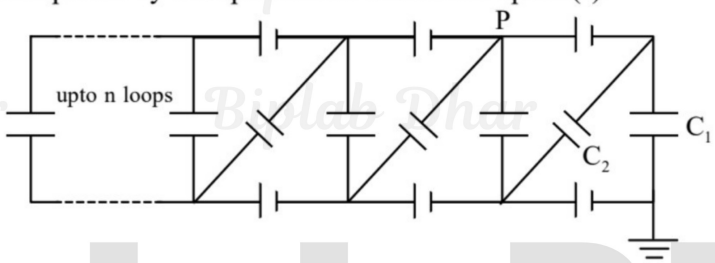
Advanced Test on: **Capacitor Circuit** Duration: **40 min.**

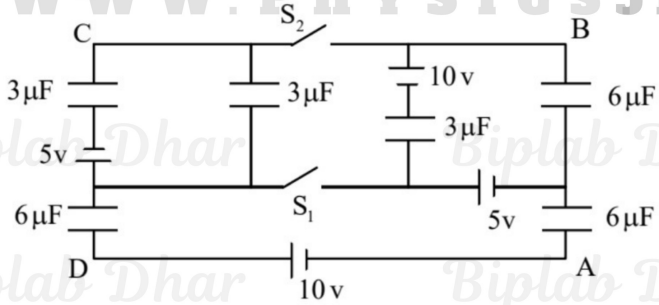
Multi options correct type

1) In the diagram shown in the figure all capacitors are of same capacitance C and all cells are of same EMF V. The circuit is repeated by n loops. Choose the correct option(s):



(A) Potential of point P for n = 3 is 10 V/7
(B) Charge on capacitor C_1 for n = 3 is 3C/5
(C) Charge on capacitor C_1 for n = 4 is 4C/9
(D) Charge on capacitor C_2 for n = 5 is 6C/11

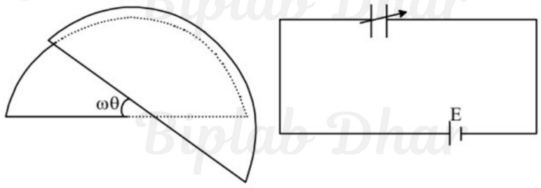
2) In the given circuit switch S_1 and S_2 are closed simultaneously. Choose the correct option(s):



(A) Charge flown through the switch S_1 is 75 μC
(B) Charge flown through the switch S_2 is 9 μC
(C) Potential difference between A and B is steady state is 1V
(D) Potential difference between D and B is steady state is 11V

Comprehension type:

A variable condenser or also known as varco is a capacitor whose capacitance can be varied. One type is varied by turning one of its plates clockwise. Suppose that a varco consists of a pair of half circle plate with diameter D separated by a distance d. The varco plate is rotating with angular velocity ω. The other plate is fixed. The plates may have some initial charge.



This varco is connected in a circuit as shown. We will consider t = 0 to $t=\frac{\pi}{\omega}$.

3) If the current is constant
(A) The angular velocity is increasing with time
(B) The angular velocity is decreasing with time
(C) The angular velocity is constant with time
(D) It is not possible

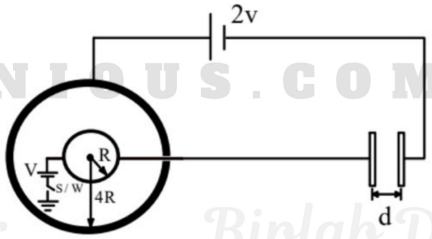
4) What torque needs to be applied to rotate the plate with constant small angular velocity?

(A) $\frac{\varepsilon_0 E^2 D^2}{16d}$ clock wise (B) $\frac{\varepsilon_0 E^2 D^2}{16d}$ anti clock wise

(C) $\frac{\varepsilon_0 E^2 D^2}{8d}$ clockwise (D) $\frac{\varepsilon_0 E^2 D^2}{8d}$ anti clock wise

Comprehension Type:

A parallel plate capacitor is placed at a large separation from two concentric spherical metal shells. The inner shell has radius R and outer one radius 4R. Separation between the parallel plate capacitors is d = 3R/16 and plates are circular discs of radius R (assume the separation to be small compared to R). The outer shell is connected with one of the plates of a parallel plate capacitor with a cell of EMF 2V, and inner shell is connected with another plate of parallel plate capacitor with a conducting wire. The inner shell is also earthed with a cell of EMF V and a switch as shown in figure. Initially inner shell is given external charge CV. C is the capacitance of parallel plate capacitor. Now answer the following questions.



5) When switch is open find the potential of inner shell

(A) 2V/3 (B) $-\frac{V}{3}$ (C) $-\frac{V}{6}$ (D) None of these

6) When switch is closed find the potential of outer shell

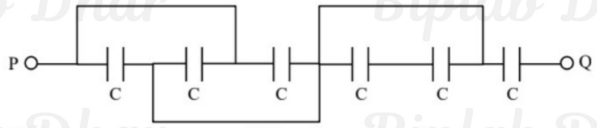
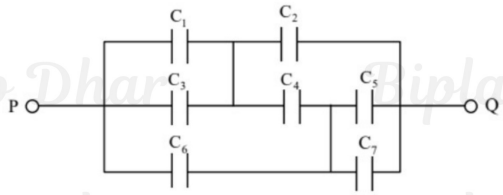
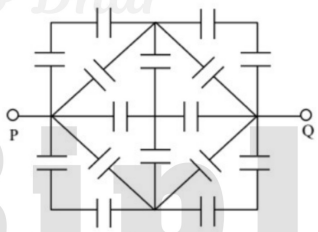
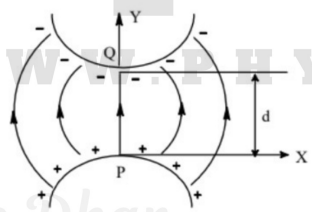
(A) 4V/5 (B) 7V/5 (C) 4V/3 (D) none of these

7) When the switch is closed Find the charge flown through switch

(A) $\frac{2CV}{5}$ (B) $\frac{7CV}{5}$ (C) $\frac{3CV}{5}$ (D) None of these

Matrix Match Type:

8) Find equivalent capacitance between P and Q and match the followings:

COLUMN – I	COLUMN – II
(A)  All capacitors are of 8 micro farads	**(P)** 5 micro-Farad
(B)  $C_1 = 23\mu F,\ C_2 = 7\mu F$ $C_3 = 12\mu F, C_4 = 13\mu F, C_5 = 1\mu F$ $C_6 = 10\mu F, C_7 = 1\mu F$	**(Q)** 6 micro-Farad
(C)  All capacitors are of capacitance $3\mu F$	**(R)** 7.5 micro-Farad
(D)  Two conductors P and Q are carrying equal and opposite charges +Q and –Q and placed close to each other as shown. If electric field along Y axis is given by $E = \frac{Q}{A\epsilon_0}\left(1 + 6\frac{y^2}{d^2}\right)$; where $\frac{A\epsilon_0}{d} = 15\mu F$. Find C_{eq} between P and Q.	**(S)** 10 micro-Farad