

# Fastest View of Molecular Motion

## A. Vocabulary I – Revision

*There is a list of expressions from the text that you are supposed to be familiar with. Revise that vocabulary and make sure that you really know what the expressions mean.*

|            |                 |             |                |           |
|------------|-----------------|-------------|----------------|-----------|
| motion (n) | observation (n) | state (n)   | release (v)    | x-ray (n) |
| effect (n) | behave (v)      | involve (v) | researcher (n) | equal (v) |

## B. Vocabulary II – New Expressions

*Can you explain the following expressions? Ask your colleague if you are in doubt.*

|                 |               |               |              |
|-----------------|---------------|---------------|--------------|
| rely on (v)     | timescale (n) | devise (v)    | essence (n)  |
| provide (v)     | rip away (v)  | encode (v)    | burst (n)    |
| devise (v)      | pulse (n)     | draw back (v) | underpin (v) |
| stringent (adj) | accuracy (n)  | insight (n)   | fire (v)     |

## Reading activities

### A. Scanning

*Read the text quickly and try to answer the following question:*

1. What was the timescale that the researchers watched molecules on?
2. What molecules and/or what parts of molecules did they observe?

### B. Comprehension I:

*Read the text again and answer the questions below:*

1. What material did the researchers use when they were trying to observe motion in a molecule?
2. What instrument was used at the experiment?
3. In the experiment – where exactly did the researchers find the information about the motion of protons in a molecule?

### C. Comprehension II:

*Re-read the text and make questions for the following answers.*

1. In the journal Science.
2. Within x-rays released after re-collision.
3. It will help scientists understand how molecules behave in chemical processes.
4. Quantum computing.

## **D. Vocabulary Building**

*Give the English equivalents of the following Czech expressions:*

1. provádět pozorování
2. vynalézt novou techniku
3. uvolnit rentgenové paprsky
4. účinek na pohyb protonů v molekule
5. řízení chemických reakcí
6. provádět testování
7. jedna atosekunda se rovná miliardtině miliardtiny sekundy
8. pochopit podstatu
9. excitovaný stav

### **Post-reading Activities**

#### **A. Description**

Give a brief description of the experiment.

#### **B. Hunt for Info**

*Try and find the English expressions for the following (The definitions follow U.S. usage in which a billion is a thousand million and a trillion is a 1 followed by 12 zeros.):*

one thousandth of a second

one millionth of a second

one billionth of a second

one trillionth of a second

one millionth of a nanosecond

#### **C. Translation**

*Translate the underlined sections of the text below. Remember, this is not to be word-for-word translation.*

## Fastest view of molecular motion

### Scientists have made the fastest ever observations of motion in a molecule.

They "watched" parts of a molecule moving on an attosecond timescale - where one attosecond equals one billion-billionth of a second.

The researchers say the study gives a new in-depth understanding of chemical processes and could be used in future technologies such as quantum computing.

The study, which relies on short pulses of light from a specially built laser, was published in the journal Science.

"Understanding how something changes in time means really understanding its essence, and we are now looking at changes on a very, very fast timescale," said team member Dr John Tisch, of Imperial College London, UK.

### Ultra-fast process

The researchers devised a new technique to "see" the motion of protons, one of the building blocks of an atom, in molecules of hydrogen and methane.

The technique involves firing a very short but intense laser pulse at a molecule, which rips an electron away, leaving the molecule in an excited ionised state.

The electron is then drawn back to the molecule, and when it collides a very short burst of x-rays is released.

"That has encoded information within it about the state of the molecule at the point of re-collision, and can give us information about the motion of the protons in this molecule," Dr Tisch told the BBC News website.

The process is ultra-fast, and the team was able to observe the effect the laser had on motion in the molecules with an accuracy of 100 attoseconds - the fastest ever recorded.

The team said being able to see detailed molecular motion would help scientists understand how molecules behaved in chemical processes, thus providing possibilities for controlling molecules.

"Control of this kind underpins future technologies, such as control of chemical reactions, quantum computing and high brightness x-ray light sources for material processing," said Professor Jon Marangos, another Imperial College author on the Science paper.

"We now have a much clearer insight into what is happening within molecules and this allows us to carry out more stringent testing of theories of molecular structure and motion."