PROCESSO SELETIVO – TURMA DE 2013

FASE 1 – PROVA DE INGLÊS

NOME: ____

ASSINATURA: ____

Você está recebendo um trecho do livro *Fundamentals of Optics and Modern Physics*, de H. D. Young. Este texto corresponde à seção 1 do Capítulo 13, *Fundamental Particles*.
Após a leitura deste texto, responda em português às perguntas apresentadas, em estrita concordância com o que está expresso no texto pelo autor. É permitida a consulta a dicionários.

Questão 1

Qual o significado do termo *átomo* utilizado pelo autor neste texto?

Questão 2

Quando a primeira partícula constituinte de um átomo foi identificada, e quem realizou a experiência que concluiu definitivamente por sua existência?

Questão 3

Que esforço foi realizado entre aproximadamente 1920 e 1930 pelos físicos?

Questão 4

Qual era a sensação preponderante entre os físicos atômicos ao final da década de 1930?

Questão 5

O que era conhecido a respeito da estrutura do núcleo por volta de 1930?

Questão 6

Cite alguns dos problemas mencionados pelo autor como sendo as perguntas fundamentais da física nesta época (1930).

Questão 7

O que a estabilidade dos núcleos sugeria?

Questão 8

Quais eram os "mistérios" da física de partículas nos anos 1900, 1930 e 1960?

Fundamental Particles, H. D. Young

ATOMIC VIEW OF MATTER

The word *atomic* is derived from two Greek words meaning *not divisible*. In this section, *atomic* is used not in the narrow sense of atoms as the smallest units of chemical elements but in a broader sense, as a representation of all matter, including the constituents of nuclei, in terms of fundamental building blocks. The atomic concept is a very ancient one, having been stated by the Greek philosophers Leucippus and Democritus in about 400 B.C. Since that time, the atomic concept has played a central role in attempts to understand the behavior and structure of matter.

During the nineteenth century, evidence for the existence of atoms and molecules grew so overwhelming that it was no longer possible to debate their existence, and it was established beyond doubt that atoms and molecules are the smallest units of chemical elements and compounds, respectively, that can exist. During the opening years of the present century it became clear that atoms of an element are not indivisible but have internal structure, implying that there are still more fundamental building blocks of which atoms are made. The first to be identified positively was the *electron*; its existence was suspected as early as 1870 and was established conclusively by the fundamental experiments of J.J. Thomson in 1897. By the mid-1930s the existence and most important properties of the proton, neutron, and positron had been put on an equally firm footing.

In the furious development of physical theory which took place in the 1920s and early 1930s, the preponderance of effort was directed towards applying the newly discovered quantum-mechanical principles to these particles in an effort to understand phenomena pertaining to atomic and molecular structure, such as energy levels, specific heats, and so on. By 1930, it appeared that the problems of *atomic* physics were essentially solved, inasmuch as the new quantum mechanics was believed to provide all the necessary principles. At this point, then, the atomic physicists could rest on their laurels, confident that all that remained was to clean up calculational details.

With respect to the structure of nucleus, however, the problems were far from solved. In fact, in 1930 virtually nothing was known about details of nuclear structure. It was known that the dimensions of nuclei are smaller by a factor of 10^5 than those of atoms and that energies associated with interactions of nuclear particles are larger by the same factor, but there was virtually no understanding of the nature of the interaction by which the nuclear particles were held together.

Even more profound problems loomed on the horizon. What is the nature of the interactions of fundamental particles? Classical physics provides only two basic interactions, electromagnetic and gravitational. The stability of nuclei suggests the existence of another strong interaction between nuclear particles. Does this third kind of interaction complete the list, or are there still others, waiting to be discovered? What about the masses of the particles? Why should there be two particles, one charged and one neutral, with approximately equal masses, and a third with opposite charge and much less mass? Should a complete theory be able to *predict* these masses? What is the status of the *photon*, the quantum of electromagnetic radiation? Should it be classified as a fundamental particle? If so, how can one understand the fact that photons can be created and destroyed in atomic processes, while the other particles seem to have a permanent existence?

In summary, while the main features of atomic structure were well understood by 1930, the corresponding problems of nuclear structure had just begun to be investigated. And there was not even the beginning of a comprehensive theory of fundamental particles that would enable the prediction of masses and other properties of the particles and the nature of their interactions. In short, the mystery of atomic structure in 1900 has its counterparts in the mystery of nuclear structure in 1930 and the mystery of the properties and interactions of fundamental particles in the mid-1960s. Some of the questions raised in the preceding paragraphs have been answered fairly completely by subsequent investigations; other remain only partially answered or completely unanswered. Thus the discussion of fundamental particles and their interactions takes us to one of the present-day frontiers in theoretical physics.

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