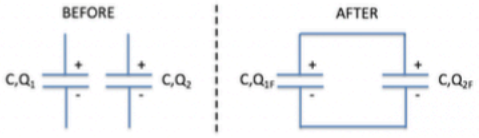
1)

[*8 pts.*] Two separate capacitors of the same capacitance C are initially charged to Q_1= 2 μC and Q_2=8 μC. Then their positive plates are connected to each other and their negative plates are connected to each other. The final charges Q_{1F} and Q_{2F} become :



4 μC and 6 μC

5 μC and 5 μC

4 μC and 4 μC

3 μC and 7 μC

2 μC and 4 μC

3 μC and 3 μC

2)

[8 pts.] A parallel-plate capacitor is held at a fixed voltage. If the separation of its plates is doubled, the electric energy stored in the capacitor is :

1/4 of the original

1/2 of the original

unchanged

doubled

quadrupled

3)

[*8 pts.*] A charged air-filled capacitor is disconnected from the battery. A sheet of dielectric with κ=3 is inserted completely filling the volume between its plates. As a result, the electric energy stored in the capacitor is :

1/9 of the original

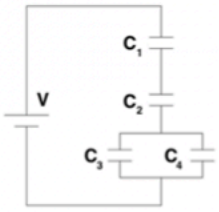
1/3 of the original

unchanged

tripled

4)

[*10 pts.*] Consider the circuit shown with voltage V and 4 capacitors with equal capacitance C. Calculate the total capacitance and the final charge on capacitor 2.



$C_{tot} = 0.25\ C,\ Q_2 = 0.5\ CV$

$C_{tot} = 0.4\ C,\ Q_2 = 0.8\ CV$

$C_{tot} = 1\ C,\ Q_2 = 2\ CV$

$C_{tot} = 0.25\ C,\ Q_2 = 0.25\ CV$

$C_{tot} = 0.4\ C,\ Q_2 = 0.4\ CV$

$C_{tot} = 1\ C,\ Q_2 = 1\ CV$

5)

5) [6 pts.] A current flows in an aluminum wire with a drift speed of the conduction electrons of 0.002 m/s. The conduction electron density in aluminum is 6.0×10^{28}/ m^3. What is the current density in the wire?

$3.3\ 10^{24}\ A/m^2$

$3.0\ 10^{31}\ A/m^2$

$4.3\ 10^{20}\ A/m^2$

$1.2\ 10^{26}\ A/m^2$

✔ $1.92\ 10^{6}\ A/m^2$

$1.92\ 10^{9}\ A/m^2$

6)

[8 pts.] Calculate the power used by a circuit that has a resistance of 150 Ω and draws a current of 0.4 A.

0.0026 W

0.16 W

24 W

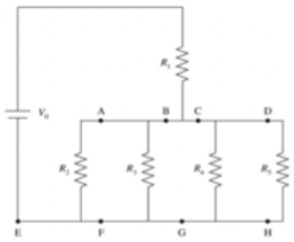
60 W

150 W

375 W

7)

[10 pts.] A voltage of V_0 = 24 V is supplied to the resistor configuration shown, with R_1 = 70 Ω and R_2=R_3=R_4=R_5= 200 Ω. Calculate the current through point A (i.e., through R_2) and through point B.



$I_A = 0.15\ A$, $I_B = 0.15\ A$

$I_A = 0.15\ A$, $I_B = 0.3\ A$

$I_A = 0.05\ A$, $I_B = 0.05\ A$

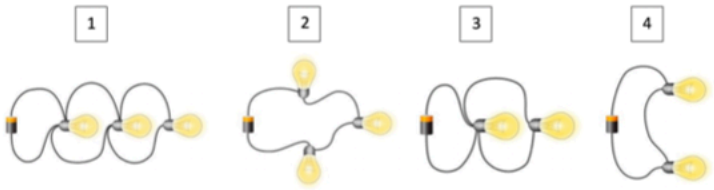
$I_A = 0.05\ A$, $I_B = 0.1\ A$

$I_A = 0.02\ A$, $I_B = 0.04\ A$

$I_A = 0.01\ A$, $I_B = 0.02\ A$

8)

[8 pts.] Order the circuits shown below according to their power output, from highest to lowest. All batteries have the same voltage, and all light bulbs have the same resistance.



1234

1342

2314

2413

3412

3124

4123

4213

9)

[8 pts.] Five wires meet at a junction. In two of the wires, a current of I1 =4.6 A and I2 = 2.7 A enters the junction, and in another two a current I3 = 2.4 and I4 = 5.3 exits the junction. Determine the current in wire 5.

0.2 A into the junction

0.2 A out of the junction

0.4 A into the junction

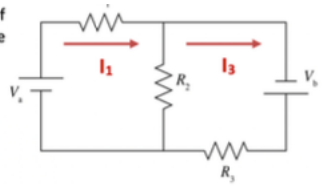
0.4 A out of the junction

0.6 A into the junction

0.6 A out of the junction

10)

10) [*8 pts.*] In the circuit shown $V_a = 20$ V and $V_b = 5$ V. Which of the following relations is correct (the arrows below define the direction of current flow for I_1 and I_3).



$20\,V - R_1 I_1 - 5\,V + R_3 I_3 = 0$

$20\,V + R_1 I_1 - 5\,V - R_3 I_3 = 0$

$20\,V - R_1 I_1 + 5\,V + R_3 I_3 = 0$

$20\,V + R_1 I_1 + 5\,V - R_3 I_3 = 0$

$20\,V - R_1 I_1 + 5\,V - R_3 I_3 = 0$

11)

l) [8 pts.] You charge an initially uncharged 68 mF capacitor through a 32 Ω resistor by means of a battery. After what time has the charge on the capacitor reached 90% of its maximum?

0.23 seconds

5 seconds

15 seconds

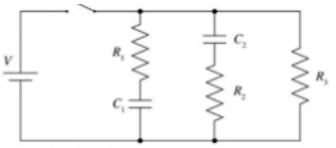
25 seconds

50 seconds

12)

[*5 pts.*] Consider the RC circuit shown in the diagram, with a battery voltage V. Before the switch is closed, both capacitors are uncharged. All the resistances are the same and equal to R, and the capacitances are $C_2 = 2C_1$.

What is the amount of current supplied by the battery immediately after the switch is closed ?



3 $\frac{V}{R}$

$\frac{V}{R}$

$\frac{2}{3}\frac{V}{R}$

$\frac{1}{2}\frac{V}{R}$

$\frac{1}{3}\frac{V}{R}$

13)

) [5pts] Same circuit as problem 12. What is the amount of current supplied by the battery a long time after the switch is closed ?

$3\frac{V}{R}$

$\frac{V}{R}$

$\frac{2}{3}\frac{V}{R}$

$\frac{1}{2}\frac{V}{R}$

$\frac{1}{3}\frac{V}{R}$

0