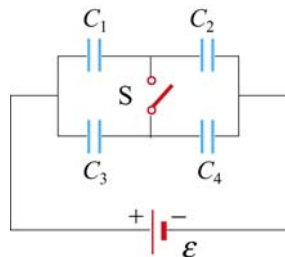


2. How does the stored energy change if the potential difference across a capacitor is tripled?
3. Does the presence of a dielectric increase or decrease the maximum operating voltage of a capacitor? Explain.
4. If a dielectric-filled capacitor is cooled down, what happens to its capacitance?

## 5.12 Additional Problems

### 5.12.1 Capacitors in Series and in Parallel

A 12-Volt battery charges the four capacitors shown in Figure 5.12.1.



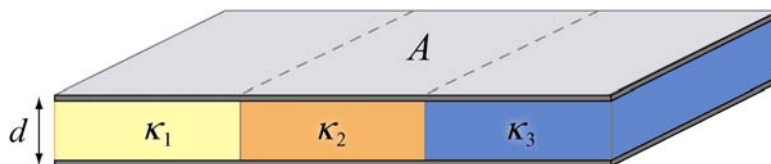
**Figure 5.12.1**

Let  $C_1 = 1 \mu\text{F}$ ,  $C_2 = 2 \mu\text{F}$ ,  $C_3 = 3 \mu\text{F}$ , and  $C_4 = 4 \mu\text{F}$ .

- (a) What is the equivalent capacitance of the group  $C_1$  and  $C_2$  if switch  $S$  is open (as shown)?
- (b) What is the charge on *each* of the four capacitors if switch  $S$  is open?
- (c) What is the charge on each of the four capacitors if switch  $S$  is closed?

### 5.12.2 Capacitors and Dielectrics

- (a) A parallel-plate capacitor of area  $A$  and spacing  $d$  is filled with three dielectrics as shown in Figure 5.12.2. Each occupies  $1/3$  of the volume. What is the capacitance of this system? [*Hint*: Consider an equivalent system to be three parallel capacitors, and justify this assumption.] Show that you obtain the proper limits as the dielectric constants approach unity,  $\kappa_i \rightarrow 1$ .]



**Figure 5.12.2**