Chapter 26 example.

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Section:- CSE/C

Q) 26.1:-

A solid .... length is l.

Solution:-

$$V_b - V_a = \int_a^b \vec{E} \cdot d\vec{s}$$

$$V_b - V_a = -\int_a^b E \cdot dr = -2k_e\lambda \int_a^b \frac{dr}{r} = -2k_e\lambda \ln\left(\frac{b}{a}\right)$$

$$C = \frac{Q}{\Delta V} = \frac{Q}{(2k_eQ/l)\ln(b/a)} = \boxed{\frac{l}{2k_e\ln(b/a)}}$$

Q 26.2:-

A spherical .... device.

Solution:-

$$V_b - V_a = -\int_a^b \vec{E} \cdot d\vec{s}$$

$$V_b - V_a = -\int_a^b E_r\,dr = -k_eQ\int_a^b \frac{dr}{r^2} = k_eQ\left[\frac{1}{r}\right]_a^b$$

$$① \quad V_b - V_a = k_eQ\left(1/b - 1/a\right) = k_eQ\,\frac{a-b}{ab}$$

$$C = \frac{Q}{\Delta V} = \frac{Q}{|V_b - V_a|} \boxed{= \frac{ab}{k_e(b-a)}}$$

Example 26.3:-

Find ...... microfarads.

Solution:-

$C_{eq} = C_1 + C_2 = 4.0\mu F$

$C_{eq} = C_1 + C_2 = 8.0\mu F$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_1} = \frac{1}{4.0} + \frac{1}{4.0} = \frac{1}{2.0\mu F}$

$\boxed{C_{eq} = 2.0\mu F}$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{8\mu F} + \frac{1}{8.0\mu F} = \frac{1}{4.0\mu F}$

$\boxed{C_{eq} = 4.0\mu F}$

$C_{eq} = C_1 + C_2 = \boxed{6.0\mu F}$

Q) 26.4:-

Two .... S_1 and S_2 are then closed.

Solution:- A

1. $Q_i = Q_{1i} + Q_{2i} = C_1 \Delta V_i - C_2 \Delta V_i = (C_1 - C_2)\Delta V_i$

2. $Q_1 = Q_{1f} + Q_{2f} = C_1 \Delta V_f + C_2 \Delta V_f = (C_1 + C_2)\Delta V_f$

$Q_f = Q_i \rightarrow (C_1 + C_2)\Delta V_f = (C_1 - C_2)\Delta V_i$

3. $\Delta V_f = \boxed{\left(\frac{C_1 - C_2}{C_1 + C_2}\right)\Delta V_i}$

B :-

4. $U_i = \frac{1}{2} C_1 (\Delta V_i)^2 + \frac{1}{2} C_2 (\Delta V_i)^2 = \frac{1}{2}(C_1 + C_2)(\Delta V_i)^2$

$U_f = \frac{1}{2} C_1 (\Delta V_f)^2 + \frac{1}{2} C_2 (\Delta V_f)^2 = \boxed{\frac{1}{2}(C_1 + C_2)(\Delta V_f)^2}$

5) $U_f = \frac{1}{2}(C_1+C_2)\left[\left(\frac{C_1-C_2}{C_1+C_2}\right)\Delta V_i\right]^2 = \frac{1}{2}\frac{(C_1-C_2)^2(\Delta V)^2}{(C_1+C_2)}$

$$\boxed{\frac{U_f}{U_i} = \frac{\frac{1}{2}(C_1-C_2)^2(\Delta V_i)^2/(C_1+C_2)}{\frac{1}{2}(C_1+C_2)(\Delta V_i)^2}}$$

6) $$\boxed{\frac{U_f}{U_i} = \left(\frac{C_1-C_2}{C_1+C_2}\right)^2}$$

example 26.5:-

A parallel .... inserted.

Solution:-

$$U_0 = \frac{Q_0^2}{2C_0}$$

$$U = \frac{Q_0^2}{2C}$$

$$\boxed{U = \frac{Q_0^2}{2kC_0} = \frac{U_0}{k}}$$

example 26.6:-

The water ..... to the field.

Solution:-

$$\Delta U = W$$

$$W = U_{90} - U_0 = (-NpE\cos 90) - (-NPE\cos 0^\circ)$$

$$-NPE = (10^{24})(6.3\times10^{-30}\,C\cdot m)(2.5\times10^5\,N/C)$$

$$\boxed{-1.6\times10^{-3}\,J}$$

example 26.7:-

A parallel ...... plates.

Solution:- A

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{\left[\frac{\epsilon_0 A}{(d-a)/2}\right]} + \frac{1}{\left[\frac{\epsilon_0 A}{(d-a)/2}\right]}$$

$$\boxed{C = \frac{\epsilon_0 A}{d-a}}$$

(b):

$$C = \lim_{a \to 0} \left(\frac{\epsilon_0 A}{d-a}\right) = \boxed{\frac{\epsilon_0 A}{d}}$$

Example 26.8

Eq 1. A parallel ...... is a fraction between o

Solution :-

$$C_1 = \frac{K \epsilon_0 A}{fd} \quad \text{and} \quad C_2 = \frac{\epsilon_0 A}{(1-f)d}$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{fd}{K\epsilon_0 A} + \frac{(1-f)d}{\epsilon_0 A}$$

$$\frac{1}{C} = \frac{fd}{K\epsilon_0 A} + \frac{K(1-f)d}{K\epsilon_0 A} = \frac{f+K(1-f)}{K} \frac{d}{\epsilon_0 A}$$

$$C = \frac{K}{f+K(1-f)} \frac{\epsilon_0 A}{d} = \boxed{\frac{K}{f+K(1-f)} C}$$