

Workbooks for laboratory works

User Manual

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1 General Information

This manual describes the functionality of the "Workbooks for laboratory works" application (hereinafter referred to as the Application), designed for conducting laboratory works within the Virtual Laboratories VR-Labs environment (hereinafter referred to as VL).

A **Workbook for laboratory work** (hereinafter referred to as the Workbook) is a collection of laboratory works to be performed in one of the VLs: "Mechanics", "Electrodynamics", "Inorganic chemistry", etc. Each laboratory work contains several tasks unified by a single topic. Multiple variants of each laboratory work can be created, with different values of indicators in the tasks. These variants are generated randomly.

Open the Workbook, view the list of laboratory work that can be performed in the VL, and you can perform specific laboratory work from the VL, which supports working with Workbooks. In this case, the work is carried out in the general interface of the VL and the corresponding Workbook (see [3 Workbook in VL](#)). If necessary, from the VL you can launch the web version of the Application (hereinafter referred to as "Workbooks" web application) in a new browser tab and continue performing laboratory work in it (see [4 "Workbooks" web application](#)).

All tasks of the laboratory work are checked automatically. The results and the work itself are saved on the server. It is possible to interrupt the execution of the laboratory work (the data will be saved) and later continue it in the web application or from VL. Subsequently, one can review the history of the laboratory work's execution and the best result of each work's completion.

2 System Requirements

Minimum system requirements for the "Workbooks for laboratory works" application:

- **Processor:** Intel Ivy Bridge series / AMD Bulldozer series;
- **RAM:** 4 GB;
- **Graphics card:**
 - integrated: Intel HD Graphics 5000 / Intel Iris;
 - discrete: GeForce 400 series or newer / Radeon HD 7000 series;
- **Screen resolution:** 1920x1080 / 1920x1200 (4K and Retina displays require more powerful graphics cards for comfortable use);
- **Supported browsers:** Chrome, Yandex.Browser, Opera 44+, Firefox 51+, Safari 15+;
- **Supported operating systems:**
 - Microsoft Windows 7 (64-bit versions) with WebGL 2.0 drivers support;
 - MacOS X Snow Leopard 10.6 with WebGL 2.0 drivers support;
 - Linux or Debian with WebGL 2.0 drivers support.

3 Workbook in VL

3.1 Opening the Workbook from VL

To open the Workbook from within VL, press the **Workbook** button  on the **Application header panel** of VL (Figure 1).

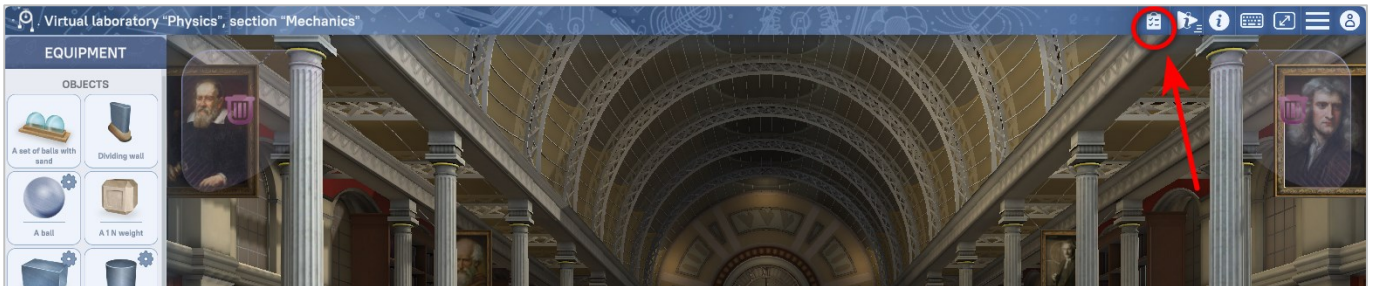


Figure 1 – Button for opening a Workbook from VL

The **Workbook for laboratory works** panel will open with a list of laboratory works for this VL (Figure 2).

3.2 Workbook panel in VL

On the Workbook panel (Figure 2), opened from VL, the following are displayed:



Figure 2 – Workbook for laboratory works panel

- 1) The button to view the history of completed laboratory works . Pressing this button displays the panel with the history of laboratory work completion on the right side of the VL window in the current tab (see [3.5 History of laboratory work completion in VL](#)).

- 2) The button to go to the "Workbooks" web application . Pressing this button closes the Workbook panel in VL, and a page of the same Workbook opens in a new browser tab (see [4.1 Workbook page](#)).
- 3) The overall progress of the user — the number of laboratory works completed out of the total number of laboratory works for VL.
- 4) Laboratory work cards. Each card contains (Figure 3):



Figure 3 – Laboratory work card

- The sequential number of the laboratory work in the list. An icon  is displayed on it if you have started the laboratory work but have not yet submitted it.



For unfinished work, the system saves the data of the answers you entered for the tasks and the status of the confirmation button:  or  (for button description, see [3.3.2 Task blocks](#)).

The icon can still be present even after receiving results for the work but is restarted. If the work is submitted and not started again, the icon is absent.

- The name of the laboratory work.
- The **Best result** button (Figure 4). This button appears if you have submitted this laboratory work for review at least once and have received the review results.

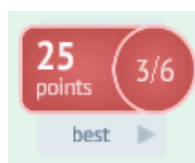


Figure 4 – Best result button

The button displays the best result you have achieved in completing all versions of this laboratory work, as well as the number of tasks completed out of the total number of tasks. The button consists of an icon and the label **best**.

The icon can be one of three colors:

- green — the laboratory work is completed excellently;
- yellow — the laboratory work is completed well or satisfactorily;
- red — the laboratory work is completed unsatisfactorily.

Pressing the button opens the panel with your best result for this laboratory work (see [3.4 Results panel in VL](#)).

- The difficulty icon . Beneath the icon, the presumed difficulty level of the laboratory work is displayed: **easy**, **medium**, or **hard**.
- The execution time icon . The estimated time to complete the laboratory work is displayed beneath it.

When you click on the laboratory work card to the right of the VL window, the laboratory work panel opens (see [3.3 Laboratory work panel in VL](#)), in which:

- If the laboratory work has already been started by you but not submitted (the card displays the icon ) , the panel for the selected laboratory work opens.
- If the laboratory work has not been started by you yet or was completed and submitted (the card does not display the icon ) the panel for a new variant of the selected laboratory work opens.

3.3 Laboratory work panel in VL

The Laboratory work panel opened in VL (Figure 5) is displayed to the right of the VL window. It allows you to explore the conditions of the experiment, enter answers to tasks, and submit the work for review.

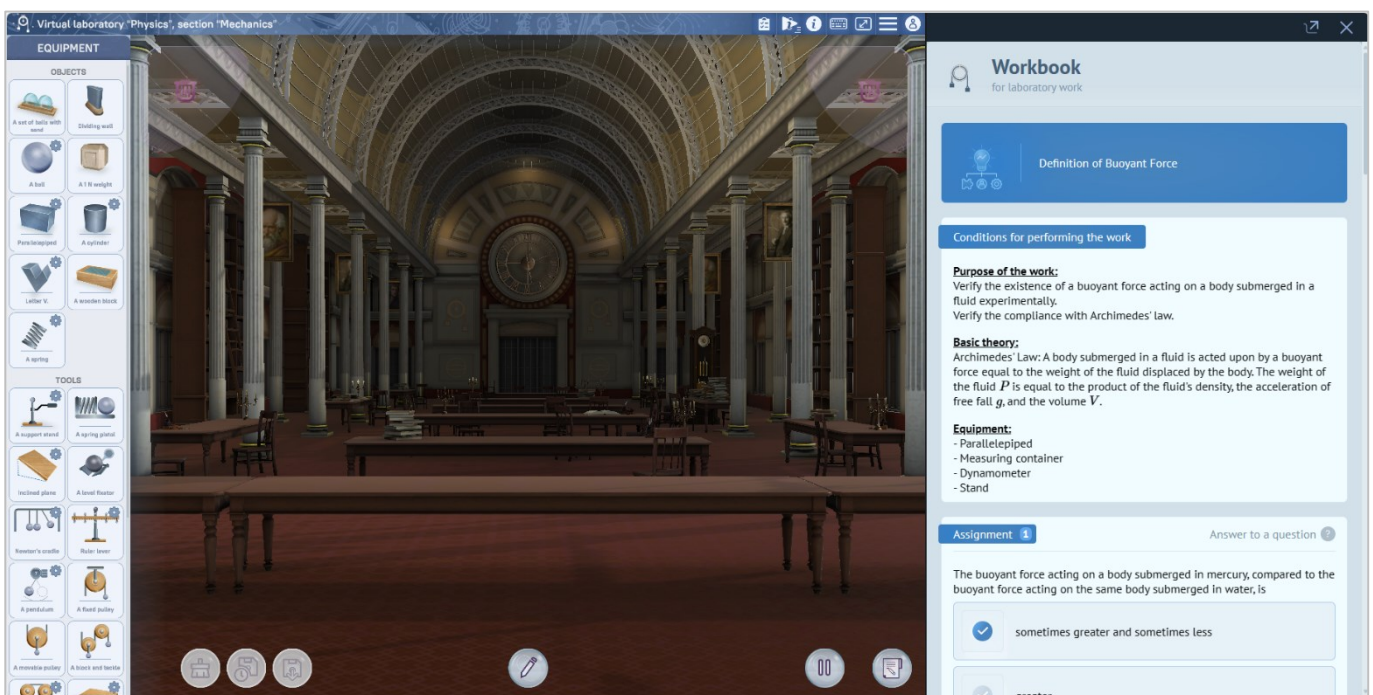


Figure 5 – Laboratory work panel opened from VL



Before moving to the web application, don't forget to save all your entered answers in VL using the  button.

The laboratory work panel displays:

- 1) The name of the work;

- 2) The conditions block (see [3.3.1 Conditions block](#));
- 3) Task blocks (see [3.3.2 Task blocks](#));
- 4) The **Submit** button. This button remains unavailable until you confirm answers to all tasks (see [3.3.3 "Submit" button](#));
- 5) The feedback block (see [3.3.4 Feedback block](#)).

The screenshot shows the 'Workbook for laboratory work' interface. At the top, a blue header bar contains the title 'Definition of Buoyant Force' and a red number '1'. Below this, a light blue box labeled 'Conditions for performing the work' (with a red '2') contains sections for 'Purpose of the work', 'Basic theory' (Archimedes' Law), and 'Equipment'. The 'Assignment' section (with a red '3') presents a multiple-choice question about buoyant force. A 'Confirm' button is at the bottom of the assignment box. The 'Submit' button (with a red '4') is located at the bottom center. At the very bottom, there is a 'Write us' link and an email icon (with a red '5').

Figure 6 – Laboratory work panel

The following buttons are displayed on the right above the panel:

-  — to close the laboratory work panel;
-  — to transition to the "Workbooks" web application. You can go to the web application and continue this laboratory work there (see [4.3 Laboratory work panel in the web application](#)). In doing so, the panel of the current laboratory work closes in VL and opens in a new browser tab.

3.3.1 Conditions block

The conditions block (Figure 7) contains a set of instructions and conditions for conducting the experiment provided by the theme of the laboratory work.

Conditions for performing the work

Purpose of the work:
 Verify the existence of a buoyant force acting on a body submerged in a fluid experimentally.
 Verify the compliance with Archimedes' law.

Basic theory:
 Archimedes' Law: A body submerged in a fluid is acted upon by a buoyant force equal to the weight of the fluid displaced by the body. The weight of the fluid P is equal to the product of the fluid's density, the acceleration of free fall g , and the volume V .

Equipment:

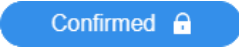
- Parallelepiped
- Measuring container
- Dynamometer
- Stand

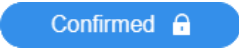
Figure 7 – Conditions block

3.3.2 Task blocks

A laboratory work may contain an unlimited number of tasks, following one another in separate blocks.

You can enter your answers in the task blocks.

After pressing the  button, the answer is saved in the database, and the answer input fields are locked; the button changes its appearance to .

You can press the  button to unlock the fields and correct the answer. After making corrections, do not forget to confirm your answer by pressing  again.

The laboratory work may include tasks of the following types:

- **Answer to a question** (see [3.3.2.1 Answer to a question](#));
- **Numeric answer** (see [3.3.2.2 Numeric answer](#));
- **Text answer** (see [3.3.2.3 Text answer](#));
- **Chart** (see [3.3.2.4 Chart](#));
- **Reaction equation** (see [3.3.2.5 Reaction equation](#));
- **Table** (see [3.3.2.6 Table](#)).

3.3.2.1 Answer to a question

The **Answer to a question** type task block (Figure 8) includes:

- the task's sequential number and type;
- the task statement;
- a set of answer options with the possibility to choose one or several answers;
- the  button.

Assignment 1 Answer to a question ?

The denser the liquid in which a body is submerged, the buoyant force acting on it is

☐ less

☐ sometimes greater and sometimes less

☐ greater

Confirm

Figure 8 – "Answer to a question" type task block

3.3.2.2 Numeric answer

The **Numeric answer** type task block (Figure 9) includes:

- the task's sequential number and type;
- the question statement;
- an editable text field for entering the answer (characters 0-9, "-", and "." are available);
- the Confirm button.

Assignment 3 Numeric answer #

Determine the distance covered by a body from a stationary air balloon in 5 seconds, assuming that the acceleration due to gravity is 9.8 m/s^2

m

Confirm

Figure 9 – "Numeric answer" type task block

3.3.2.3 Text answer

The **Text answer** type task block (Figure 10) includes:

- the task's sequential number and type;
- the task statement;
- an editable text field for entering the answer;
- the Confirm button.

Assignment 1

Text answer Aa

The name we give to any process where the velocity changes is

Confirm

Figure 10 – "Text answer" type task block

3.3.2.4 Chart

The **Chart** type task block (Figure 11) includes:

- the task's sequential number and type;
- the task statement;
- a coordinate plane for plotting the chart;
- a table for data entry for the chart plotting;
- the

Confirm

 button.

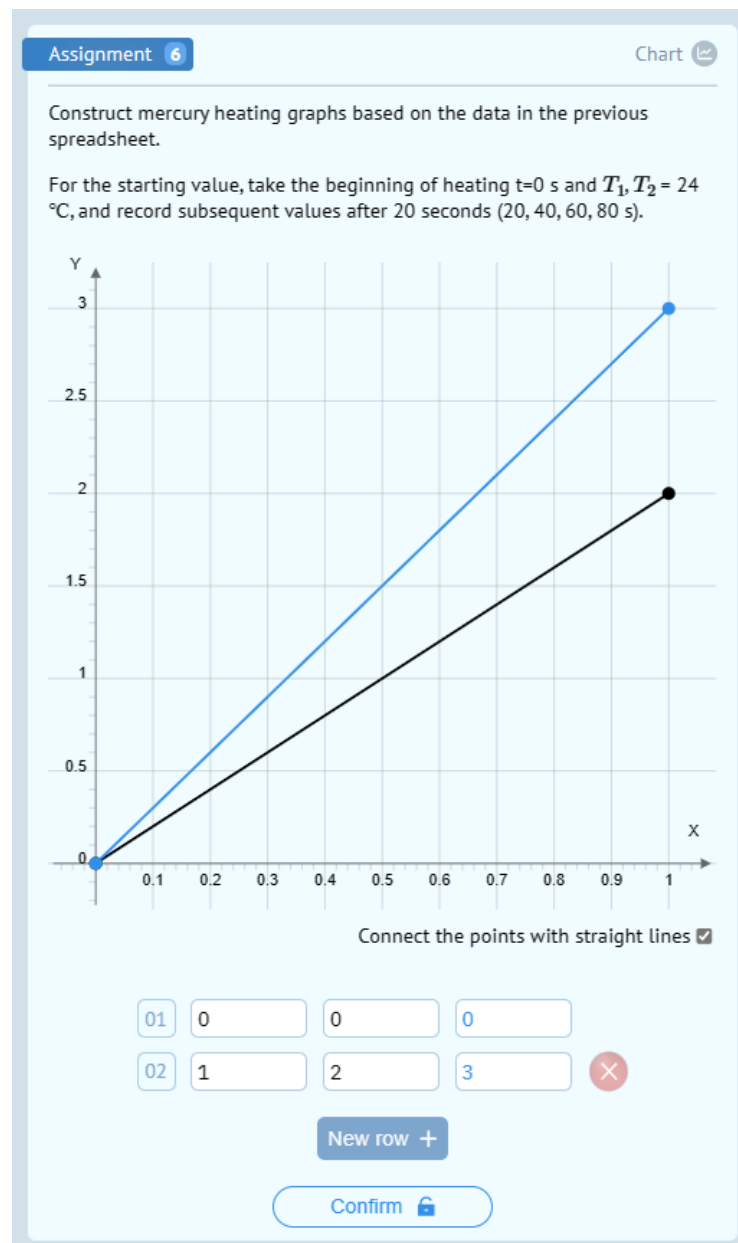


Figure 11 – "Chart" type task block

To plot the chart, enter the X and Y coordinates of the chart points into the table. To the right of the table you can find the row deletion buttons  (for each row of the table except the first). There is a button to add a new row  below the table.

As soon as a table row is filled in, a corresponding point will be displayed on the coordinate plane. If the checkbox **Connect the points with straight lines** is on, then the points are connected with each other in the order of their rows in the table. The color of the points and the lines connecting them matches the color of the values of these points' coordinates in the table column.

The coordinate plane is displayed at a default scale. As more points are added, the scale adjusts so that all points of the chart are displayed.

3.3.2.5 Reaction equation

The **Reaction equation** type task block (Figure 12) includes:

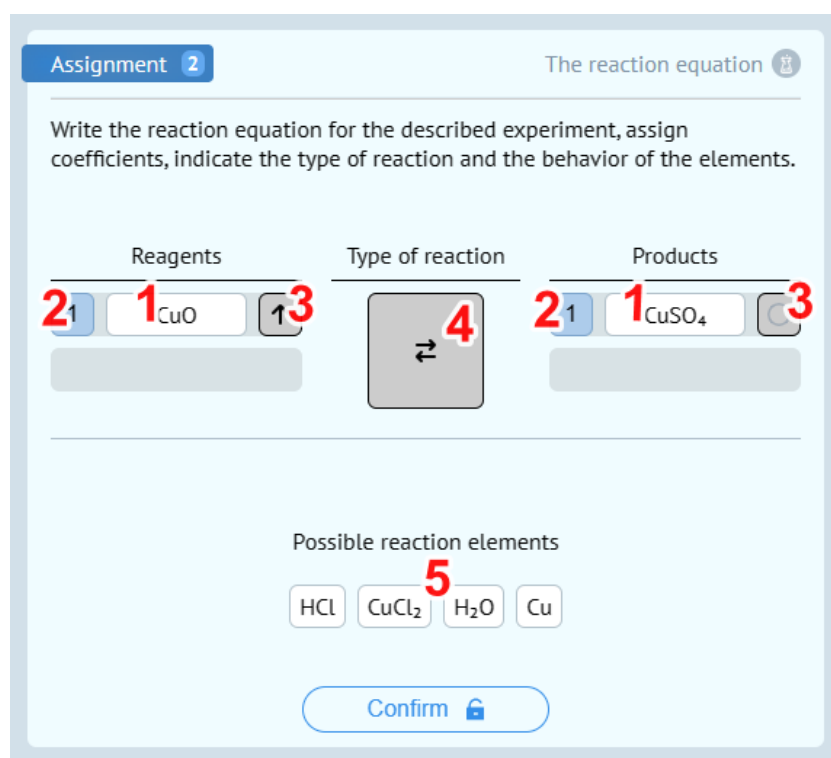


Figure 12 – "Reaction equation" type task block

- the task's sequential number and type;
- the task statement;
- a field for entering the substance formula (1). A card with the name of the substance from the **Possible reaction elements** set (5) is dragged into this field. After entering the formula, fields (2) and (3) appear;
- a field for entering the coefficient (2) — the number of substance molecules needed for the reaction. The range of acceptable values: 0–9. This field appears provided that a substance formula has been inserted in field (1);

- a substance behavior field (3). Field (3) appears provided that a substance formula has been inserted in field (1). Clicking on the field displays a dropdown list with substance behavior options:
 -  — the substance precipitated because it is insoluble;
 -  — a gas was formed, it evaporates and no longer participates in the reaction;
 -  — the substance neither precipitated nor evaporated as a gas;
- a reaction type field (4). Clicking on the field displays a dropdown list:
 -  — irreversible reaction;
 -  — reversible reaction;
 -  — the reaction proceeds upon heating;
 - **Not go** — the reaction does not proceed;
- a set of draggable cards with names of reactants and reaction products (5);
- the  button.

3.3.2.6 Table

A table in tasks can be presented in two forms:

- as a table with a **fixed** set of rows (Figure 13). Some cells in such a table may be pre-filled;

Assignment 2

Table

Study the flight range of the ball shot at different angles and fill in the table. For this, perform the following actions:

1. Place a spring pistol attached to a stand on the work desk. Its angle of inclination is adjusted by the rotation handle.
2. Set the pistol spring's force to 5N. To ensure the same force for repeated shots, lock the set force value with the 'Save Point' tool.
3. Place a touch detector and a dividing wall under the pistol on the work desk. The wall will prevent the ball from rolling out of the work area.
4. Make a wooden ball with a diameter of 4 cm using the tools of the virtual laboratory.
5. Make shots from the height of 60 cm at the angles of inclination of the pistol indicated in the table. After each shot, measure the flight range of the ball S with the 'Ruler' tool and enter the result into the table.

	Experiment	h , cm	α , degrees	S , cm
01	1	60	15	
02	2	60	30	
03	3	60	45	
04	4	60	60	
05	5	60	75	

Confirm

Figure 13 – Partially filled table

- as a table with a **non-fixed** set of rows (Figure 14) — rows can be added or deleted. All cells in this table are initially empty and need to be filled. You can use a table like this one as an auxiliary block for performing other tasks, for example, for storing information about a series of identical measurements. Whether a table is automatically checked or not depends on the task.

Assignment 1 Table

Example of a task with a table

	V, cm^3	P_1, N	P_2, N	F_a, N
01				
02				

New row +

Confirm

Figure 14 – Auxiliary block

The **Table** type task block includes elements:

- the task's sequential number and type;
- the task statement or recommendations for using the table;
- the table. Hovering over a column title displays a tooltip with the column name;
- row deletion buttons (to the right of each row, except for the first one) and a button to add a new line . These buttons appear only for the table with an unfixed length;
- the button.

3.3.3 "Submit" button

The button is locked while there still are unconfirmed answers. Hovering over the button displays an icon indicating this — , along with a tooltip "Please, answer all questions before submitting the laboratory".

When all answers are confirmed, the color of the button changes from gray to blue. Pressing the button initiates the automatic checking of your answers on the server, after which the results panel of the laboratory work opens (see [3.4 Results panel in VL](#)).

You can submit the current version of the laboratory work for review only once. Your answers and the evaluation are recorded in the database and will be accessible when viewing this version of the laboratory work in the future.

Next time you attempt to complete this laboratory work, a new version with different values in the tasks will be created.

3.3.4 Feedback block

The **feedback** block (Figure 15) is located under the **Submit** button.

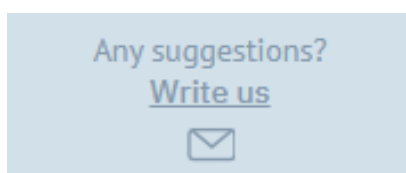


Figure 15 – Feedback block

Pressing the **Write us** button displays the feedback form overlaying the screen (Figure 16).

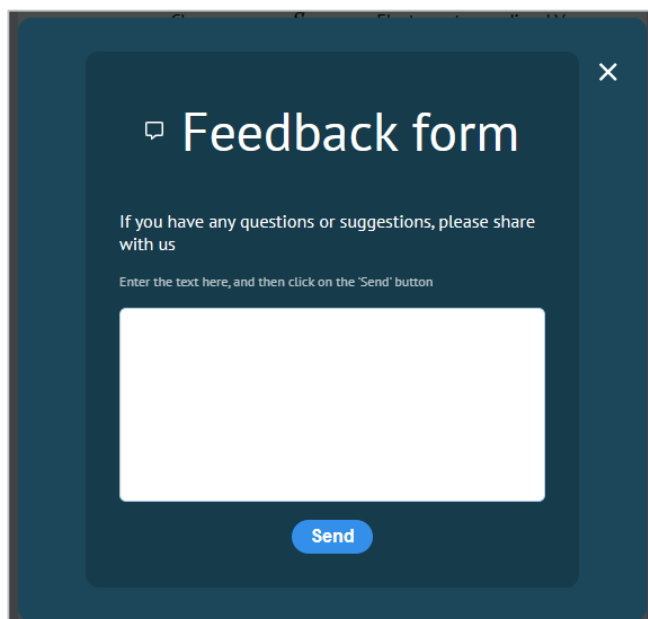


Figure 16 – Feedback form

To send a message, enter its text and press the **Send** button. To close the form, press .

3.4 Results panel in VL

The results panel (Figure 17) opens to the right of the VL window under the following circumstances:

- automatically upon completing the laboratory work (i.e., after pressing the **Submit** button on the laboratory work panel opened from VL — see Figure 6) and after conducting the automatic review;
- when pressing the **Best result** button on the panel with the list of laboratory works opened in VL (Figure 2);
- from the history opened from VL, when pressing the **Best result** button (Figure 18).

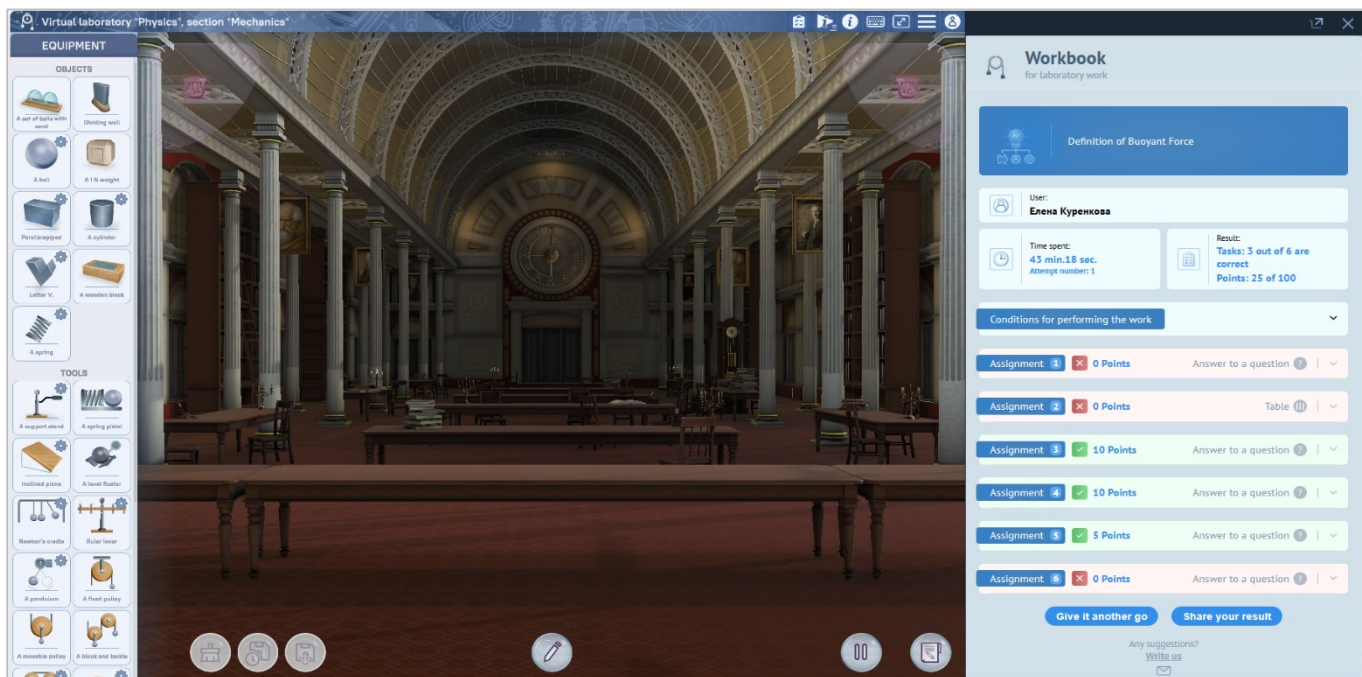


Figure 17 – Results panel in VL

When you navigate to the results of laboratory work via a link (created by pressing **Share your result** on the results page or the **Copy link** button on the history page), the results panel will not open in VL but in a web application tab (see 4.4 Results panel in the web application).

The results panel displays the following elements:

- 1) The name of the laboratory work.
- 2) The surname and first name of the user who completed the work.
- 3) The time spent panel: the time interval between the start and completion of the work, as well as the attempt number. The calculation of the time spent considers all the time the laboratory work was open: from the moment it was opened in the web application or VL until the **Submit** button was pressed.
- 4) The results output panel: the number of tasks correctly completed out of the total number of tasks and the number of points earned out of the total possible points.
- 5) A set of conditions and tasks blocks. All blocks are collapsed. They can be expanded by pressing the  button on the right side of the block. All fields in the block are locked, displaying the data you entered. Each task block displays one of the icons:
 -  — The task is solved correctly;
 -  — The task is partially solved;
 -  — The task is solved incorrectly.
- 6) The **Give it another go** button. Pressing this button opens the panel of a new variant of the laboratory work (Figure 6) with different values in the tasks.

- 7) The **Share your result** button. Pressing this button copies the link to the laboratory work to the clipboard, and a message appears: "Your link has been generated and copied to the clipboard".
- 8) Feedback block (see [3.3.4 Feedback block](#)).

The following buttons are displayed to the right above the results panel:

-  — to go to the "Workbook" web application. Pressing this button closes the results panel, and a panel with the same results opens in a new browser tab in the web application (see [4.4 Results panel in the web application](#)).
-  — to close the results panel.

3.5 History of laboratory work completion in VL

To view the history of works you have completed from within VL, press the  button in the upper right corner of the Workbook panel (2 in Figure 2). A panel with the history of laboratory works that were completed in this VL will open to the right of the VL window (Figure 18).

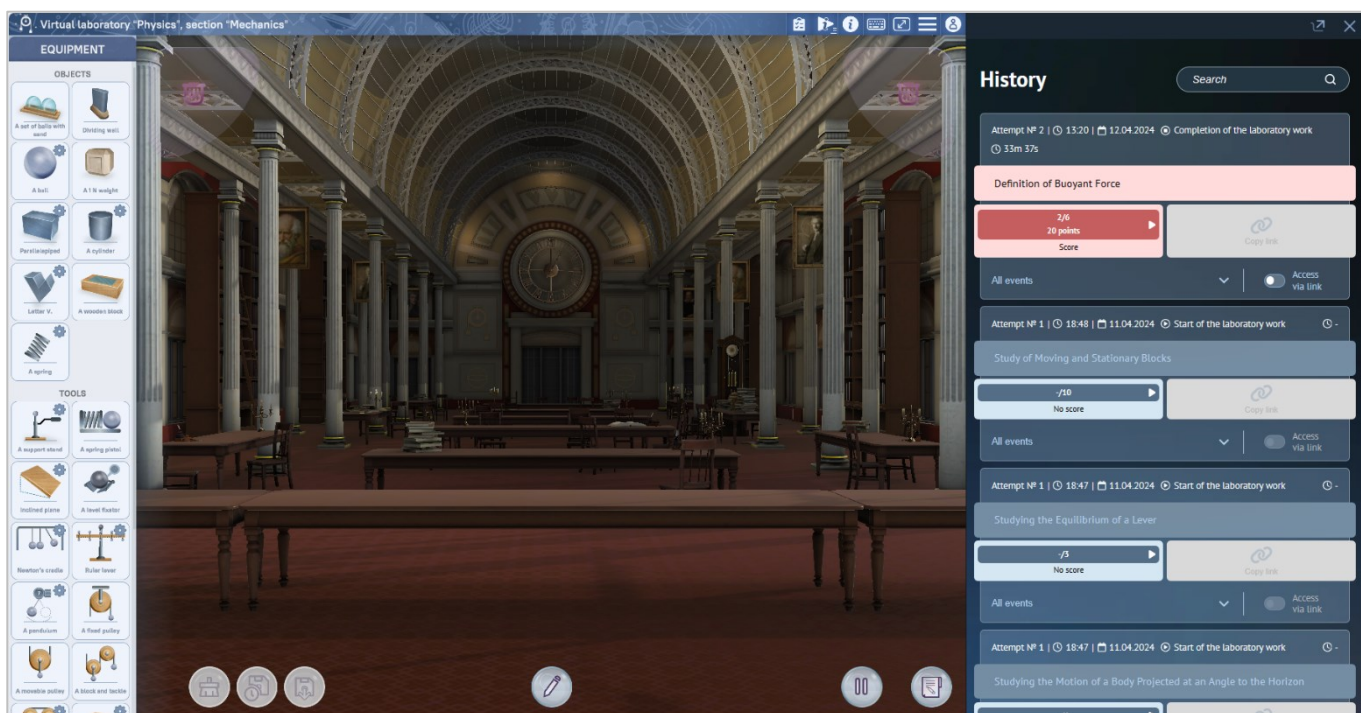


Figure 18 – History of laboratory work completion opened from VL

The history panel displays:

- a search bar. Typing at least one character filters the list of cards to those whose names contain the typed character combination;
- cards that contain information about all your attempts to complete works in the current VL. Each card displays (Figure 19):

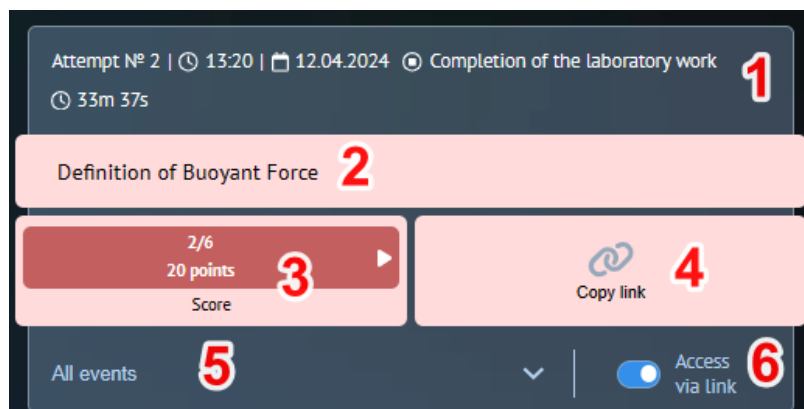


Figure 19 – Laboratory work completion history card

- 1) attempt number, time, date, and description of the last event related to the completion of the laboratory work;
- 2) the name of the laboratory work;
- 3) the **Best result** button — for navigating to the results of the laboratory work. The button displays the number of tasks you have completed out of the total number of tasks in this laboratory work. Upon pressing the button:
 - if the laboratory work is completed (button is colored in green, yellow, or red), the results page opens (see [3.4 Results panel in VL](#));
 - if the results are not yet obtained (button is colored in gray), then the page of this unfinished laboratory work opens (see [3.3 Laboratory work panel in VL](#));
- 4) the **Copy link** button — for copying the link to the results page of the laboratory work to the clipboard (see [4.4 Results panel in the web application](#)). The button is available if the link access control toggle (6) is enabled;
- 5) a list of events related to the completion of the laboratory work (by default, the list is collapsed). Using  /  buttons you can expand/collapse the list. A record of each event contains: the time and date of registration of the event, as well as a description of the event;
- 6) the link access control toggle . This toggle becomes available after receiving the results of the laboratory work review. By default, the toggle is turned off.

Before you have received the results of the laboratory work review, the card has a neutral (gray) look. The **Copy link** button and the toggle on the card are locked.

After receiving the results of the review, the button (4) and the toggle (6) will be unlocked, and the card will be colored in one of the colors:

- green — the laboratory work is completed excellently;
- yellow — the laboratory work is completed well or satisfactorily;
- red — the laboratory work is completed unsatisfactorily.

The following buttons are displayed to the right above the history panel:

-  — to go to the "Workbooks" web application. When you click the button, the history panel closes, and the same history in the web application opens in a new browser tab (see section [4.5 Viewing history in the web application](#));
-  — to close the history panel.

4 "Workbooks" web application

You can go to the "Workbooks" web application:

- using the  button on the Workbook panel opened in VL;
- using the  button located above the panels opened from the VL: laboratory panel, results panel, history panel.

4.1 Workbook page

The Workbook page contains a list of all the variants of laboratory works intended for completion in one VL.

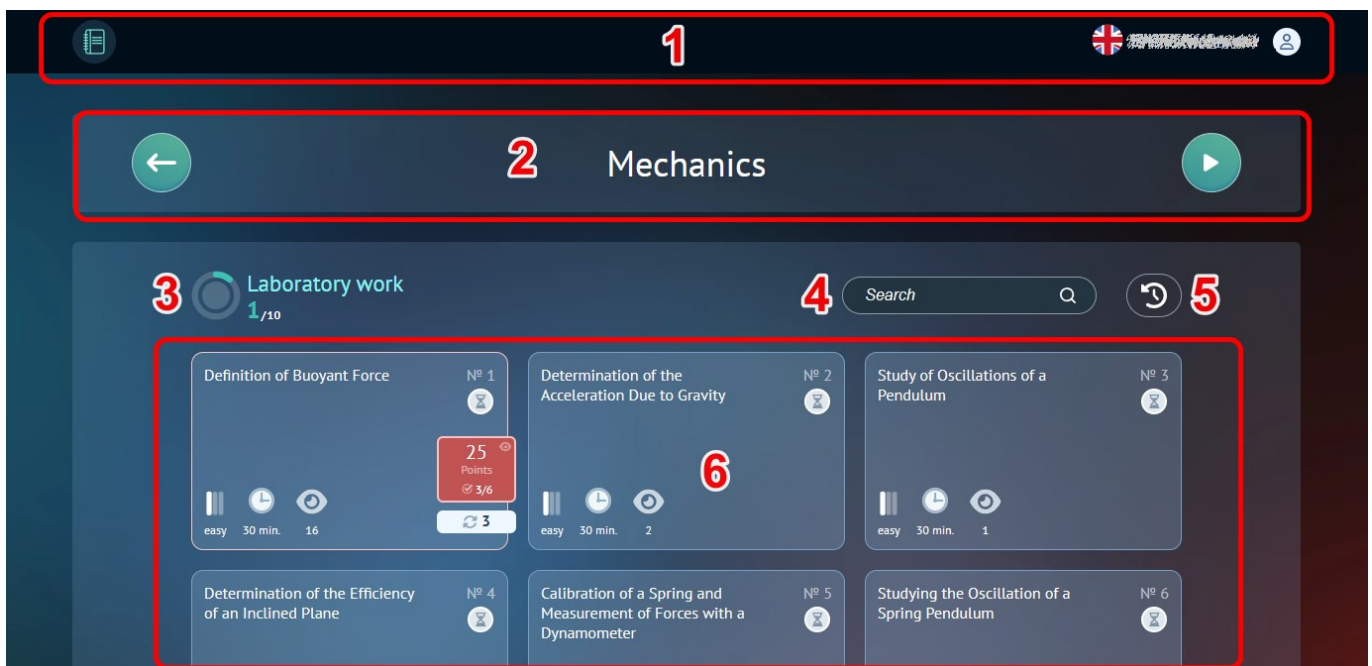


Figure 20 – Workbook page

On the Workbook page (Figure 20) the following are displayed:

1) The application header, which contains:

- a button to go back to the list of Workbooks  (see [4.2 List of Workbooks](#));
- a button for choosing localization. Clicking on this button opens a menu containing available options for regional settings (Figure 21). When a new option is selected, the page reloads with the new settings applied;



Figure 21 – Regional settings menu

- a button with the user's surname, name, and icon. Clicking on it opens a menu (Figure 22), consisting of items:

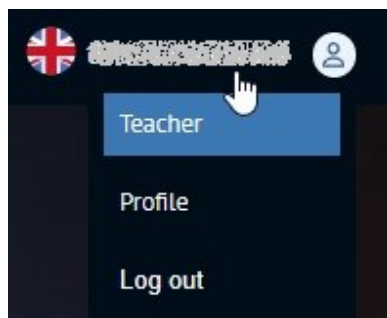


Figure 22 – User menu

- the current role of the user;
- **Profile** — selecting this item opens your user profile on the VR-Labs portal in a new tab;
- **Log out** — selecting this item opens the authorization page on the VR-Labs portal in the current tab.



The application header is displayed on all pages of the "Workbooks" web application.

2) The navigation panel, which includes:

- a **Back**  button — for returning to the previous page;
- the name of the VL for which the set of laboratory works is formed;
- a button to launch the VL . Clicking the button launches the VL in a new tab.



The navigation panel is displayed on all pages of the selected Workbook.

- 3) Current user progress — the number of laboratory works you have completed out of the total number of laboratory works created for the selected VL.
- 4) Search bar. Entering at least one character in the search bar filters the list of cards to only those whose laboratory work title contains the entered character combination.
- 5) Button for viewing the history of laboratory work . Clicking the button displays the page with the history of laboratory work completion in the current tab (see [4.5 Viewing history in the web application](#)).

6) Laboratory work cards. Each card displays (Figure 23):

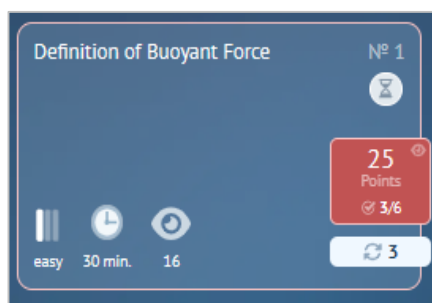


Figure 23 – Laboratory work card

- the title of the laboratory work;
- the sequential number of the laboratory work;
- The assignment is not completed yet icon  is displayed if you have started the laboratory work but have not yet submitted it. The name of the icon is shown when you hover over it. The  icon may be present even if the results have already been obtained, but the work has been started again. If the work is submitted and not started again, the icon is absent;



For incomplete work, the data of the answers you entered for the tasks and the status of the confirmation button:  or  (see the description of the button in 3.3.2 Task blocks) are saved.

- the **Difficulty level**  icon, under which the presumed difficulty level of the laboratory work is displayed: **easy**, **medium**, or **hard**;
- the **Completion time**  icon, the estimated time to complete the laboratory work is displayed beneath it;
- the **Views**  icon, the number of launches of the laboratory work by all users is displayed beneath it;
- the **Best result** button to go to the best result (Figure 24). The button is displayed if you have submitted this laboratory work for assessment at least once and have received the assessment results.

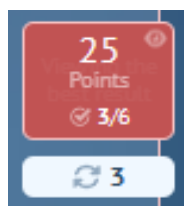


Figure 24 – The "Best result" button

The button displays the best result you have achieved in the course of completing all variants of this laboratory work, and below that, the number of your attempts. Depending on the outcomes of the laboratory work, the color of the button can be:

- green — the laboratory work is completed excellently;
- yellow — the laboratory work is completed well or satisfactorily;
- red — the laboratory work is completed unsatisfactorily.

Pressing the button opens a panel with your best result for this work (see [4.4 Results panel in the web application](#)).

Clicking the laboratory work card (outside the **Best result** button) in the current tab opens the laboratory work panel (see [4.3 Laboratory work panel in the web application](#)).

4.2 List of Workbooks

The page with the list of Workbooks opens using the  button in the **Application header**. It displays the cards of all Workbooks. Each of the Workbooks is intended for performing laboratory work in one of the overhead lines (Figure 25).

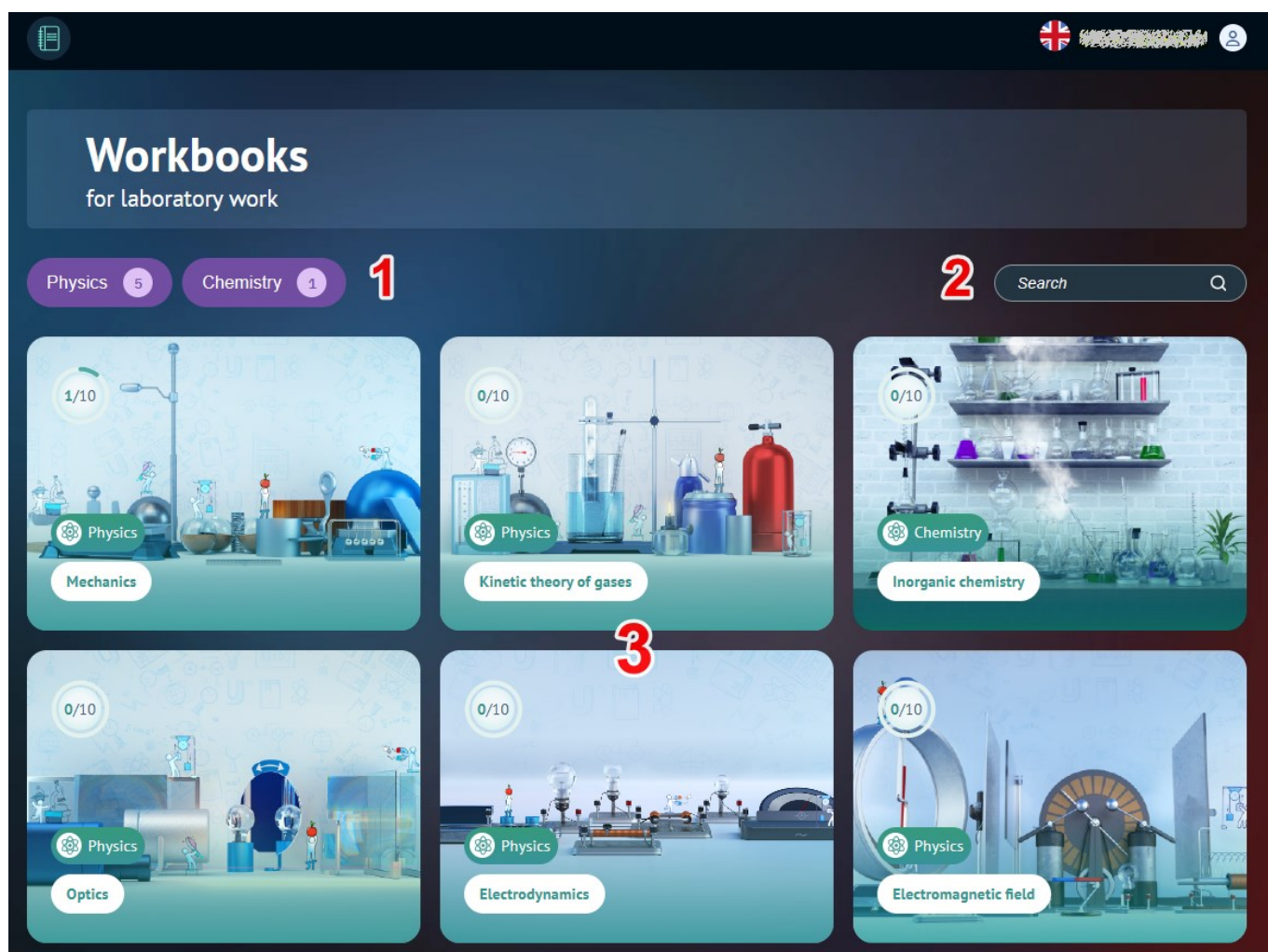


Figure 25 – List of Workbooks

Displayed on this page are:

- 1) A filter panel, containing a set of toggle buttons. Each button displays the name of a VL category ("Physics", "Chemistry") and the number of cards in the list that belong to this category. By

default, all buttons are turned off, and all cards are displayed on the screen. Clicking on a button activates the corresponding filter, and only the cards that fall into this category remain in the list (Figure 26).

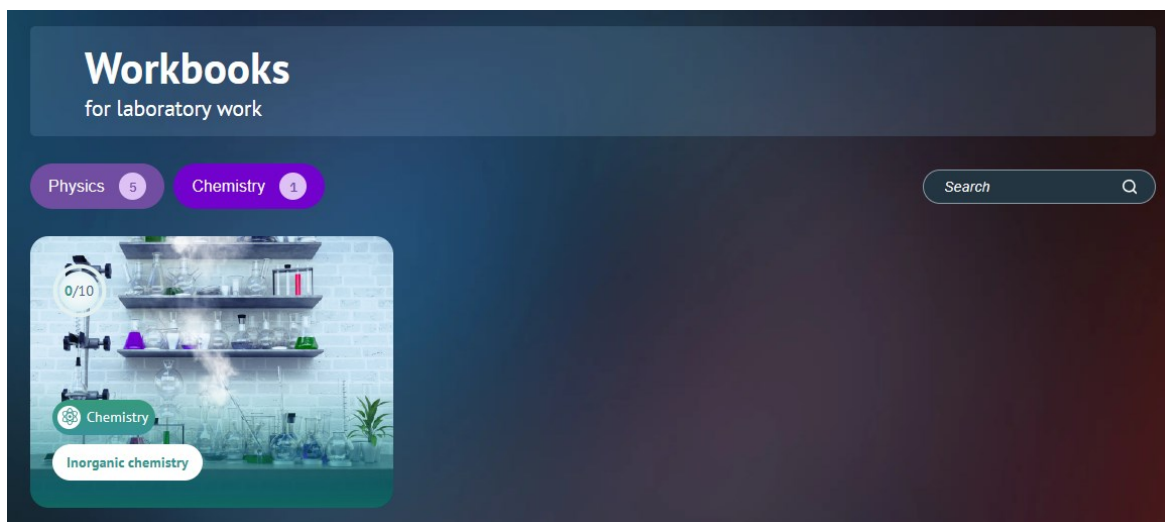


Figure 26 – "Chemistry" filter activated

- 2) Search bar. When at least one character is entered into the search bar, the list of cards narrows down to those whose VL name contains the entered character combination. Their number is displayed on the filter buttons.
- 3) Workbook cards, each of which contains (Figure 27):



Figure 27 – Workbook card

- the current user progress (1) — the number of laboratory works you have completed in this Workbook out of the total number of laboratory works in this Workbook;
- the VL category name (2);
- the name of the VL (3) for which the set of laboratory works is formed.

Clicking on a card takes you to the page of the selected Workbook (Figure 20).

If you do not have a license for the VL, the corresponding Workbook card will appear in black and white (Figure 28), and clicking on it will display the "Sorry! You have no access to virtual laboratory" window (Figure 29).

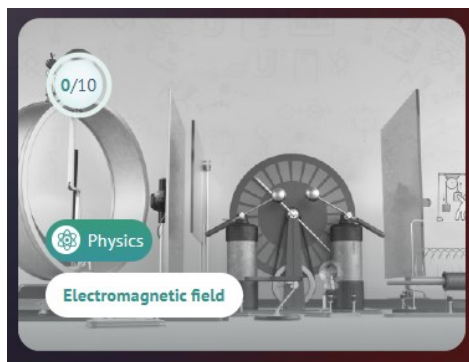


Figure 28 – Workbook card without a VL license

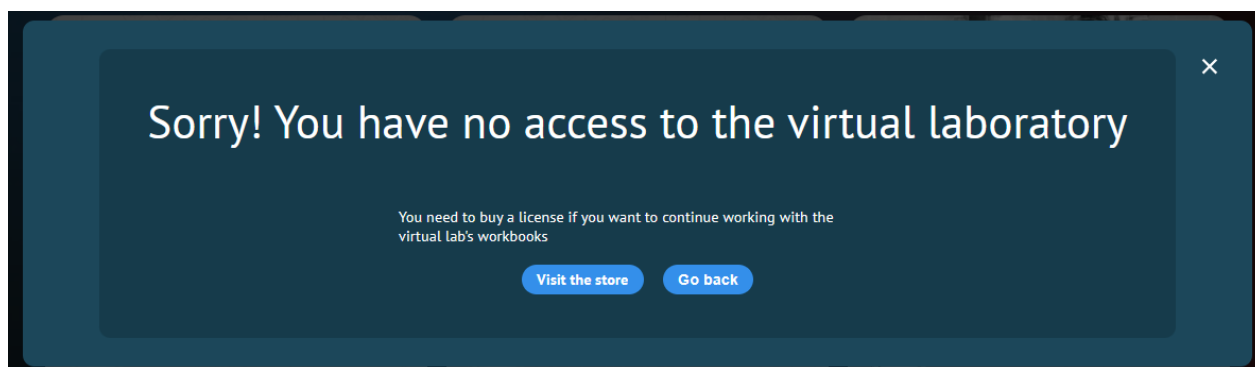


Figure 29 – "No access to Virtual laboratory" window

4.3 Laboratory work panel in the web application

The laboratory work panel in the web application (Figure 30) is similar to the panel opened from the VL (see [3.3 Laboratory work panel in VL](#)).

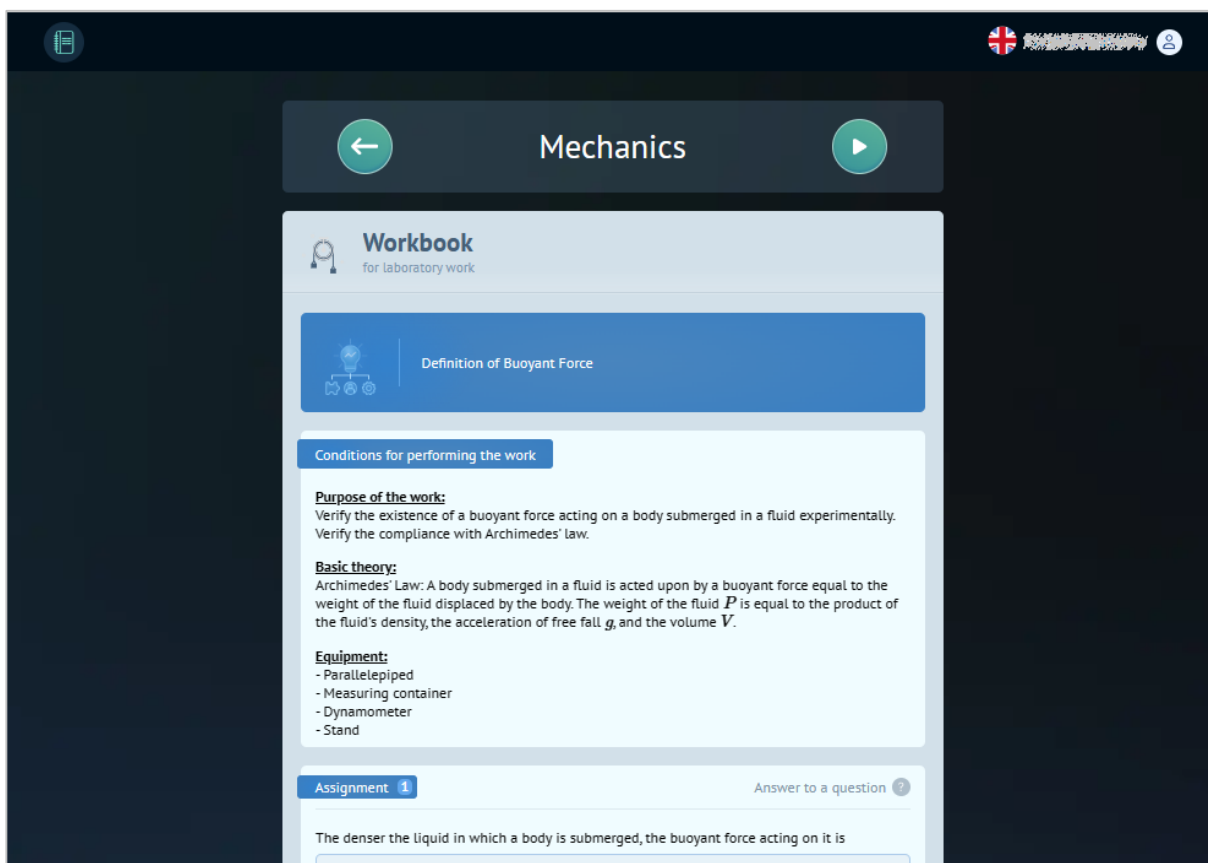


Figure 30 – Laboratory work panel in the web application

When transitioning to a selected laboratory work:

- if the laboratory work has not been started yet or was completed and submitted, the panel of a new variant of the selected laboratory work opens;
- if the laboratory work was already started and not submitted, the panel of the selected unfinished laboratory work opens.

Using the  button on the navigation panel, you can transition to VL and continue working on this laboratory work there (see [3.3 Laboratory work panel in VL](#)). With this move, this work will become inaccessible on the web application page you left. Remember to save all your entered answers in the web application using the  button before moving to VL.

The blocks of conditions and tasks are described in detail in [3.3 Laboratory work panel in VL](#).

4.4 Results panel in the web application

The results panel in the web application (Figure 31) is similar to the panel opened from the VL (see [3.4 Results panel in VL](#)).

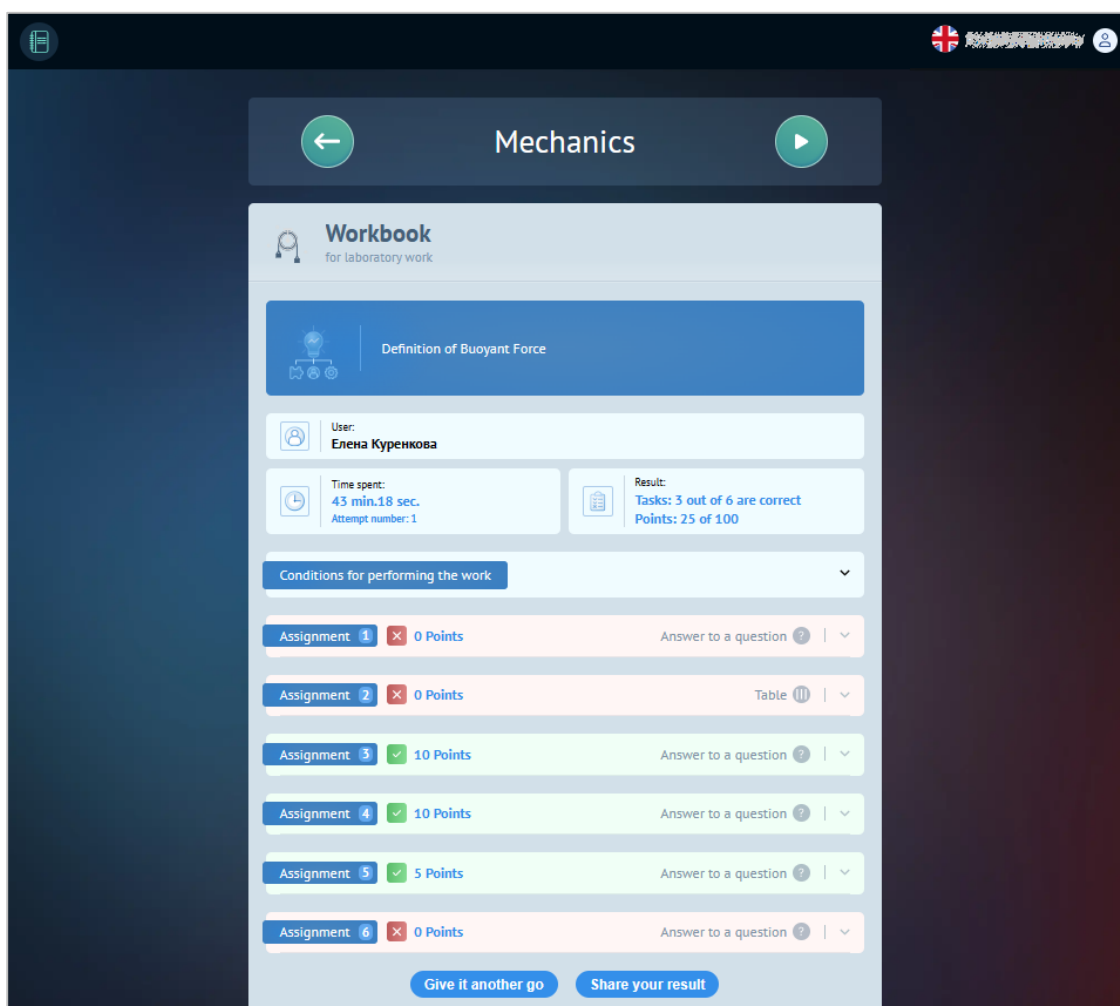


Figure 31 – Results panel of the laboratory work in the web application

You can navigate to the page with the results panel of the laboratory work (Figure 31) in one of the following ways:

- automatically after completing the laboratory work (after pressing the **Submit** button) and the completion of the automatic checking;
- from the Workbook page with the list of laboratory works — by pressing the **Best result** button on the card of the laboratory work;
- via a link created by pressing the **Share your result** button on the same results panel;
- from the history of laboratory work completion (see [4.5 Viewing history in the web application](#)):
 - via a link created by pressing the **Result** button;
 - via a link created by pressing the **Copy link** button.

Using the  button on the navigation panel, you can open a new browser tab with the VL featuring the panel of a new variant of this laboratory work (see [3.3 Laboratory work panel in VL](#)).

4.5 Viewing history in the web application

To view the history of the laboratory works you have completed from a specific Workbook, press the  button on the page of that Workbook (Figure 20). Instead of a list of laboratory work, a list of cards will be displayed with information about all your attempts to perform laboratory work in the selected VL (Figure 32).

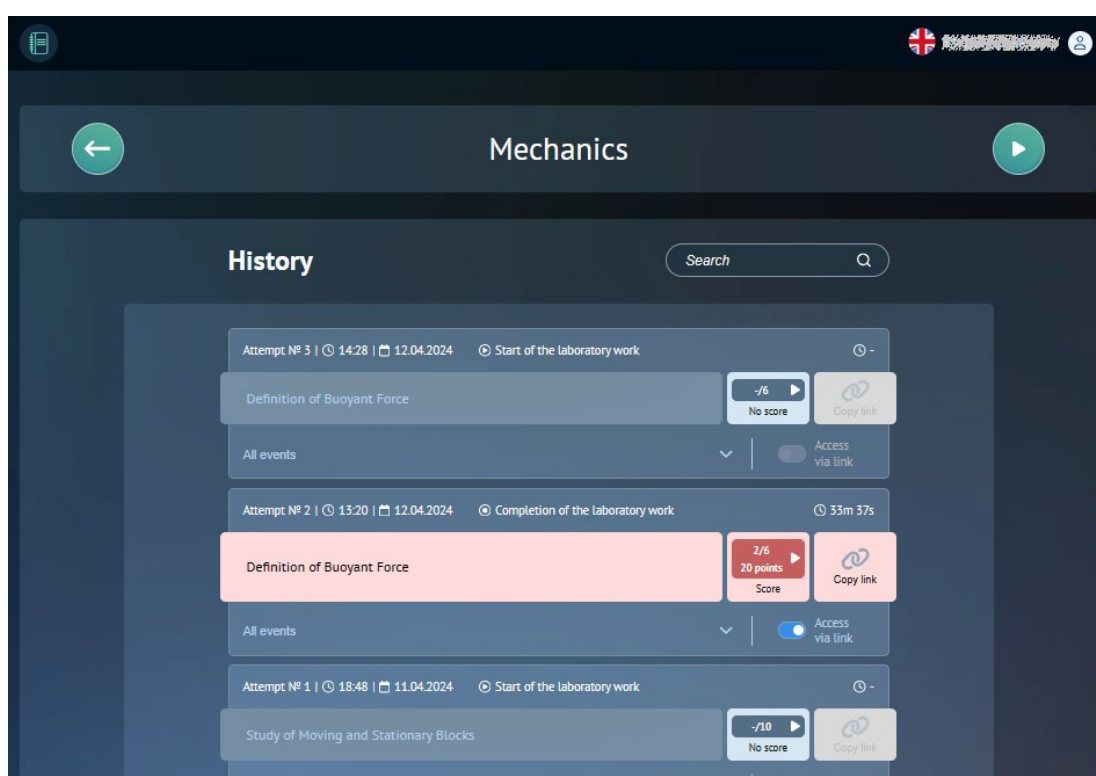


Figure 32 – History of laboratory work completion in the web application

All elements of the cards are similar to the elements of the history cards opened from the VL (see [3.5 History of laboratory work completion in VL](#)).

Using the  button on the navigation panel, you can open the selected VL in a new browser tab.

5 Procedure for completing a laboratory work

5.1 Opening a laboratory work

You can open a laboratory work in one of the following ways:

- in the VL where this work will be carried out;
- in the "Workbooks" web application.

5.1.1 Opening a laboratory work in VL

To open a laboratory work in VL:

- 1) Press the Workbook call button  on the **Application header** panel of VL (Figure 1). A Workbook with a list of laboratory works for this VL will open (Figure 2).
- 2) Select the laboratory work and click on its card with the left mouse button. A panel of the work will open to the right of the VL window (Figure 5).

 *If the selected laboratory work has not yet been started or was completed and submitted, a page with a new variant of this laboratory work will open. If the selected laboratory work has already been started and not submitted (the card displays an icon ) , a page with the selected unfinished variant of this work will open.*

5.1.2 Opening a laboratory work in the "Workbooks" web application

To open a laboratory work in the "Workbooks" web application:

- 1) Press the Workbook call button  on the **Application header** panel of VL (Figure 1). A Workbook with a list of laboratory works for this VL will open (Figure 2).
- 2) In the upper right corner of the Workbook, click the  button to go to the web application. The Workbook panel in the VL will close, and the same Workbook page will open in a new browser tab (Figure 20).
- 3) Select the laboratory work and click on its card with the left mouse button. The laboratory work panel will open (Figure 30).

 *If the selected laboratory work has not yet been started or was completed and submitted, a page with a new variant of this laboratory work will open. If the selected laboratory work has already been started and not submitted (the card displays an icon ) , a page with the selected unfinished variant of this work will open.*

5.1.3 Simultaneous access to the laboratory work on two resources

If the laboratory work is opened on one resource (in the web application or VL) and then on the second one (in VL or the web application), access to the laboratory work on the first resource will be closed. An "Access denied" window will open (Figure 33).

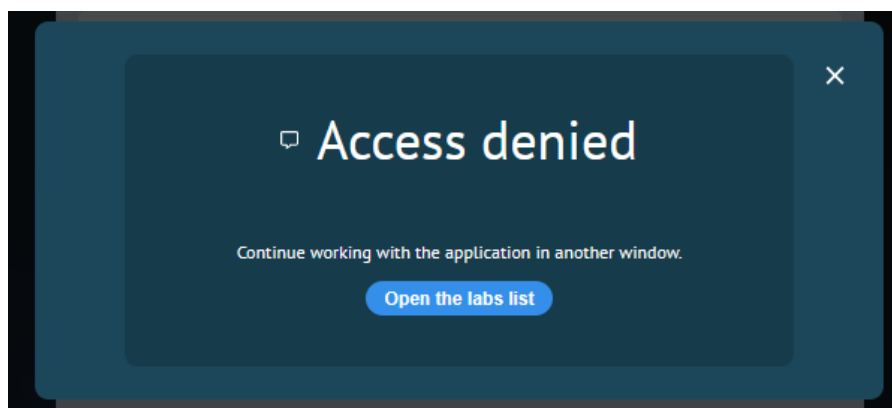


Figure 33 – "Access denied" window

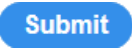
If the first resource was VL, then the button to go to the list of Workbook (Figure 25) is not displayed in the window.

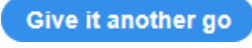
5.2 Performing the laboratory work

- 1) Read the conditions and tasks of the laboratory work.
- 2) Depending on the type of task block (see [3.3.2 Task blocks](#)):
 - **Answer to a question** (Figure 8) — select one or several correct answers;
 - **Numeric answer** (Figure 9) and **Text answer** (Figure 10) — enter your answer in the text field;
 - **Chart** (Figure 11) — perform the following actions:
 - a) Enter the coordinates of the chart points into the table cells. As soon as there is enough data to plot a point, a new point with the entered coordinates will appear on the coordinate plane.
 - b) Use the  button to add a new line and the  buttons to delete lines from the table (except for the first one).
 - c) Check the **Connect the points with straight lines box** if you need to connect the points. The line will pass through them in the order of the rows with corresponding coordinates.
 - **Reaction equation** (Figure 12) — perform the following actions:
 - a) Drag the card with the substance formula into the **Reagents** field from the **Possible reaction elements** list. Fields for entering the coefficient and the substance behavior will become available.
 - b) Enter the coefficient value.
 - c) Open the dropdown list in the substance behavior field and select one of the three values.

- d) Similarly, enter the formula, coefficient, and type of substance behavior in the **Products** field.
- e) Open the dropdown list **Type of reaction** and choose one of the four values.
- f) If necessary, formulate the next equation.
- **Table** — depending on the type of table:
- If it is a table with a fixed number of rows (Figure 13), fill in the empty cells/
 - If it is a table with a variable number of rows (Figure 14), fill in all the cells of the table. If necessary, add new rows to the table (button ) or delete unnecessary ones (button )
- 3) Press the  button to save your answer. If you wish to change your answer, press the  button, correct the mistake, and press the  button again.
- 4) Repeat steps 2 and 3 for all tasks of the laboratory work.

5.3 Completing the laboratory work

Press the  button (it becomes available once the answers to all tasks have been confirmed). The answers are sent to the server for automatic checking. After the review is completed, the results panel opens.

After receiving the results, you can do the work again by pressing the  button, or you can copy the link to the results by pressing the  button.