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The Ruse Branch of the Union of Scientists in Bulgaria was founded in 1956. Its first Chairman was Prof. Stoyan Petrov. He was followed by Prof. Trifon Georgiev, Prof. Kolyo Vasilev, Prof. Georgi Popov, Prof. Mityo Kanev, Assoc. Prof. Boris Borisov, Prof. Emil Marinov. The individual members number nearly 300 recognized scientists from Ruse, organized in 13 scientific sections. There are several collective members too – organizations and companies from Ruse, known for their success in the field of science and higher education, or their applied research activities. The activities of the Union of Scientists – Ruse are numerous: scientific, educational and other humanitarian events directly related to hot issues in the development of Ruse region, including its infrastructure, environment, history and future development; commitment to the development of the scientific organizations in Ruse, the professional development and growth of the scientists and the protection of their individual rights.

The Union of Scientists – Ruse (US – Ruse) organizes publishing of scientific and popular informative literature, and since 1998 – the "Proceedings of the Union of Scientists- Ruse".

SERIES 5

"MATHEMATICS, INFORMATICS AND PHYSICS"

VOLUME 7

CONTENTS

LEARNING DEVELOPMENT CYCLE APPLIED TO PHYSICS THROUGH ADAPTIVE LEARNING METHODOLOGY

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Abstract: *In the present work on the base of the concept of Learning Development Cycle and in accordance with the Adaptive Learning Methodology experimented bilingual tests on Physics subjects are considered. They are elaborated on the open source platform Moodle and are addressed to Bulgarian and foreign students studying Physics at different stages of their education.*
Keywords: *learning development cycle, adaptive learning systems*

INTRODUCTION

The concept of Adaptive Learning Systems [1] as a specific new approach is connected with the computer based instructional technologies for contemporary education. Changes in the technology of delivering information create altering of foundational, long-held views on gaining knowledge. The classic models of distributing learning as courses, curricula, and degrees are still central, even though technology and new needs on the part of learners are creating a climate that requires a more dynamic alternative. This is for example the possibility for students to find the necessary material on the subject or quizzes and tests for their training on a certain internet platforms connected with their educational institution. Thus the materials allow remote access, if the students are enrolled in the corresponding course. In creating our educational, instructional and testing subject-matter materials we used MOODLE, an open source platform.

Since the world has become networked and connected and in this environment of colossal change, the design methodologies used to foster learning also have changed. As George Siemens [2] pointed out we need a new Learning Development Cycle (LDC) 'to bridge the gap between design approaches and knowledge needs of academic and corporate learners'. According to [2] Learning Development Cycle is a meta-learning design model. The different domains of learning address different approaches, intent, and desired outcomes. LDC consists on the following stages:

1. Scope and object of learning design
2. Creation of learning resources
3. User experience
4. Meta-evaluation to determine effectiveness and accuracy of design process and assumptions
5. Formative and summative evaluation of project and learner experience.

The purpose of the work is to show how the fulfilment of the above listed stages of Learning Development Cycle may be accomplished via the combined traditional and new approaches to delivering knowledge to students and control of students' learning.

REALIZATION OF THE STAGES OF LEARNING DEVELOPMENT CYCLE

Here we shall review consecutively the stages 1 to 5 applied for the subject of Physics as it has been implemented by us so far.

Scope and object of learning design

Based on the academically accepted curricula in the University of Ruse (RU) and Department for Language Teaching and International Students (DLTIS) at the University of Sofia these are as follows: General Physics, Applied Physics, Atomic and Nuclear Physics and Theoretical Physics.

The instructional design here begins with some type of stated learning objectives that depend on the nature of the course and the particular subject-matter of the above listed subjects. In fact, learning objectives serve more to guide the designer (teacher) than to guide the learner. So, the designer decides what volume of the material will be presented as lectures, classroom guided exercises or experiments, and which parts of subject-matter may be placed on Moodle platform for self-learning according to the individual learning demands. The purpose of this separation of the material is to fulfil the demands of Kolb's cycle [3, 4] of experiential learning design.

As the content of the subject is generally predetermined by the accepted curricula and the limited amount of lectures and exercises in the classroom we shall focus our attention on the opportunities offered by Moodle platform as one of the many Adaptive Learning Systems.

Creation of learning resources

During the second stage of LDC, designers design, develop, and deliver learning materials on the corresponding platforms of RU and DLTIS. A key component in traditional and adoptive learning is content type analysis. The main task in this process is to determine the nature of content and the best way of presenting it. Here a well-designed resource in congruence with the aims of the course is very important because of the fact that the students have an access to a large learning network. So the learning experience has to be piloted with feedback actively incorporated into the ongoing design and development of the learning process.

The students in RU and DLTIS are from Bulgaria as well as from other countries. This fact is reflected in the languages in which the knowledge is being delivered to them. We have Physics courses in Bulgarian and English. Up to now there are a number of textbooks and educational and self-testing materials in electronic form, published on the Internet on Moodle servers of RU and DLTIS and accessible to students for online use.

This way of knowledge distribution is affluent of many opportunities for a large variety of illustrative material to be used in order to make the studied and then posed problems more clear and easily acceptable. The quizzes and tests are organized in paragraphs, chapters or groups of related chapters and as final annual objective test exams. Some examples of working bilingual tests are given in the Appendices.

User Experience and Piloting

The design of online supplements is used by students to study or to try solving quizzes and problems inside the computer labs and outside of the classroom. When online, the students may work with their personal speed, consult with the books or other available instructions and thus better understand, analyze, visualize, relate and make sense of information and finally to learn experientially the subject of Physics. A very important moment in this approach is the self-assessment by electronic tests – as soon as the test is over the student is aware of the extent and assimilation of terminology and laws in Physics. The discussions in the classroom are after they had sufficient time to train themselves on the quizzes and problems. In the classroom, the teacher can engage learners in mindful processing of information without the intervention of formal instructions, more fluently and facilitating the learning process.

Meta-evaluation

This is the process of evaluating the actual effectiveness of the learning design. Exploring successes and analyzing the obstacles helps the entire design process to improve its effectiveness during a future revision of existing learning resources. Meta-evaluation is critical to further continual development of the model and learning design. By the feedback information about students' access to the tests stored on the Moodle system the designer may get full information about the time of access to a particular test, the number of attempts the students did to solve it, the points they won in each of these attempts. In this way we have stored available information for the interests, endeavors, successes and troubles of students during the process of their experiential learning. This feedback is of great help to the instructor in order to gain vision on the topics which need more or less attention during the traditional forms of knowledge transmission and also as a material for self-study on the internet and how to reorganize the formulation of the given tasks. Hence the process of learning becomes accelerated for both sides – the instructor and the students help each other to improve the learning design through this type of communication.

CONCLUSIONS

Our methodological experiments lead to the following conclusions:

1. Moodle based teaching materials give the opportunity for more explicit and flexible realization of the steps in the Kolb and Siemens models for the benefit of the students.
2. The students become more involved in the process of mastering physical science.
3. Training through Moodle students get significant improvement of their skills in solving physical quizzes and problems.

REFERENCES

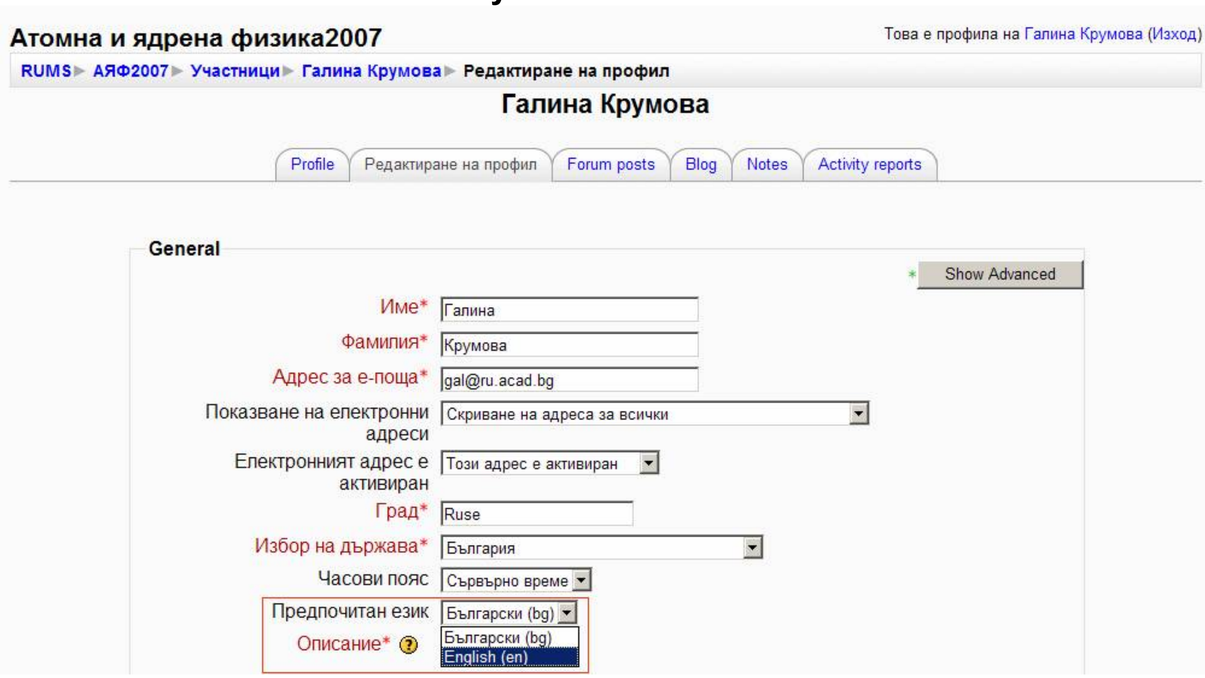
[1] Adaptive Learning Systems. http://www.atp.nist.gov/atp/97wp-lt.htm

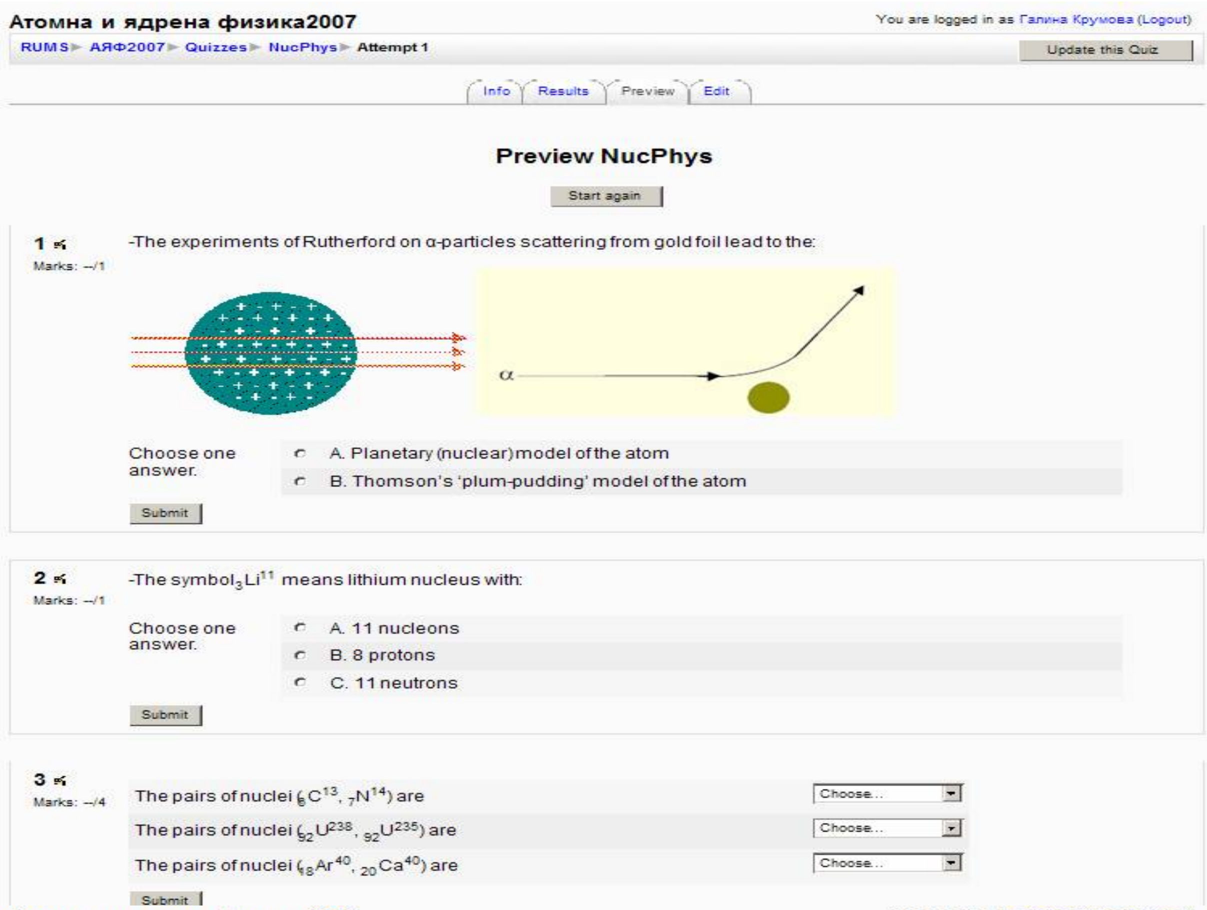
[2] Siemens G. Bridging Learning Design and Modern Knowledge Needs. http://www.elearnspace.org/Articles/ldc.htm

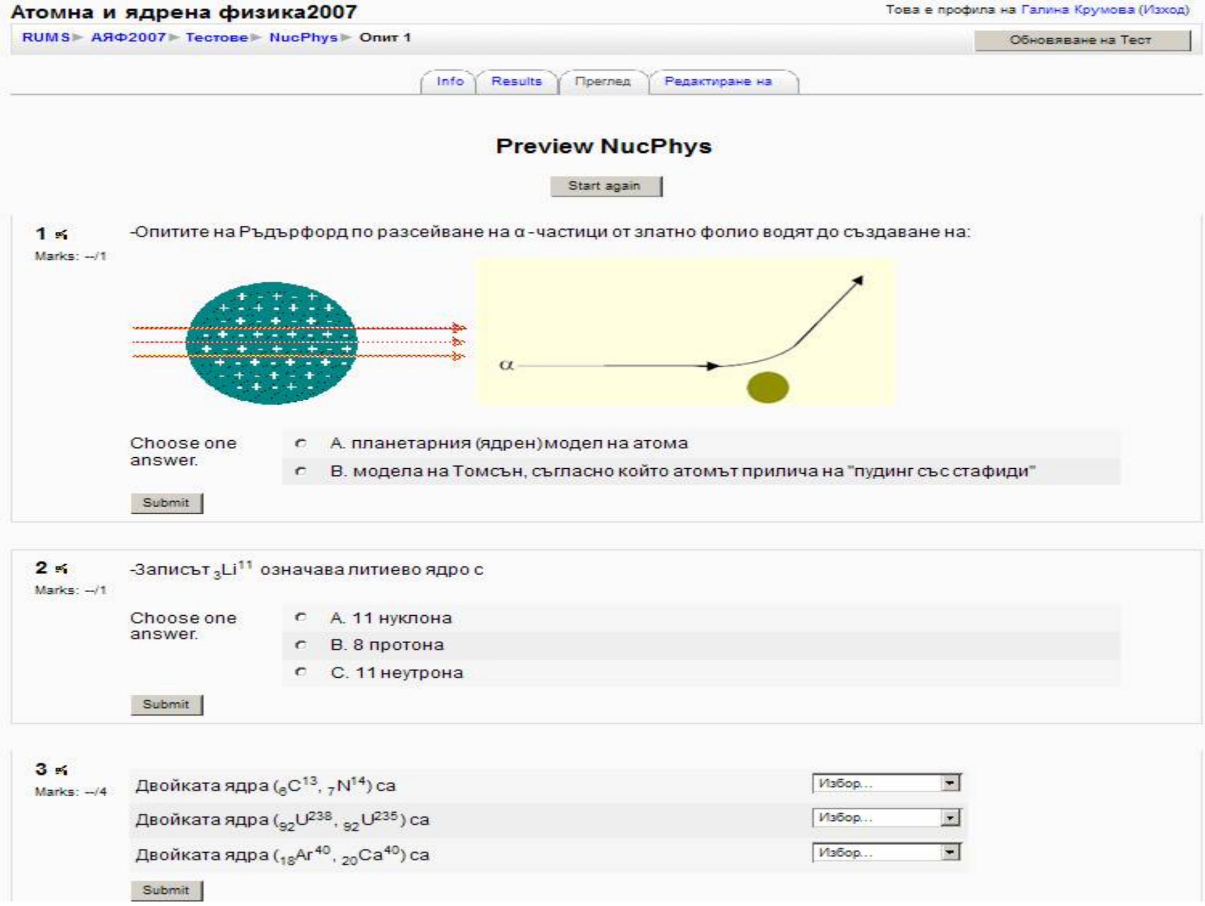
[3] Kolb, D. A. Experiential learning: Experience as the source of learning and development. Prentice-Hall, Englewood Cliff, 1984.

[4] Bolan, C. Incorporating experiential learning theory into the instructional design of online courses. Nurse Educator, 28 (1), 10 -14, 2003.

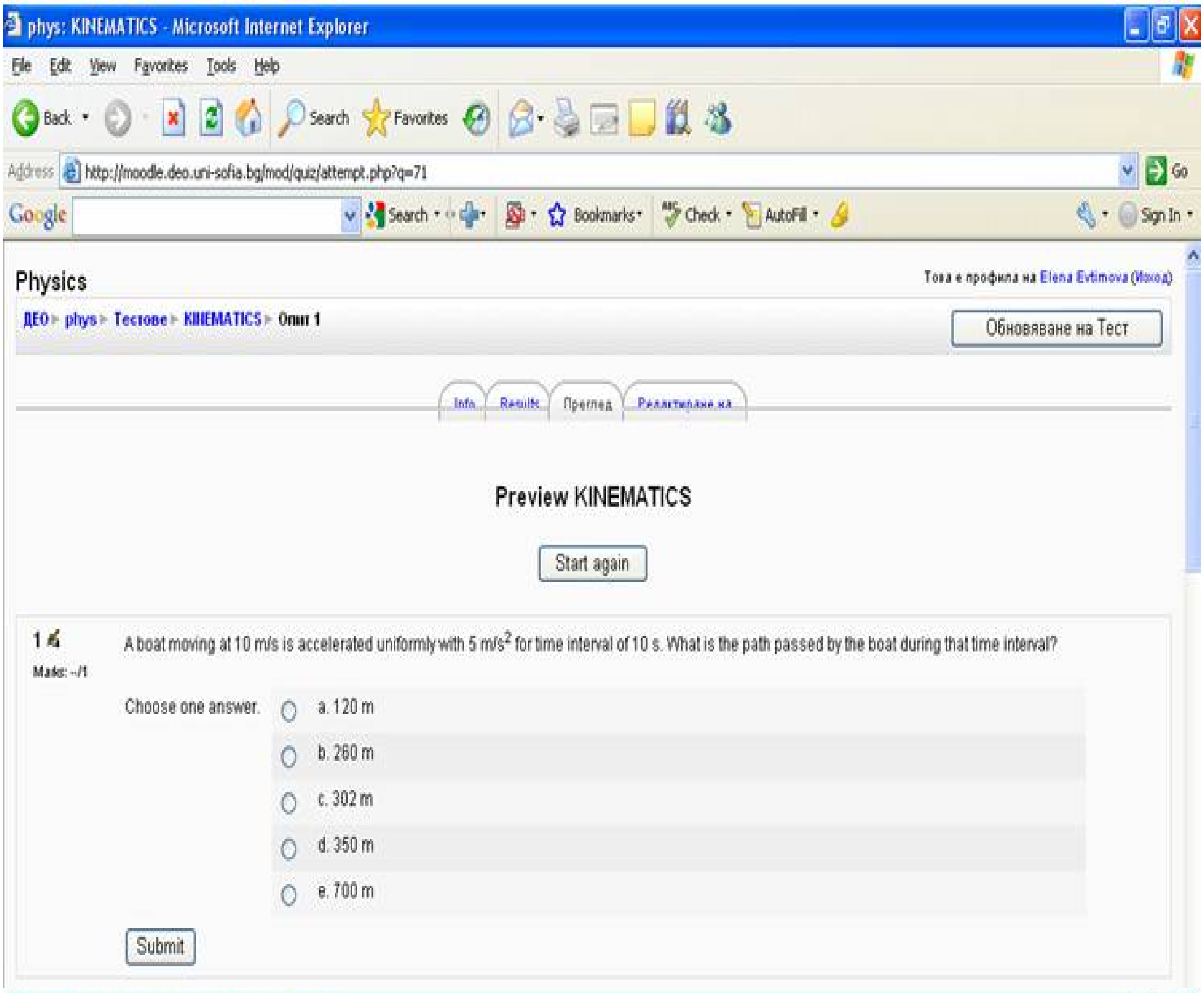
APPENDIX I: A part of bilingual (English and Bulgarian) quiz on Atomic and Nuclear Physics in MOODLE

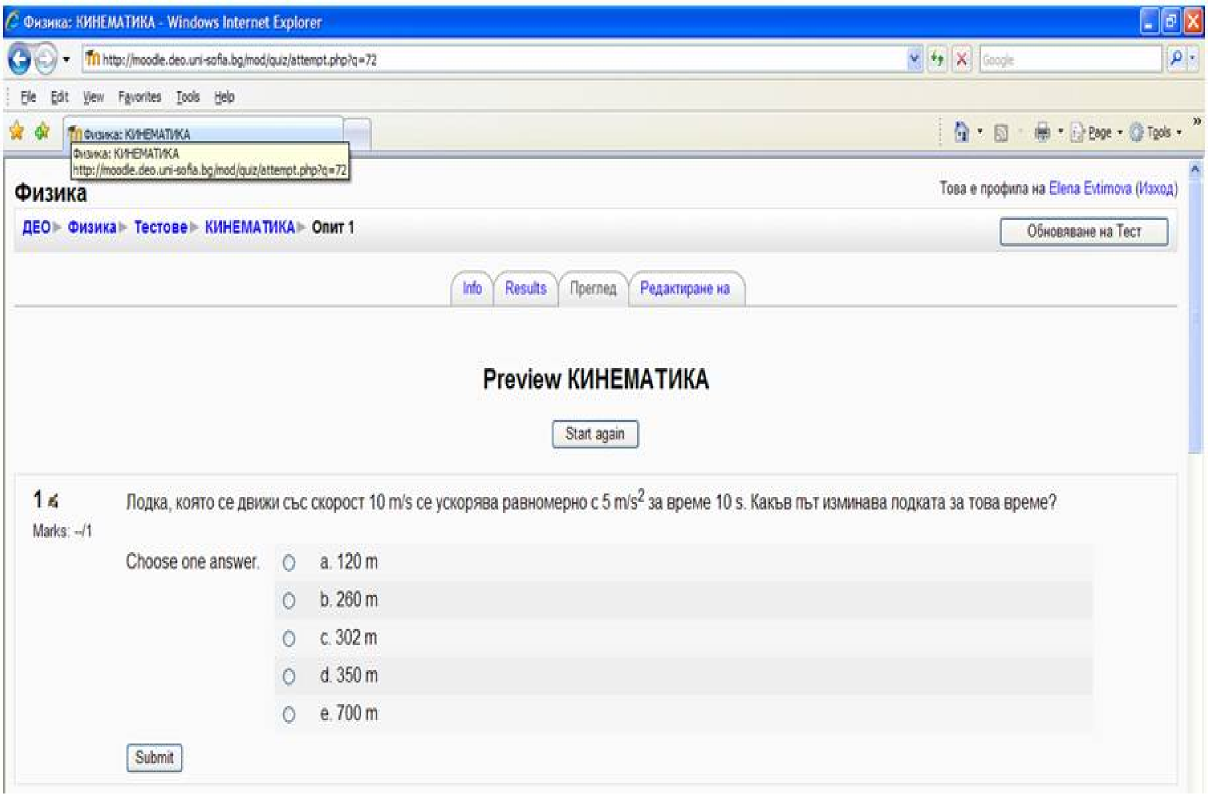


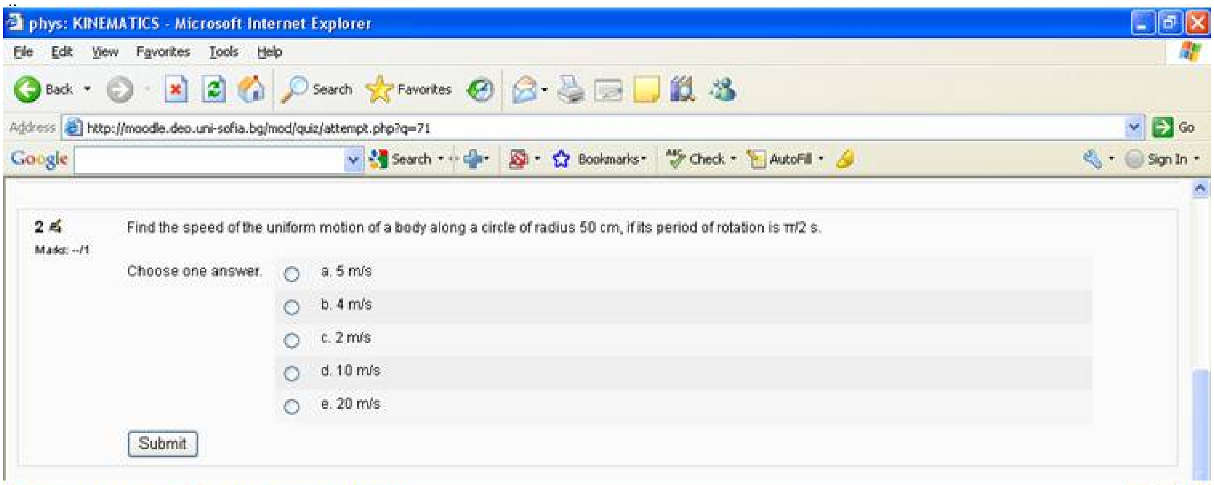


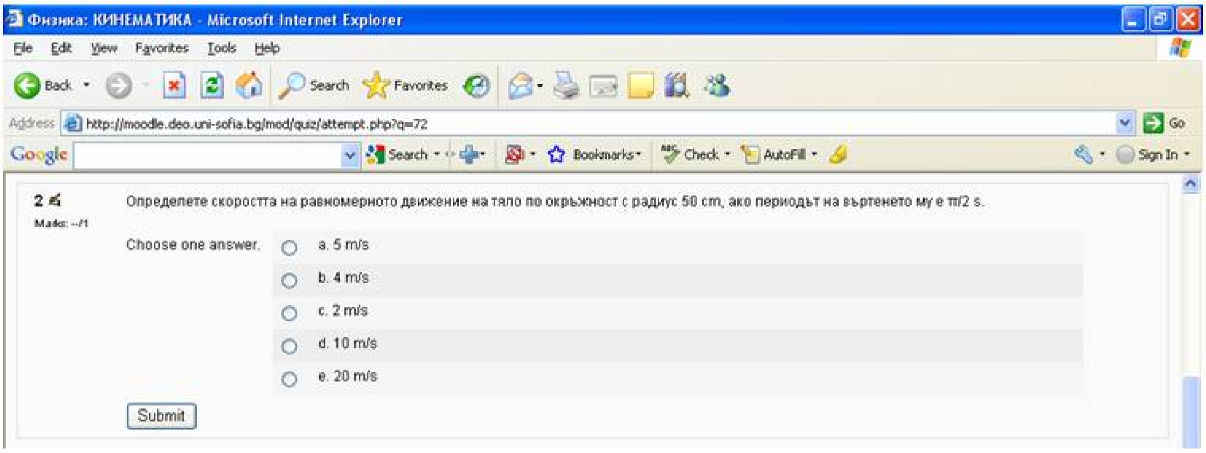


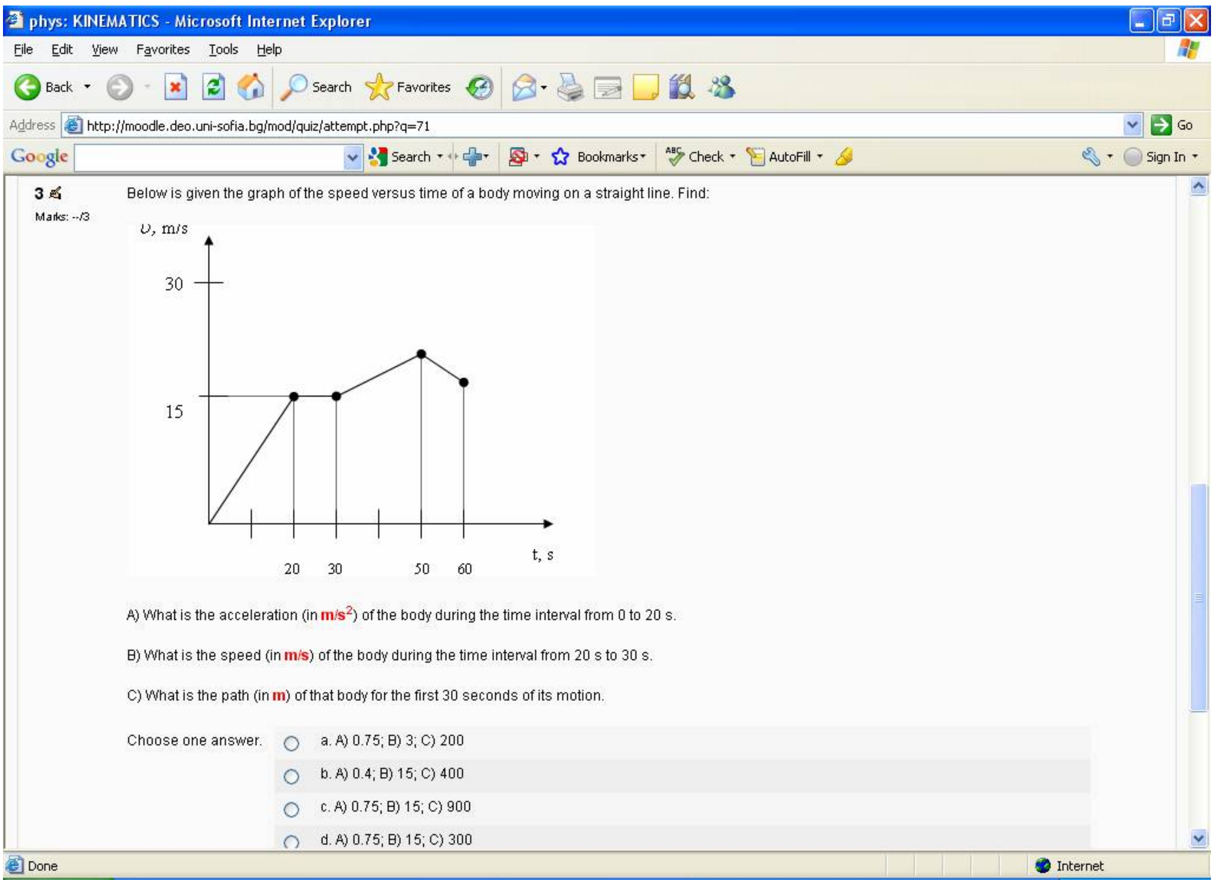
APPENDIX II: A part of bilingual (EN and BG) quiz on Kinematics in MOODLE

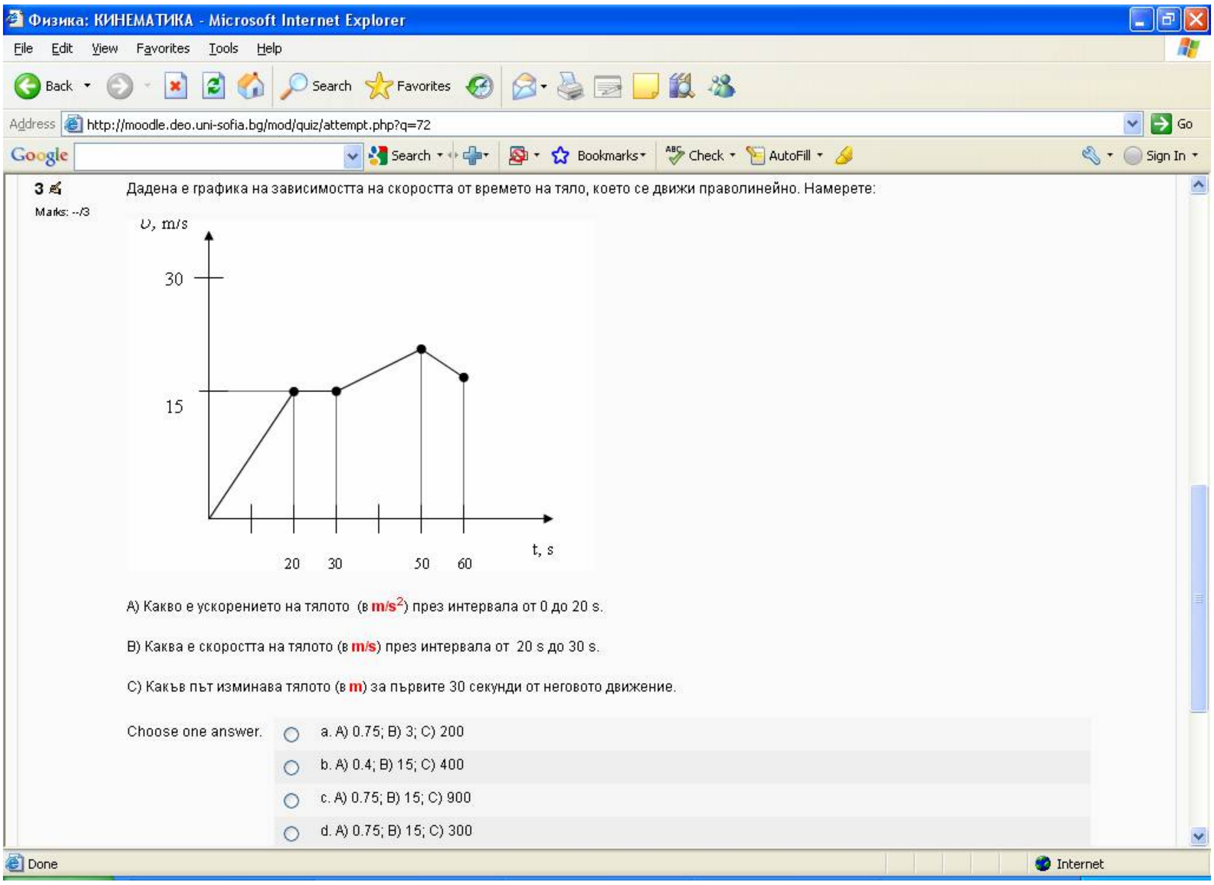

phys: KINEMATICS - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://moodle.deo.uni-sofia.bg/mod/quiz/attempt.php?q=71
Go
Search Bookmarks Check AutoFill Sign In
Physics
Това е профила на Elena Evtimova (Изход)
ДЕО phys Тестове KINEMATICS Опит 1
Обновяване на Тест
Info Results Преглед Редактиране на
Preview KINEMATICS
Start again
1
Marks: --/1
A boat moving at 10 m/s is accelerated uniformly with 5 m/s2 for time interval of 10 s. What is the path passed by the boat during that time interval?
Choose one answer.
a. 120 m
b. 260 m
c. 302 m
d. 350 m
e. 700 m
Submit


Физика: КИНЕМАТИКА - Windows Internet Explorer
http://moodle.deo.uni-sofia.bg/mod/quiz/attempt.php?q=72
File Edit View Favorites Tools Help
Физика: КИНЕМАТИКА
Page Tools
Физика
Това е профила на Elena Evtimova (Изход)
ДЕО Физика Тестове КИНЕМАТИКА Опит 1
Обновяване на Тест
Info Results Преглед Редактиране на
Preview КИНЕМАТИКА
Start again
1
Marks: --/1
Лодка, която се движи със скорост 10 m/s се ускорява равномерно с 5 m/s2 за време 10 s. Какъв път изминава лодката за това време?
Choose one answer.
a. 120 m
b. 260 m
c. 302 m
d. 350 m
e. 700 m
Submit


phys: KINEMATICS - Microsoft Internet Explorer
http://moodle.deo.uni-sofia.bg/mod/quiz/attempt.php?q=71
2
Marks: --/1
Find the speed of the uniform motion of a body along a circle of radius 50 cm, if its period of rotation is π/2 s.
Choose one answer.
a. 5 m/s
b. 4 m/s
c. 2 m/s
d. 10 m/s
e. 20 m/s
Submit


Физика: КИНЕМАТИКА - Microsoft Internet Explorer
http://moodle.deo.uni-sofia.bg/mod/quiz/attempt.php?q=72
2
Marks: --/1
Определете скоростта на равномерното движение на тяло по окръжност с радиус 50 cm, ако периодът на въртенето му е π/2 s.
Choose one answer.
a. 5 m/s
b. 4 m/s
c. 2 m/s
d. 10 m/s
e. 20 m/s
Submit


phys: KINEMATICS - Microsoft Internet Explorer
http://moodle.deo.uni-sofia.bg/mod/quiz/attempt.php?q=71
3
Marks: --/3
Below is given the graph of the speed versus time of a body moving on a straight line. Find:
υ, m/s
30
15
t, s
20
30
50
60
A) What is the acceleration (in m/s²) of the body during the time interval from 0 to 20 s.
B) What is the speed (in m/s) of the body during the time interval from 20 s to 30 s.
C) What is the path (in m) of that body for the first 30 seconds of its motion.
Choose one answer.
a. A) 0.75; B) 3; C) 200
b. A) 0.4; B) 15; C) 400
c. A) 0.75; B) 15; C) 900
d. A) 0.75; B) 15; C) 300
Done
Internet



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ЦИКЪЛЪТ ЗА УПРАВЛЕНИЕ НА ЗНАНИЯТА ПО ФИЗИКА В СЪОТВЕТСТВИЕ С МЕТОДОЛОГИЯТА НА АДАПТИВНОТО ОБУЧЕНИЕ

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Резюме: *В настоящата работа на базата на концепцията за цикъла на управление на знанието и в съответствие с методологията на адаптивното обучение е направен преглед на експериментирани двуезични тестове по физика. Те са разработени върху отворената платформа Moodle и са адресирани към българските и чуждестранни студенти, изучаващи физика на различни етапи от своето обучение.*

Ключови думи: *цикъл за управление на знанията, системи за адаптивно обучение*

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