CCD Devices

**Capacitance is the ratio of charge to voltage on an object**

Example: A CCD pixel has a capacitance of 1.7x10-12 F. What is the voltage across it if it has been charged 6.0x104 electron charges? (1 e = 1.602x10-19 C)

Example: A 3.1x10-10 m2 CCD pixel has a capacitance of 2.3 pF (x10-12) If after being exposed to light, it has picked up a charge of 3.45x10-14 C, what is the voltage across it? How many electrons were displaced from the pixel? If photons displaced these electrons, then what is the photon flux in photons/m2 incident on the CCD? (Assume 100% efficiency) (1 e = 1.602x10-19 C)

Example:

Nikon D3x: (CMOS), Sensor size = 35.9x24.0 mm = 861.6 mm2, 6048x4032 resolution = 24 Mega pixels

(Let’s assume a quantum efficiency of 70%)

A) What is the area of each pixel?

B) If light with a photon flux of 4.5x1019 photons/m2/s is incident on the sensor for 1/250th of a second, what is the resulting charge on the pixel?

C) If the voltage across the pixel is 2.4 mV, what is the capacitance of the pixel?

D) If I am 183 cm tall, and my image on the sensor is 19.2 mm tall, what is the “magnification” in this case?