Physics 208 - Grading Sheet.

Dept. of Physics and Astronomy. TAMU.

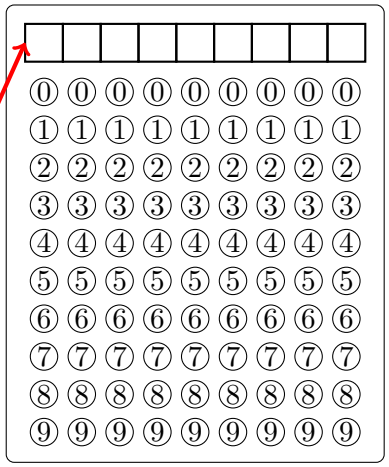
Marking Instructions

Fill oval completely ① ● ③ ④ ⑤

Erase cleanly ① ② ③ ④ ⑤

Students Fill Only this information

1. First Name: _____ Last Name: _____
2. Section: _____
3. Clearly hand-write your 9-digit UIN in the square boxes at the right.
4. Then fill out the bubbles below corresponding to the digits in the UIN.



Exam Information:

1. Fill whether this is exam 1, 2, 3 or the Final ① ② ③ Ⓕ

Graders Fill Only this information

List of Learning Objectives: mark only those objectives achieved.

1. ① ② ③ ④ ⑤	21. ① ② ③ ④ ⑤	41. ① ② ③ ④ ⑤	61. ① ② ③ ④ ⑤
2. ① ② ③ ④ ⑤	22. ① ② ③ ④ ⑤	42. ① ② ③ ④ ⑤	62. ① ② ③ ④ ⑤
3. ① ② ③ ④ ⑤	23. ① ② ③ ④ ⑤	43. ① ② ③ ④ ⑤	63. ① ② ③ ④ ⑤
4. ① ② ③ ④ ⑤	24. ① ② ③ ④ ⑤	44. ① ② ③ ④ ⑤	64. ① ② ③ ④ ⑤
5. ① ② ③ ④ ⑤	25. ① ② ③ ④ ⑤	45. ① ② ③ ④ ⑤	65. ① ② ③ ④ ⑤
6. ① ② ③ ④ ⑤	26. ① ② ③ ④ ⑤	46. ① ② ③ ④ ⑤	66. ① ② ③ ④ ⑤
7. ① ② ③ ④ ⑤	27. ① ② ③ ④ ⑤	47. ① ② ③ ④ ⑤	67. ① ② ③ ④ ⑤
8. ① ② ③ ④ ⑤	28. ① ② ③ ④ ⑤	48. ① ② ③ ④ ⑤	68. ① ② ③ ④ ⑤
9. ① ② ③ ④ ⑤	29. ① ② ③ ④ ⑤	49. ① ② ③ ④ ⑤	69. ① ② ③ ④ ⑤
10. ① ② ③ ④ ⑤	30. ① ② ③ ④ ⑤	50. ① ② ③ ④ ⑤	70. ① ② ③ ④ ⑤
11. ① ② ③ ④ ⑤	31. ① ② ③ ④ ⑤	51. ① ② ③ ④ ⑤	71. ① ② ③ ④ ⑤
12. ① ② ③ ④ ⑤	32. ① ② ③ ④ ⑤	52. ① ② ③ ④ ⑤	72. ① ② ③ ④ ⑤
13. ① ② ③ ④ ⑤	33. ① ② ③ ④ ⑤	53. ① ② ③ ④ ⑤	73. ① ② ③ ④ ⑤
14. ① ② ③ ④ ⑤	34. ① ② ③ ④ ⑤	54. ① ② ③ ④ ⑤	74. ① ② ③ ④ ⑤
15. ① ② ③ ④ ⑤	35. ① ② ③ ④ ⑤	55. ① ② ③ ④ ⑤	75. ① ② ③ ④ ⑤
16. ① ② ③ ④ ⑤	36. ① ② ③ ④ ⑤	56. ① ② ③ ④ ⑤	76. ① ② ③ ④ ⑤
17. ① ② ③ ④ ⑤	37. ① ② ③ ④ ⑤	57. ① ② ③ ④ ⑤	77. ① ② ③ ④ ⑤
18. ① ② ③ ④ ⑤	38. ① ② ③ ④ ⑤	58. ① ② ③ ④ ⑤	78. ① ② ③ ④ ⑤
19. ① ② ③ ④ ⑤	39. ① ② ③ ④ ⑤	59. ① ② ③ ④ ⑤	79. ① ② ③ ④ ⑤
20. ① ② ③ ④ ⑤	40. ① ② ③ ④ ⑤	60. ① ② ③ ④ ⑤	80. ① ② ③ ④ ⑤

Physics 208 – Comprehensive Exam

Spring 2017 (all sections) April 28th, 2017

Please fill out the information and read the instructions below, but
do not open the exam until told to do so.

Rules of the exam:

1. You have 120 minutes (2.0 hrs) to complete the exam.
2. Formulae are provided to you with the exam on a separate sheet. Make sure you have one before the exam starts. You may *not* use any other formula sheet.
3. Check to see that there are 10 numbered (five double-sided) pages containing blank pages for additional work if needed (pages 2 and 10), in addition to the scantron-like cover page. **Do not remove any pages**.
4. If you run out of space for a given problem, the last page has been left blank and may be used for extra space. Be sure to indicate *at the problem under consideration* that the extra space is being utilized so the graders know to look at it!
5. You will not be allowed to use calculators on this exam since all problems use symbols in their problem statements or the numbers have been chosen to make any required arithmatic calculations straight forward. If there are problems resulting in numerical answers you may leave them in fractional form.
6. **NOTE** that you **must** show your work clearly to receive full credit.
7. Cell phone use during the exam is strictly prohibited. Please turn off all ringers as calls during an exam can be quite distracting.
8. Be sure to put a box around your $\boxed{\text{final answer(s)}}$ and clearly indicate your work. Credit can be given **only** if your work is legible, clearly explained, and labelled.
9. All of the questions require you show your work and reasoning.
10. Have your TAMU ID ready when submitting your exam to the proctor.

Fill out the information below and sign to indicate
your understanding of the above rules

Name: _____ UIN: _____
(printed *legibly*)

Signature: _____ Section Number: _____

Instructor: Holt Mioduszewski Kocharovskya Rogagchev
(**circle one**)

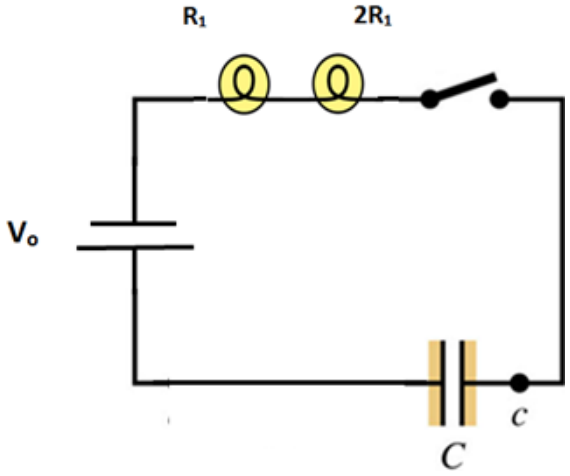
Intentionally left blank:

Short Answers:

A) Two light bulbs with resistances R_1 and $2R_1$ are in series with a capacitor C and a battery with voltage V_o. At time $t = 0$ a switch S is flipped to close the circuit.

i) The current drops to half of its initial value, what are the potential differences across resistor R_1 and across resistor $2R_1$?

ii) How much energy is stored in the capacitor at that instant?

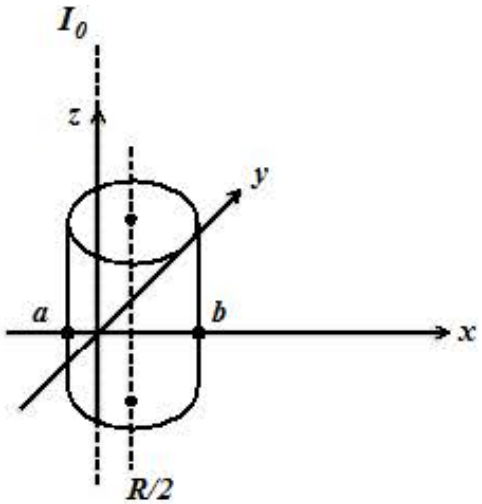


LO	S	U
40.1		
42.1		
44.1		
30.1		
39.1		

B) A long conducting wire lies along the z-axis and carries a current I_o , along the positive z-direction. A length L of the wire is enclosed by a cylindrical shell of radius R whose central axis is parallel to the z-axis but shifted a distance $R/2$ along the x-axis.

i) What are the magnetic field vectors $\vec{B}_a$ and $\vec{B}_b$ at the locations a and b shown in the figure?

ii) If the current is doubled, does the magnetic flux through the cylinder increase, decrease, or remain constant? Explain.

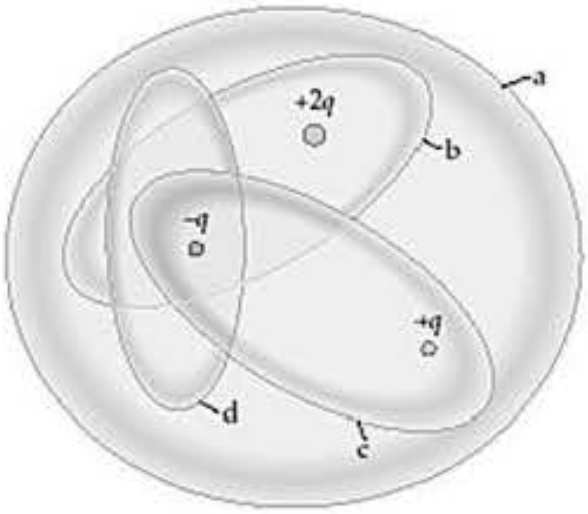


LO	S	U
1.1		
56.1		
57.1		
58.1		

C) The figure shows four Gaussian surfaces surrounding a distribution of charges. For the following questions, choose from Gaussian surfaces a, b, c, d.

i) Which Gaussian surfaces have a total electric flux of $+q/\epsilon_o$ through them?

ii) Which Gaussian surfaces have no total electric flux through them?

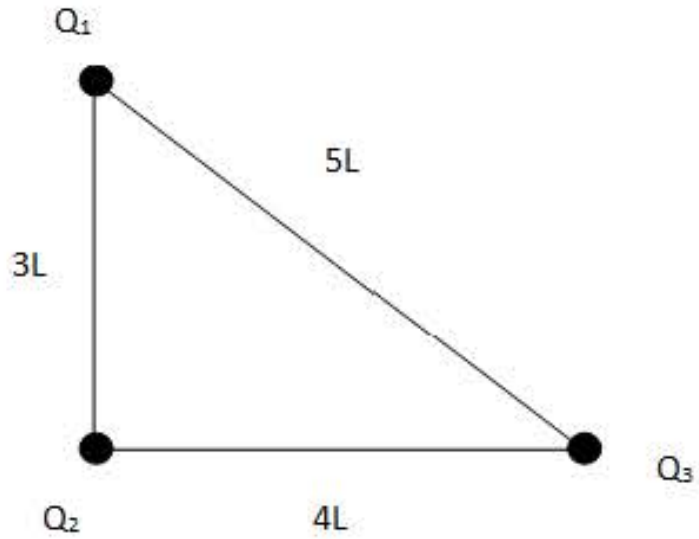


LO	S	U
16.1		
17.1		
16.2		
17.2		

D) Three positive point charges, Q_1, Q_2 and Q_3, are located on the corners of a right triangle as shown in the figure.

i) Find the force (magnitude and direction) exerted on charge Q_3 due to the other two charges.

ii) What is the value of the electric field (magnitude and direction) at the location of charge Q_3?



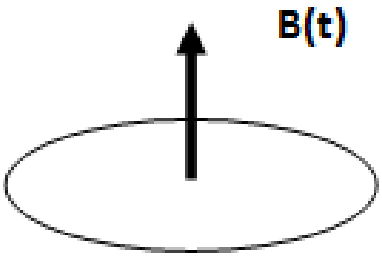
LO	S	U
1.2		
2.1		
10.1		
1.3		
2.2		
12.1		

E) A circular loop of wire of radius, r, lies in the xy plane and is subject to a spatially uniform but time-changing magnetic field,

$B(t) = (5.0\ \text{T} - (0.1\ \text{T/s}^2)\ t^2)$ in the z-direction.

i) Find the induced **EMF** produced in this loop.

ii) Indicate in the figure the direction that the induced current will flow under these circumstances.

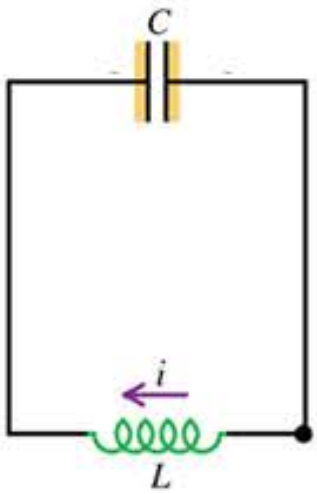


LO	S	U
58.2		
59.1		
60.1		

F) At $t = 0$ in the LC circuit shown below, the capacitor is uncharged and there is a current of I_{max} flowing clockwise in the circuit.

i) Find the maximum value of the charge that will appear on the capacitor.

ii) How long after $t = 0$ does it take for the capacitor to reach this value of charge for the first time?

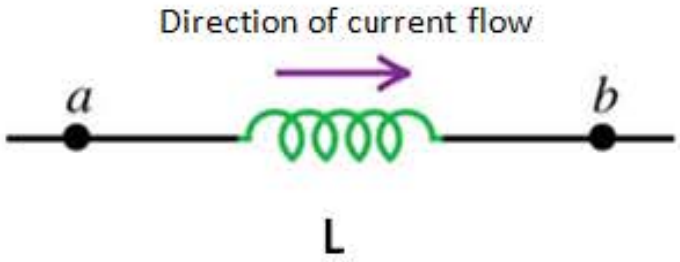


LO	S	U
68.1		
30.2		
70.1		

G) The current is changing as a function of time through an unknown inductor. When the current through the inductor is decreasing at a rate of 5.0 A/s, the voltage across the inductor is measured to be 20.0 V.

i) In terms of the quantities given, what is the value of the self inductance of this inductor?

ii) Indicate in the sketch which side of the inductor will be at the higher potential under these conditions.

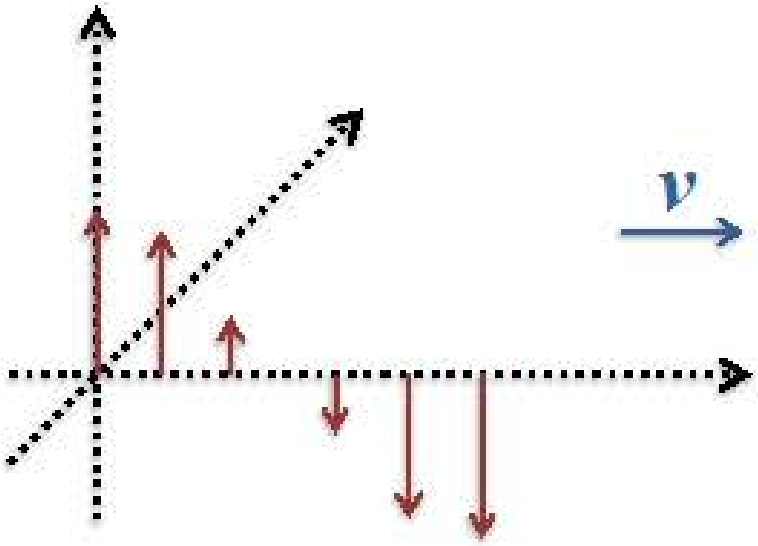


LO	S	U
67.1		
60.2		

H) The electric field components of a propagating electromagnetic wave are shown in the figure below at time t=0. The electric field is given by $\vec{E}(z,t) = E_o\ cos(kz - \omega t)\hat{j}$ at an arbitrary point in time and space along the line of propagation. The direction of propagation is labeled **v**.

i) On the figure below, label the x,y and z axes. Draw the magnetic field components of the electromagnetic wave at the same points where the electric field is shown.

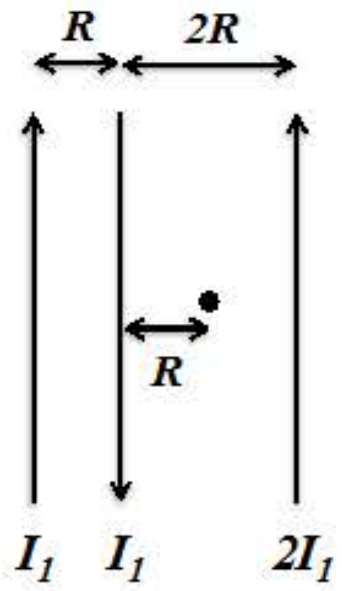
ii) Write down the expression for $\vec{B}(z,t)$ in vector notation.



LO	S	U
75.1		
76.1		
75.2		
1.4		
76.2		

Prob 1 Three very long current-carrying wires are aligned parallel with each other in the x-y plane. The left wire carries a current I_1 upward, the middle wire carries a current I_1 downward, and the right wire carries a current $2I_1$ upward.

(a) What is the magnitude and direction of the magnetic field halfway between the middle and right wires?



(b) What is the net force per unit length on the middle wire due to the other wires?

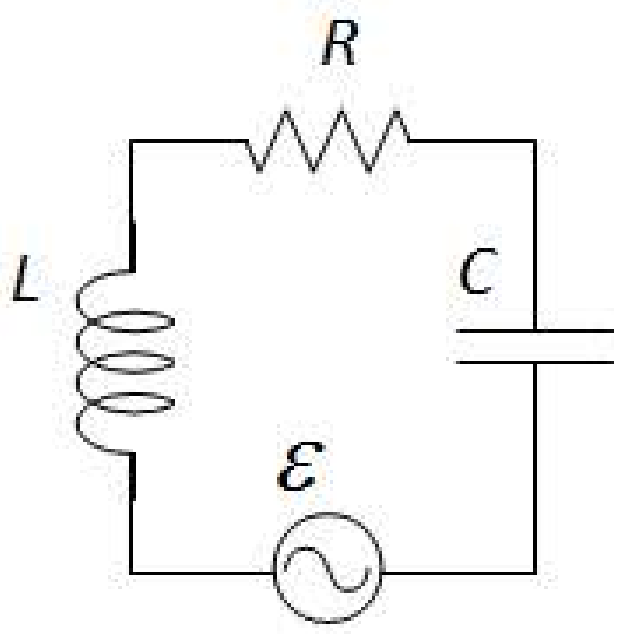
LO	S	U
2.3		
3.1		
48.1		
56.2		
57.2		
3.2		
55.1		

Prob 2 In the RLC circuit shown, the generator voltage can be represented by $\mathcal{E}\ (t) = \mathcal{E}_{\max}\ \ cos(\ \omega t + \phi)$. The values of the resistance R, peak generator voltage $\mathcal{E}_{\max}$, generator frequency ω and phase angle ϕ by which the generator EMF leads the current are known values **(L and C are not known)**.

(a) Find the peak current, $I_{\max}$, through this circuit in terms of the known values.

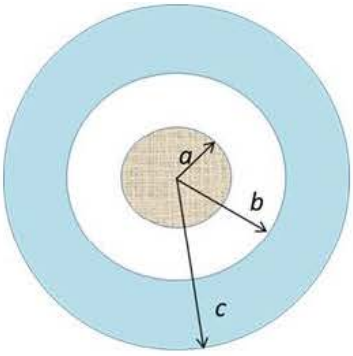
(b) What is the average power input for this circuit (again, in terms of the known values)?

(c) What would be the maximum current if the frequency, ω, is set to ω_o the resonant frequency?



LO	S	U
72.1		
3.3		
74.1		
73.1		

Prob 3 A dielectric sphere of radius a is uniformly charged with a negative electric charge $(-Q)$. A spherical *conducting metal shell* of internal radius b and external radius c is positively charged with a charge $2Q$ and is wrapped concentrically around the dielectric sphere, as shown in the figure.



(a) Calculate the electric field as a function of distance r from a center of the sphere for the following regions: (i) $a < r < b$, (ii) $b < r < c$, (iii) $r > c$.

(b) Sketch the electric field lines in all these four regions in the figure. In this same figure sketch at least 3 equipotential surfaces.

(c) Calculate the surface density of electric charge on the inner and outer surfaces of the metal shell.

(d) Suppose a point positive charge q is placed at the distance $2c$ from the center of dielectric sphere. Find the work done **by the net electric field** when this charge moves to the new position at the distance $3c$ from the center of dielectric sphere.

LO	S	U
18.1		
19.1		
8.1		
19.2		
20.1		
19.3		
14.1		
25.1		
8.2		
20.2		
3.4		
6.1		
22.1		
26.1		

Extra Space: