

PHY202: Electricity, magnetism and light
Fall 2017 Test 1
No calculators.
Exam time: 50 minutes
Exam, Form: A

Name: _____

Student Number: _____

TA: _____

Date: _____

Section 1. Matching of scientific terms and concepts (4 pts.)

- | | |
|-------------------|---|
| _____ kosmos | (a) a thing that is created skillfully and inventively to serve a particular purpose |
| _____ impart | (b) a typically black or blackish mineral that occurs as prismatic crystals in granitic and other rocks |
| _____ endow | (c) make (information) known; communicate |
| _____ appreciable | (d) provide with a quality, ability, or asset |
| _____ artificer | (e) large or important enough to be noticed |
| _____ engross | (f) someone who supports a particular party, person, or set of ideas |
| _____ tourmaline | (g) denoting a type of fracture in a solid (such as flint or quartz) that results in a smooth rounded surface resembling the shape of a scallop shell |
| _____ fillet | (h) covered thinly with gold leaf or gold paint |
| _____ leisure | (i) absorb all the attention or interest of |
| _____ gilt | (j) a skilled craftsman or inventor |
| _____ progeny | (k) a chemical compound that neutralizes or effervesces with acids and turns litmus |
| _____ conchoidal | (l) a descendant or the descendants of a person, animal, or plant; offspring |
| _____ contrivance | (m) inborn; natural |
| _____ alkali | (n) the universe seen as a well-ordered whole |
| _____ innate | (o) time of rest from labor |
| _____ adherent | (p) a concave strip of material roughly triangular in cross section that rounds off an interior angle between two surfaces |

Section 2. Multiple choice (5 pts.)

1. Consider a cubical box. Four identical positive charges are placed at the top corners of the box. Four identical negative charges are placed at the bottom corners of the box. A negative charge is placed at the center of the box. The net force on the charge at the center is directed
 - (a) straight upwards
 - (b) straight downwards
 - (c) toward one of the side faces of the box
 - (d) it depends on the value of the charge at the center
 - (e) it depends on whether the top or bottom charges are stronger
2. Which of the following objects has a non-zero capacitance?
 - (a) a Muschenbrook bottle filled with water
 - (b) two thin parallel sheets of aluminum foil separated by a mylar film
 - (c) an aluminum sphere suspended from a silk thread
 - (d) a person standing on a wax sheet
 - (e) all of the above
3. Two nearby wires carry electrical currents in opposite directions. The repulsive force between the wires is F . If the current in both wires is doubled and the distance between them is also doubled, then the repulsive force
 - (a) is doubled
 - (b) is quadrupled
 - (c) is halved
 - (d) remains the same
 - (e) becomes attractive
4. A 1000 pound weight is placed on one end of a one-meter long straight lever. This weight must be lifted at a constant speed with a 250-pound force. Where might the fulcrum be placed so as to accomplish this task?
 - (a) 20 cm from the heavy weight
 - (b) 25 cm from the heavy weight
 - (c) 40 cm from the heavy weight
 - (d) 55 cm from the heavy weight
 - (e) none of the above
5. A long copper wire connects the positive and negative terminals of a car battery. The wire is oriented in the north-south direction. The north-most end of the wire is connected to the copper terminal of the battery; the south-most end is connected to the zinc terminal. If a compass needle is suspended directly below the wire, and the battery is switched on, the end of the needle that had been facing northwards deflects
 - (a) eastward
 - (b) westward
 - (c) downward
 - (d) upward
 - (e) none of the above

Section 5. Charge collision problem (5 pts.)

Suppose that a tiny charged particle of charge q_1 and mass m_1 , is fixed at a location $x = 0$ inside a long narrow tube. Both the tube and the charge are immobile. A second charged particle of charge q_2 and mass m_2 is fired down the tube towards the first particle. The initial position of particle 2 is $x = L$ and its velocity is v . (The tube prevents the particles from deflecting sideways, but otherwise has no effect on the charges.)

1. What is the initial kinetic energy of particle 1? Particle 2?
2. Write down a mathematical formula for the force acting on charge 2 as it is approaching charge 1.
3. What happens to the speed of particle 2 as it approaches particle 1? Will it ever come to a complete stop? If so, what happens to charge 2 *after* it has come to a complete stop?
4. What is the distance of closest approach that particle 2 gets to particle 1? You may write your answer in terms of the variables provided. Will the charges ever strike one another?
5. Will charge 2 ever get back to its original speed? If so, at what location inside the tube?

Section 6. Laboratory essay

Answer the following questions clearly and concisely. Use neat handwriting and correct grammar and punctuation.

1. (3 pts.) Consider the laboratory experiments you have carried out thus far this semester. Now carefully describe a specific way in which you would make one of your experiments better. I am looking for some insightful ideas regarding techniques, strategies, methods, or goals. Explain carefully how this change would likely affect your results or conclusions. (You will get no credit for simply stating that you would collect more data.)