CAPS questions

1. In the photo at the top of the page, the upper-right capacitor has a capacitance of 1000 µF and a working voltage of 35 V. What is the most charge it can store?

$q = C \cdot V = 1000 \times 10^{-6} F \cdot 35 V$
$= .035$ coulombs

2. You find a capacitor that is not labeled. You hook it up to a 12-volt battery and determine that it stored 45 nC of charge. What is the capacitance?

$q = C \cdot V$, therefore $C = q/V$
$= 45 \times 10^{-9}$ coul $/ 12V$
$= 3.8 \times 10^{-9} F$
$= 3.8$ nF

3. The capacitor inside the flash unit of a disposable camera has a capacitance of 120 µF.

(a) If it is charged up the voltage of the battery, 1.5V, how much charge would be stored on the capacitor?

$q = C \cdot V = 120 \times 10^{-6} F \cdot 1.5 V = 1.8 \times 10^{-4}$ coul
$= .18$ mcoul

(b) The answer to question (a) is not nearly enough charge to fire the flash. The flash requires about 35 millicoulombs of charge, so the electrical engineers designing the flash use a transformer circuit to boost the voltage high enough to get that much charge on the capacitor. How high does the voltage need to be?

$q = C \cdot V$, so $V = \frac{q}{C} = \frac{.035 \text{ coul}}{120 \times 10^{-6} F} = 290 V$

4. In the photo at the top of the page, the smaller of the two gray capacitors has a capacitance of 47 µF and a working voltage of 35 V. Can you safely use this capacitor to store one millicoulomb of charge?

$q = C \cdot V = 47 \times 10^{-6} F \cdot 35 V$ ← maximum voltage
$= .0016$ coul $= 1.6$ mcoul

Yes, this cap can store 1 mcoul without exceeding the maximum allowed voltage.

5. You have a bunch of medium-size capacitors, but you need a larger capacitance. Do you connect the capacitors in series or parallel?

Parallel capacitances add together.

6. You have three capacitors: 470 pF, 1000 pF, and 22 nF. What is their combined capacitance if you wire them (a) in series, and (b) in parallel? Give both your final answers in both pF and nF.

(a) series

$\frac{1}{C_{tot}} = \frac{1}{470 pF} + \frac{1}{1000 pF} + \frac{1}{22000 pF} = .003173...$

$C_{tot} = \frac{1}{.003173\ldots} = 315\,pF = .315\,nF$

(b) parallel

$C_{tot} = 470pF + 1000pF + 22000pF$

$= 23470\,pF = 23.47\,nF$