Physics 204– Practice Exam
for February 27, 2008
George Horton

Name: _____
I have read the instructions below.

Your name sticker

with exam code

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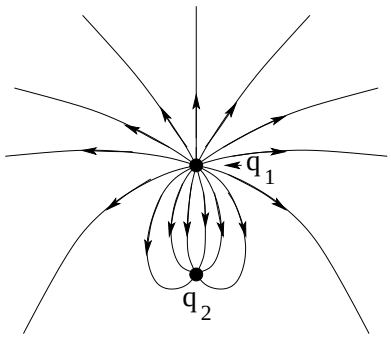
1. The exam will last from 9:40 to 11:00 P.M. Use a #2 pencil to make entries on the answer sheet. Enter the following id information now, before the exam starts.
2. In the section labelled NAME (Last, First, M.I.) enter your last name, then fill in the empty circle for a blank, then enter your first name, another blank, and finally your middle initial.
3. Under STUDENT # enter your 9-digit Rutgers ID number.
4. Enter 204 under COURSE, and your section number under SEC.
5. Under CODE enter the exam code given above.
6. During the exam, you may use a calculator and are allowed one $8\frac{1}{2} \times 11$ inch sheet of paper with whatever you want hand-written on it. Xeroxed or printed sheets are **not permitted** and will be confiscated.
7. The exam consists of 17 multiple choice questions. For each multiple choice question mark only one answer on the answer sheet. There is no deduction of points for an incorrect answer, so even if you cannot work out the answer to a question, you should make an educated guess.
8. Turn off any cell phone or other communication device, and pack it away in a place clearly inaccessible. You may not use your cell-phone as a clock or in any other way during the exam.
9. Before starting the exam, make sure that your copy contains all 17 questions. Raise your hand if this is not the case, and a proctor will help you. Also raise your hand during the exam if you have a question.
10. A proctor will check your name sticker and your student ID when you turn in the exam. Please have them ready.
11. You are not allowed to give help to any other student, ask for help from anyone but a proctor, or change your seat without permission from a proctor. Doing so will result in a zero score for the exam.
12. Please hand in the cover sheet and the answer sheet. You may take the rest of the exam with you when you leave.
13. Please sign in at the top to indicate that you have read and understood these instructions.
14. Some constants are given on the last page.

1. In the figure are shown the electric field lines for two charges separated by a small distance. Find the ratio q_1/q_2.



   a) $\frac{5}{2}$
   b) $-\frac{5}{2}$
   c) $\frac{3}{2}$
   d) $-\frac{3}{2}$
   e) -1

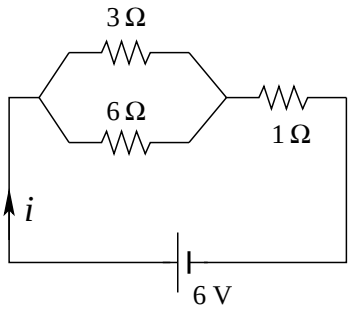
2. In the Bohr model of the hydrogen atom, an electron is at a fixed distance 0.51×10^{-10} m away from the proton, and moves in a circle around it. What are the magnitude and direction of the *electric field* due to the proton at the location of the electron?

   a) 5.54×10^{11} N/C, away from the proton
   b) 5.54×10^{11} N/C, towards the proton
   c) 2.77×10^{11} N/C, away from the proton
   d) 2.77×10^{11} N/C, towards the proton
   e) 5.54×10^{11} N/C, tangential to the electron's orbit

3. Two small metallic spheres are both charged. They are then briefly brought into contact

   a) If the initial force between them was repulsive, after touching each other the force between them may be repulsive or attractive.
   b) If the initial force between them was attractive, after touching each other the force between them is always repulsive.
   c) If the initial force between them was attractive, after touching each other the force between them may be repulsive or zero.
   d) Whatever the initial force existed between the charges, after touching each other, the force between them can never be zero.
   e) If after touching each other, the charges are brought back exactly to their original positions, the force between them will be unchanged.

4. In the circuit shown, find the current i.



a) 1 A
b) 5 A
c) 3 A
d) 2 A
e) 4 A

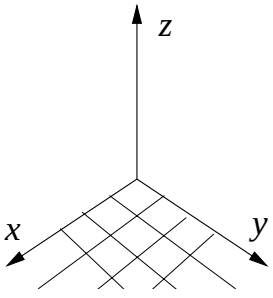
5. A parallel plate capacitor is attached to the terminals of a battery and charged. The battery is now removed and then the distance between the plates is doubled. The electric field between the plates is

a) doubled
b) halved
c) unchanged
d) multiplied by four
e) divided by four

6. When resistors are connected in parallel, we can be certain that

a) the same current flows in each one.
b) the potential difference across each is the same.
c) the power dissipated in each is the same.
d) the equivalent resistance is greater than the resistance of any one of the individual resistors.
e) the potential difference across the resistor nearest to the battery is always largest.

7. A proton moves perpendicularly to a uniform magnetic field $\vec{B}$ at a velocity of 1×10^7 m/s, and experiences an acceleration of 2.0×10^{13} m/s^2 in the $+x$ direction when its velocity is in the $+z$ direction. Find $\vec{B}$.



a) 0.021 T in the $-y$ direction
b) 0.021 T in the $+y$ direction
c) 0.21 T in the $+y$ direction
d) 0.21 T in the $-y$ direction
e) none of these

8. Two wires, each carrying a current I into the page, are located at opposite corners of a square of side r as shown. What is the magnitude of the magnetic field at the third corner, A.

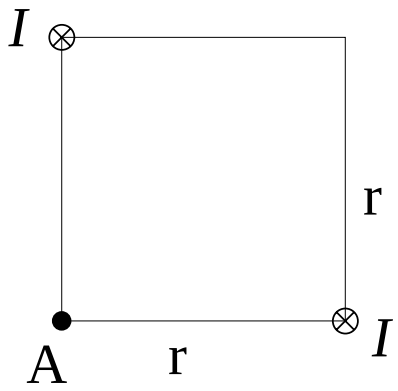
a) $\dfrac{\mu_0 I}{2\pi r}$

b) $\sqrt{2}\dfrac{\mu_0 I}{2\pi r}$

c) $2\dfrac{\mu_0 I}{\pi r}$

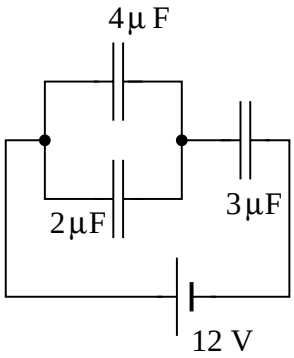
d) $\sqrt{2}\dfrac{\mu_0 I}{\pi r}$

e) $\dfrac{\mu_0 I}{\pi r}$



9. Find the equivalent capacitance of the group of capacitors shown, and find the charge on the 3 μF capacitor

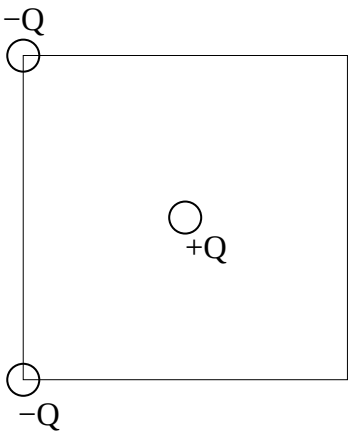
a) 2 μF, 24 μC
b) 2 μF, 2 μC
c) 4.3 μF, 5.2 μC
d) 4.3 μF, 2.7 μC
e) none of these



10. A point charge $+Q$ is placed at the center of a square, and a second point charge, of $-Q$, is placed at the upper left corner. It is observed that an electrostatic force of 2 N acts on the positive charge at the center.

Now a third charge, $-Q$, is placed at the lower left corner of the square. What are the magnitude and direction of the total force that now acts on the positive charge at the center?

a) zero
b) $2\sqrt{2}$ N, to the left
c) $2\sqrt{2}$ N, to the right
d) 4 N, to the left
e) 2 N, to the left



11. Electric field lines

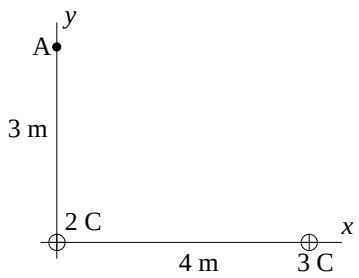
a) circle clockwise around positive charges.
b) circulate counterclockwise around positive charges.
c) radiate outwards from negative charges.
d) radiate outwards from positive charges.
e) are always closed loops.

12. A 60 W light bulb and a 100 W light bulb are connected in series so the same current flows through each bulb. If the total potential difference across the two bulbs is 120 V:

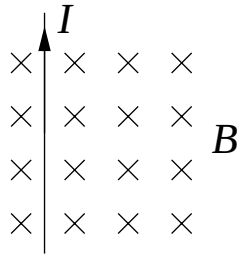
a) both bulbs are brighter than normal, with the 100 W bulb being brighter.
b) both bulbs are at normal brightness, with the 100 W bulb being brighter.
c) both bulbs are dimmer than normal, but the 100 W bulb is the brighter of the pair.
d) both bulbs are dimmer than normal, but they each have the same brightness.
e) both bulbs are dimmer than normal, but the 60 W bulb is the brighter of the pair.

13. Two charges of 2 C and 3 C are located on the x-axis as shown. What is the electric potential at the point A on the y-axis, in appropriate units?

a) $\frac{19}{15}k$
b) $\frac{27}{225}k$
c) $\frac{19\sqrt{2}}{15}k$
d) $\frac{27\sqrt{2}}{225}k$
e) none of these

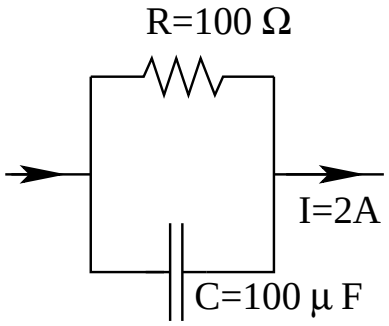


14. A wire, carrying a current I, is placed in a magnetic field as shown in the figure. The wire experiences a force



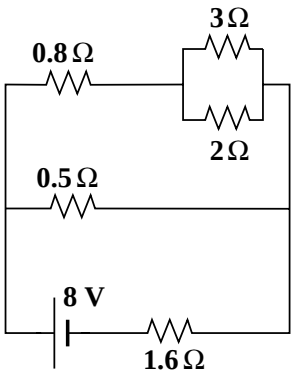
a) into the page
b) out of the page
c) to the left
d) to the right
e) no force at all

15. A steady current, I, flows through the circuit shown. How much charge is stored on a plate of the capacitor?



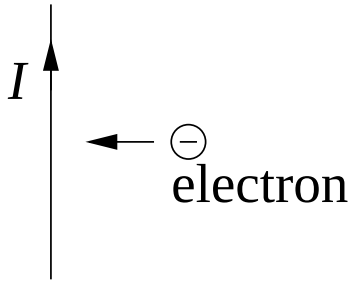
a) 2.0×10^{-4} C
b) Cannot be determined from the information given.
c) 2.0×10^{-2} C
d) 1.0×10^{-2} C
e) 0

16. In the circuit, the current flowing through the 1.6 Ω resistance is



a) 1.0 A
b) 2.0 A
c) 2.5 A
d) 4.0 A
e) 6.0 A

17. A current I flows in a wire up the page as shown. An electron is travelling to the left towards the wire.



a) The electron is undeflected.
b) The electron is deflected up the page.
c) The electron is deflected down the page.
d) The electron is deflected into the page.
e) The electron is deflected out of the page.

Some Constants

electromagnetic permittivity ϵ_0	8.854×10^{-12} C^2/N-m^2
electromagnetic constant $k_e \equiv \frac{1}{4\pi\epsilon_0}$	8.9875×10^9 N-m^2/C^2
magnitude of electron charge	1.602×10^{-19} C
electron mass	9.11×10^{-31} kg
proton mass	1.67×10^{-27} kg
magnetic permeability μ_0	$4\pi \times 10^{-7}$ T·m/A
speed of light in vacuum	2.998×10^8 m/s