Physics 207 – Exam 2

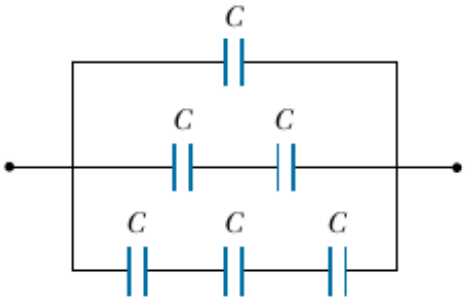
Sections (519-524; 525-530) – March 9, 2022

1) A parallel plate capacitor has capacitance C and it is charged with a charge Q. When the distance between the parallel plates is doubled, what happens to V, the potential difference between the plates, and U the potential energy of the capacitor?

A) V becomes half as great and U becomes half as great.
B) V becomes twice as great and U becomes half as great. [4]
C) V becomes twice as great and U becomes twice as great. [8]
D) V becomes half as great and U becomes four times as great.
E) V does not change and U does not change.
F) V becomes half as great and U becomes twice as great. [4]

2) Evaluate the equivalent capacitance of the configuration shown in Figure. All the capacitors are identical, and each has capacitance C.

A) $\frac{11}{6}$C [8]
B) 6 C
C) $\frac{1}{6}$C
D) $\frac{13}{7}$C
E) $\frac{6}{11}$C [4]
F) $\frac{7}{13}$C

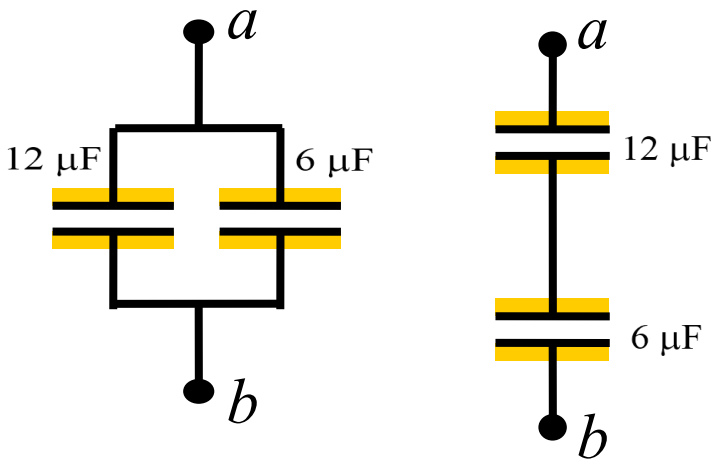


3) You slide a slab of dielectric between the plates of a parallel-plate capacitor while keeping the *charges* on the plates constant. What happens to V, the potential difference between the two plates, and U, the potential energy of the capacitor?

A) V decreases and U increases. [4]
B) V increases and U decreases. [4]
C) V decreases and U decreases. [8]
D) V increases and U increases.
E) V remains the same and U increase.
F) V increases and U remains the same.

4) A 12μF capacitor and a 6μF capacitor are connected first in a parallel and then in a series way. If the potential difference V_{ab} is the same in both cases, what is the ratio of the charges on the 12μF capacitor?

A) 3 [8]
B) 4
C) 5
D) 3/2 [4]
E) 1/2
F) 2



5) Suppose that the current through a conductor varies with time according to the expression $I(t) = I_0 \frac{t}{t_0}$ where I_0 and t_0 are constants. How much charge Q passes a fixed observation point within the conductor between $t = 0$ and $t = t_0$? If the cross-section area is A, what is the current density J at $t = t_0$?

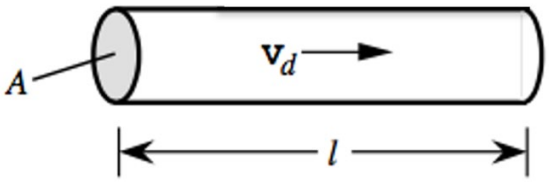
A) $Q = I_0\, t_0/2$ $J = I_0/A$ [8]
B) $Q = I_0 t_0$ $J = I_0/A$ [4]
C) $Q = I_0\, t_0/2$ $J = 2\, I_0/A$ [4]
D) $Q = I_0$ $J = I_0$
E) $Q = I_0/t_0$ $J = AI_0$
F) $Q = I_0\, t_0/3$ $J = 3\, I_0/A$

6) A metal wire of resistance R is cut into three equal pieces that are then connected side by side to form a new wire whose length is equal to one-third the original length. What is the resistance of this new wire?

A) 3R
B) R/3
C) 9R
D) R/9 [7]
E) R/2
F) R/6

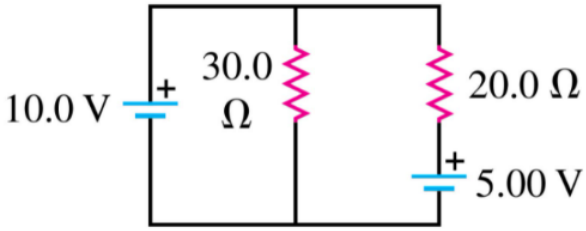
7) Consider a wire of area A=4 mm^2 and length l=3 m. If a voltage difference of 4.5 V is applied to its ends, then a current of 2 A flows through it. Find the resistivity ρ.

A) $9.0\text{x}10^{-9}$ Ω/m
B) $3.0\text{x}10^{6}$ Ω/m (2)
C) $3.0\text{x}10^{-6}$ Ω-m (8)
D) $3.0\text{x}10^{-3}$ Ω-m
E) $6.0\text{x}10^{-6}$ Ω/m
F) $2.0\text{x}10^{-9}$ Ω-m



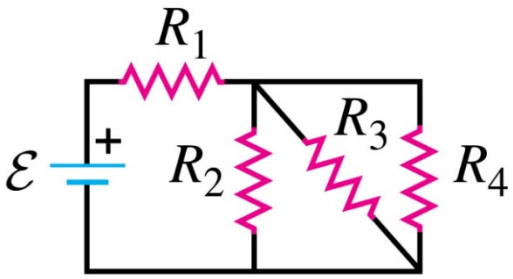
8) The magnitudes of current following through the 30 Ω AND 20 Ω resistor are respectively

A) 1/3 A, 3/4 A [3]
A) 1/3 A, 1/4 A [7]
A) 1/3 A, 1/10 A [2]
A) 1/6 A, 3/4 A
A) 1/6 A, 1/4 A [4]
A) 1/6 A, 1/10 A
A) 1/6A, 3/4 A



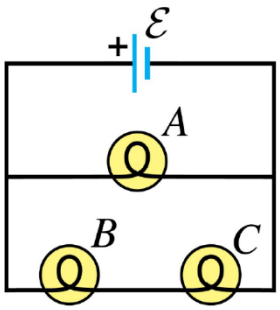
9) In the following circuit, Ɛ =12 V and $R_1 = R_2 = R_3 = R_4 = 1$ Ω, the current flowing through the resistor R_1 is

A) 3 A [2]
B) 4 A
C) 9 A [8]
D) 12 A
E) 14 A
F) 16 A [4]
G) 18 A [2]



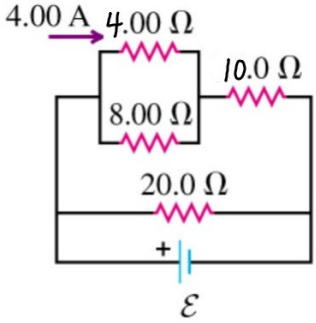
10) Three identical light bulbs are connected to a source of emf as shown. The light bulb A will shine

A) as bright as B
B) as bright as C
C) as bright as B and C combined [2]
D) twice as bright as B [2]
E) twice as bright as C [2]
F) twice as bright as B and C combined [7]



11) In the following circuit, the current flowing through the 4.00 Ω resistor is 4.00 A, the current flowing through the 20.0 Ω resistor must be

A) 0.8 A [2]
B) 1.2 A
C) 2.0 A
D) 3.0 A [2]
E) 3.8 A [8]
F) 4.6 A
G) 5.2 A



12) A capacitor with capacitance C is charging through a resistor R using a battery with emf ε . When the current is at 1/8 of its maximum value, the capacitor will have been charged to

A) 1/8 of its maximum charge
B) 2/8 of its maximum charge
C) 3/8 of its maximum charge
D) 4/8 of its maximum charge
E) 5/8 of its maximum charge
F) 6/8 of its maximum charge
G) 7/8 of its maximum charge [7]

13) In the following circuit, the switch has been closed for a long time. The current through the resistor R_2 and the charge on the LOWER plate of the capacitor are

A) 2 A, 52 μC
B) 2 A, -52 μC [4]
C) 3 A, 36 μC [6]
D) 3 A, -36 μC [8]
E) 4 A, 20 μC
F) 4 A, -20 μC [4]