

5. (a) The capacitance of a parallel-plate capacitor is given by $C = \epsilon_0 A/d$, where A is the area of each plate and d is the plate separation. Since the plates are circular, the plate area is $A = \pi R^2$, where R is the radius of a plate. Thus,

$$C = \frac{\epsilon_0 \pi R^2}{d} = \frac{(8.85 \times 10^{-12} \text{ F/m}) \pi (8.2 \times 10^{-2} \text{ m})^2}{1.3 \times 10^{-3} \text{ m}} = 1.4 \times 10^{-10} \text{ F} = 140 \text{ pF} .$$

- (b) The charge on the positive plate is given by $q = CV$, where V is the potential difference across the plates. Thus, $q = (1.4 \times 10^{-10} \text{ F})(120 \text{ V}) = 1.7 \times 10^{-8} \text{ C} = 17 \text{ nC}$.