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ITMO University
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International Research and Educational Center
for Physics of Nanostructures

SYNOPSIS
for the subject
"Name of the Subject"

on the topic:
A LONG TITLE OF MY CRAZY SYNOPSIS THAT I CANNOT EVEN
PRONOUNCE CORRECTLY

Student:
Group No. xxxx   *Surname, Name*

Tutor:
position, degree   *Surname, Name*

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INTRODUCTION

This is a publishing system called LATEX, you can use it to write texts. The text is divided into paragraphs by inserting an empty line into the source code.

You can make some words **bold**, or produce_{subscripts}, or you can combine any formatting_{**as you wish**}. It is also possible to type whole paragraphs in italics—just like this:

Several competing theories have emerged, attempting to describe the optical properties of ternary quantum dots. Generally, they are based on the phenomenon of localization of photoexcited charge carriers on defects or lattice sites, which leads to the appearance of additional energy states inside the QD band gap. However, despite prominent interest to ternary QDs, information on their energy structure and mechanisms of radiative transitions is still relatively scarce. This is primarily due to the high complexity and a large number of processes occurring in these nanocrystals. Also, to date, there is no exhaustive description of how the optical properties of ternary QDs are affected by the external environment, i.e., the solvent or matrix, the ligand molecules, proximal fluorophores, plasmonic nanoparticles, and so on. For instance, ligand molecules can significantly modify the optical properties of ternary QDs and their complexes. Investigation of these effects is of high importance. The characteristic features of FRET from t-QDs to dye molecules also remain unclear. Utilization of donors with a broad spectrum of low-energy electronic states, such as ternary QDs, can enable simultaneous transfer of photoexcited energy to several different acceptor molecules with different efficiencies. This phenomenon is of great fundamental and practical interest.

In a few upcoming examples we will show how you can use LATEX for altering the text formatting and style. We will create several chapters, sections, and subsections which will appear in the Table of Contents automatically. We will learn to generate lists (both numbered and unnumbered), figures and their captions, clickable links and references to other sections and specific objects in the text. Among other things, we shall see how to generate tables and an automatically assembled bibliography list. General rules and recommendations for preparing a synopsis can be found in the Russian standard for preparation of reports on research and development, design, technological and design and technological works (GOST 7.32-2017).

1 THIS IS THE FIRST LARGE PART (CHAPTER). LISTS, REFERENCES, LABELS, BIBLIOGRAPHY

When creating a document in LaTeX, you must choose one of the supported classes (the command `documentclass` in the beginning of the main file). The choice of the class defines a set of functions and commands that are available in the document. For instance, the `memoir` class which is used in the current template provides a broad functionality for tuning the page format, style of headings, Table of Contents, etc. Therefore, `memoir` is well suitable for synopses and theses.

The hierarchical parts in `memoir` are the following: the highest-level `chapter`, the second-level `section`, and the third-lever `subsection`. Right now, we shall create several sections and subsections and check their appearance.

1.1 This is a section heading. Numbered and unnumbered lists

In this section, we will see how to make various lists, including unnumbered lists as well as multilevel numbered lists. GOST tells us that items and subitems are written with a paragraph indent. Let us leave an empty space before the first item and after the last one to visually separate the list from the rest of the text. GOST does not explicitly prohibit this, and it looks much better this way. This is what an unnumbered list looks like:

– item one, short;
– item two, long, does not fit one line and is therefore partially moved to the next line;
– the last item in the list.

1.1.1 The subsection where we demonstrate the appearance of multilevel numbered lists

Now let us deal with numbered lists. The required formatting is already defined in the main file. It will look like this:

1. First item
   a) First subitem of the first item

b) Second subitem of the first item

2. Second item

    a) First subitem of the second item

    b) Second subitem of the second item

        i. This is already the third-level item

        ii. Let us make one more third-level item. It is large enough to demonstrate how the text in a numbered list is moved to the next line

    c) Third subitem

1.2 Labels and references

In LaTeX, there are quite a lot of possibilities for creating various links/references in the text. You can refer to any specific places, pages, figures, tables, sections, etc., and LaTeX will automatically pick up the desired page number and/or name. To generate beautiful references, we use the `hyperref` package. It is important to remember that for referring to a specific place you must put a label there. A reference to Introduction, for example, will not work unless a label is placed after the chapter is declared in the source code.

Furthermore, you can put a label literally anywhere and refer to this place from anywhere else in the text by using special commands `ref` and `hyperref`. The first one returns **only a clickable number** of a section, figure, math expression, etc. (if it is available), while the second one allows you to make a hyperlink from any word or text, as well as combine this text with an automatically loaded number. For example, with `hyperref` we can make a nice link to Section 2.1, where we will learn how to generate figures and captions. It is also possible to use just the `ref` command, but in this case only the number will work as a hyperlink, without the word "Section": Section 2.1.

1.3 Bibliography

Making bibliography in LaTeX is simple: insert references from Google Scholar (in bibtex format) into the `.bib`-file, assign a `citekey` to each of them, and use it in the text wherever you need to cite one or more works. The `citekey`

is essentially just a unique label, but for bibliographic entries. When an entry is copied from Google Scholar, the `citekey` is assigned automatically. Citation and formatting of the bibliography is done using the `biblatex` package, and the reference format is specified in the main file. For the demonstration purpose, this template already has a `.bib`-file with several references in it. Let's try to cite them and see how it will look in the document. The citation preferences are adjusted to match the English language for all citations, so make sure that you have an English version of any reference that is originally in another language. For example, let us cite a couple of foreign articles to see how it works. Here is one of them [1], and here is a bunch of three [2–4].

2 THE SECOND CHAPTER, WHERE WE DISCUSS FIGURES AND MATHEMATICAL EXPRESSIONS

2.1 Figures

2.1.1 Regular single figures. Adjusting the size, captions, and references in the text

Figures in LaTeX are numbered automatically. If we assign them unique labels, then we can refer to them from anywhere in the text. References to figures in the text, as well as references to sections and bibliographic citations, are clickable. For example, Figure 1 shows some unknown bird. By default, figures will resize to fit the width of the text, but in the figure environment you can set the width manually. For example, here the width is set to half the width of the text. Figure captions are made according to the GOST rules: centered, no period at the end, a full-text word "Figure", and an em dash as a separator. The caption font is smaller than the main text font (12 point). It is not prohibited and looks better that way.

Figure 1 — This is some sort of bird

Now, let us demonstrate a multi-line caption. For the sake of an example, we have added another totally unknown bird that is presented in Figure 2. By the way, one can notice that the figure size is different here—one third of the text width.

Figure 2 — Here is another bird. This one is different from the first bird in some ways, namely in the beak shape, the color of feathers, habitat, and its talkativeness. We are not sure about the latter, though: the bird certainly looks like a parrot, but this is not 100%

We add some text here to show the size of the spacing after the figure caption. We did not change this value, decided to keep the default for the current document class.

2.1.2 Complex multilevel figures

Now, let us look at more complex figures. It is often needed to generate two to four subfigures which are numbered (a), (b), and so on. We create such objects by using the `subfigure` environment and the tools provided by the `subcaption` package. Using the Figure 3 as an example, let us show how to define the geometry and position of subfigures. Here we have two images of different sizes, so we manually aligned them in height.

By using the same tools as before, we can refer not just to the whole figure, but also to a specific subfigure. For example, we can easily refer to this beautiful tiger presented in Figure 3b. Finally, it is also possible to create multilevel drawings that contain more than two subfigures. Let us add another image at the bottom center. Note that LaTeX can swap images (as well as other float objects) and the surrounding text to avoid large blank spaces on pages.
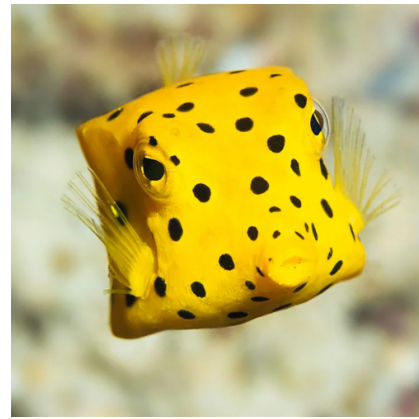
(a)

(b)

Figure 3 — Tigers. Figure (a) shows a tiger who is casually walking in savanna, while figure (b) demonstrates the one who is bathing in a pond. The tiger in (b) looks quite satisfied

(a)

(b)

(c)

Figure 4 — Various fish

Figure 4 exhibits three photos of equal size, with the third one being positioned at the bottom center. By playing with the tools we can easily generate a reference which looks like if is was leading to several subfigures, whereas in re-

ality it leads to the whole figure at once. For instance, we can do something like this: Figure 4a–c.

2.2   Mathematical expressions

Here, everything is simple. You can just google how to generate math expressions and formulas, what packages you need to load for this, etc. Formulas can be inserted directly into the text, this is done using single $ characters. For example, you can make such a thing: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. It is inconvenient to refer to such formulas. A more elaborate way is to make a formula on a separate line and assign it a number and a label. In this case, later you can refer to this formula from anywhere in the text using the commands `ref` and `hyperref`. This is typically done with the `equation` environment. Here is an example:

$$\frac{n!}{k!(n-k)!} = \binom{n}{k}. \tag{1}$$

Here is a simple reference to Formula 1. If is of course possible to use `hyperref`, which allows you to get a different look: Formula 1. Choose the one whichever you like more.

By the way, LaTeX has additional functionality for drawing nice chemical equations. As an example, we shall consider Formula 2. To create such formulas, you have to load an optional package called `mhchem`.

$$Na_2SO_4 \xrightarrow{H_2O} Na^+ + SO_4{}^{2-}. \tag{2}$$
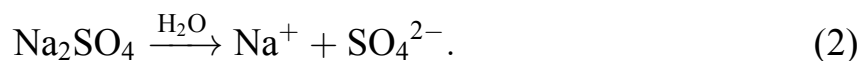
3 TABLES

Let us now deal with tables. Naturally, LATEX allows you to make large and complex tables, but it is rarely reasonable to do it manually. Different websites like this one are commonly used, which help you to generate the correct source code. There are no strict regulations in GOST that state how tables should look like; it is, however, important to maintain the proper captions, numbering, and references. All the necessary formatting and style is already built in this template. Remember that, according to GOST, you must not put a period mark in the end of the table caption, as well as in the end of the figure caption. By using the above-mentioned website, we can produce, for instance, such a table:

Table 1 — This is a random table from the Internet which contains the price of some wild animals that can be found elsewhere in the world

Animal	Description	Price ($)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99

This is obviously possible to generate a reference to this table. Let us look at the Table 1 and say that we have finished this.

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