Consider a parallel plate capacitor with charge $Q$ on each plate charged to a potential difference $V$. The work done to charge the capacitor is

a) $QV$

b) $QV/2$

c) $2QV$

d) $Q^2/V$

e) zero

f) none of the above
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.

Why does electric field not change?
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 capacitors in series

$$C_1 = C_2 = 3\varepsilon_0 A / d \quad \text{and} \quad C = 3\varepsilon_0 A / 2d$$

and single capacitor

$$C = \varepsilon_0 A / (d/3) \quad \text{and} \quad C = 3\varepsilon_0 A / d$$

1. case (a).
2. case (b).
3. The two capacitances are equal.
Consider a simple parallel-plate capacitor whose plates are given equal and opposite charges and are separated by a distance \(d\). Suppose the plates are pulled apart until they are separated by a distance \(D > d\). The electrostatic energy stored in the capacitor is

1. greater than \(Q = \text{const}\)
2. the same as \(C_f < C_i\)
3. smaller than \(U = \frac{Q^2}{C}\)

before the plates were pulled apart.

Or: plates attract, need to do extra work, increase potential energy
A dielectric is inserted between the plates of a capacitor. The system is then charged and the dielectric is removed. The electrostatic energy stored in the capacitor is

1. greater than \( C_f < C_i \)
2. the same as \( U = \frac{Q^2}{C} \)
3. smaller than

it would have been if the dielectric were left in place.

Or: dielectric polarized, attracted to the plates, need to do work to take it out.
A parallel-plate capacitor is attached to a battery that maintains a constant potential difference $V$ between the plates. While the battery is still connected, a glass slab is inserted so as to just fill the space between the plates. The stored energy

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