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Problem 1A

- (a) Calculate the capacitance of the series combination of a 4.0pf capacitor and a 2.0pf capacitor. 1.3 pf
- (b) Calculate the capacitance of the parallel combination of a 3.0pf capacitor and a 1.5pf capacitor. 4.5 pf
- (c) An electron is subjected to an electric field of 370 V/m. Find its acceleration.  $6.5 \times 10^{13} \text{ m/s}^2$
- (d) A 1.5 volt battery is connected across a 100pf capacitor. Find the charge on the capacitor.  $1.5 \times 10^{-10} \text{ C}$
- (e) The electric potential in a region of space is given by  $V = Cx^2$ .  
Find the electric field.  $E = -2Cx$

$$a) \frac{1}{C_{\text{eff}}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{C_1 + C_2}{C_1 C_2} \quad C_{\text{eff}} = \frac{C_1 C_2}{C_1 + C_2} = \frac{8}{6} \text{ pf} = \frac{4}{3} \text{ pf}$$

$$b) C_{\text{eff}} = C_1 + C_2 = 4.5 \text{ pf}$$

$$c) a = \frac{F}{m} = \frac{qE}{m} = \frac{1.6 \times 10^{-19} \text{ C} \times 370 \text{ N/C}}{9.1 \times 10^{-31} \text{ kg}} = 6.5 \times 10^{13} \text{ m/s}^2$$

$$d) C = \frac{Q}{V} \quad Q = CV = 100 \times 10^{-12} \text{ f} \times 1.5 \text{ V} = 1.5 \times 10^{-10} \text{ C}$$

$$e) E = -\frac{dV}{dx} = -\frac{d(Cx^2)}{dx} = -2Cx$$