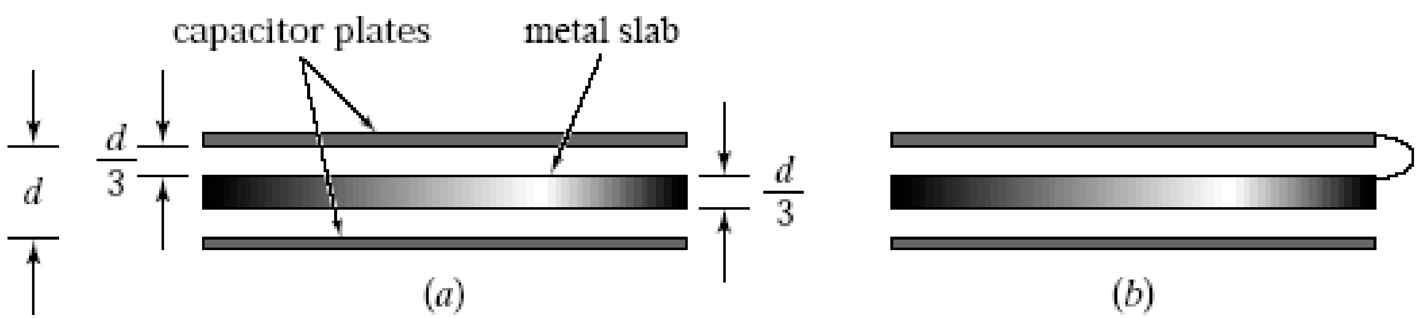
Table 30-2
Three electric vectors

Name	Symbol	Associated with	Boundary Condition
Electric field	**E**	All charges	Tangential component continuous
Electric displacement	**D**	Free charges only	Normal component continuous
Polarization (electric dipole moment per unit volume)	**P**	Polarization charges only	Vanishes in a vacuum

Defining equation for **E**	$\mathbf{F} = q\mathbf{E}$	Eq. 27-2
General relation among the three vectors	$\mathbf{D} = \epsilon_0\mathbf{E} + \mathbf{P}$	Eq. 30-23
Gauss's law when dielectric media are present	$\oint \mathbf{D} \cdot d\mathbf{S} = q$ (q = free charge only)	Eq. 30-26
Empirical relations for certain dielectric materials*	$\mathbf{D} = \kappa\epsilon_0\mathbf{E}$	Eq. 30-24
	$\mathbf{P} = (\kappa - 1)\epsilon_0\mathbf{E}$	Eq. 30-25

* Generally true, with κ independent of **E**, except for certain materials called *ferroelectrics*; see footnote on page 667.

Consider two capacitors, each having plate separation d. In each case, a slab of metal of thickness $d/3$ is inserted between the plates. In case (a), the slab is not connected to either plate. In case (b), it is connected to the upper plate. The capacitance is higher for



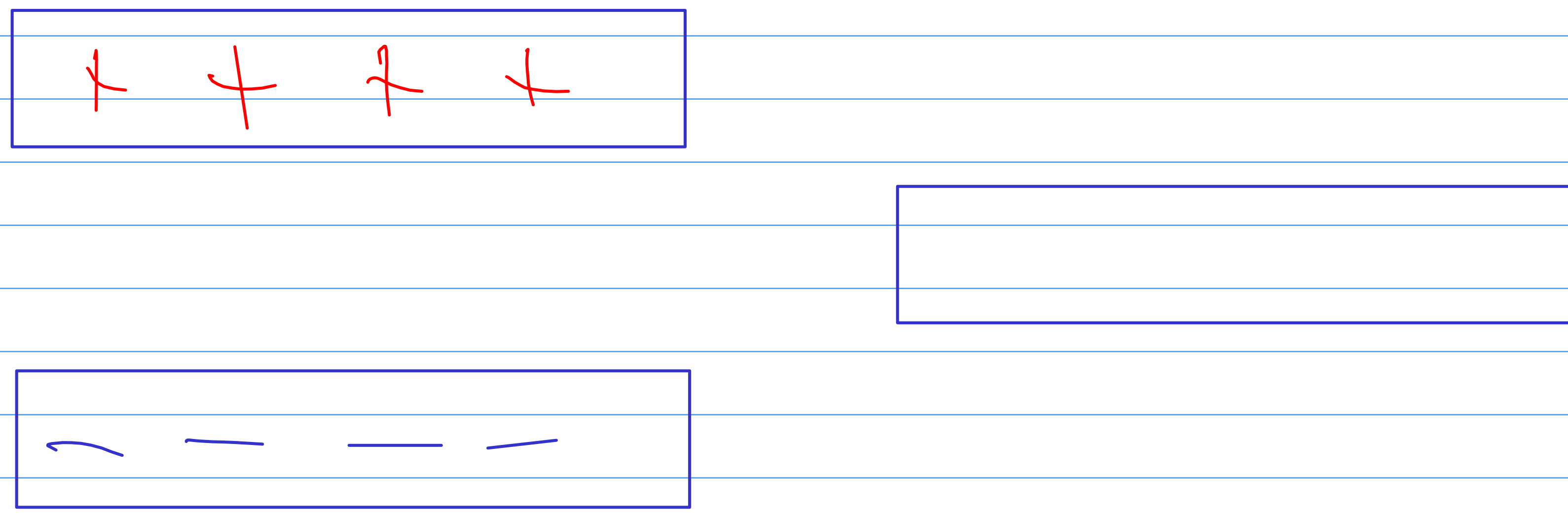
1. case (a).
2. case (b).
3. The two capacitances are equal.

Consider a capacitor made of two parallel metallic plates separated by a distance d. The top plate has a surface charge density $+\sigma$, the bottom plate $-\sigma$. A slab of metal of thickness $l < d$ is inserted between the plates, not connected to either one. Upon insertion of the metal slab, the potential difference between the plates

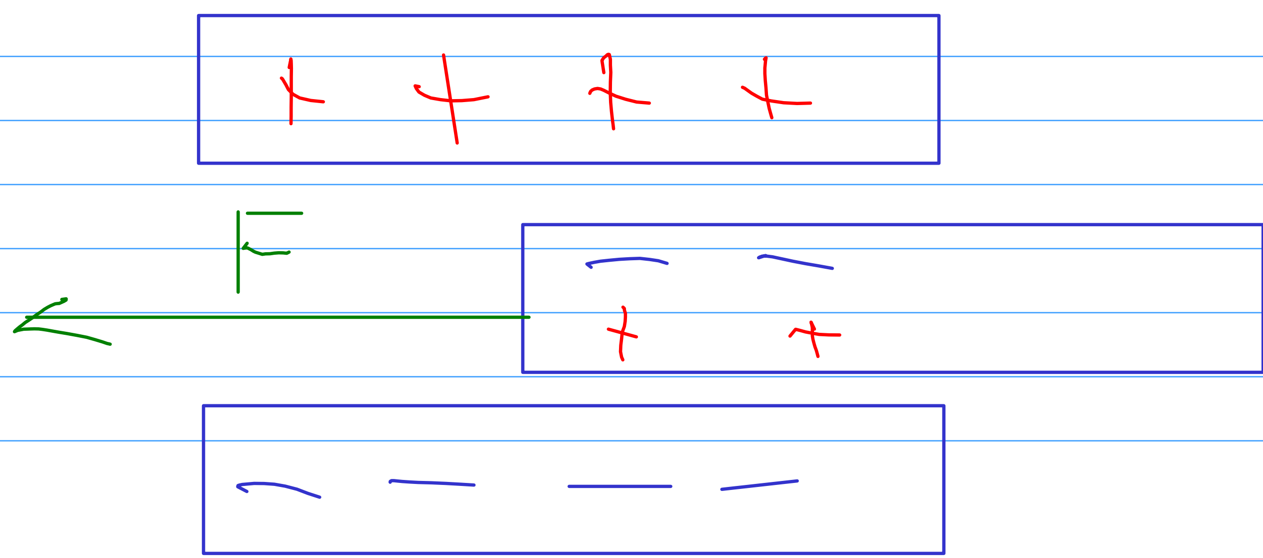
1. increases.
2. decreases.
3. remains the same.

2 -Asrbeit nötig, um Platte zu entfernen

Ausgangslage:



beim Einschieben:



$\Rightarrow$ Das $\vec{E}$-Feld verrichtet Arbeit (+) an der Platte.

$\Rightarrow$ E_C muss abnehmen

$\Rightarrow$ E muss abnehmen

$\Rightarrow$ U nimmt ab.