PHYSICS

BOOKS - NN GHOSH PHYSICS (HINGLISH)

COMBINATION OF CAPACITORS

Examples

1. Three capacitors of capacitance 4,5 and 8 μF are connected in such a way that the first

two are in parallell and the third is in series with them. Find the capacity of the combination

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2. Three capacitors of capacitances $2\mu F, 3\mu F$ are connected in parallel and the combination is charged up by a battery of 110 V. Calculate the total change taken from the battery and the charges on the capations.

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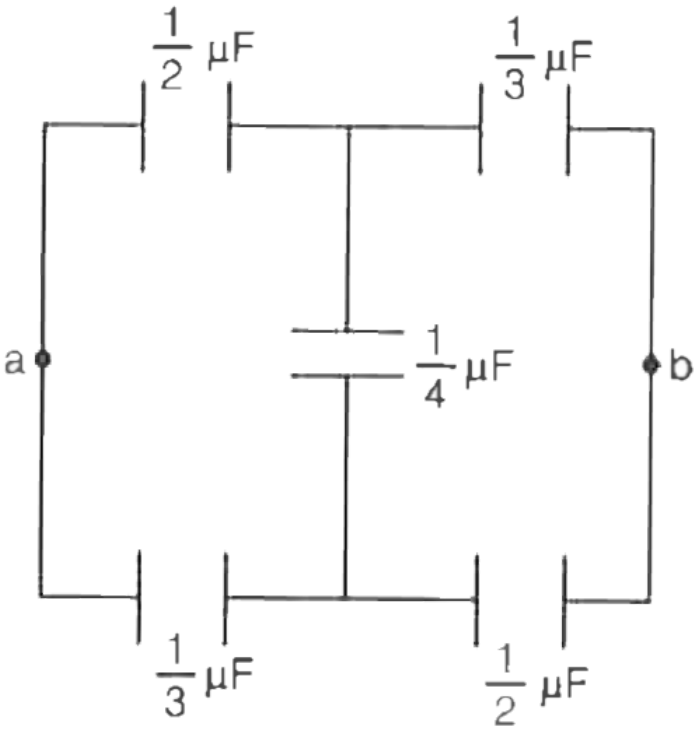
3. Five capacitors are connected as shown in figure 6.4. Calculate the equivalent capaitance between a and b.



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4. Three capacitors of capacitance 2.4 and $6\mu F$ are connected in series. Can a voltage of 11,000 V be applied to this battery of capacitors? The puncture voltage os each capacitor is 4000 V.

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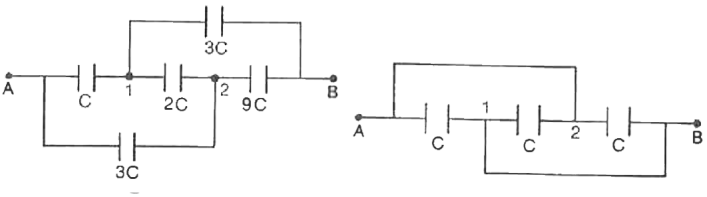
5. Find the equivalent capacitancy of the sysyem of capacitors shown in figures 6.6 (a)

and 6.6 (b)



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Exercise

1. Theee capacitors of capacitance 1,2,and 3 μF connected in series. Find the resultant capacitance.

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2. Therr capacitors of capacitance 4,3 and 2 μF are connected in such a way that the first and second are in series and the third in parallel with them. Find the equivalent capacitance.

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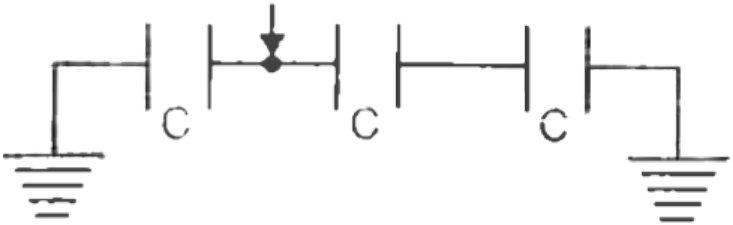
3. Three identical capacitors are first connected in series and then the first and the

last condutors of the combination areconnected to earth. A change Q is communicated to the secong conductor of the first capacitor. Prove that the potential of'this conductor is $2Q/3C$ where C is the capacitor.



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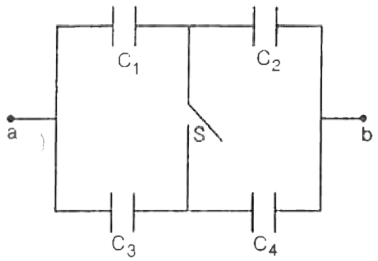
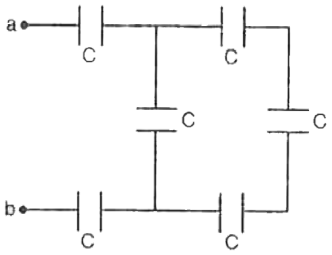
4. Four capacitors C_1, C_2, C_3 and C_3 are connected as shown in figure 6.12. Calculate the equivalent capacitance when (i) witch S is open, (ii) switch S is closes. Take capacitance of the capacitor tobe 1,2,3 and 4 μF, respectively.





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5. Show that in problem 3 the potential of the second conductor of the second capacitor is $Q/3C$.

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6. In the network of identical capacitors shoen in the fugure 6.13, and find the equivalent capacitance between a and b.

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7. Three capacitors of capacitance 1,2 and ,3 μF are connected in such a way that the first and the second are in parallel anad the third is in series with the combinationof the other two. Calculate the equivalent capacitance. If a potential difference of 200 V is applied across the combinnation, what is the charge on each capacitor?

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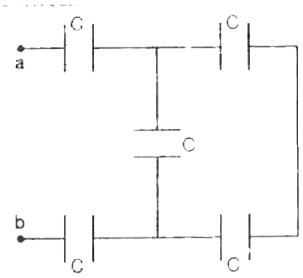
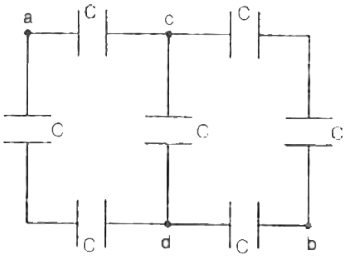
8. In the network of capacitors shown in figure 6.14 find the equivalent capacitance between a and b. Take C=2 μF





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9. Two batteries emfs 12 V and 13 V are joined in series through two capacitors. The positive of the 12-V battery is joined to the negative of

the 13-V battery through a capacitor of 3 μF and the negative of the 12-volt battery is joined to the positive of the 13-volt battery through a 7 μF capacitor. Calculate the steadypotential differences across the capacitors.

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10. Calculate the steady p.d. across the capacitors of the above problem when the two batteries are in parallel.

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11. In the network of identical capacitors (figure 6.15), find the capacitance between (i) a and (b), (ii) c and d.

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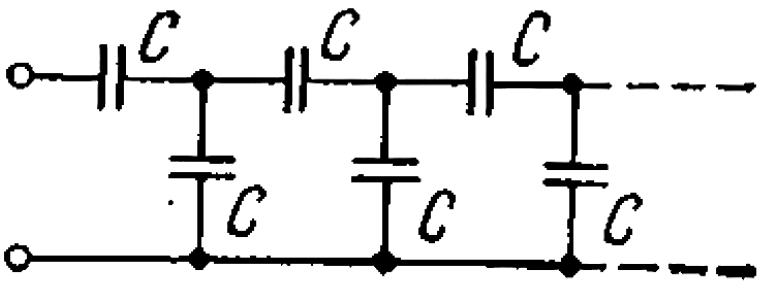
12. Find the capacitance of an infinite circuit formed by the repetitioin of the same link consisting of two indentical capacitors, each

with capacitors C (fig).



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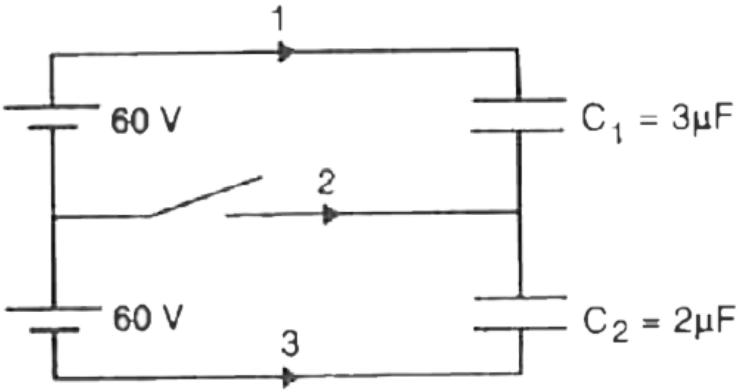
13. In the circuit shoenin figure 6.17 the emf of each better is 60 V, and the capacitances of the capacitors are $C_1 = 3\mu F$ and $2\mu F$. Find

the charges which will flow after the switch is colosed through the wires 1,2 and 3 n the directions indicated by the arrows.



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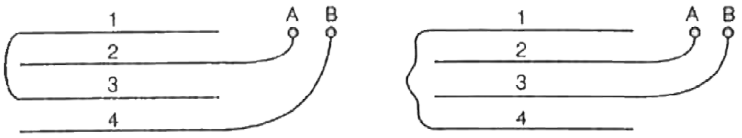
14. Foue idnetical plates arlocated in air at equal distances.d. The area of each plate is equal to S. Find the capacitance of the systyem

between A and B if the plates are connected as shown in figure 6.18 and figure 6.19



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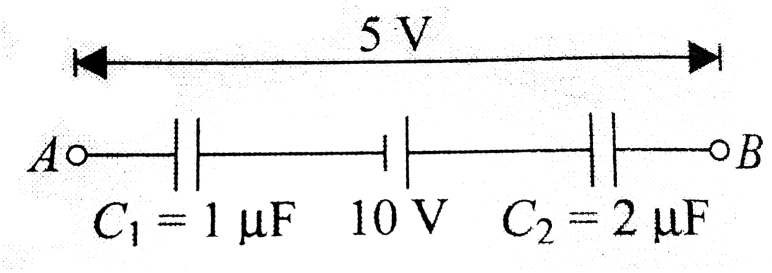
15. A circuit has section AB as shown in The emf of the cell is $10V$, and the capacitors have capacitances $C_1 = 1\mu F$ and $C_2 = 2\mu F$.



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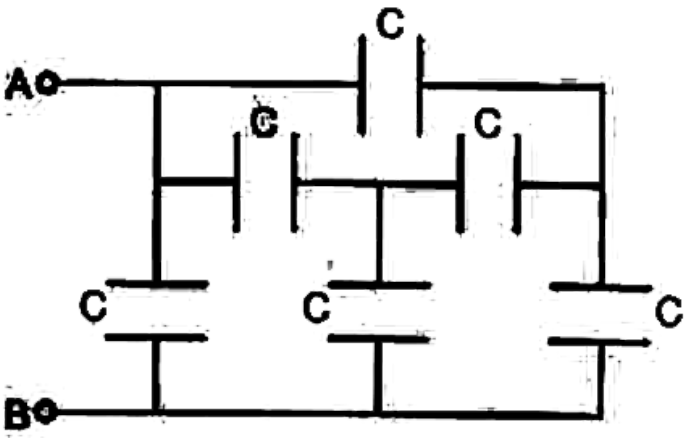
16. Find the equiivalent capacitance of the circuit of capacitors between A and B in figure 6.21.



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17. There are two rows of capacitos in series, the capacitance of ecah capacitor bein C. The rows are branched by a number of cpacitors of the same capacitance. Calculate the equivalent capacitance of the infinite ladder like rame of capacitance.

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18. Tow capacitons which have the same dielectric material $(\varepsilon_r = 2)$ are connected in

series and the combnationis putacross a steady p.d. of 220 V. what will be eheir p.d.s if the dielctric of the smaller capacitor is replaced by a dielectric of relative permittivity 5?

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19. Two capacitors of capacitance C_1 and C_2 are connected in parallel and a charge Q is delivered to the combination. The two are then disconnected and reconnected in series.

What are the new potential differences and charge on the capacitors?

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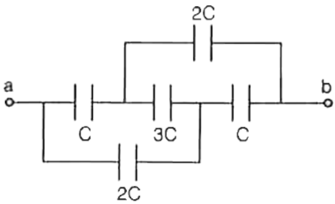
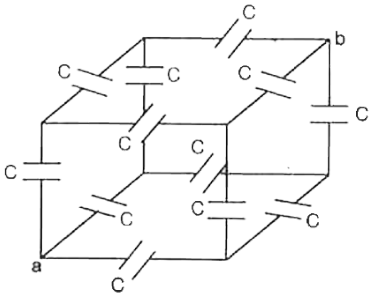
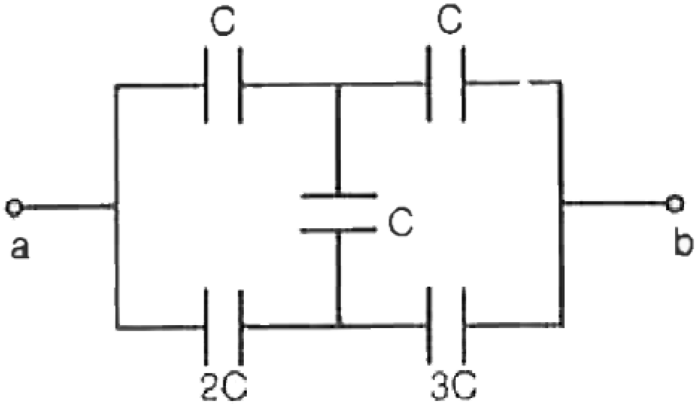
20. Calculate the equivalent capacitance between the points indicated the figures 6.22, 6.23 and 6.24.







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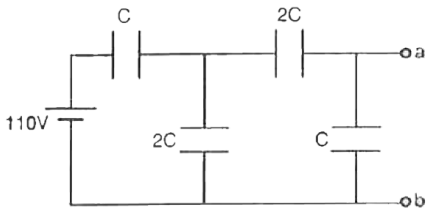
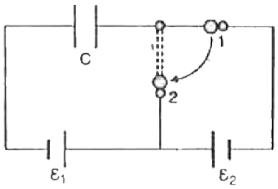
21. Find the potential difference between the points a and b of the circuit in figure 6.25

when the battery has an emf of 110 V.





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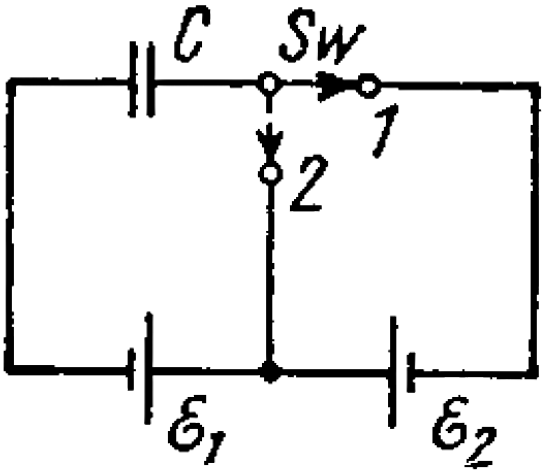
22. What amount of heat will be generated in the circuit shown in Fig. after the swich Sw is

shifted from position 2 ?



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23. In figure 6.12 $C_1 = 9\mu F, C_2 = 6\mu F, C_3 = 4\mu F$ and $6_4 = 6\mu F$ The potential of poitn a is 10 V and

that of b is 35 V calculate the potentials of the terminal of the key S (i) when it is open and (ii) when it is closed. Also calculate the charge that passes through S when it is clossed.

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24. The gap between the plates of a parallel plate capacitor is filled with glass of dielectric constant $k = 6$ and of specific resistivity $100G\Omega m$. The capacitance of the capacitor is $4.0\mu F$. When a voltage of $2.0kV$ is applied to

the capacitor, the leakage current of the capacitor will be.

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25. The gap between the plates of a prallel-plate capacitor is filled up with two dielectric layers 1 and 2 thickness d_1 and d_2 permittivities ε_1 and ε_2 and resistivities ρ_1 and ρ_2. A dc voltage V is applied to the capacitor with electric field directed from layer 1 to layer 2 find σ the surface density of extraneous

charges at the boundary between the dielectric layers and the condition under with $\sigma = 0$.

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26. A capacitor with capacitance $C = 400pF$ is connected via a resistance $R = 650\Omega$ to a source of voltage V_0. How soon will the voltage developed across the capacitor reach a value $V = 0.90V_0$?

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27. A capacitor filled with dielectric of permittivity $\varepsilon = 2.1$ losses half the charge acquired during a time interval $\tau = 3.0\ \mathrm{min}$. Assuming the charge to leak only thorugh the dielectric filler, calculate its resistivity.

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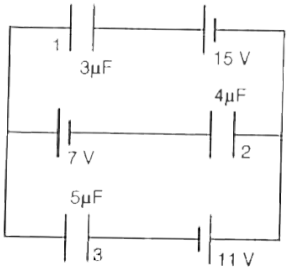
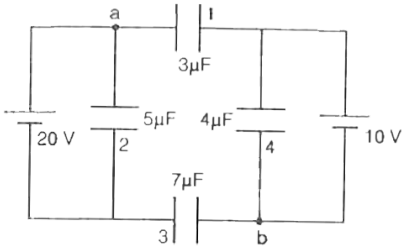
28. In the following circuit (figure 6.22) find the potential difference across the capacitors 1, 2,

and 3.





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29. Find the potential difference between the points a and b of the circuit (figure6.28) and charge on capacitor 1.

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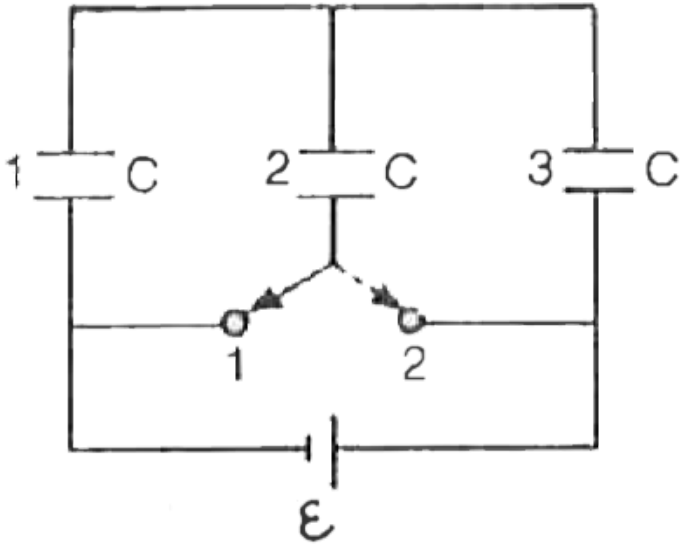
30. What amount of heat will be genarated in the circuit shoenin figure 6.29 after the



switch is shifted from position 1 to position2?

[Hint: Heat produce = change in stored energy + extra energy drawn from the battery.]

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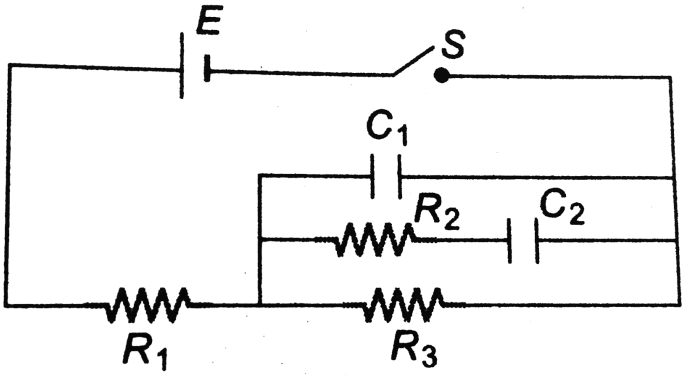
31. Determine the current through the battery in the circuit shown in figure.



(a) immediately after the switch S is closed

(b) after a long time.

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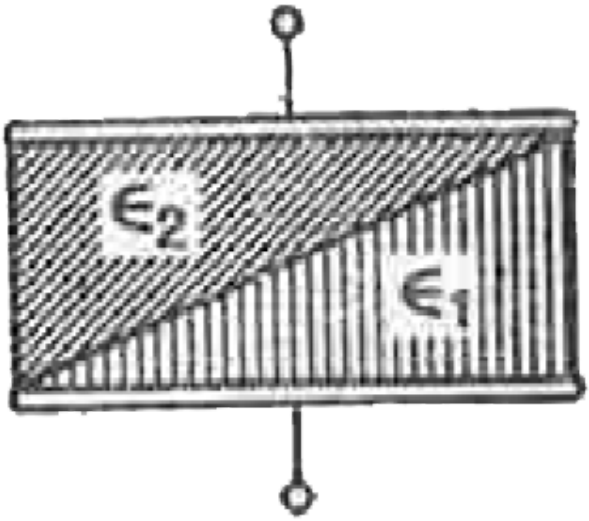
32. Caalcualte the capacitance of a parallel-plate capacitor of plate are A and plate separation d. The dielectric consists of two wedges of relative permitlvties $es\pi_1$ and ε_2 as shown in the figure (fig.6.31).

[Hint: If dC id the capacitance of an elementary strip at a distance x from the left ent then



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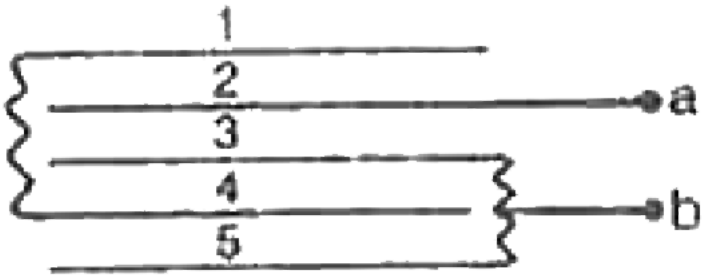
33. Five foils, each of area A, are placed one above the other separateed by dielectrics of thickness d and dielectric coefficient ε. Find the equivalent capacitance between a and b, if plates 1 and 4 are joined, and 3 and 5 are



joined.

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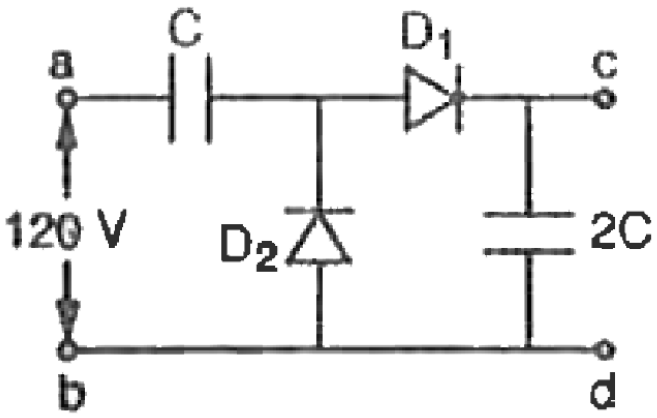
34. Figure shows the connection of two ideal diodes and two capacitors C and 2C. A 120-volt battery is connected to the input terminals with a at positive potential and b at lower potential. Find the putput voltage.



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