AP Physics C
Mr. Forrest:

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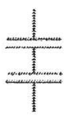
Ch. 29 (capacitors) and Ch. 31 (circuits) Conceptual Questions

1. Each capacitor in the circuits below has a capacitance of *C*. What is the equivalent capacitance of each group of capacitors?

a.

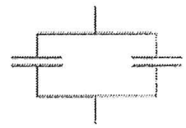


$C_{eq} =$ $\frac{C}{2}$

$\frac{1}{C_{TOT}} = \frac{1}{C} + \frac{1}{C}$

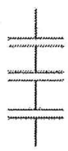
$\frac{2}{C} = \frac{1}{C_{TOT}}$

b.



$C_{eq} =$ $2C$ $\quad C + C$

c.

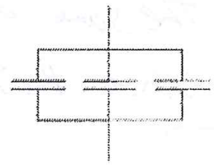


$C_{eq} =$ $\frac{C}{3}$

$\frac{1}{C} + \frac{1}{C} + \frac{1}{C} = \frac{1}{C_T}$

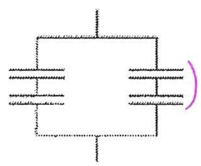
$\frac{3}{C} = \frac{1}{C_T}$

d.



$C_{eq} =$ $3C$ $\quad C + C + C$

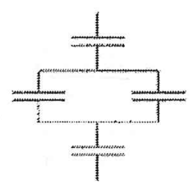
e.

$\frac{C}{2}$ () $\frac{C}{2}$

$\frac{C}{2} + \frac{C}{2} = C_{TOT}$

$C_{eq} =$ C

f.

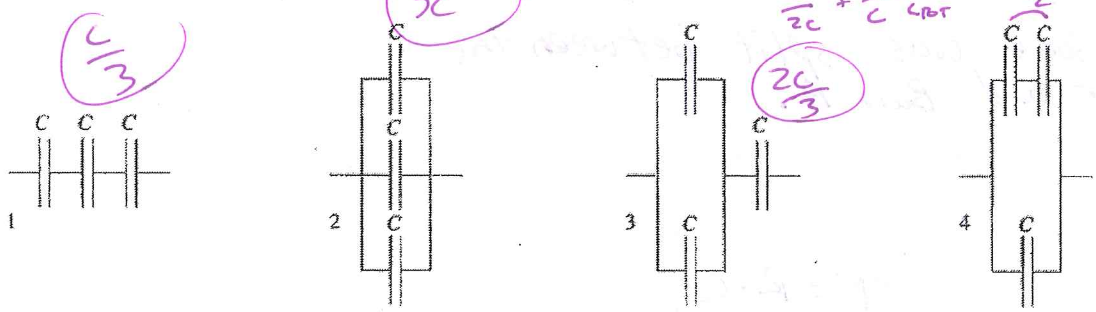
$2C$ (

$C_{eq} =$ $\frac{2C}{5}$

$\frac{1}{C} + \frac{1}{2C} + \frac{1}{C}$

$\frac{5}{2C} = \frac{1}{C_{TOT}}$

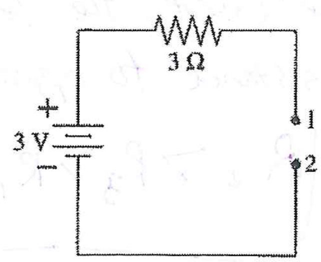
2. Rank in order, from largest to smallest, the equivalent capacitance (C_{eq}) of each of the four groups of capacitors.



1: $\frac{C}{3}$ 2: $3C$ 3: $\frac{1}{2C} + \frac{1}{C} = \frac{1}{C_{TOT}}$, $\frac{2C}{3}$ 4: $\frac{C}{2}$, $\frac{C}{2} + C = \frac{3C}{2}$

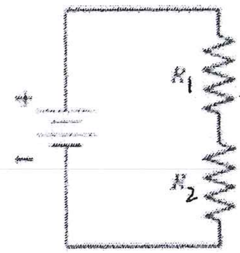
$2 > 4 > 3 > 1$

3. The wire is broken on the right side of the circuit. What is the potential difference (ΔV_{12}) between points 1 and 2? Explain your reasoning.



3 Volts. No current flowing so no ΔV across resistor. Via the loop rule there must be a ΔV of 3 V since $\Delta V_{loop} = 0$

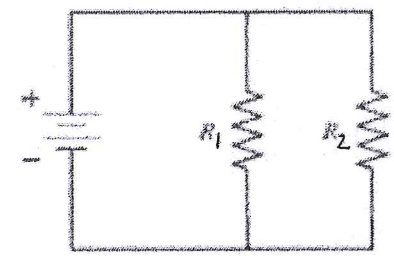
4. The circuit to the right has two resistors, with $R_1 > R_2$. Which of the two resistors dissipates the larger amount of power? Explain your logic.



$P = I^2 R$; I is the same in a series circuit, so
or
$P = V \cdot I$
or
$P = \frac{V^2}{R}$

$P_1 > P_2$

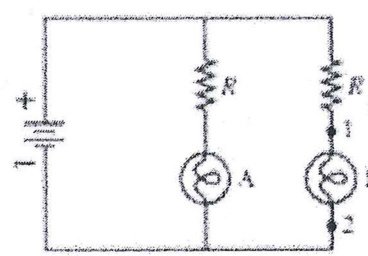
5. The circuit to the right also has two resistors, with $R_1 > R_2$. Which of the two resistors dissipates the larger amount of power? Explain your logic.



$P = \frac{V^2}{R}$ Voltage is the same across both, so since $R_1 > R_2$

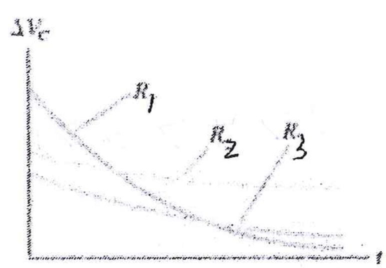
$P_2 > P_1$

6. Bulbs A and B in the diagram to the right are identical, and both are glowing. Bulb B is then removed from its socket. Does the potential difference ΔV_{12} between points 1 and 2 increase, decrease, stay the same, or become zero? Explain.



ΔV_{12} actually increases. Since no current flows in that branch, all the ΔV is now between 1 & 2, whereas before some was split between the resistor and Bulb B.

7. The diagram to the right shows voltage as a function of time of a capacitor as it is discharged (separately) through three different resistors. Rank, in order from largest to smallest, the values of the resistances R_1 to R_3.



$\tau = R \cdot C$,

Same capacitor, so the steeper the curve, the less the resistance to oppose discharging.

So... $R_2 > R_3 > R_1$