1. Light bulb

Create a two-page document to introduce the operation and the history of the light bulb. Create the document using a word processor.

The source text can be found in file `bulbsource.txt`. The pictures to be inserted into the document are `lamp1.png` and `lamp2.jpg`.

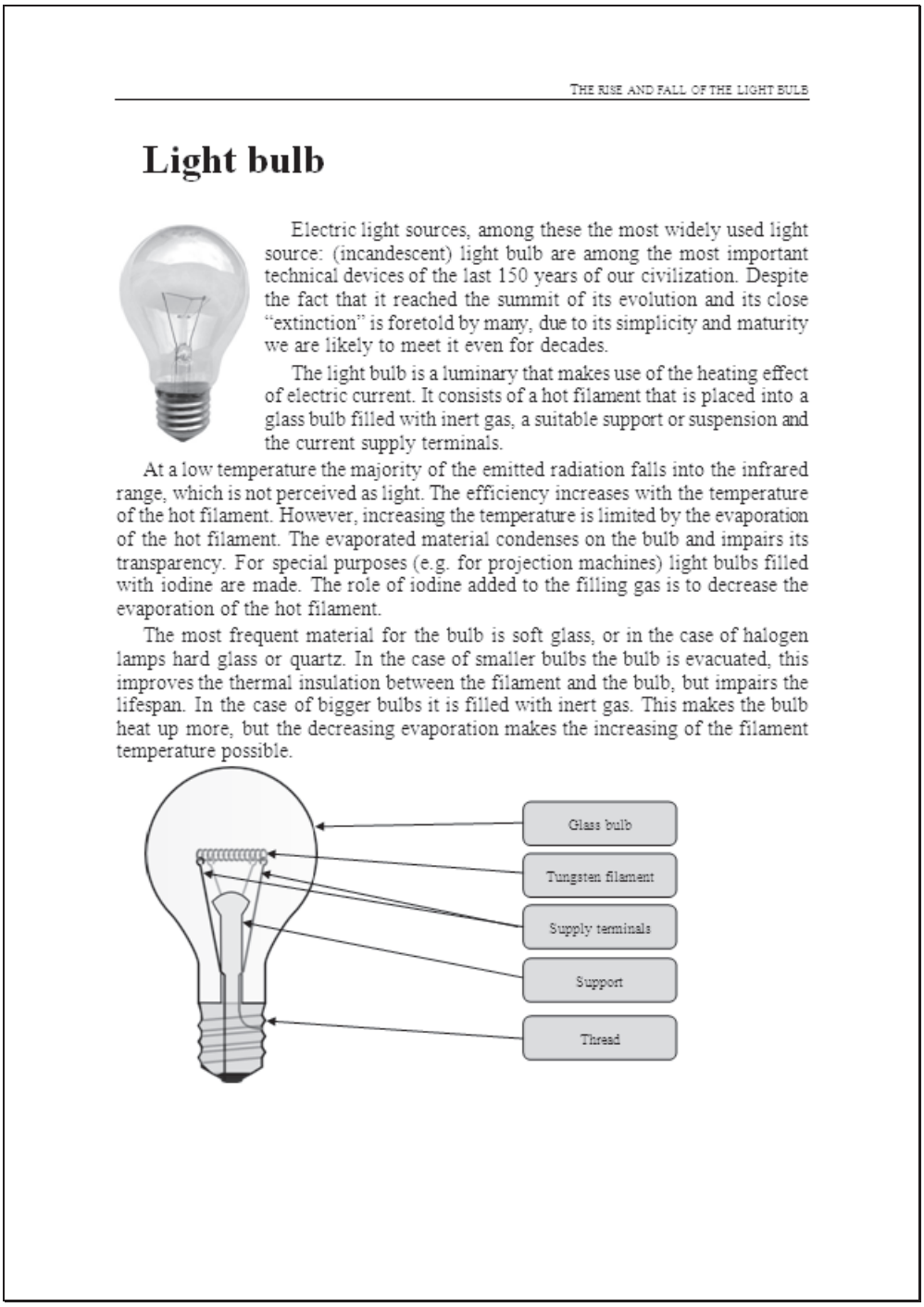
1. Open file `bulbsource.txt`, which is UTF-8 encoded, using the word processor. Save your work in the default format of the program as `lightbulb`.
2. In the document set the left and right margins to 2.6 cm, the top margin to 3 cm and the bottom margin to 2 cm.
3. The default font format of every text– with the exception of the captions of the figure –is Times New Roman (Nimbus Roman) of size 13 points. The first lines of the paragraphs are indented by 0.6 cm, they are justified and the spacing after them is 3 points.
4. Create the header above the title, its distance from the top of the page should be 1.75 cm. Type in the text: "The rise and fall of the light bulb"! Besides the default font format of the word processor the text should be formatted with small caps and aligned right. Underline the contents of the header with a thin line between the left and right margins according to the example.
5. The font size of the title is 26 points, the font style is bold and the spacing after it is 24 points. The font size of the other two subtitles shown in the example is 20 points, the font style is bold and the spacing after them is 12 points.
6. Insert picture `lamp2.jpg` next to the paragraph after the title and align it left. Change it proportionally so that its width becomes 3 cm.
7. Insert a page break according to the example and create the figure according to the following:
    a. Insert picture `lamp1.png` on the left and change its width proportionally to 4 cm.
    b. Create the captions on the right in five boxes with rounded corners. The width of the boxes is 3.5 cm, their height is 1 cm and their background is light gray. The boxes of the captions are positioned precisely under each other, they should not touch or overlap each other. The texts within the boxes are aligned centered horizontally.
    c. From the captions 6 arrows should point at the corresponding parts of the figure according to the example.
8. Create the list after the first subtitle. The bullet should be the circle with two crossed lines representing the light bulb.
9. Insert footnotes for the names "***T. A. Edison***" and "***A. N. Lodygin***" using the default font style and size and the format shown in the example. Take the texts from the braces after the names. Delete the braces and do not leave redundant spaces.

The exercise continues on the next page.

10. Create a text box of size 5 cm × 5 cm to explain the name "***Tungsram***" next to the last paragraph before the second subtitle and align it to the right according to the example. Take the text from the braces before the paragraph, then delete the braces and the redundant spaces. In the text box the background is dark gray, the font size is 14 points and the font colour is white.
11. Use hyphenation in the document where it is required.

40 marks

Example:



THE RISE AND FALL OF THE LIGHT BULB

Light bulb

Electric light sources, among these the most widely used light source: (incandescent) light bulb are among the most important technical devices of the last 150 years of our civilization. Despite the fact that it reached the summit of its evolution and its close "extinction" is foretold by many, due to its simplicity and maturity we are likely to meet it even for decades.

The light bulb is a luminary that makes use of the heating effect of electric current. It consists of a hot filament that is placed into a glass bulb filled with inert gas, a suitable support or suspension and the current supply terminals.

At a low temperature the majority of the emitted radiation falls into the infrared range, which is not perceived as light. The efficiency increases with the temperature of the hot filament. However, increasing the temperature is limited by the evaporation of the hot filament. The evaporated material condenses on the bulb and impairs its transparency. For special purposes (e.g. for projection machines) light bulbs filled with iodine are made. The role of iodine added to the filling gas is to decrease the evaporation of the hot filament.

The most frequent material for the bulb is soft glass, or in the case of halogen lamps hard glass or quartz. In the case of smaller bulbs the bulb is evacuated, this improves the thermal insulation between the filament and the bulb, but impairs the lifespan. In the case of bigger bulbs it is filled with inert gas. This makes the bulb heat up more, but the decreasing evaporation makes the increasing of the filament temperature possible.

Example for the Light bulb exercise:

THE RISE AND FALL OF THE LIGHT BULB

History:

- ⊗ The first lamp with a hot filament placed into a closed, evacuated glass bulb was made by T. A. Edison[1] and A. N. Lodygin[2]. The hot filament of this lamp was made of carbon.
- ⊗ The next milestones of the development of light bulbs were the discovery of lamps with the hot filament made of osmium and tantalum.
- ⊗ Nowadays the hot filament is made of tungsten and it is wound into a double spiral to decrease the heat loss.
- ⊗ The ordinary structure of the light bulb was improved substantially by Imre Bródy. He designed the light bulb filled with two gases (krypton and nitrogen). He also discovered how one could extract krypton and xenon from the air.
- ⊗ The United Light Bulb and Electricity Co., which was founded in 1896, already manufactured light bulbs with tungsten filaments in 1911. The factory was known as Tungsram abroad.

The ordinary household light bulbs are produced for the network voltage of 230 V and their power uptake is 25, 40, 60 or 100 W. Light bulbs with smaller or greater power uptake or operating at different voltages also exist, for example flashlight bulbs, reflectors.

Tungsram is an acronym created from the English word "tungsten" and the German word "wolfram", which both stand for the same key metal.

The replacement of light bulbs

Compact fluorescent lamps were first commercialised in the 1980s to replace light bulbs. These lamps have a long lifespan, they last for 15000 hours as opposed to the 1000-1500-hour lifespan of the traditional light bulbs. Actually they are small-sized fluorescent tubes equipped with the driving electronics that can be driven into the socket of light bulbs. In addition, their energy uptake is one fifth of their ordinary companions. They generally contain inert gas, usually argon at low pressure, sometimes mixed with mercury.

The other popular and more and more widespread lighting alternative is LED, that is, light-emitting diode. It has many advantages: it operates with a small current, at a low voltage. Their switching speed is high as opposed to the compact light sources, it can fit into a pocket, it is impact-resistant and its lifespan is long. LEDs, which were developed in 1962, are still expensive. In addition, they are sensitive to changes in current and dislike heat.

[1] Thomas Alva Edison (1847-1931)
[2] Alexander Nikolayevich Lodygin (1847-1923)