Institute of Linguistics LIN1063/Phy/May07

Time: 1 hour

LC 1063 Academic Reading & Writing (Physics) End of Semester Test

1. Draw up a reference list in the format prescribed by Faculty of Science, Department of Physics, for the following three items:

A.	**MOEMS: Micro-opto-electro-mechanical Systems** **M. Edward Motamedi** Rockwell Science Center, Thousand Oaks, California ISBN-10: 0819450219 ISBN-13: 978-0819450210 First published 2006 Reprinted 2007 © 2006 Kimberly Physics Inc. 200 W56 St Chicago Illinois 60606
B.	**American Journal of Physics** March 2007 Volume 75 pages 216-219 Published by the American Association of Physics Teachers **Optical Doppler Shift Movement Using A Rotating Mirror** Luis Bernal Luis Bilbao *Physics Department, Faculty of Sciences, University of Mar del Plata, Argentina*.
C.	**Active Galaxies: Quasars** page 25 last updated 6/1/2006 Eric Lentz, and Raphael Hix Department of Physics & Astronomy, University of Tennessee, Knoxville, TN 37996, USA http://csep10.phys.utk.edu/astr162/lect/active/quasars.html

2. Edit the following sentences by underlining any errors and correcting them:

2.1 Atoms can make transitions between the orbits allowed by quantum mechanics' by absorbing or emit exactly the energy difference between the orbits.

2.2 This allows us to construct and study many new kind of Hamiltonians that would previously be ignored.

2.3 Quantum mechanics is an association between states in a mathematically Hilbert space and experimental measurable probabilities.

2.4 Researchers have found by the early 1930s that the Townsend mechanism was unable to predict the breakdown processes at atmospheric pressure and on distances over 1 cm.

2.5 Due to impact ionization, the initial seed starts growing. If that were the only mechanism, the space charge neutrality remains unchanged.

3. <u>Edit/Proof read</u>, to the point marked END OF EDITING/PROOF READING TASK, the following adapted excerpt from an article by M. Arrayas and J. L. Trueba [*] about electrical breakdown and streamer discharges, so that it is written in a suitably academic tone. <u>Underline and number</u> those parts of the text that require alteration/elimination and <u>write out</u> the revised parts in the space provided below the passage.

Abstract Physical principles of electrical breakdown are talked about in this article. The phenomena of streamer formation and spontaneous branching are studied in terms of a fluid description based on kinetic theory. Particular attention is paid to a minimal model which is suitable for non-attaching gases. The reader gets evidence that anode directed fronts can branch because of a Laplacian instability. Finally an electric shielding factor is introduced which allows us to extend previous results to curved geometries.

1. Introduction

Benjamin Franklin suspected that lightning was an electrical current in nature, and he wanted to see if he was totally right. One way to test his idea was to see if lightning would pass through metal. He decided to use a metal key and looked around for a way to get the key up near the lightning. He used a child's toy, a kite, to prove that lightning is really a stream of electrified air, known today as plasma. His famous stormy kite flight in June of 1752 led him to come up with many the terms that you and I still use today when we talk about electricity: battery, conductor, condenser, charge, discharge, uncharged, negative, minus, plus, electric shock and electrician.

A cubic centimetre of air contains more or less 2.7×10^{19} molecules of oxygen (O_2), nitrogen (N_2), water vapour (H_2O) and some other gases. The charged particles are stuck together by powerful electric forces to form electrically neutral atoms and molecules, and as a result air is an excellent insulator. If we apply an electric field to a volume filled with neutral particles, electric current will not flow through the stuff, because there are no charged particles present. However, if a strong electric field is applied to matter of low conductivity and some electrons or ions are created, then the few charges that are moving around can generate an avalanche of more charges by impact ionization. A low temperature plasma is created, resulting in an electric discharge. The change in the properties of a dielectric that causes it to become conductive is known as electrical breakdown. Breakdown is essentially a threshold process. No changes in the state of the medium are noticeable for some time while the electric field from one side to the other of a discharge gap is gradually increased. Suddenly, at a certain value of the field, instruments detect a current and even a flash can be observed.

END OF EDITING/PROOF READING TASK

In the following part of the text <u>select</u> the correct answer by underlining, if a choice is provided. If no choice is given, <u>supply</u> an appropriate <u>single-word expression</u>.

Discharges are non-equilibrium processes that occur in initially non-ionized matter **(1) _____ (opened; exhibited; subjected; exposed)** to a strong electric field. Understanding the basic mechanisms of an electric discharge is a challenging problem involving ideas from non-equilibrium thermodynamics, atomic physics, electromagnetism and pattern formation. Discharges can **(2) _____ (put on; take up; configure; assume)** many different modes of appearance depending on the spatial and temporal characteristics of the electric field and on the ionization and charge transport properties of the medium. Phenomenologically, discharges can be classified into stationary ones, such as arc, glow or dark discharges, and transient ones, such as sparks and leaders [1]. The distinctions among the various discharge phenomena seem to vary among authors.

1.1 Townsend mechanism

In 1889 F. Paschen **(3) _____ (found; had found; has found; was finding)** empirically that the breakdown characteristic of a gap is a function of the product of the gas pressure and the gap length. Paschen's law is usually written as $V=f(pd)$, where V is the voltage **(4) _____ (over; on; across; between)** the gap, p is the pressure and d is the **(5) _____ (gap; gap's; gaps'; gapping)** distance.

Townsend managed to explain this observation. He studied the variation of the electrical current between two parallel plate electrodes filled with gas. The electrodes' separation and gas pressure were typically of one centimetre and one atmosphere. A high voltage was applied between the electrodes and some initial electrons were produced by illumination of the cathode with a UV **(6) _____ (producer; exuder; source; material)**. The current in the circuit was measured for varying voltages. **(7) _____ (In the beginning; At the start; First; Next)** there was a proportional increase in the current as the result of photoelectrons drifting towards the anode. Then, there was a range of applied voltages in which the current was constant, as the field was strong enough to enable all the liberated electrons to reach the anode, but too weak to cause any multiplication of electrons by ionization of the gas. Finally, for higher voltages, there was exponential growth. Townsend related this increase of the current to ionization of the gas by electron collisions.

Defining N as the number of electrons at distance z from the cathode, after one mean free path for ionization λ_i, an electron produces on average one electron–ion pair. **(8) _____ (However; So; In contrast; Albeit)** the increase in the number of electrons that can be expected in any slab of gas of thickness dz is

$$\mathrm{d}N = N\alpha\mathrm{d}z\,, \qquad (1)$$

where the inverse of the ionization mean free path $\alpha = 1/\lambda_i$ is called the ionization coefficient. Integrating equation (1), yields $N = N_0\exp(\alpha z)$, where N_0 is the number of electrons at the cathode. **(9) _____ (Resultingly; It results that, Due to this result; As a result),** the electron and positive ion populations grow exponentially with distance. This **(10) _____ (process; phenomena; system; principle)** is called an electron avalanche.

[*] Had this test not contained a reference task, the appropriate references accompanying the excerpted article would have appeared here.