = Q)$

what if L = HUGE

$$E_y = \frac{2k\lambda}{y}\left(\frac{1}{\sqrt{2y^2/L^2 + 1}}\right)$$

$L \gg y \quad (2y/L)^2 \to 0$

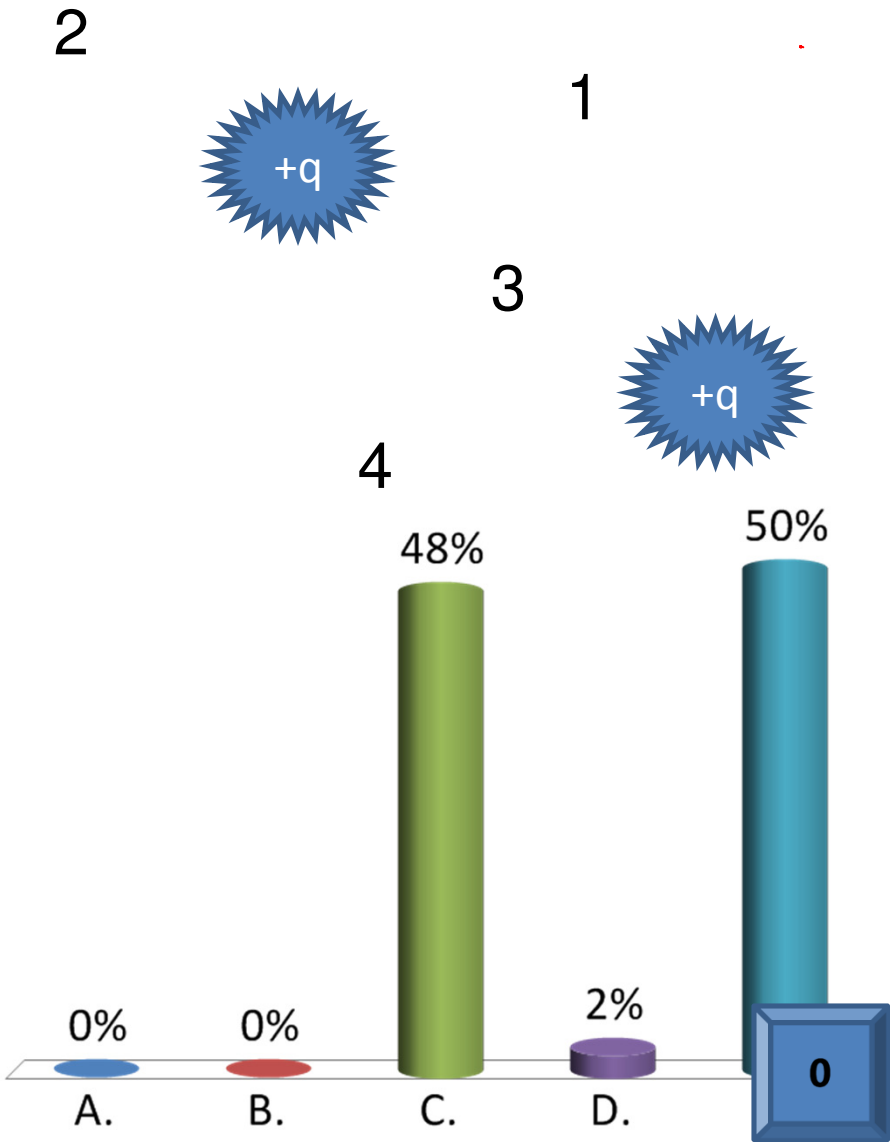
$$E_y = \frac{2k\lambda}{y}$$



(c)

At which point is the electric field zero in this diagram?

A. This point
B. That point
✓ C. The other point
D. No, this one
E. The electric field is never zero on this page



Where could you put an electron so that it would feel no electric force??

2

1

+q

3

+q

4

A. This point

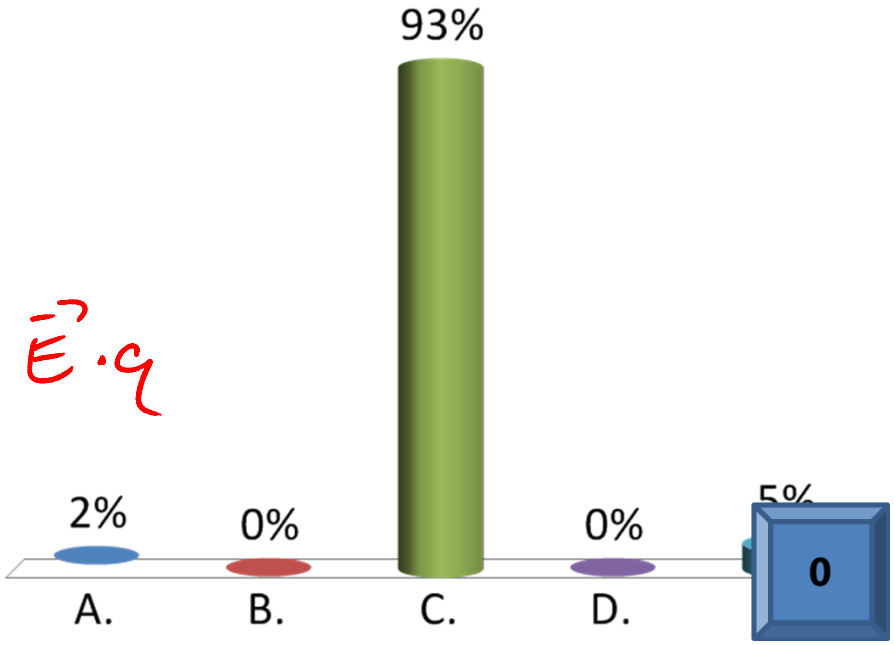
B. That point

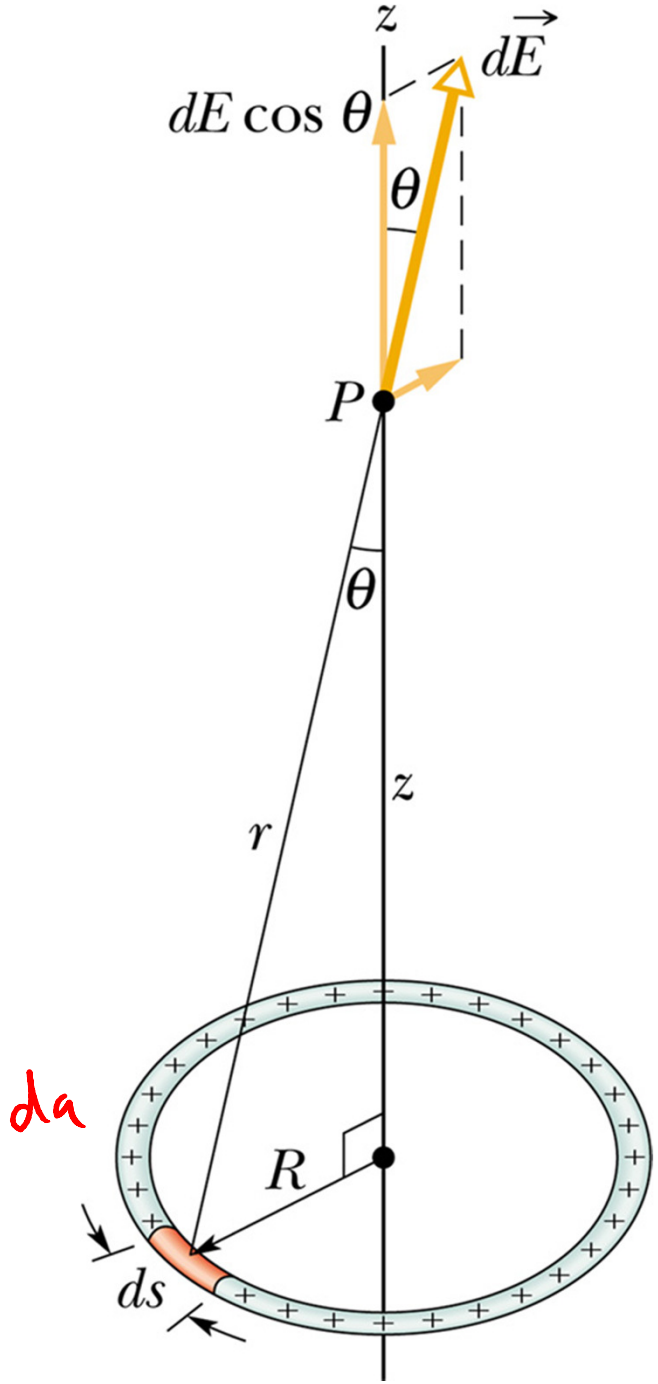
✓ C. The other point

D. No, this one

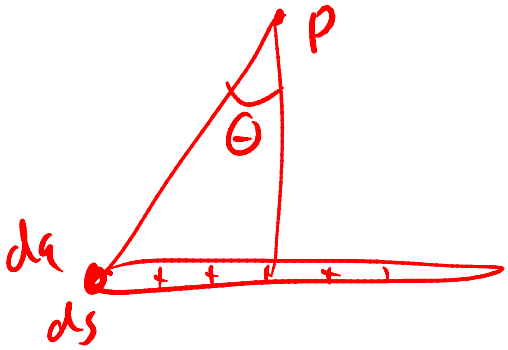
E. The electric field is never zero on this page

$\vec{F} = \vec{E} \cdot q$

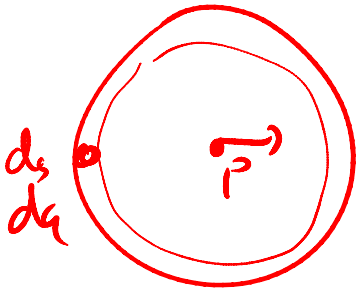




from side.



from above:



Q on Loop

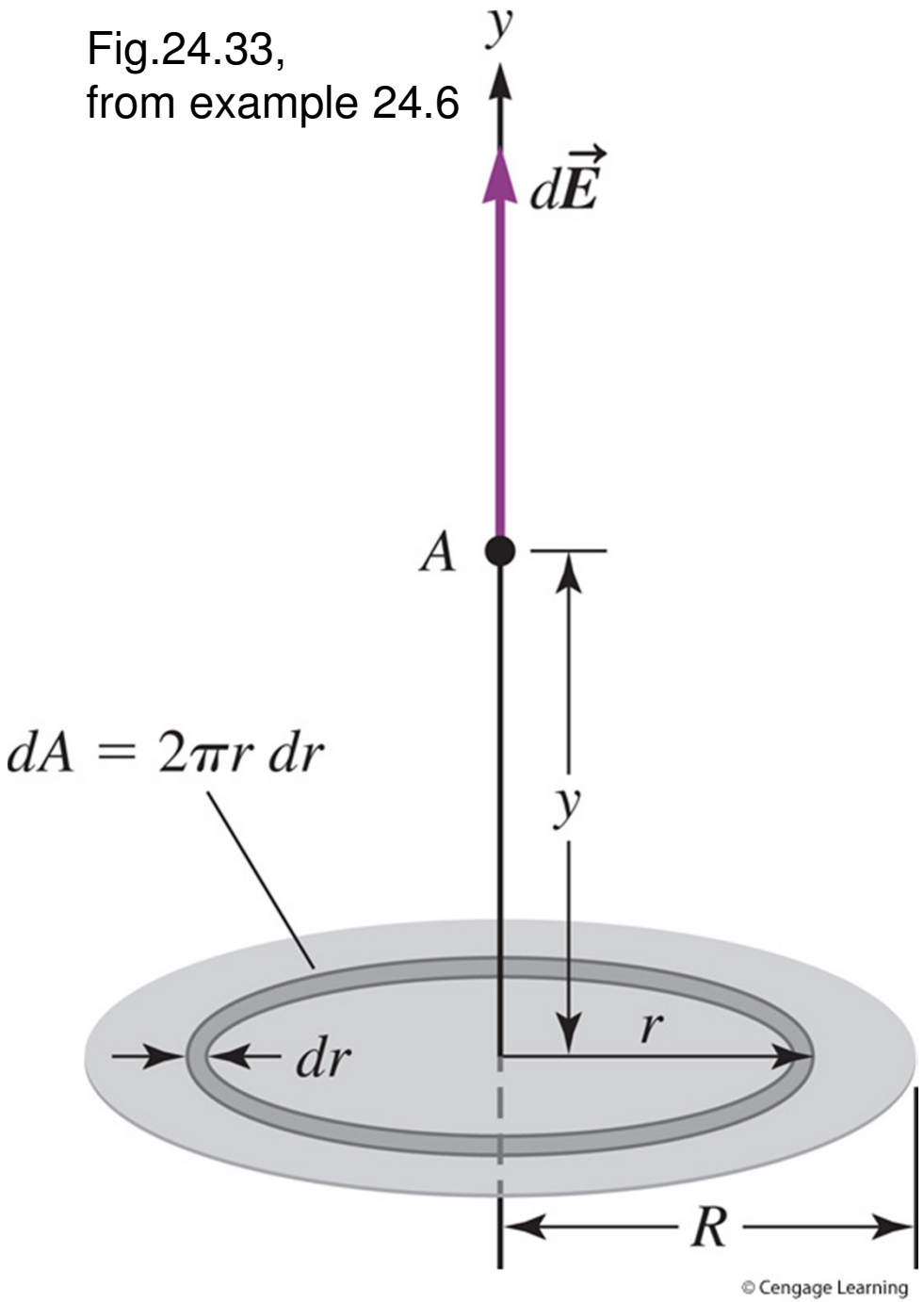
$$\lambda = \frac{Q}{2\pi R}$$

$$dq = \lambda\, ds$$

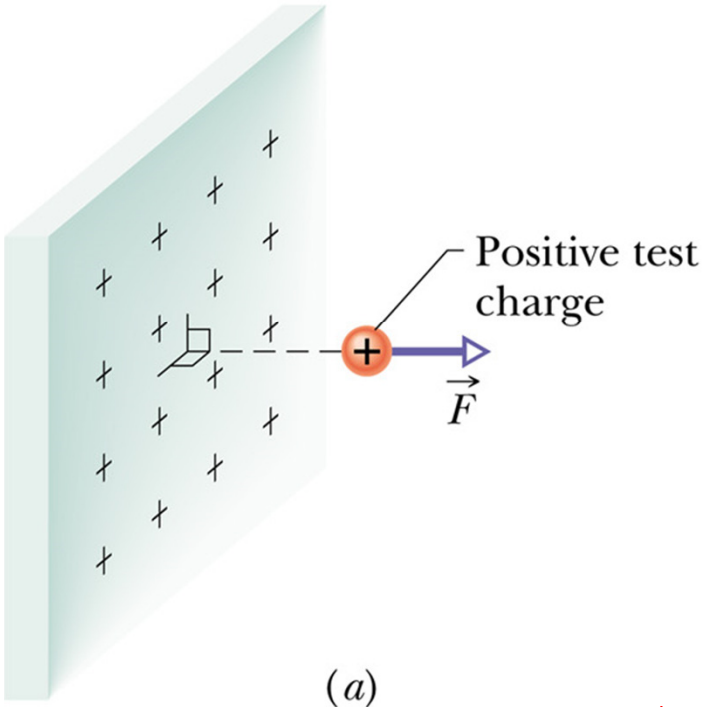
$2\pi R$ "s"

$$dE_z = \frac{k\lambda z\, ds}{(z^2+R^2)^{3/2}} = \frac{k\lambda z}{(z^2+R^2)^{3/2}} \int ds$$

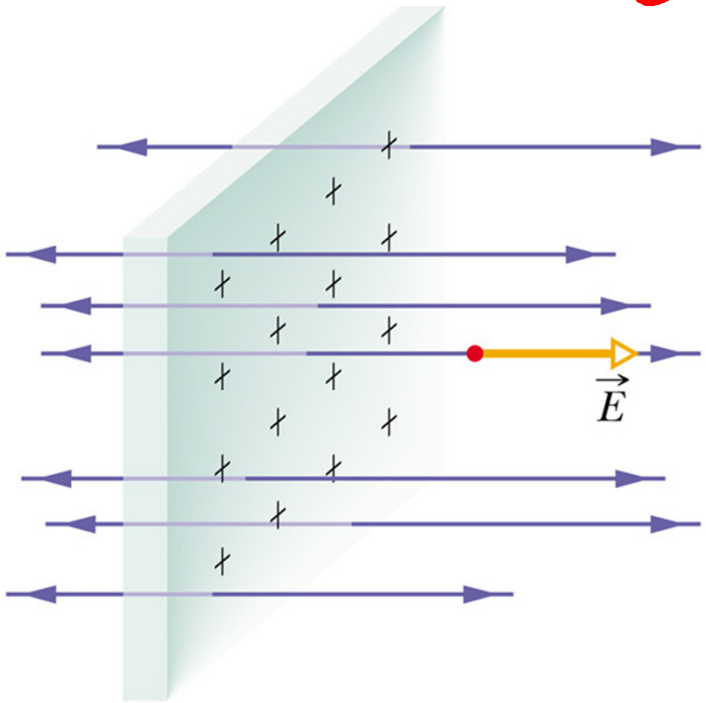
Fig.24.33,
from example 24.6



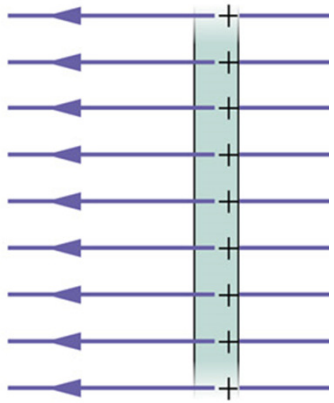
$\sigma = C/m^2$ $\quad k = \frac{1}{4\pi\varepsilon_0}$ $\quad E = \frac{\sigma}{2\varepsilon_0}$



(a)



(b)



(c)