

LEARNING GUIDE

TRANSFORMATIONS

THE ENERGY CHALLENGE

SCIENCE AND TECHNOLOGY

TSC-4061-2



IN COMPLIANCE
WITH THE
NEW PROGRAM

SOFAD

LEARNING GUIDE

TRANSFORMATIONS

THE ENERGY CHALLENGE

SCIENCE AND TECHNOLOGY

TSC-4061-2



SOFAD

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Legend: l = Left c = Centre r = Right
t = Top b = Bottom

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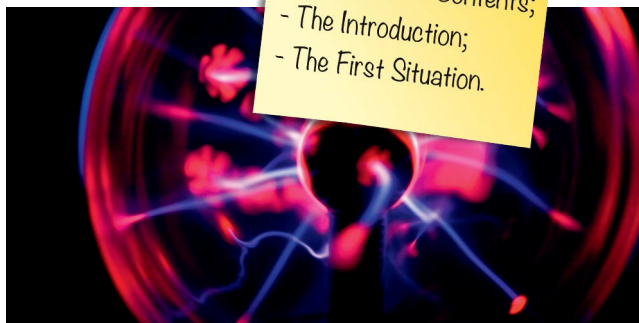
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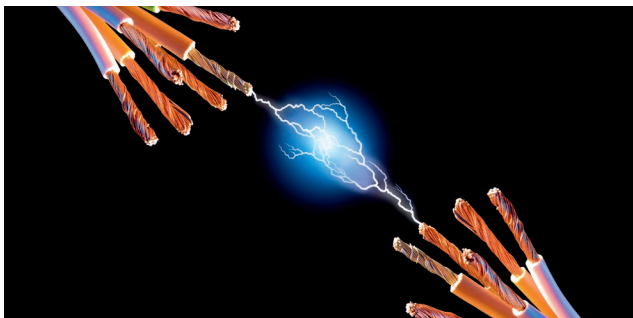
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About this Learning Guide

Welcome to the learning guide for *The Energy Challenge* course. This **Secondary IV** course in the **Science and Technology** program is intended to develop your ability to deal with situations relating to:

- the transformation of energy and energy efficiency;
- the basic principles of electricity and electrostatics;
- the operation of series and parallel electrical circuits;
- magnetism and electromagnetism;
- energy challenges.

Listed below are the three competences you will develop:

- seeks answers or solutions to scientific or technological problems;
- makes the most of his/her knowledge of science and technology;
- communicates in the languages used in science and technology.

You are now invited to carry out the learning activities presented in the six chapters of this learning guide.

Portailsofad.com

Video capsules and printable versions of the of the complementary resources for this guide and the rest of the TRANSFORMATIONS collection are available at portailsofad.com; they will assist you throughout the course.



CHAPTER ORGANIZATION

The learning process presented in each chapter allows you to make progress by building on what you learned in the previous sections. The following diagram illustrates this process and states the educational aim of each section.

INTRODUCTION TO THE CHAPTER

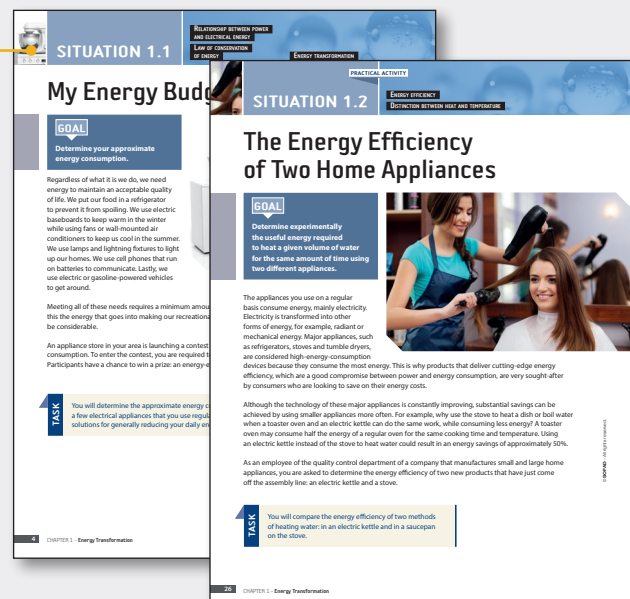
The first page describes the context and the theme that will provide the basis for learning the new concepts introduced in the chapter.



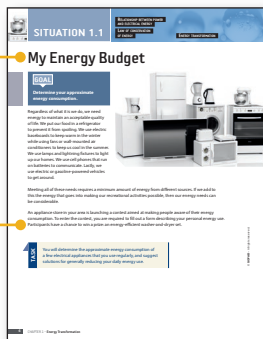
A table of contents opposite the first page presents the knowledge to be acquired in the two learning situations and the theme of each one.

SITUATIONS

There are two learning situations in each chapter: one is theoretical and the other is practical, in the form of an experiment. The learning process in both situations allows you to acquire new concepts and develop competencies within real-life, meaningful contexts.



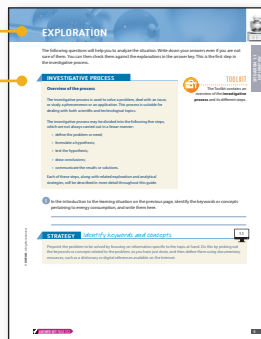
PARTS OF A LEARNING SITUATION



PRESENTATION OF THE LEARNING SITUATION

This page sets out the main theme of the chapter, briefly describes the context of the learning situation, and provides the information needed to complete the task.

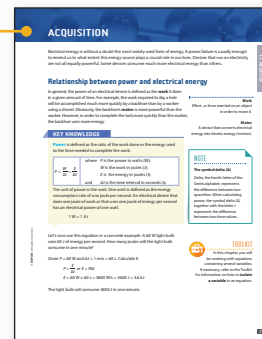
A text box describes the task to be carried out later on, in the *Solution* section. This task is the starting point for acquiring the new knowledge that will enable you to complete it.



EXPLORATION

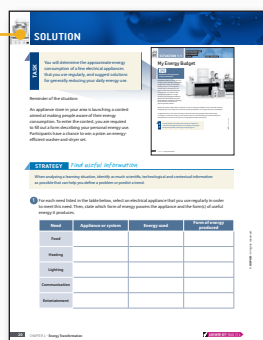
In this section you will analyze the information provided in the learning situation and identify what you already know about the topic at hand, as well as the new knowledge you will need to complete the task.

Different aspects of the investigative process in science and exploration strategies are suggested here.



ACQUISITION

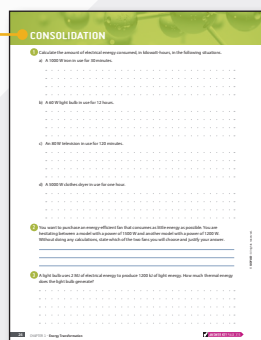
In this section, you will acquire the knowledge required to complete the task.



SOLUTION

When you get to this section, you should have all the knowledge you need to complete the task described at the beginning of the chapter.

Additional elements of the investigative process in science and exploration strategies are suggested here.



CONSOLIDATION

This section allows you to put into practice the knowledge covered in *Acquisition A* and *Acquisition B*. Like the Integration exercises, the Consolidation exercises also help you to develop the competencies.

AT THE END OF THE CHAPTER

KNOWLEDGE SUMMARY

This section summarizes all the key concepts presented in the chapter.

INTEGRATION

This section includes complex exercises and scenarios that require you to apply what you have learned in the chapter.

LES

The learning and evaluation situation (*LES*) is a complex task similar to those that you will encounter in the final exam. It includes a rubric for the competencies (competency evaluation chart).

ADDITIONAL MATERIALS

SELF-EVALUATION

This last activity will prepare you for the final examination for this course and will help you to determine the extent to which you have mastered the subject matter. The self-evaluation activity is divided into two parts.

Part 1: Explicit Evaluation of Knowledge

This part consists of questions that are not related to one another. Each question focuses on a specific area of knowledge.

Part 2: Evaluation of Competencies

In this part, you will be asked to solve a task similar to those you encountered in each chapter of this guide. You will be required to carry out tasks that involve various areas of knowledge applied to a new context.

Instructions

- Carefully read each question before answering it.
- You may use a calculator.
- Show all your work and detailed calculations.
- Once you have completed this activity, correct it using the answer key for each question.

Performance Analysis

Since this is a self-evaluation activity, you will be checking your results yourself against the answer key found at the end of this guide. This will enable you to determine the extent to which you have mastered the course content and whether you are ready to sit for the final examination. In light of this exercise, you may find the need to review certain concepts. You will be provided with instructions in this regard.

REVIEW

My Energy Budget

1 Complete the table below by filling in the missing prefixes and multiplying factors.

Prefix	Multiplying factor
kilo	10^3
mega	10^6
micro	10^{-6}
milli	10^{-3}

2 Match the following forms of energy with the examples given below: chemical energy, mechanical energy, radiant energy, thermal energy.

- A light-emitting diode produces light.
- Plants store their energy from glucose decomposition.
- A solar geyser shows a energy stage at speed.
- An electric kettle brings water to a rolling boil.

3 True or false? The SI unit of measure for energy is the kilojoule.

Electrostatics

1 What is the name of the first element in the periodic table? What is its symbol?

- Complete the following definitions of types of rocks with the missing words.
 - _____ rocks arise from the _____ of molting rocks.
 - _____ rocks are formed through the cooling and solidification of _____.
 - _____ rocks are formed by the accumulation and consolidation of _____.

APPENDIX A

Formulas

Constant flow	$P = \frac{W}{t}$
Current intensity	$I = \frac{Q}{t}$
Ohm's law	$V = IR$
Electrical resistance	$R = \frac{V}{I}$
Equivalent resistance (in series)	$R_{eq} = R_1 + R_2 + \dots + R_n$
Equivalent resistance (in parallel)	$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$
Power	$P = \frac{W}{t}$
Electrical power	$P = VI$
Heat	$Q = mc\Delta T$
Energy efficiency	$\eta = \frac{W_{out}}{W_{in}} \times 100\%$
Transformer	$\frac{V_1}{V_2} = \frac{I_2}{I_1}$

SELF-EVALUATION

A *Self-Evaluation* activity is found at the beginning of the *Additional Materials* section. This activity allows you to assess what you have learned and the competencies you have developed during the course. It also helps you to determine what subject matter you have mastered and what concepts you must review before completing the *Scored Synthesis Activity*.

REVIEW

In the *Situation* sections, you will come across *Reminder* text boxes containing topics covered in previous courses, which are essential for understanding new concepts or completing the assigned task.

The questions and exercises in the *Review* section will help you review the topics appearing in the *Reminder* text boxes.

APPENDICES

This section presents additional information such as abbreviations and units of measure.

GLOSSARY

The key concepts are **bolded blue** and the terms that are defined in the body text of the chapters are **bolded black**.

- Chapter 1: 2008**
 Mathematical operations on numbers, whose result is the positive value of that number. For example, the absolute value of -3 is denoted as | -3 | and the result is 3.
- Chapter 2: 101**
 A rechargeable cell or battery.
- Chapter 3: 240**
 A suspension of solid particles or liquid droplets, in air or another gas.
- Chapter 4: 70**
 A homogeneous material made up of at least two different elements (one of which is a metal), which give it specific physical properties.
- Chapter 5: 101**
 Alternating current (AC) is the flow of electric current in which the direction of the flow of electrons switches back and forth in regular periods.
- Chapter 6: 210**
 Generator of alternating current.
- Chapter 7: 110**
 A component used to measure current intensity in an electrical circuit. It is connected in series to the circuit.
- Chapter 8: 140**
 Group of cells connected in series or in parallel.
- Chapter 9: 200**
 Compact solid rock deposit which lies beneath and where a power plant is built.
- Chapter 10: 240**
 Energy produced from renewable, biological sources such as biomass.
- Chapter 11: 240**
 A liquid fuel produced from biomass (e.g. ethanol and bioethanol).

GLOSSARY

Key concepts **bolded blue** and terms **bolded black** in the body text of the chapters also appear in the *Glossary*.

ANSWER KEY

SITUATION 1: MY ENERGY BUDGET

- 1.1** Complete the table below by filling in the missing prefixes and multiplying factors.
- 1.2** Match the following forms of energy with the examples given below: chemical energy, mechanical energy, radiant energy, thermal energy.
- 1.3** True or false? The SI unit of measure for energy is the kilojoule.
- 1.4** Complete the following definitions of types of rocks with the missing words.
- 1.5** What is the name of the first element in the periodic table? What is its symbol?

RUBRICS FOR THE COMPETENCIES

Competency	Indicator	Level 1	Level 2	Level 3	Level 4
1.1	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.
1.2	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.
1.3	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.
1.4	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.
1.5	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.	Identify the main concepts of the course.

RUBRICS FOR THE COMPETENCIES

After completing a learning and evaluation situation, or *LES*, you can use the *Rubrics for the Competencies* at the end of the guide to evaluate your work. You can then complete the abbreviated rubric found at the end of each *LES*.

HEADINGS

TASK

You will explain which of the two approaches ...

Presents the task to be carried out as part of the learning situation.

REMINDER

Thermal energy is due to the motion of particles that make up an object. Its unit of measure is the joule (J).

Refers to knowledge acquired in previous courses and to review exercises related to this *Reminder*.

KEY KNOWLEDGE

An **electrical circuit** is a set of components connected to a source of current by conductors.

Presents new key concepts to be learned. This knowledge is prescribed by the program of studies.

INVESTIGATIVE PROCESS

B...

The first step in the investigative process is to define the problem ...

Presents aspects of the investigative process in science that can be applied in various situations.

STRATEGY

Consider ...

When an investigative process involves forming an opinion or ...

Presents exploratory or analytical strategies that can be applied in various situations.

DID YOU KNOW?



"Seeing" a magnetic field
Place a bar magnet on a table and cover ...

Encourages you to discover additional scientific, historical and cultural information related to the concepts being studied.

NOTE

A light-emitting diode is an electronic component in which the current ...

Provides additional information or points out possible exceptions to the concept in question.



TOOLKIT

See the multimeter user guide ...

Refers to information found in the **Toolkit**.



PRACTICAL ACTIVITY BOOKLET

You may now design your stair lift prototype in the ...

Prompts you to complete a section in the practical activity booklet.



These symbols refer to Web resources (links or videoclips) available at portailsofad.com.

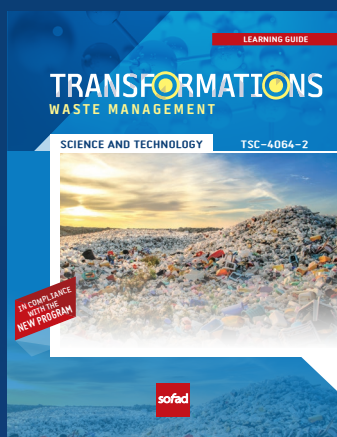
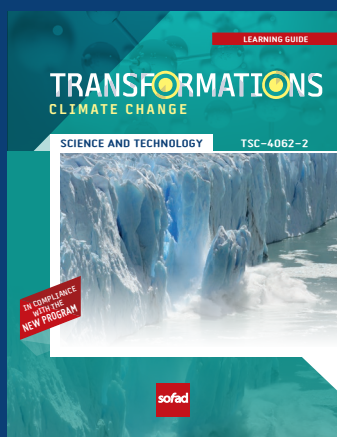
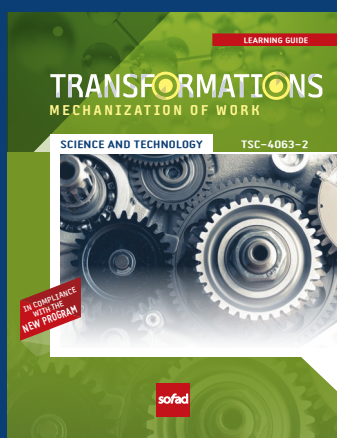
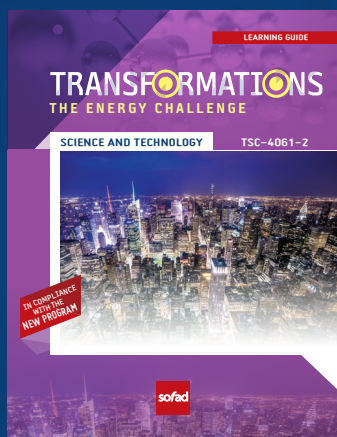
SCORED ACTIVITY

You must now do Scored Activity 1. It is available on the course website ...

Indicates that you are now ready for the scored activity, which will test your understanding of the material covered so far. At the very end of the course you will complete a synthesis activity, which deals with all the material in the course.

These activities are presented in separate booklets. Once completed, they must be submitted to your teacher (or tutor), who will mark them and provide feedback.

The **TRANSFORMATIONS** collection consists of all the courses in the Diversified Basic Education Program for Secondary IV and Secondary V.



SOFAD

The courses in the **TRANSFORMATIONS** collection feature a learning process based on the acquisition of prescribed knowledge through interesting and meaningful learning situations. The instructional approach underlying this learning process is outlined below:

PRESENTATION OF THE LEARNING SITUATION

EXPLORATION OF THE LEARNING SITUATION

KNOWLEDGE ACQUISITION

SOLUTION OF THE LEARNING SITUATION

CONSOLIDATION OF LEARNING

The knowledge and competencies to be developed become meaningful through investigations that require learners to use inductive and deductive reasoning skills. The learning guides provide a variety of simple exercises and more complex tasks that address the needs of both learners and teachers. Additional resources are available on Sofad's e-learning portal.

Components of the **TRANSFORMATIONS** collection:

- Experimental (or Practical) Activity Booklet (Print and PDF versions)
- Toolkit (PDF versions)
- Learning Guide (Print and PDF versions)
- Teaching Guide (PDF version)
- Video clips of concepts and laboratory techniques
- Kits of materials for the experimental and practical activities
- Scored activities
- Answer keys

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