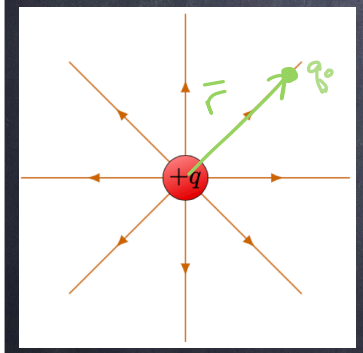
PHY 117 HS2024

Week 8, Lecture 2

Nov. 6th, 2024

Prof. Ben Kilminster

yesterday:

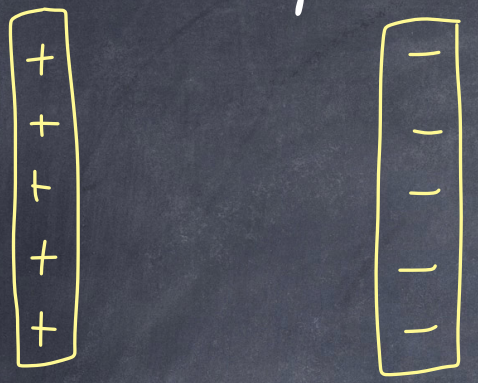


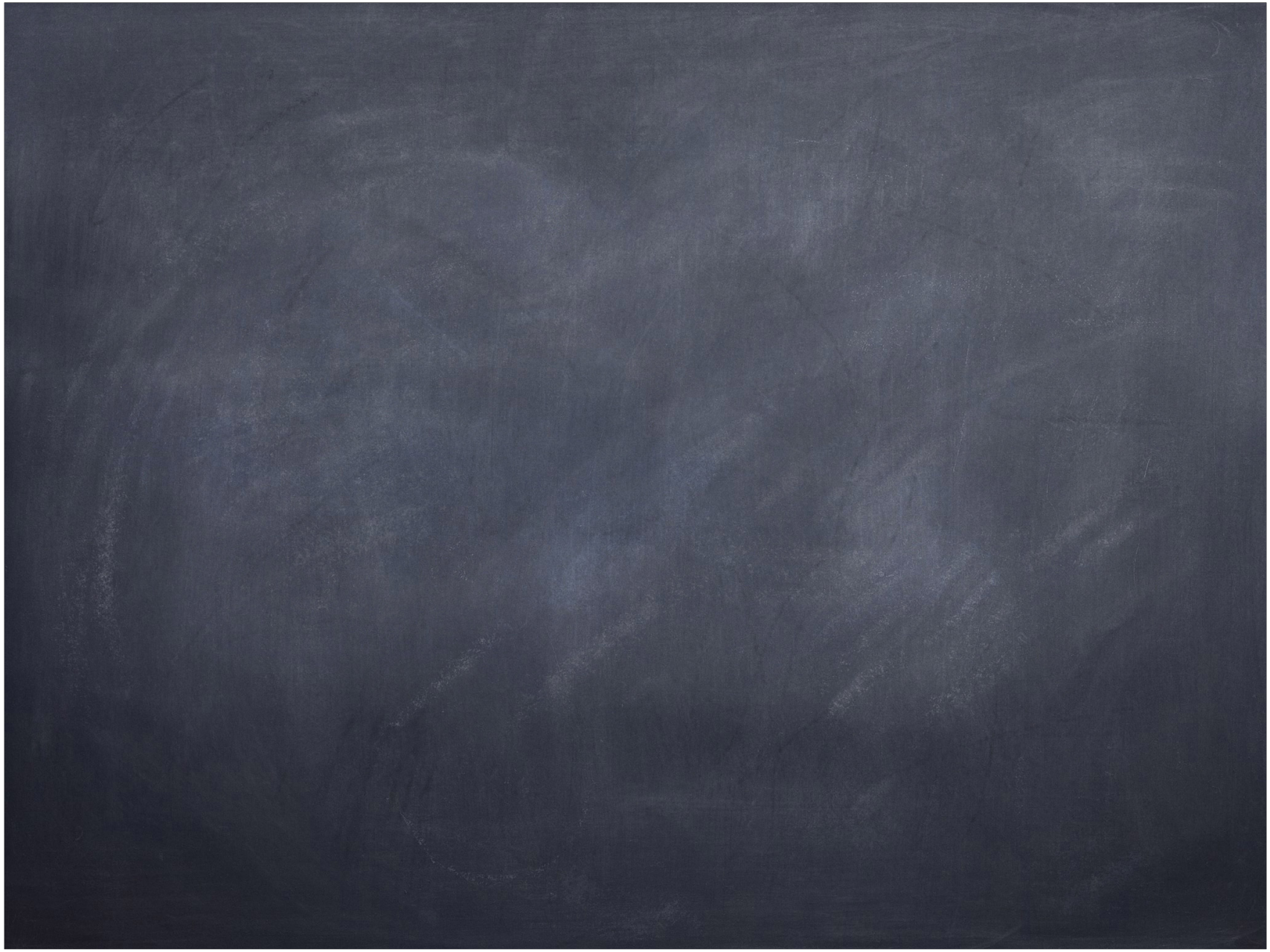
$\vec{E} = \frac{kq}{r^2}\hat{r}$ for a point charge

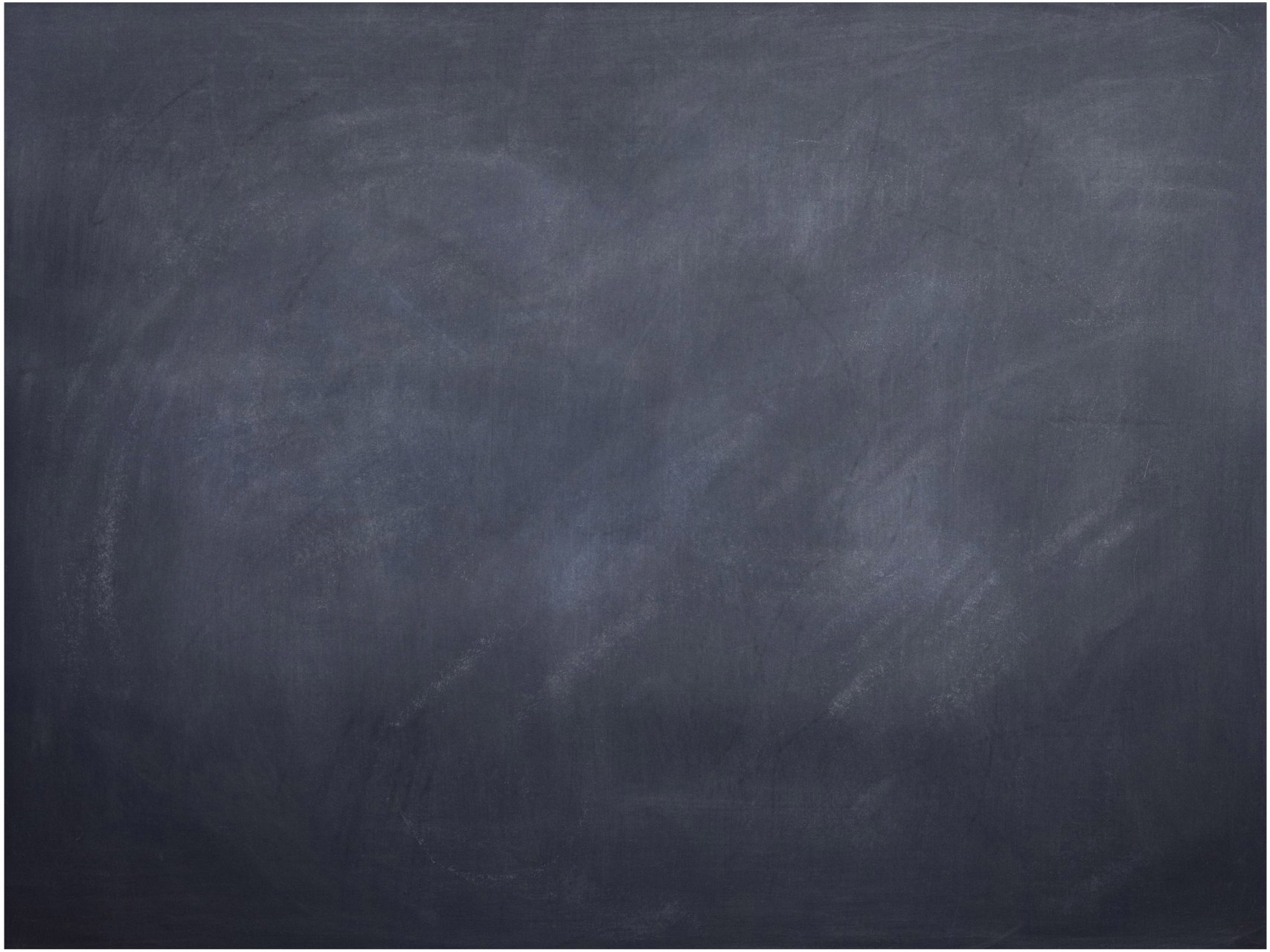
Today:

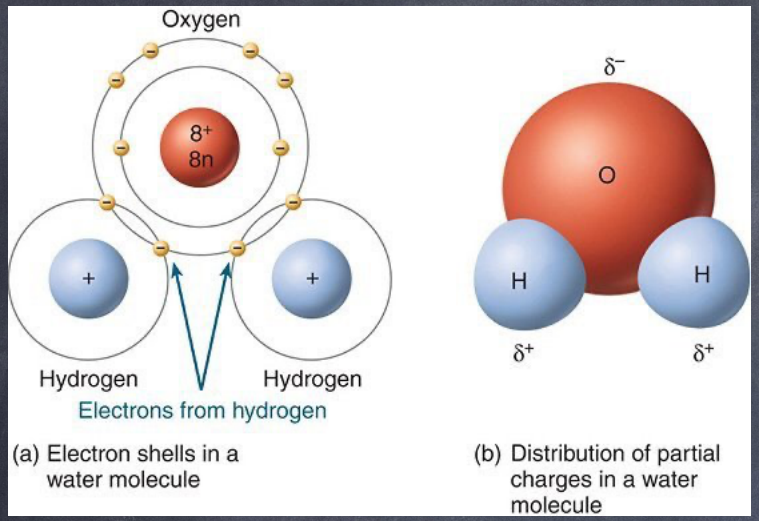
- electric dipoles
- Gauss' Law for computing $\vec{E}$
- electric field in a conductor

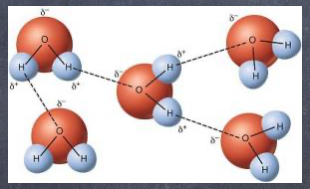
what will happen to a charge +q in between 2 planes of + and − charge?

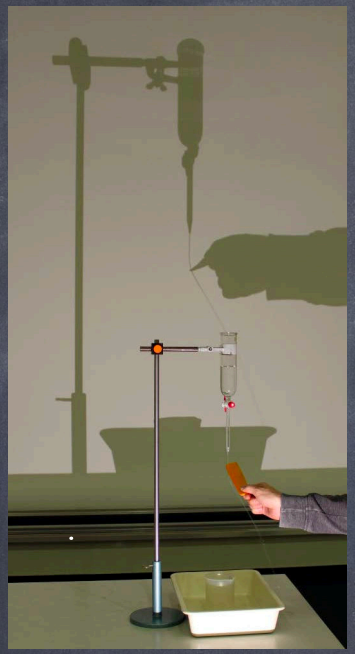




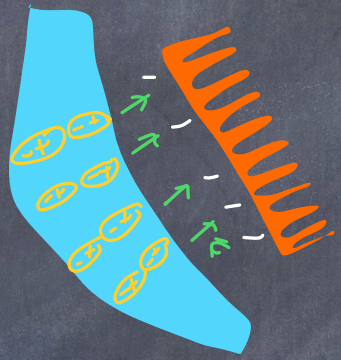



Oxygen
8+
8n
+
+
Hydrogen
Hydrogen
Electrons from hydrogen
(a) Electron shells in a water molecule
δ−
O
H
H
δ+
δ+
(b) Distribution of partial charges in a water molecule

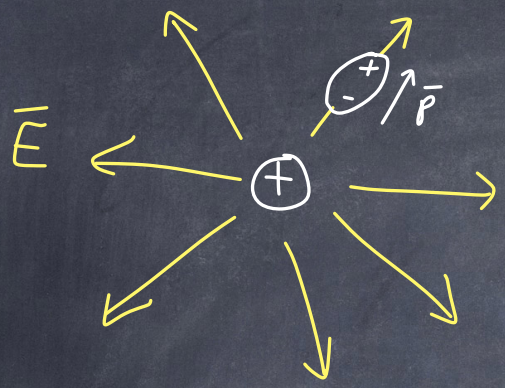


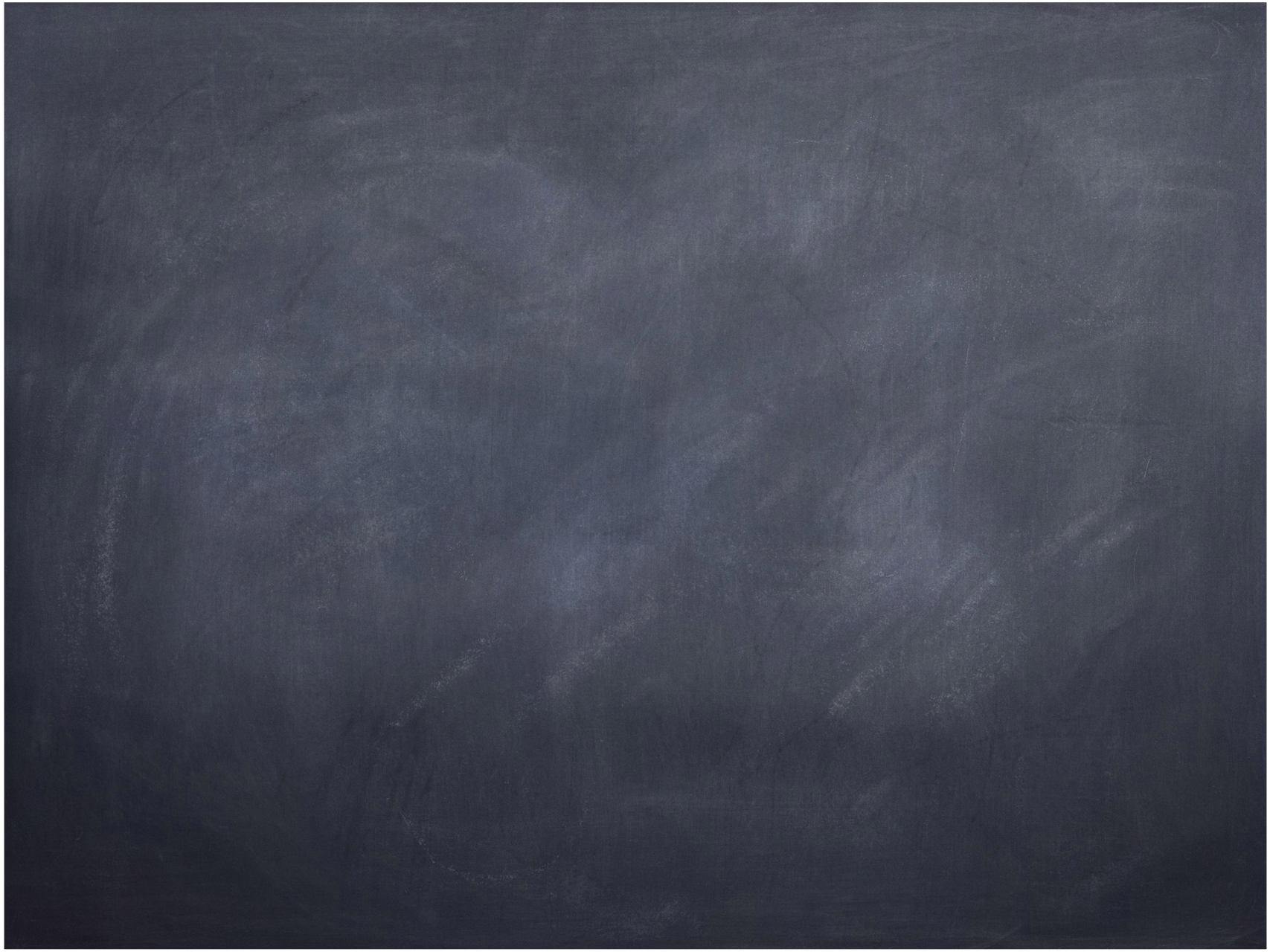


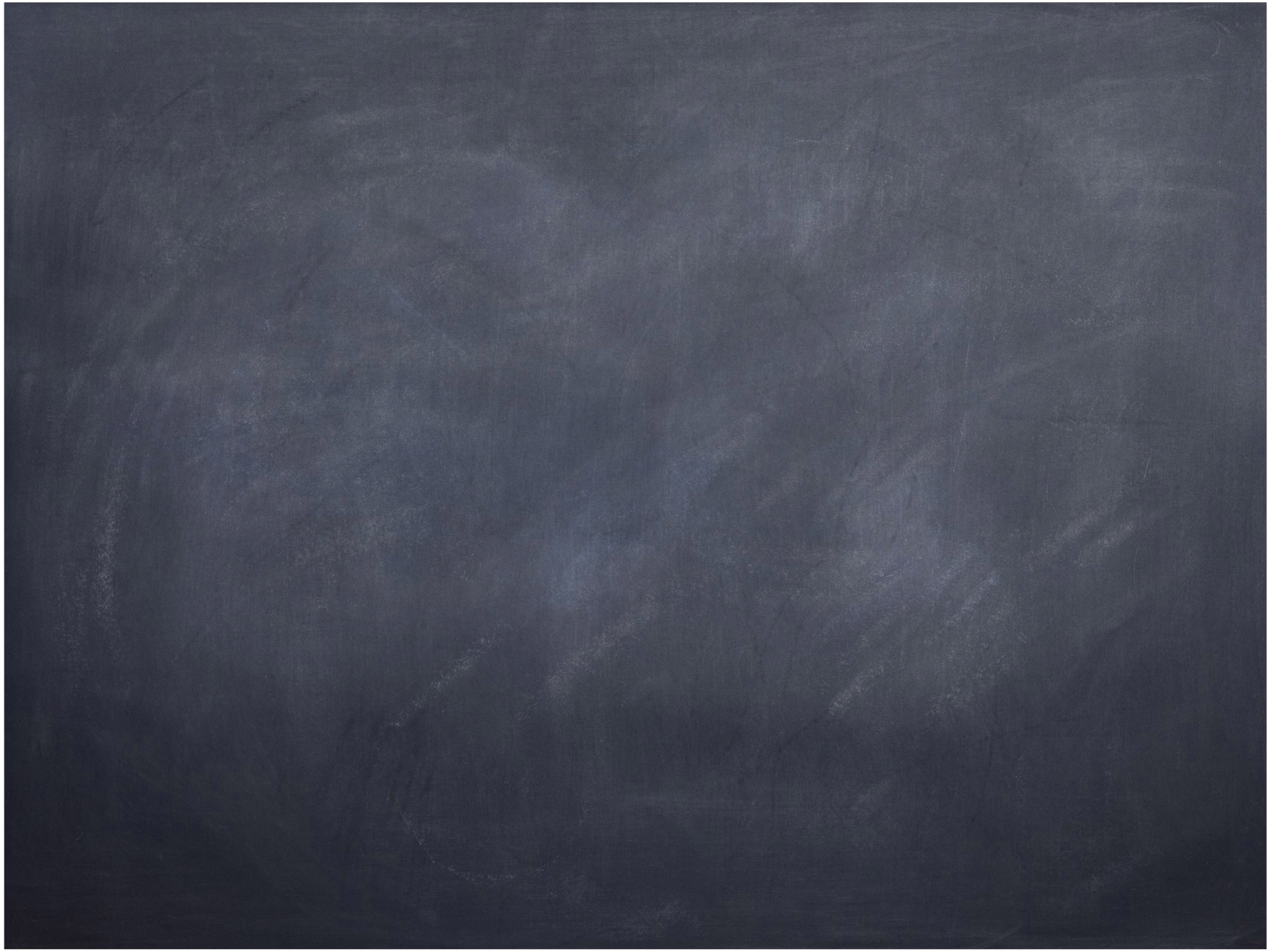
why?

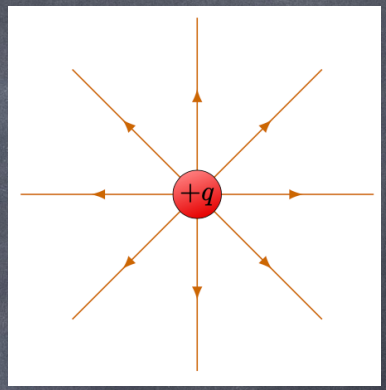


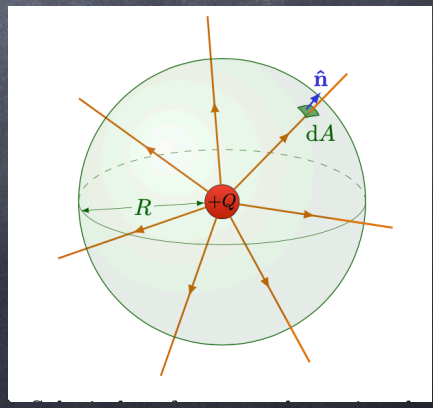
In a non-uniform $\bar{E}$-field, dipole feels a force.

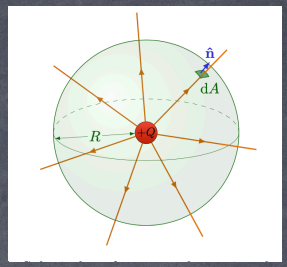


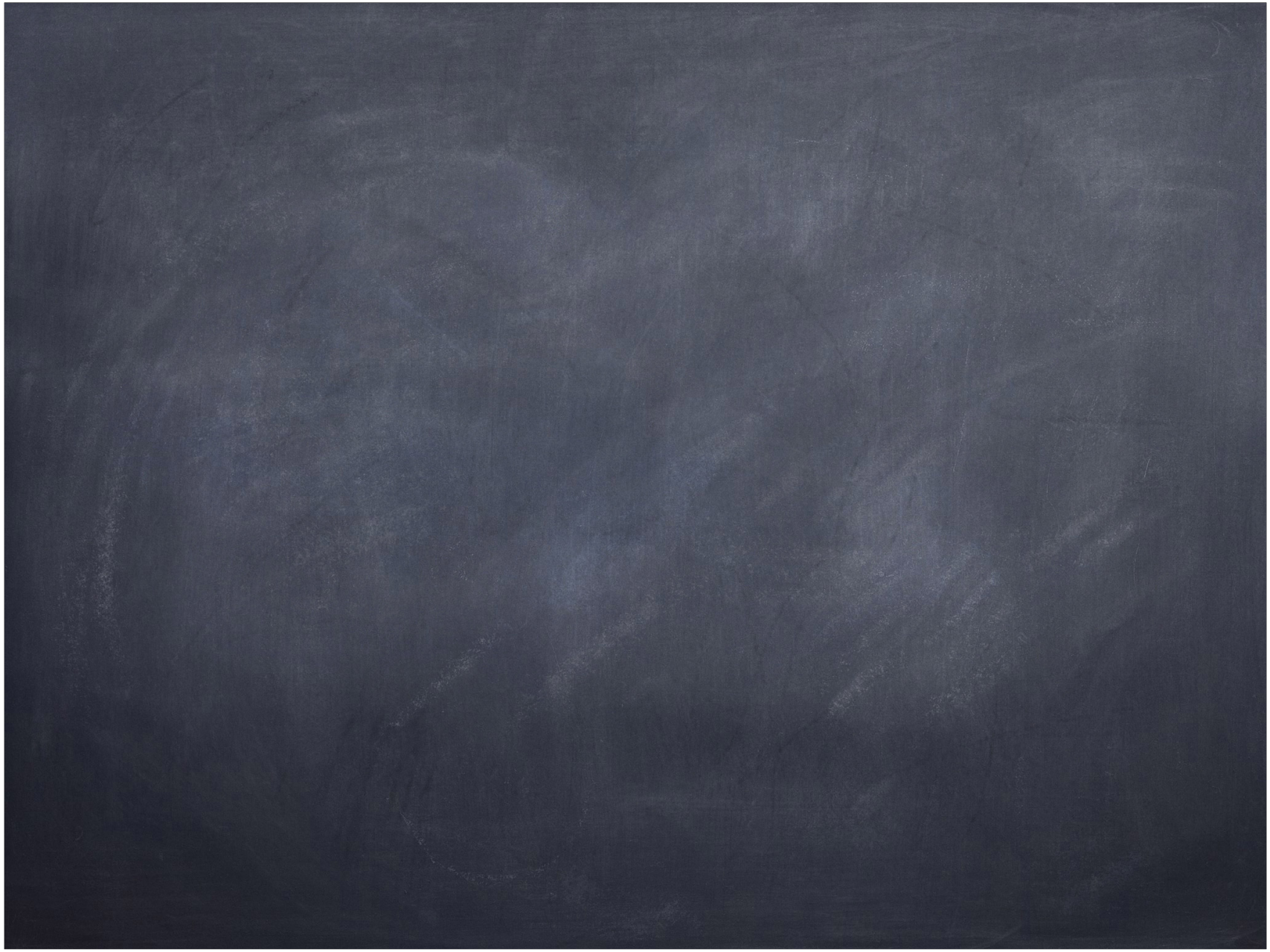




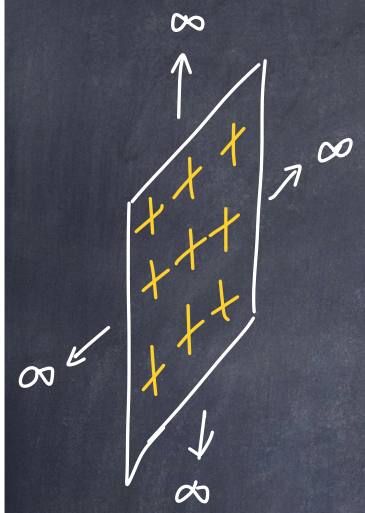

+q


n̂
dA
R
+Q

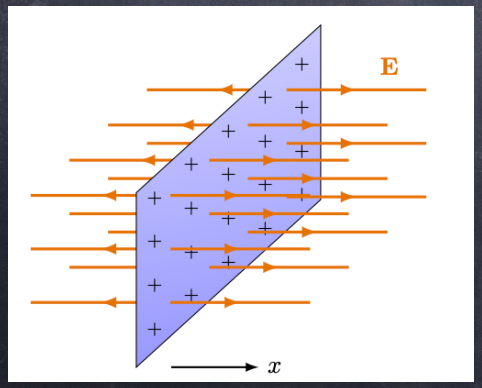

n̂
dA
R
+Q



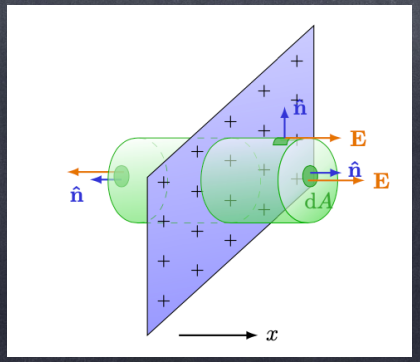
What is $\vec{E}$ for an infinite plane of charge, with charge density, $\sigma = \frac{Q}{A}$?

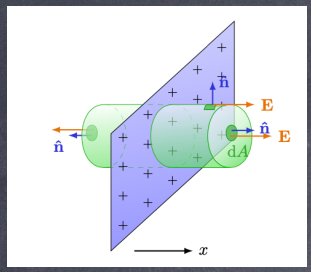


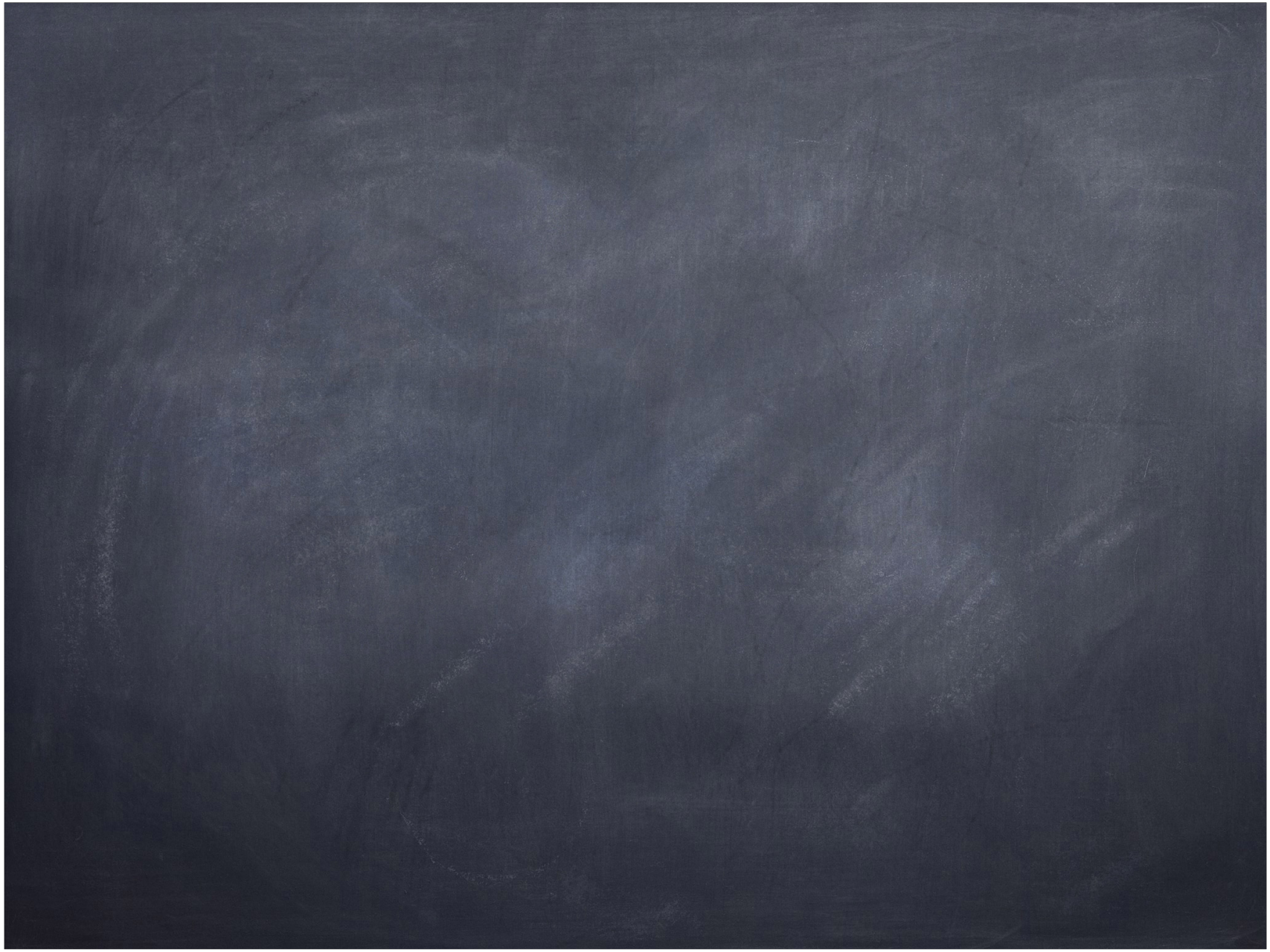
1)

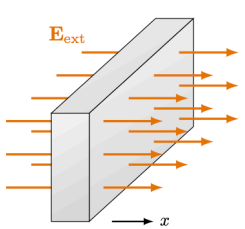


2)

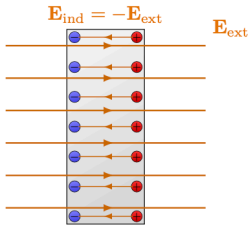



n̂
E
n̂
E
dA
x

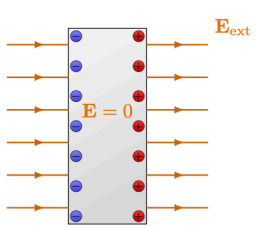




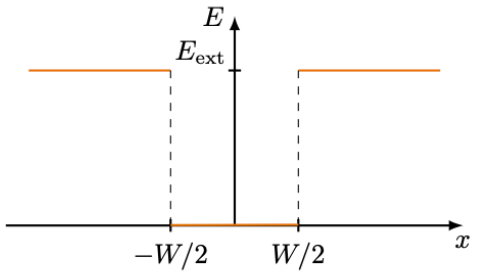
(a) An external field $\mathbf{E}_{\text{ext}}$ is applied to a slab of conducting metal.



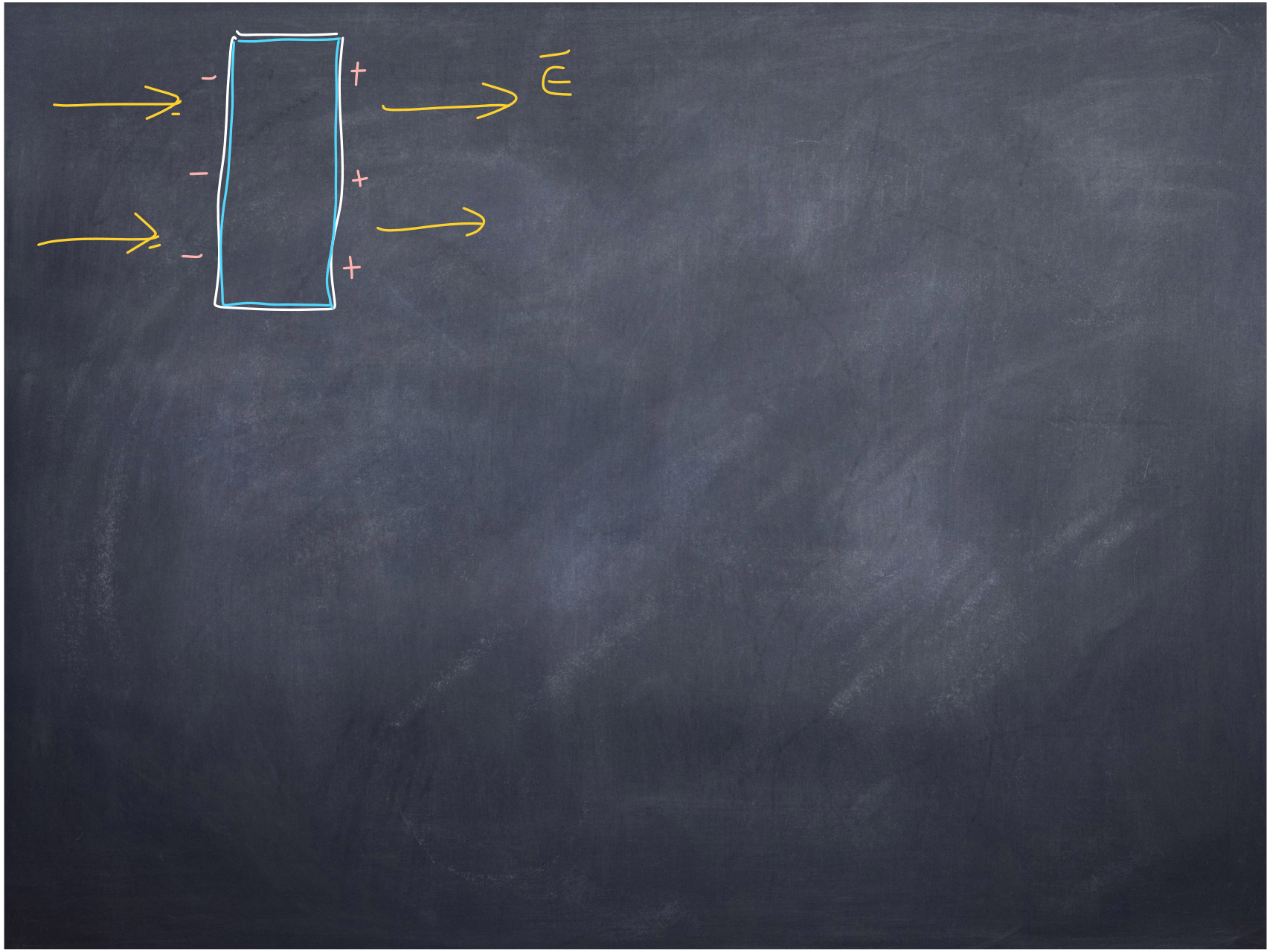
(b) The free charges redistribute and create an internal field $\mathbf{E}_{\text{ind}}$.



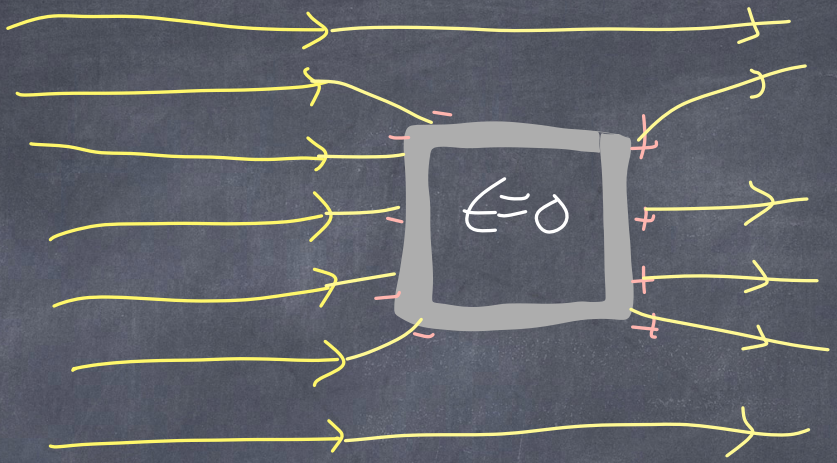
(c) Once the charge has settled, the internal and external fields cancel.

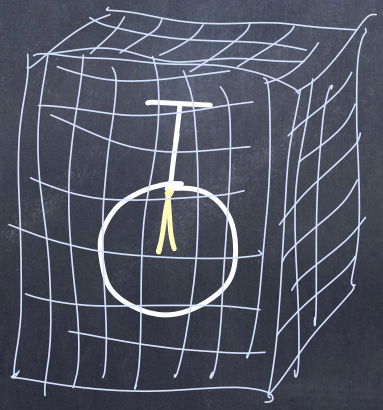


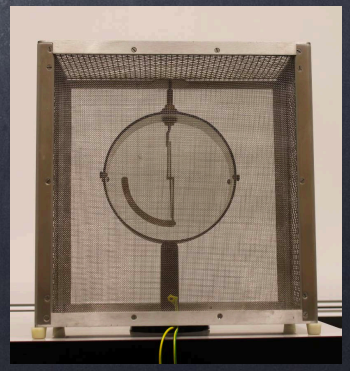
(d) Plot of electric field vs. r.


-
+
-
+
-
+
$\vec{E}$

Faraday cage







Quiz 4

When torque is zero, angular momentum is zero.

False

1 | 41 | 38

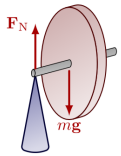
$\vec{\tau} = \frac{d\vec{L}}{dt}$ A torque means $\vec{L}$ is changing

Question

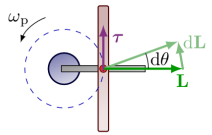
Which direction does a spinning object precess.

In the direction of the angular momentum of the spinning object.

1 | 31 | 42



(a) The handle allows the disk to spin around its axis and around the pivot.



(d) Torque τ perpendicular to angular momentum **L**, will only change its direction.

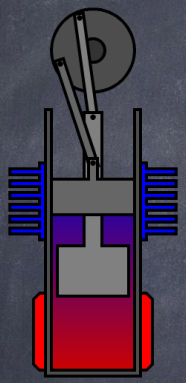
Precession is in direction of $d\vec{L}$, the change in $\vec{L}$. Comes from torque on a spinning object.

In an enclosed system of two pistons, the pressure is higher on the smaller piston than on the larger piston.

4

41

52



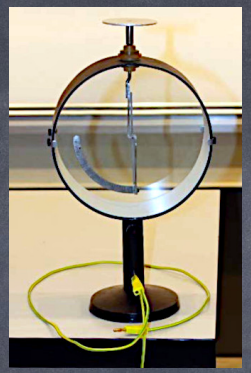
In a cycle, where $P_i = P_f$, and $V_i = V_f$, no work is done.

3

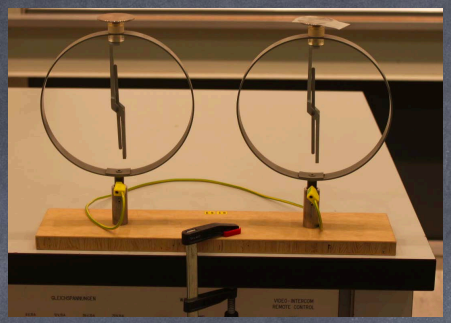
26

42

ES2

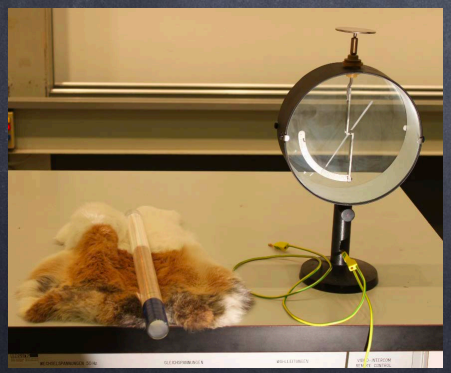


ES8

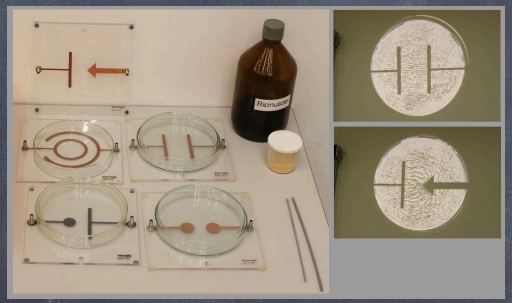


ES19

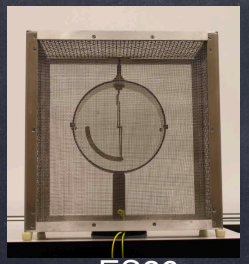
ES20



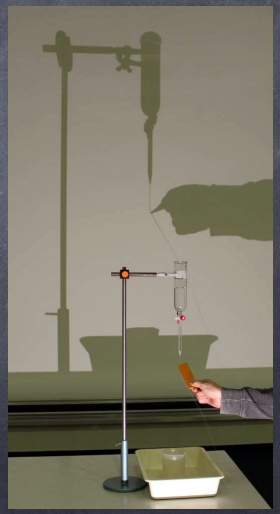
ES24



ES40



ES26



ES43