Test_1,

James

Keep this exam **CLOSED** until advised by the instructor.

Fill out the bubble sheet: last name, first initial, student number, section number. Leave the code area empty.

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50 minute long closed book exam.

One 8.5 by 11 handwritten help sheet is allowed.

When done, hand in your **bubble sheet** and your **exam**.

Thank you and good luck!

Possibly useful constants:

- $c = 3.00 \times 10^8$ m/s
- $\epsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2
- $\mu_0 = 4\pi \times 10^{-7}$ Tm/A
- $e = 1.60 \times 10^{-19}$ C

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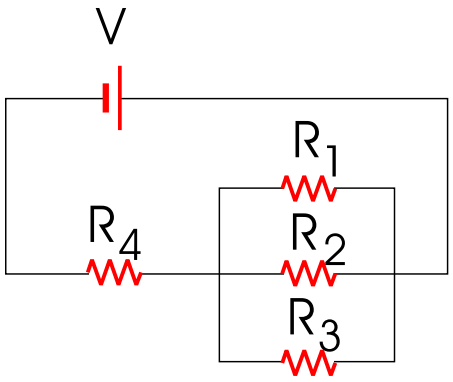
9 pt The average Sun-Earth distance is 149.5 million kilometers. How long does it take for the sunlight from the surface of the Sun to reach us here on Earth?
(in `min`*)*

1.A◯ 5.19 **B**◯ 6.07 **C**◯ 7.10
D◯ 8.31 **E**◯ 9.72 **F**◯ 1.14×10^1
G◯ 1.33×10^1 **H**◯ 1.56×10^1

10 pt Find the equivalent resistance of the circuit shown in the figure.



Assume that V = 30.5 V, R_1 = 15.7 Ω, R_2 = 8.19 Ω, R_3 = 4.58 Ω and R_4 = 18.8 Ω.
(in `ohm`*)*

2.A◯ 4.46 **B**◯ 5.58 **C**◯ 6.97
D◯ 8.71 **E**◯ 1.09×10^1 **F**◯ 1.36×10^1
G◯ 1.70×10^1 **H**◯ 2.13×10^1

3 pt An uncharged capacitor and a resistor are connected in series to a source of EMF. If ε = 4.08 V, C = 21.6 μF, and R = 136 Ω, calculate the time constant τ of the circuit.
(in `ms`*)*

3.A◯ 1.66 **B**◯ 2.21 **C**◯ 2.94
D◯ 3.91 **E**◯ 5.20 **F**◯ 6.91
G◯ 9.19 **H**◯ 1.22×10^1

3 pt

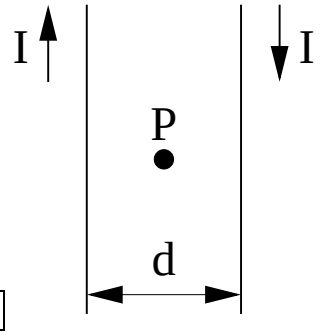
Calculate the maximum charge on the capacitor.
(in `uC`*)*

4.A◯ 9.48 **B**◯ 1.37×10^1 **C**◯ 1.99×10^1
D◯ 2.89×10^1 **E**◯ 4.19×10^1 **F**◯ 6.08×10^1
G◯ 8.81×10^1 **H**◯ 1.28×10^2

3 pt

Calculate the charge on the capacitor after one time constant.
(in `uC`*)*

5.A◯ 4.36×10^1 **B**◯ 4.93×10^1 **C**◯ 5.57×10^1
D◯ 6.29×10^1 **E**◯ 7.11×10^1 **F**◯ 8.04×10^1
G◯ 9.08×10^1 **H**◯ 1.03×10^2



9 pt
The two parallel wires shown in the figure carry currents of I = 9.36 A in opposite directions and are separated by a distance of d = 6.13 cm. Calculate the net magnetic field at point **P** midway between the wires. Use the direction out of the page as the positive direction and into the page as the negative direction in your answer.
(in `T`*)*

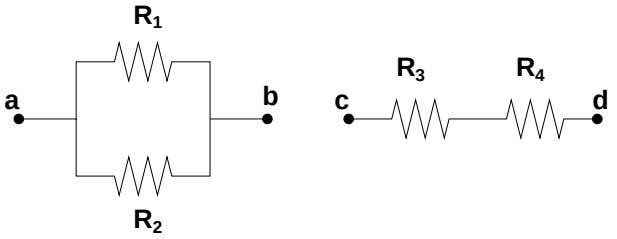
6.A◯ -3.66×10^{-4} **B**◯ -2.44×10^{-4} **C**◯ -1.22×10^{-4}
D◯ -6.11×10^{-5} **E**◯ 0.00 **F**◯ 6.11×10^{-5}
G◯ 1.22×10^{-4} **H**◯ 2.44×10^{-4}

9 pt The index of refraction for water is 1.33. What is the maximum angle inside this material at which a light ray can exit when the material is surrounded by air?
(in `deg`*)*

7.A◯ 1.10×10^1 **B**◯ 1.59×10^1 **C**◯ 2.31×10^1
D◯ 3.35×10^1 **E**◯ 4.86×10^1 **F**◯ 7.05×10^1
G◯ 1.02×10^2 **H**◯ 1.48×10^2

9 pt An AC adapter for a telephone answering machine uses a transformer to reduce the line voltage of 120 V to a voltage of 4.00 V. The RMS current delivered to the answering machine is 555 mA. If the primary (input) coil of the transformer has 1080 turns, then how many turns are there on the secondary (output) coil?

8.A◯ 20 **B**◯ 27 **C**◯ 36 **D**◯ 48
E◯ 64 **F**◯ 85 **G**◯ 113 **H**◯ 150



8 pt

Consider the sections of two circuits illustrated above. Select True or False for all statements.

▷ R_{cd} is always less than or equal to R_3.
9. **A**◯ True **B**◯ False

▷ R_{ab} is always less than or equal to R_1.
10. **A**◯ True **B**◯ False

▷ After connecting **a** and **b** to a battery, the voltage across R_1 always equals the voltage across R_2.
11. **A**◯ True **B**◯ False

▷ After connecting **c** and **d** to a battery, the current through R_3 always equals the current through R_4.
12. **A**◯ True **B**◯ False

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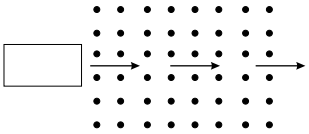
8 pt A square loop of wire with a small resistance is moved with constant speed from a field free region into a region of uniform B field (B is constant in time) and then back into a field free region to the right. The self inductance of the loop is negligible.



▷ When leaving the field the coil experiences a magnetic force to the left.
13. **A**◯ True **B**◯ False

▷ Upon entering the field, a counterclockwise current flows in the loop.
14. **A**◯ True **B**◯ False

▷ Upon leaving the field, a clockwise current flows in the loop.
15. **A**◯ True **B**◯ False

▷ When entering the field the coil experiences a magnetic force to the right.
16. **A**◯ True **B**◯ False

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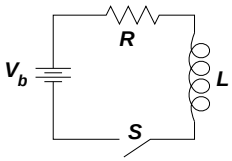
9 pt After the switch **S** is closed for a long time in the circuit shown in the figure, what is the energy stored in the inductor?



DATA: $V = 11.7$ V, $R = 101\ \Omega$, $L = 8.92 \times 10^{-1}$ H.
(in `J`*)*

17.**A**◯ 5.98×10^{-3} **B**◯ 7.48×10^{-3} **C**◯ 9.35×10^{-3}
D◯ 1.17×10^{-2} **E**◯ 1.46×10^{-2} **F**◯ 1.83×10^{-2}
G◯ 2.28×10^{-2} **H**◯ 2.85×10^{-2}

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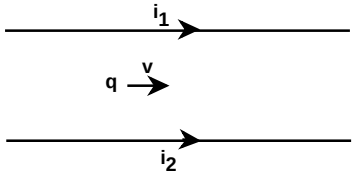
10 pt In the picture the two wires carry current i_1 and i_2, respectively, with positive current to the right. The charge q is positive and has velocity v to the right.



Select True or False for the following statements.

▷ If i_1 is less than i_2, then the force on q is to the bottom of the page.
18. **A**◯ True **B**◯ False

▷ If $i_1 = 0$ and i_2 is greater than zero then the force on q is to the bottom of the page.
19. **A**◯ True **B**◯ False

▷ If $v = 0$, then the force on q is zero.
20. **A**◯ True **B**◯ False

▷ If $i_2 = 0$ and i_1 is greater than zero, then the force on q points into the page.
21. **A**◯ True **B**◯ False

▷ If $i_1 = 0$ and i_2 is greater than zero, then the magnetic field near charge q points into the page.
22. **A**◯ True **B**◯ False

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10 pt An AC generator supplies an RMS voltage of 110 V at 50.0 Hz. It is connected in series with a 0.570 H inductor, a 6.70 μF capacitor and a 311 Ω resistor. What is the impedance of the circuit?
(in `ohm`*)*

23.**A**◯ 2.04×10^2 **B**◯ 2.96×10^2 **C**◯ 4.29×10^2
D◯ 6.23×10^2 **E**◯ 9.03×10^2 **F**◯ 1.31×10^3
G◯ 1.90×10^3 **H**◯ 2.75×10^3
