

Prova de Seleção 2012

ATENÇÃO!

Instruções para realização da prova

- a) Deixe todos os seus objetos pessoais aos cuidados dos fiscais de prova
- b) Não inicie a prova antes de autorizado
- c) A prova terá duração máxima de 3 horas, a partir da autorização de início
- d) Não é permitido nenhum tipo de consulta, seja a material impresso, eletrônico ou a outras pessoas
- e) Não identifique nenhuma das folhas com pelo seu nome ou qualquer número de identidade. Você será identificado em lista de presença separada
- f) Identifique TODAS as folhas APENAS com o seu **código de candidato**, a ser informado antes do início das provas
- g) Qualquer violação a estas instruções resulta em desclassificação imediata do candidato

After reading the article below, choose the best answer to each of the **ten questions**. Answer all questions based **only on what is stated or implied in the article**

Inspirational Chemistry

H. Gray and J. Labinger

Science 2011, 331:1365

Throughout 2011, nations are celebrating the International Year of Chemistry. This worldwide recognition of the importance of chemistry is somewhat unusual. It is true that chemistry has been called “the central science,” not only by chemists but even in Wikipedia (of course, that article may have been written by a chemist), perhaps as a metaphor for its role in connections between the fundamental concepts of physics and the practical problems of biology. Furthermore, it is the discipline that will continue to drive the discoveries that tackle today's most vexing challenges: solving the energy problem, developing and producing new treatments for diseases, devising advanced materials for a host of applications, and many more. It seems most appropriate to talk of chemistry as overlapping, rather than bridging, other disciplines. And most certainly it is time to celebrate the creative future of chemistry, which lies in myriad directions.

So why does chemistry often take a back seat to other sciences? Traditionally (for most of the 20th century, at least), the paradigmatic face of science in the public view was physics; more recently, biology appears to be sharing (or even taking over) that role. Curiously, chemistry has never been able to claim a comparable place in the sun. Some people have argued that chemistry is ultimately reducible to physics; others, that chemistry is merely technology, a collection of enabling methodologies, posing no deep questions and offering no profound meaning. Although chemistry unquestionably has its own eloquent spokespersons, few if any are household names—counterparts to the likes of Stephen Hawking, Carl Sagan, or Stephen Jay Gould. The grand themes that attract

so much interest to physics and biology—the origin of the cosmos, the workings of life, a theory of everything—are not so widely recognized in chemistry. Why is this so, inasmuch as almost everything is chemistry?

We suggest that the noble themes in chemistry are there, but may be a little harder to see. One can look outward to the universe, or inward to the mind, and recognize the complexity and profundity of the questions to be answered. The problems that contemporary chemistry tackles are just as fundamental, but may not be as immediately obvious to the non-chemist. We could illustrate this claim in many ways, but perhaps one has received the broadest sustained attention: photosynthesis. How can light be harvested and converted to electrochemical energy that is sent off so efficiently in two directions: to both reductively generate the building blocks of life from carbon dioxide and oxidize water to oxygen? This extraordinarily complex question, to be sure, is closely linked to aspects of both physics (but cannot be completely reduced to physics) and biology; but the answer clearly lies in the realm of chemistry. And the workings of each individual component, as well as the entire integrated system that nature has constructed, pose questions that are fully as deep and inspirational as those in any other field of science. Moreover, on the practical side, the answers will be needed to devise methods for making comparably effective use of solar power, which at present appears to be the only resource of sufficient magnitude to cope with the world's long-term energy needs.

With a solution to this problem, we could not only stop turning all the fossil fuels generated by billions of years of natural photosynthesis into carbon dioxide, but even begin to reverse the process. Let's take this International Year of Chemistry as a call to focus on such grand visions. By turning up the power of fundamental research to address daunting challenges, this could well become the Century of Chemistry.

Question 1:

The author focuses primarily on...

- (A) the role of chemistry as a science that links physics and biology
- (B) how chemistry could be reduced to physics in order to contribute to biology
- (C) the reasons why chemistry is not as popular as other sciences
- (D) how chemistry develops technology that are used as methodologies in other sciences
- (E) the importance of the International Year of Chemistry to the worldwide community of scientists

Question 2:

Which of the following statements about the role of chemistry as a science is accurate?

- (A) Chemistry is the leading science in the development of energy efficient technology
- (B) Even without integration with chemistry, physics and biology may be able to answer complex questions
- (C) Chemistry is important because it interacts and contributes to both physics and biology, therefore participating in development of important scientific concepts
- (D) Challenging scientific questions in biology and physics, such as photosynthesis, were already answered by chemists
- (E) Because chemistry is complex, other fields of science have attracted more attention

Question 3:

It can be inferred from the passage about the problems faced by chemistry that...

- (A) without a deep understanding of chemical concepts, biologist would have never described photosynthesis
- (B) only chemists are able to fully grasp the magnitude of the challenge behind the scientific questions that they tackle
- (C) chemists still do not fully understand the process of photosynthesis
- (D) photosynthesis is the most fundamental problem in chemistry
- (E) the International Year of Chemistry celebrates the solution of the most important question in chemistry: photosynthesis

Question 4:

According to the author, "chemistry often takes a back seat to other sciences" because...

- (A) the public has been misled into the belief that physics and biology are more important
- (B) chemistry can be reduced to physics in a small scale
- (C) questions in chemistry are not complex or have limited importance
- (D) most popular science communicators have no background in chemistry
- (E) paramount questions in chemistry are implicit in major scientific problems, which overlap with other fields

Question 5:

The author implies which of the following about energy issues?

- (A) Scientific advances in chemistry could enable not only the reduction of carbon emissions, but also to sequester carbon from the atmosphere
- (B) Lessons learned by chemists on describing the photosynthesis process make them the best candidates to solve the energy related issues
- (C) Chemists use energy in a more efficient way than scientists of other fields
- (D) Chemistry holds the answers to the methodological challenges of developing cutting-edge solar power technology
- (E) Emerging energy requirements are increasing because policy makers are unaware of technological achievements in the field of chemistry

Question 6:

It can be inferred from the passage that the recognition of chemistry's merit in scientific discoveries would be strengthened if which of the following were found to be true?

- (A) Chemists successfully develop technological innovation that solves energy related problems
- (B) General acknowledgment that most complex scientific questions and important discoveries are interdisciplinary
- (C) The celebration of the International Year of Chemistry takes place at a developing nation, where the general public tends to know less about recent achievements in the field of chemistry
- (D) Eloquent spokespersons, such as Stephen Hawking, Carl Sagan and Stephen Jay Gould, start writing about major breakthroughs in chemistry
- (E) People stop arguing that chemistry is reducible to physics, or merely an assembly of highly technological methods

Question 7:

It can be inferred from the passage that "to cope with world's long-term energy needs" it is necessary to...

- (A) support projects on research and engineering that aims to create ultra-efficient technology to convert sunlight into other forms of energy that could be used by humans
- (B) recognize the place of chemistry among the most important scientific fields
- (C) create an international multidisciplinary effort, integrating physics, biology and chemistry, to increase the efficiency of fossil fuels
- (D) use photosynthesis to oxidize water to oxygen in a worldwide scale
- (E) reverse the natural photosynthetic process, which has been operating on carbon dioxide during several billions of years

Question 8:

According to the author, the “worldwide recognition of the importance of chemistry is somewhat unusual” because...

- (A) Wikipedia articles on chemistry are usually written by chemists, therefore the international recognition may be flawed
- (B) only chemists recognize the importance of chemistry, while the general public believes it is not important, which is paradox to the International Year of Chemistry
- (C) although chemistry is considered an important scientific discipline, scientific questions that attract most of attention are usually not attributed to chemistry
- (D) the worldwide recognition is, in fact, an acknowledgment of the links between chemistry and other sciences, such as physics and biology
- (E) only developed nations, which are at the frontier of science, recognize the importance of chemistry, therefore the recognition is not as widespread as chemists believe

Question 9:

The author implies that “this could well become the Century of Chemistry” if...

- (A) chemistry strengthen its connections with fundamental concepts in physics and practical problems in biology
- (B) chemists, working together with focus on long-term ambitious goals, manage to solve complex problems with practical implications, such as clean energy technology
- (C) celebrations of the International Year of Chemistry successfully advertise the importance of chemistry as a science
- (D) chemists continue working on developing and producing new medical treatments, and devising advanced materials for host applications
- (E) scientific communicators recognize internationally the major achievements of chemistry

Question 10:

According to the author, the process of converting light into electrochemical energy is...

- (A) simultaneously related to both physics and biology, although fully understood only under the scope of chemistry
- (B) achieved only through photosynthesis
- (C) requires two directions: carbon dioxide and oxidize water to oxygen
- (D) needs to be studied from two directions: chemistry and physics
- (E) an extraordinarily complex questions that has never been answered by physicists, biologists or chemists