⚠ This quiz has been regraded; your new score reflects 2 questions that were affected.

Quiz 2

[redacted]

Instructions

You have exactly two hours to do this quiz. It is an open-book quiz, and you can use EP2 material given to you this semester (problem-solving solutions, lecture notes, etc). but you are not allowed to use the internet to solve the problems. You can use calculators for math and matrix calculations. If you need help with solving integrals in this quiz - you are allowed to use free integral solving sites, such as **https://www.integral-calculator.com/ (https://www.integral-calculator.com/)** . Needless to say, you also are not allowed to collaborate with anyone or seek help from anyone in solving these problems.

If you have technical problems: immediately contact the KSU help desk and let me know. You can reach me on zoom (**https://ksu.zoom.us/j/95088882288 (https://ksu.zoom.us/j/95088882288)**), discord, and email: **maravin@gmail.com (mailto:maravin@gmail.com)**

Good luck!

This quiz was locked May 16, 2021 [redacted]

Attempt History

Attempt	Time	Score	Regraded
[redacted]			

[redacted]

Submitted Mar 5, 2021 at 6:21pm

[redacted]

Question 1

3 / 3 pts

When one says that a capacitor *C* has a charge *Q* that means that the actual charges on its plates are

- Q, Q
- Q/2, -Q/2
- Q, -Q
- Q/2, -Q/2
- Q, 0

Correct!

Question 2

Original Score: 3 / 3 pts Regraded Score: 3 / 3 pts

This question has been regraded.

If you increase the distance between the plates of the parallel plate capacitor connected to a battery, you will

- increase the capacitance
- increase the potential difference
- not affect the potential difference
- decrease the potential difference
- make Prof. Maravin cry

ou Answered

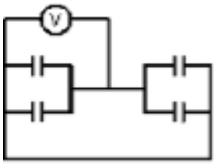
orrect Answer

Question 3

Original Score: 0 / 3 pts Regraded Score: 3 / 3 pts

This question has been regraded.

The voltmeter in the circuit given below reads 100 V. And all the capacitors are exactly the same and have 500 μF capacitance. The magnitude of the charge on each capacitor is



- 0.2 C
- 0.5 C
- 20 C
- 50 C
- none of these ✓

Correct!

Question 4

3 / 3 pts

You connect two capacitors, C_1 and C_2, in parallel and apply a 100 V potential difference to the combination. If you replace a combination with an equivalent capacitor and apply the same 100 V potential difference, the charge on the equivalent capacitor will be the same as

- the charge on C_1

Correct!

- ✓ the sum of the charges on C_1 and C_2
- the difference of the charges on C_1 and C_2
- the product of the charges on C_1 and C_2
- none of the above

Question 5

3 / 3 pts

When it is time to replace your car battery with the new one, you need to ensure that the ratings of the old and new car battery match. Usually the units of this rating is $A \cdot h$. This unit is a unit of

- power
- energy
- current

Correct!

- ✓ charge
- force

Question 6

0 / 3 pts

If you make an integral of a current density $\vec{j}$ and a vector element of area $d\vec{A}$ over some surface area, then this integral $\int_{area} \vec{j} \cdot d\vec{A}$ represents

the electric flux through the area

ou Answered

the average current density at the position of the area

the resistance of the area

the resistivity of the area

orrect Answer

the current through the area

Question 7

3 / 3 pts

A rod made of some conductive material has resistance *R*. The rod was stretched to twice its original length keeping the volume the same. The new resistance of a longer rod is

R/2

R

2*R*

Correct!

4*R*

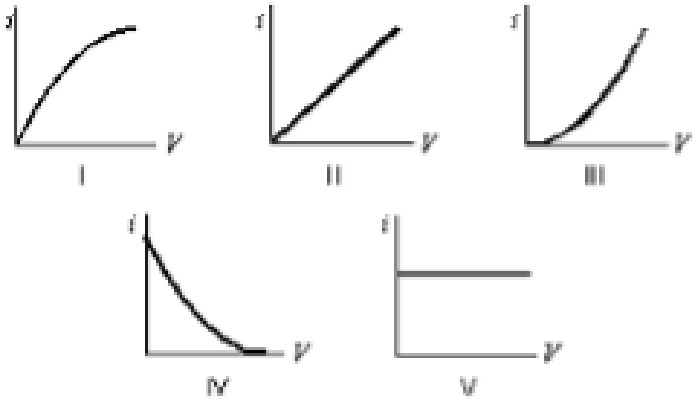
8*R*

None of the above

Question 8

3 / 3 pts

Which of the following five graphs relate the current and potential difference on some circuit element that obeys Ohm's law?



- I
- II ✓ Correct!
- III
- IV
- V

Question 9

3 / 3 pts

The loop rule that states that the sum of all the potential differences and EMFs around a closed loop equal zero is a consequence of

- Newton's third law.
- Ohm's law
- Smirnoff's rule
- Maravin's law

conservation of charge

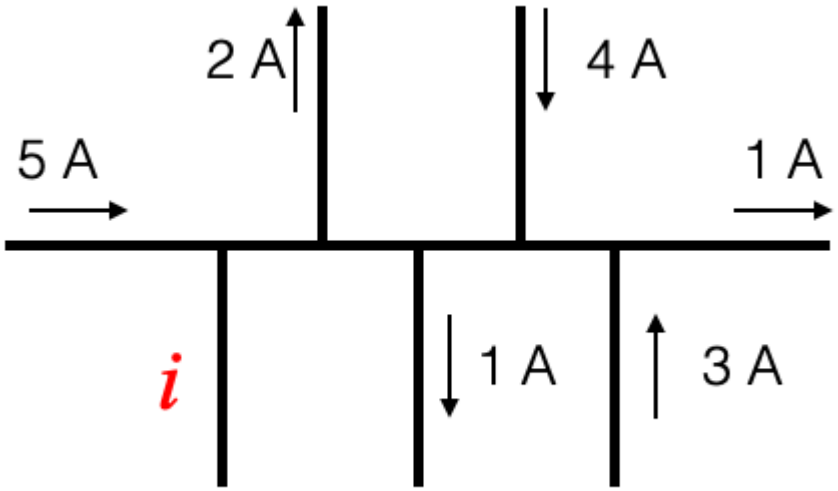
Correct!

conservation of energy

Question 10

0 / 3 pts

Someone showed you a part of an electric circuit shown below with the current values and direction in all but one of the branches. What's the magnitude and the direction of the missing current *i*?



orrect Answer

8 A, down

8 A, up

ou Answered

6 A, down

6 A, up

4 A, up

impossible to tell

Question 11

3 / 3 pts

Before taking your Ferrari Testarossa for a spin one nice sunny afternoon, you opened the hood of the car and noticed that both of the headlights are connected in parallel to a 12-V battery. The total power that this battery supply to headlights is 48 Watts. You realized that the resistance of each headlight bulb is:

- 8 Ohms
- 6 Ohms

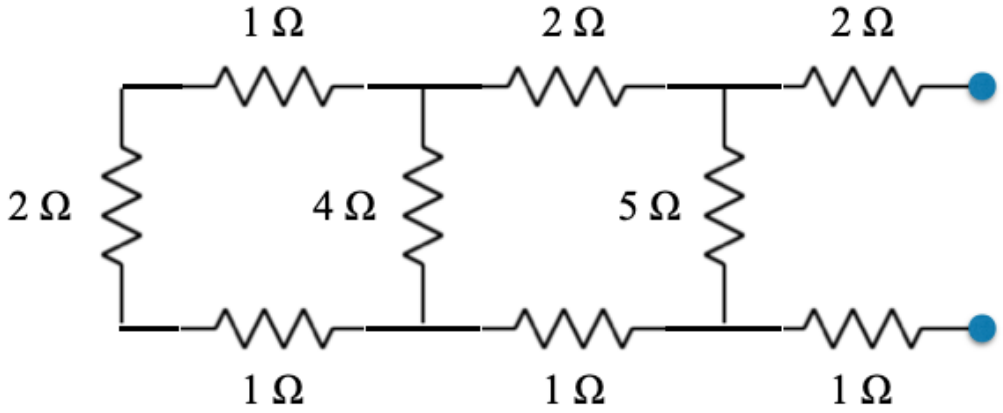
Correct!

- 4 Ohms
- 2 Ohms
- 1 Ohms
- None of the above

Question 12

3 / 3 pts

If you are to substitute a combination of the resistors given below with a single resistor you would pick up the following resistance



- 2.5 Ohms
- 4 Ohms
- 5.5 Ohms

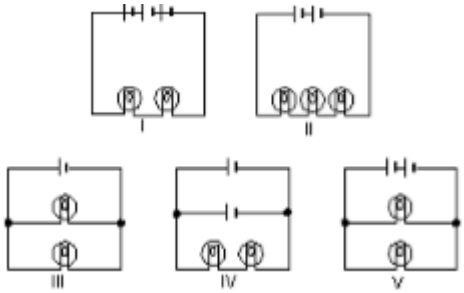
Correct!

- 6 Ohms
- 6.5 Ohms
- none of the above

Question 13

0 / 3 pts

In the circuits below all the batteries and the light bulbs are identical. In which of those circuits the bulbs will be dimmest?



I

ou Answered

II

III

orrect Answer

IV

V

Question 14

3 / 3 pts

You have a 120 Ohm resistor connected in series with a capacitor to a battery. After 10 ms of charging the capacitor, its charge is about half of its final value. From this, you deduce that the capacitance is about

83.3 μF

Correct!

120 μF

1.2 F

None of the above

Question 15

3 / 3 pts

Your evil EP2 Prof. Maravin wrote on a blackboard the following expression: $R\frac{dq}{dt} + \frac{q}{C} = \mathcal{E}$ that describes some specific process. What is that process?

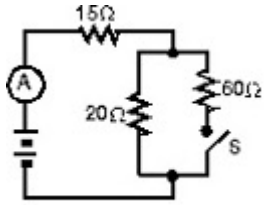
Correct!

- ✓ a charging capacitor
- a discharging capacitor
- a capacitor that has been disconnected
- a charging resistor
- an oscillating circuit

Question 16

3 / 3 pts

In the circuit depicted below, when the switch is closed, the ammeter reads 0.1 A.



What will happen to the ammeter if you open the switch?

- it will increase slightly
- it will remain the same

Correct!

- ✓ it will decrease slightly
- it will doubles

Question 17

[redacted]

One morning you find yourself marooned on an uninhabited island with a box of 3V batteries, about fifty of the 100 Ω resistors, and a box of twenty 1 μF capacitors. To construct a signaling device you need to make the following items from some of the parts available to you. Draw a clear diagram of the following:

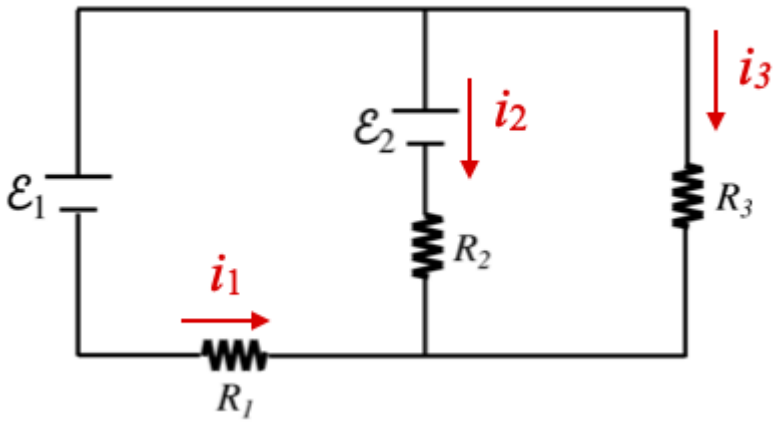
(a) (4 points) a 350 Ω resistor

(b) (4 points) a 0.25 μF capacitor

(c) (4 points) a 12 V battery

exam 2 17,18.pdf (https://k-state.instructure.com/files/16951585/download)

Question 18



In the circuit above you have two batteries and three resistors labeled as $\mathcal{E}_1$, $\mathcal{E}_2$ and R_1, R_2, and R_3, respectively. To help the graders out, use the directions of the currents shown in the figure.

(a) (6 points) Deduce three independent equations for three unknown currents. Use the symbolic notation for resistances and voltages

(b) (4 points) Take $\mathcal{E}_1$ = 10 V, $\mathcal{E}_2$ = 12 V, R_1 = R_2 = 1000 Ω, and R_3 = 0.1 Ω. Solve for currents. You can do it by solving the system of equations from (a), or if you see a simpler path to a very good estimate of the exact

answer, use it, explaining whatever approximation you make in one or two sentences (*Hint: Wow,* R_3 is a very small resistance!)

(c) (4 points) Do the same thing for the case of the same batteries but different resistors: R_1 = 1 MΩ and R_2= R_3 = 10 Ω. (*Hint:* R_3 *is huge!*)

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[redacted]

Question 19

[redacted]

Being isolated in the middle of the pandemic with nothing to do, you decide to do your own EP2 experiments to impress your lab instructor. You start by using a 9V battery, some nice copper wires of negligible resistance, and two 12 inch flat copper pan lids you "borrowed" from your roommate to serve as plates for your makeshift parallel plate capacitor. You also have a nice multimeter that you intend to use as an ammeter for your experiments.

Experiment 1: you set the lids to be separated by about 0.5 inch from each other and connect to the battery with an ammeter to measure the current.

(a) (2 points) Draw the circuit of the "capacitor", battery, and ammeter.

(b) (2 points) As soon as you complete the circuit, the current is maximal and you measured it to be 1 A. What's the internal resistance of the battery?

(c) (2 points) What's the capacitance of your capacitor?

(d) (2 points) How much energy is stored in this capacitor?

Experiment 2:

After the capacitor is fully charged, you disconnect the battery. Now you increase the separation of the capacitor's plates to about 1 inch.

(e) (2 points) What's the new charge on the capacitor?

(f) (2 points) How much energy is stored in this capacitor?

(g) (2 points) And how much work did you do to separate the plates?

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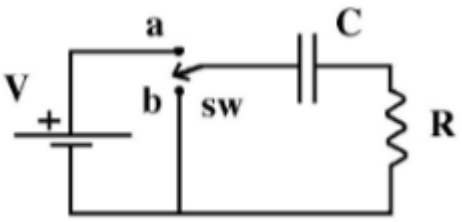
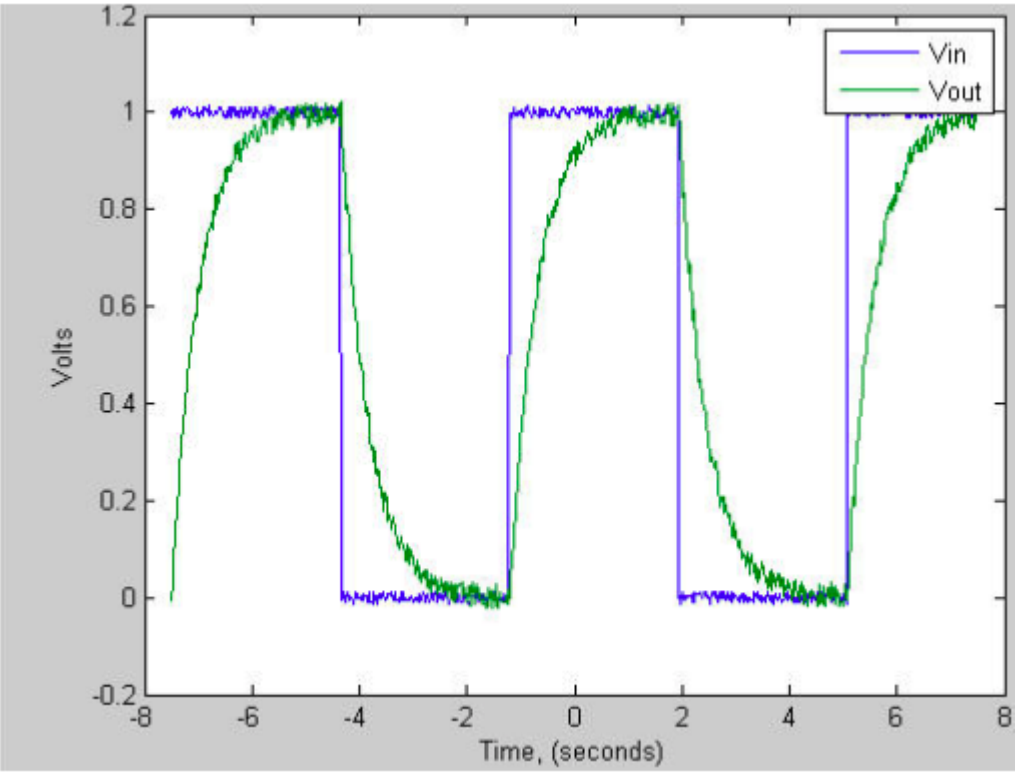
Question 20

[redacted]

Here is a circuit from your last studio. An electronic switch SW switches the connection every 3 seconds.



This results in the following voltage reading across the capacitor (green) and capacitor and resistor (blue):



(a) (4 points) use the graph to estimate the τ_{RC} constant for this circuit

(b) (2 points) if the resistor is 200 Ω, what is the capacitance?

(c) (6 points) What is the current through the resistor at 0.5 seconds after the switch is in A position? (0.5 seconds since the capacitor started charging)? (*Hint: 1/3 or 2/3 rule does not apply here. Remember that i = dQ/dt*)

exam 2 20.pdf (https://k-state.instructure.com/files/16951605/download)

[redacted]