

English Turbo

The Students of Engineering

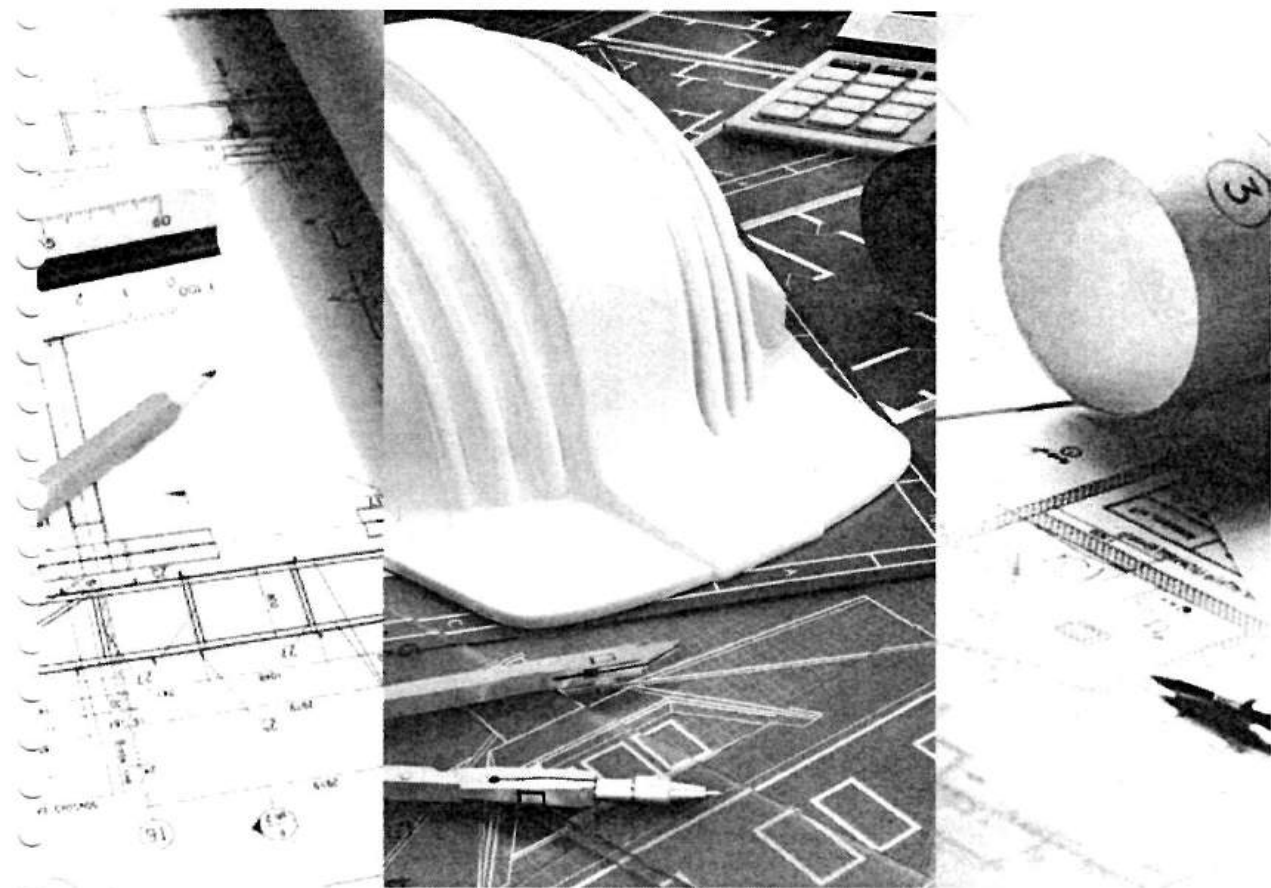
Department of Foreign Languages

Amirkabir University of Technology



AMIRKABIR

UNIVERSITY OF TECHNOLOGY
THERAN POLYTECHNIC



ر. کبیر

دريا رو به روی بانک ملت

دانشجویی

64542287

091:

قیمت: 28.000 توم

زبان 2

The History of Engineering

In this chapter, you will

- read about the history of engineering and engineering education
- study how to use headings as guides when reading a passage,
- increase your knowledge of adjective clauses in English,
- learn about the essential features of a paragraph, and
- learn some general and technical vocabulary.

The History of Engineering



TUNE IN FOR THE READING

Reading Strategy 1: USING TITLES AND HEADINGS AS GUIDES

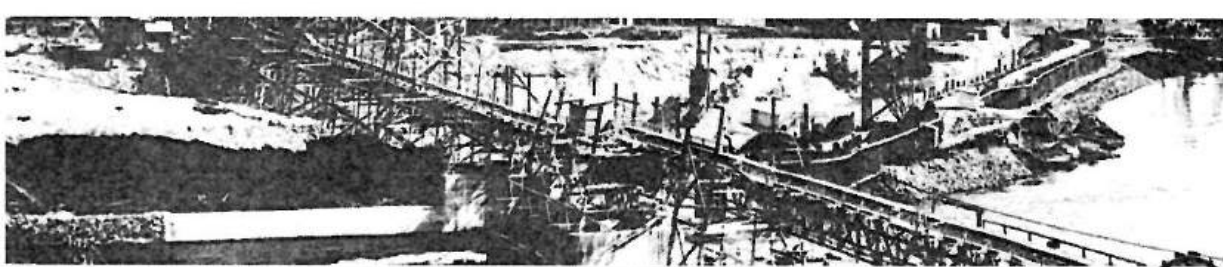
Headings in a text can help us better understand the organization and content of an essay. Checking out the headings in a text is one form of previewing which helps you see the text organization and predict and as a result expect the content of the essay before you read it.

Sometimes the headings are missing, or you are asked to match the headings with different parts of the text. In such cases, reading the first sentence in each section can be of great help.

Before You Read

In the following text, there are three missing headings. Here are the headings. Try to match each heading with the right section by only reading the first sentence of each paragraph.

- 1 *Education in Engineering*
- 2 *Engineering and the Future*
- 3 *Engineering and the Industrial Revolution*



A Brief History of Engineering

The history of engineering in the context of the way we live and interact with nature and each other is very much the history and pre-history of humanity itself. Human beings are partly defined as tool designers and users, and it is this *innovation* and the design and use of tools that accounts for so much of the direction and pace of change of history.

The history of engineering as a profession began with tool and weapon making over 150,000 years ago. Military engineering was soon joined by civil engineering in the quest for defense and development of early infrastructure. Engineering professionalization continued with the development of craft and guild knowledge, and the formalization of *associated* knowledge and education. Simple patriarchal forms of engineering education existing in ancient societies developed into vocational technical schools of different types in the Middle Ages and particularly during the Renaissance and the Scientific Revolution of the sixteenth and seventeenth centuries.

Leonardo da Vinci, for example, had the official title of *Head Engineer*¹ and his notebooks reveal an increasing engineering interest in how things worked. Galileo Galilei developed the scientific approach which was a method to the understanding of the natural world and analysis of practical problems – a landmark in the development of engineering, mathematical representation, structural analysis and design that continued into the *Industrial Revolution*.

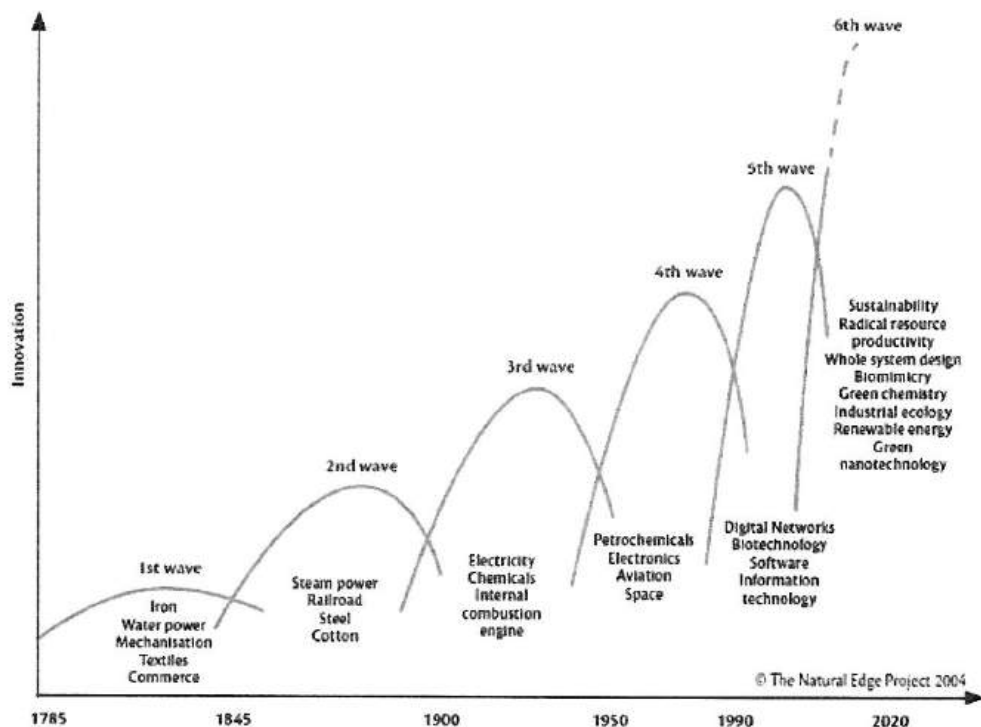
A.

Engineering powered the so-called Industrial Revolution which in fact took off in the United Kingdom in the eighteenth century spreading to Europe, North America and the world, replacing muscle by machine in a synergistic combination between knowledge and capital. The first Industrial Revolution took place from 1750 to 1850 and focused on the textile industry. The second one focused on steam and the railways between 1850 and 1900 and the third Industrial Revolution was based on steel, electricity and heavy engineering from 1875 to 1925. This was followed by the fourth Industrial Revolution based on oil, the automobile, and mass production, taking place between 1900 and 1950 and onward, and the fifth phase was based on information and telecommunications and the post-war boom from 1950 onward. These waves of innovation and industrial development have become known as Kondratiev waves, K-waves, long waves, super-

¹ Ingegnere Generale

cycles or *surges*, and relate to cycles in the world economy of around fifty years duration consisting of alternating periods of high and low sectoral growth. It is argued that the sixth wave based on new knowledge production and application in such fields as IT, biotechnology and materials began around 1980, and the possible seventh wave based on sustainable 'green' engineering and technology is seen to have begun around 2005.

Figure 1: Waves of Innovation



TECHNICAL CHECK 1



A. Recalling Information. Choose the best option for the following items.

- How was knowledge and skill taught in the earliest forms of engineering education?
 - Through tool designing and using
 - Through the vocational technical schools
 - Through transmission of knowledge from father to son
 - Through joining military engineering with civil engineering
- Which item is **NOT** correct about the industrial revolution?
 - The latest wave of revolution is based on green engineering and technology.
 - It started in the UK in the 19th century and spread to Europe and North America.
 - Most waves lasted about half a century.
 - The first five waves are also known as K-waves.

3. Where in Section A, can we find a definition for 'Industrial Revolution'?

- a. No definition is given.
- b. 1st paragraph
- c. 2nd paragraph
- d. 3rd paragraph

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 Human being's ability to use and design tools has largely affected the history of engineering.
- 2 Leonardo da Vinci developed the foundations of the Scientific Approach.
- 3 The 5th wave was affected by the rapid developments after the world war.

Part 2

B.

The most crucial period in the development of engineering was the eighteenth and nineteenth centuries particularly the Iron and Steam Ages. Early interest in the development of engineering education took place in Germany in the mining industry, with the creation in 1702 of a school of mining and *metallurgy* in Freiberg. One of the oldest technical universities is the Czech Technical University in Prague founded in 1707. In France, engineering education developed with the creation of the *National School of Bridges & Roads*² (1747) and *School of Mining*³ (1783). The *Polytechnique School*⁴, the first technical university in Europe teaching the foundations of mathematics and science, was established in 1794 during the French *Revolution*. Under Napoleon's influence, France developed the system of formal schooling in engineering after the Revolution, and engineering education in France has retained a strong theoretical and military character. The French model influenced the development of polytechnic engineering education institutions around the world at the beginning of the nineteenth century.

By the end of the nineteenth century, most of the now industrialized countries had established their own engineering education systems based on the French and German 'Humboldtian' model. In the twentieth century, the professionalization of engineering continued with the development of professional societies, *journals*, meetings, conferences, and the professional accreditation of exams, qualifications and universities, facilitating education, the flow of information and continued professional development.

² *École Nationale des Ponts et Chaussées*

³ *École des Mines*

⁴ *École Polytechnique*



A. Recalling Information. Choose the best option for the following items.

- Which item is **NOT** correct according to the text?
 - Mining was one of the first fields to be academically taught in engineering.
 - Engineering has been heavily affected by the French and German models.
 - The French system of education is characterized by a strong theoretical character.
 - The German system resulted in the development of polytechnic institutes around the world.
- Why is the Polytechnique School important in the history of engineering?
 - It was the first technical University in Europe.
 - It worked under the Napoleonic influence.
 - It was the first technical university teaching the foundation of math and science.
 - It helped retain a strong theoretical and military character in engineering education.
- Which item is **NOT** correct according to the text?
 - Steam technology had a great effect on the development of engineering education.
 - It did not take industrialized countries a long time to develop their own engineering programs.
 - The interest in engineering education in Germany started with mining.
 - The 18th and 19th centuries were very important in the history of engineering education in Europe.

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- The Polytechnique School was founded in 1794 in Germany.
- The British system of engineering education followed that of French model.
- Engineering continued professionalism through professional societies in the 20th century.

Part 3

C.

The Humboldtian model is, *ironically*, one of the factors that led to the contemporary decline of interest in engineering at university level; the fact that the mathematical base is regarded as too abstract, out of touch, *laborious* and boring by many young people. This in turn has led to a questioning of the Humboldtian model and increasing interest in problem and activity-based learning. The Humboldtian model also underpins the linear model of innovation. The model is based on the Humboldtian notion that pure,

/aɪ'ri

/lə'

disinterested, basic scientific research, followed by applied research and development, leads to knowledge applications, production and *diffusion*.

Engineering, therefore, has a particular need to overcome the Humboldtian notions underlying the 'fundamentals' approach to education and linear model of innovation, and to position itself more effectively in the development dialogue and bring fun into the fundamentals of engineering education through such approaches as problem-based learning. For the future of engineering, an obvious goal is the need to focus specifically on the important role engineering will play in addressing the UN Millennium Development Goals, especially poverty reduction and sustainable development, and the vital role of engineering in climate change *mitigation* and adaptation in the development of sustainable, green, eco-engineering and associated design, technology, production and distribution systems and infrastructure.



TECHNICAL CHECK 3

A. Recalling Information. Choose the best option for the following items.

1. What is implied in the text about the Humboldtian Model?
 - a. It is one of the factors raising students' interest in engineering.
 - b. Its model of innovation is a linear one.
 - c. This model has proved not to be very effective and needs to be changed.
 - d. It supports having an abstract mathematical base for engineering.
2. Which one is **NOT** among the steps engineering need to take in modern days?
 - a. Overcome the Humboldtian model in engineering.
 - b. Follow a problem-solving approach to Engineering education.
 - c. Apply the linear model of innovation.
 - d. Position itself more into a developmental dialogue.
3. Which option best expresses the goals engineering need to focus on in future?
 - a. Poverty reduction and sustainable development
 - b. UN goals, climate change, and eco-engineering
 - c. Climate change mitigation and adaptation in development
 - d. The UN Millennium Development Goals

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- | | | |
|---|---|-------|
| 1 | Linear Model of Innovation is a result of the problem-based learning. | |
| 2 | Humboldtian model has been able to enhance students' interest in engineering. | |
| 3 | It is important for engineering to address the UN Millennium Goals. | |

Practice A. Now, read the following sentences carefully and replace the underlined word(s) or phrase with an appropriate synonym from the text.

- Recent pressure at work may explain his behavior.
- Canada enjoyed a real economic growth in the postwar years.
- A sudden increase in the number of the refugees has concerned the authorities.
- The city of Mycenae played an important role in the history of Greece.
- The article deals with the problems of malnutrition in the country.
- Their ideas spread quickly across Europe.
- According to the police, there has been a decrease in the level of violence in the city over the past 2 years.

Practice B. Choose the word which best completes the following statements.

abstract
underpins

ironically
mitigation

contemporary
take off

infrastructure
distribution

- Mimi became jealous when Jack's career started to
- A \$65 billion investment package is needed in education, health care and
- Good independent journalism a free, democratic society.
-, he had decided not to install a burglar alarm before the break-in occurred.
- His new job has brought a slight of the monotony of his life.
- Since its opening in 1978, the gallery has been seen as the main center for art in the city.
- Human beings are the only creatures capable of thought.

LANGUAGE FUNCTION: ADJECTIVE CLAUSES IN A NUTSHELL



An Adjective Clause

An adjective could be a single or compound word which comes before a noun or after a linking verb:

He has an *expensive* car.

Learning English is *easy*.

John looked quite *upset* after he heard the news.

It is also possible to have a complete clause as an adjective describing a previous noun. These clauses are called adjective (or relative) clauses. A relative pronoun (e.g., who, whom, which, or that) is needed to introduce an adjective clause.

Who and **that** refer to people and are used as *subject* of the relative clause, i.e., they are used before a main verb:

The man *that is teaching English* is my brother.

This is the researcher *who published the paper in the journal*.

Whom and **that** refer to people and are used as the object of the relative clause, i.e., they are used before a noun or pronoun in the subject position of the relative clause and as the object of the verb in the adjective clause:

She is the girl *whom I saw in the mall*.

The student *that you want to meet* is here.

Which and **that** refer to *things* (and *animals*) as both subject and object of the relative clause:

The books *which I bought* were very interesting. (*which* is the object of the relative clause: *I bought which*)

The book *which is about geometry* is very interesting. (*which* is the subject of the relative clause)

The book *that is over that shelf* is written by a famous writer. (*that* is subject of the relative clause)

Where and **when** are relative pronouns modifying place and time, respectively.

This is the school *where (in which) I studied*.

Autumn is the season *when (that) birds migrate to the south*.

Whose refers to possession (of *people* but sometimes of *places* and *things*). Examples:

The man *whose car I bought* is an engineer.

Points to Remember:

1. *Who* is used instead of *Whom* in informal English. However, when used as object of proposition only *whom* is acceptable.

This is the professor *to whom I wrote* (or *whom I wrote to*).

2. *Whom*, *which* (as object) and *that* (instead of *whom* and objective *which*) can be omitted.

Don't omit *who*, subjective *which* and *that* when used as the subject.

The student (*whom/that*) *they interviewed* was very competent.

The book (*which/that*) they borrowed from us was about physics.

3. In objective relative clauses (*whom, which, that*), do not repeat the object.

The man *whom* I saw ~~him~~ in the street was Nick's brother.

This is the article *which* they sent ~~it~~ to the conference.

4. Often it is possible to use *that* instead of *who, whom, which* and *when*. But *that* is not used as the object of preposition.

This is the professor *to whom* (but not *that*) I wrote.

This is the professor *whom* (or *that*) I wrote to.

5. Separating an adjective clause with two commas from the main clause means that the information it presents is not necessary. In such cases, *that* cannot be used as a relative pronoun.

My brother who teaches English lives in Tehran (I have several brothers).

My brother, who teaches English, lives in Tehran (I only have one brother).

LANGUAGE FUNCTION



Practice A. Join the following sentences to form a relative clause.

1. Last week, I registered for a workshop. The workshop was about biomedical engineering innovations.

2. Mary is a music teacher. Johanna is practicing with her.

3. The person is Joe's brother. I used to work for him.

4. Do you know the man? Ali bought the man's car.

5. The government is going to ban factories. Factories cause a lot of air pollution.

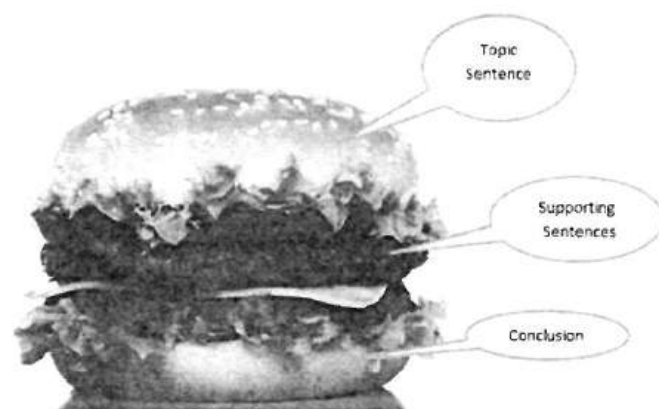
Practice B. Complete the following sentences using the right relative pronoun.

1. The girl you want to meet is Mina's sister.
2. He is the man works for the police.
3. The house Nima Yooshij was born is still standing.
4. Do you know the date we are going to visit the museum?
5. As he was sitting on the hill, he was painting the horses were running down the hill
6. The results of this study confirms the hypotheses of the research are congruent with previous studies.



WRITING ESSENTIALS

In *English Dynamo*, you got familiar with basic concepts in writing a paragraph. In *English Turbo*, after a short review of some of the most important concepts presented in the previous book, the essentials of writing an essay will be discussed. Here is a brief review of what you studied in *English Turbo* about the structure of a paragraph:



A paragraph is a unit of thought made up of a set of related sentences. All the sentences of the paragraph work together to develop a single idea. A paragraph can stand alone as an independent discussion of one idea, or paragraphs can be put together into a larger unit such as an essay.

The paragraph contains three parts. The **topic sentence** states the main idea of the paragraph. Sentences in the body of the paragraph **support** the main idea with specific details. They are called **supporting sentences**. The **conclusion** summarizes the ideas in the paragraph. All the parts of the paragraph work together.



Read the following paragraph and determine what role each underlined sentence plays in this paragraph.

Primitive Methods of Lie Detection

Throughout history there have been efforts to distinguish the guilty from the innocent and to tell the liars from the truthful. For example, a method of lie detection practiced in Asia involved giving those suspected of a crime a handful of raw rice to chew. After chewing for some time, the persons were instructed to spit out the rice. The innocent person was anticipated to do this easily, whereas the guilty party was expected to have grains of rice sticking to the roof of the mouth and tongue. This technique relied on the increased sympathetic nervous system activity in the presumably fearful and guilty person. This activity would result in the drying up of saliva that, in turn, would cause grains of rice to stick in the mouth. A similar but more frightening technique involved placing a heated knife blade briefly against the tongue, another method used for criminal detection. An innocent person would not be burned while the guilty party would immediately feel pain, again because of the relative dryness of the mouth. Many of these methods relied (unknowingly) on the basic physiological principles that also guided the

VOCABULARY SELF STUDY



Word		Pronunciation	Word		Pronunciation
abstract	adj.	/ˈæb.strækt/	metallurgy	n.	/ˈmet.əl.əː.dʒi/
account for	v.	/əˈkaunt fɔːr/	mitigation	n.	/ˌmɪt.əˈgeɪ.ʃən/
accreditation	n.	/əˈkred.əˈteɪ.ʃən/	muscle	n.	/ˈmʌs.əl/
adaptation	n.	/æd.əpˈteɪ.ʃən/	notion	n.	/ˈnou.ʃən/
address	v.	/əˈdres/	obvious	adj.	/ˈɑːb.vi.əs/
ancient	adj.	/ˈeɪn.jənt/	overcome	v.	/ˌoʊ.vəˈkʌm/
approach	n., v.	/əˈprəʊtʃ/	pace	n.	/peɪs/
associated	adj.	/əˈsoʊ.si.eɪ.tɪd/	particularly	adv.	/pəˈtɪk.jə.lə.li/
capital	n.	/ˈkæp.ə.təl/	patriarchal	adj.	/ˌpeɪ.triˈɑːr.kəl/
character	n.	/ˈker.ək.tə/	poverty	n.	/ˈpɑː.və.ti/
climate	n.	/ˈklaɪ.mət/	power	v.	/ˈpaʊ.ə/
combination	adj.	/ˌkɑːm.bəˈneɪ.ʃən/	profession	n.	/prəˈfeʃ.ən/
crucial	adj.	/ˈkruː.ʃəl/	pure	adj.	/pjʊə/

decline	n.,v.	/di'klaɪn/	qualification	n.	/,kwɑːlə.fə'keɪ.ʃən/
define	v.	/dɪ'faɪn/	quest	n.	/kwɛst/
dialogue	n.	/'daɪ.ə.lɑːg/	reduction	n.	/rɪ'dʌk.ʃən/
diffusion	n.	/dɪ'fjuː.ʒən/	renaissance	n.	/'ren.ə.sɑːns/
distribution	n.	/,dɪs.trɪ'bjuː.ʃən/	retain	v.	/rɪ'teɪn/
duration	n.	/duː'reɪ.ʃən/	reveal	v.	/rɪ'viːl/
effectively	adv.	/ə'fek.tɪv.li/	revolution	n.	/,rev.ə'luː.ʃən/
establish	v.	/ɪ'stæb.lɪʃ/	sectoral	adj.	/'sektərəl/
facilitate	v.	/fə'sɪl.ə.teɪt/	specifically	adv.	/spə'sɪf.ɪ.kl.i/
flow	n.	/fləʊ/	surge	n.	/sɜːdʒ/
fundamental	n.	/,fʌn.də'men.təl/	sustainable	adj.	/sə'steɪ.nə.bəl/
guild	n.	/ɡɪld/	synergetic	adj.	/'sɪn.ə.dʒɪtɪk/
industrial	adj.	/ɪn'dʌs.tri.əl/	take off	v.	/teɪk ɑːf/
infrastructure	n.	/'ɪn.frə'strʌk.tʃə-/	take place	v.	/teɪk pleɪs/
innovation	n.	/,ɪn.ə'veɪ.ʃən/	textile	n.	/'tek.staɪl/
institution	n.	/,ɪn.stə'tuː.ʃən/	theoretical	adv.	/,θiː.ə'ret.kəl/
ironically	adv.	/aɪ'rɑː.nɪ.kəl.i/	underlying	adj.	/,ʌn.də-'laɪ.ɪŋ/
journal	n.	/'dʒɜː.nəl/	underpin	v.	/,ʌn.də-'pɪn/
landmark	n.	/'lænd.mɑːrk/	vital	adj.	/'vaɪ.təl/
mass	adj.	/mæs/	vocational	adj.	/voo'keɪ.ʃən.əl/

Earthquake; The Force of Nature

In this chapter, you will

- read about some of the most earthquake resistant structures,
- learn how to skim the text to obtain general information,
- learn more about adjective clauses,
- learn how to narrow a topic before you start writing, and
- learn some general and technical vocabulary.

Top 5 Earthquake Resistant Structures



TUNE IN FOR THE READING

Reading Strategy 2: SKIMMING THE TEXT BEFORE READING

Skimming is reading rapidly in order to get a general overview of the material. Skimming tells you what general information is within a section. Use skimming in previewing (reading before you read), reviewing (reading after you read), determining the main idea from a long selection you do not wish to read, or when trying to find source material for a research paper.

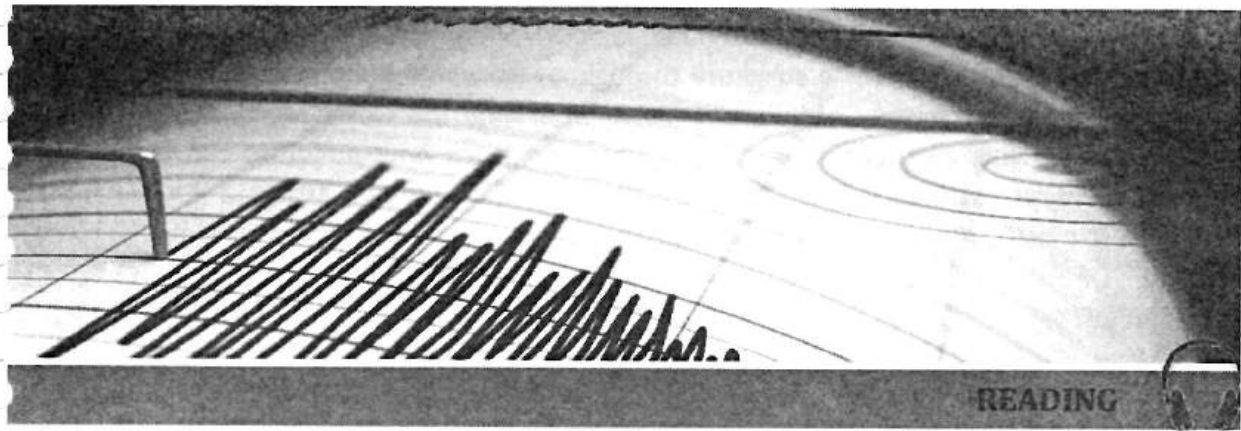
To skim, prepare yourself to move rapidly through the pages. You will not read every word; you will pay special attention to typographical cues-headings, boldface and italic type, indenting, and bulleted and numbered lists.

In order to skim the text, you need to follow these steps:

- Read the title first. Generally, titles will give you the most important idea of the text.
- Then read the sub-headings (if any) of the text. It will give a basic idea about the text and what is in it.
- If there is no sub-heading, read the first line or first few lines of the text. It will give you the gist of the text.
- If you want to skim it further, you may read the first lines of all the paragraphs and focus on the emphasized (bolded & italicized) words in them to get more ideas about the text.

Before You Read

Look at the passages in Part 1, 2 and 3 and follow the steps mentioned above in order to obtain as much information as possible from the text prior to reading. Then check and discuss the obtained information with your instructor and classmates.



Part 1

An Earthquake

An earthquake (also known as a quake, tremor or *temblor*) is the shaking of the surface of the Earth, resulting from the sudden release of energy in the Earth's lithosphere that creates *seismic* waves. Earthquakes can range in size from those that are so weak that they cannot be felt to those violent enough to toss people around and destroy whole cities. The seismicity or seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time. At the Earth's surface, earthquakes *manifest* themselves by shaking and sometimes displacement of the ground. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a *tsunami*. Earthquakes can also trigger landslides, and occasionally volcanic activity.

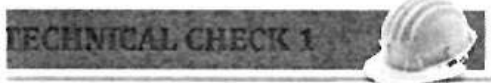
Earthquakes are among the most destructive forces of nature. Structures and infrastructures suffer the most when an earthquake *strikes* a seismically active region in the world. Seismic loadings must, therefore, be taken into account when designing structures especially those that are considered as skyscrapers.

The Mechanism of an Earthquake

As an engineer, it is important to initially understand what the problem is to make the solving part easy. So, what exactly is an earthquake and how do they happen? Everyone knows about the existence of tectonic plates and how they influence the movement of the Earth's crust. Earthquakes happen when these tectonic plates *collide* with each other and produce large magnitudes of energy measured using the *Richter* scale. The movement of these tectonic plates can be attributed to one simple physical phenomenon – convection.

Professor Iain Stewart, a geologist from Plymouth University, argues that having information about how earthquakes happen and how they affect structures might make people, in general, and engineers, in particular, prepared to stand against it. Knowing that

waves *radiate* from the base of a structure throughout its whole body is essential in designing earthquake-resistant buildings. Let's roam around the world together and discover the top five earthquake-proof structures and learn how buildings can be designed to resist extreme seismic loadings. The below countdown (Parts 2 & 3) represents five *exemplar* earthquake resistant structures and buildings across the globe.



A. Recalling Information. Choose the best option for the following items.

1. Which of the followings is **NOT** related to an earthquake?
 - a) It is a tremor caused by the Earth shakings.
 - b) It enjoys an impulsive discharge of energy.
 - c) Earth's lithosphere is shaken by the seismic waves.
 - d) Temblors and quakes refer to the seismicity of the Earth.
2. How do earthquakes manifest themselves?
 - a) By the replacements of the layers of the Earth
 - b) Via trembles of the ground in a region
 - c) Through Tsunami-induced dislocations of the earth's crust
 - d) By means of the offshore activities of the seabed
3. According to the text, it is argued that earthquakes can directly trigger the followings **EXCEPT**
 - a) volcanic activities
 - b) landslides
 - c) tsunamis
 - d) floods

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 Convection, as a phenomenon in physics, is the major push behind the movement of Tectonic plates.
- 2 In order to stand against earthquakes, scientists need to collect information about the features of the ground.
- 3 Essential in making buildings resistant to earthquake, waves radiate from the top to the base of the structure need to be taken care of.

V. Sabiha Gökçen International Airport

Sabiha Gökçen is one of the two international airports in Istanbul, Turkey, which is located near the North Anatolian *fault*. It was designed by the engineering firm Ove Arup to have 300 base isolator systems that can *withstand* earthquakes up to 8 Mon the Richter scale. The base isolators can reduce lateral seismic loadings by 80% which makes it one of the largest seismically *isolated* structure in the world.

IV. Transamerica Pyramid

The Transamerica Pyramid is an *iconic* 1970s structure hosted by the Californian city of San Francisco which sits closely beside the San Andreas and Hayward faults. In 1989, the Loma Prieta earthquake struck the structure at a magnitude of 6 on the Richter scale which caused the top story to *sway*, by almost one foot from side to side, for more than a minute but the building stood tall and undamaged.

This earthquake resistance feat can be attributed to the 52-foot-deep steel and concrete foundation that is designed to freely move with seismic loadings. Vertical and *horizontal* loadings are supported by a unique truss system above the first level with interior frames extending up to the 45th level. The complex combination of these structural systems makes the building resistant to *torsional* movements and allows large horizontal base shear forces to be absorbed.



III. Burj Khalifa

Burj Khalifa is simply one of the most iconic supertall structures in the world, and it is also earthquake resistant! The structure is composed of mechanical floors where outrigger walls connect the perimeter columns to the interior walling. The *perimeter* columns, then, are able to contribute support for the lateral resistance of the structure and the verticality of the columns also help with carrying the gravity loads.

As a result, Burj Khalifa is exceptionally stiff in both lateral and torsional directions. A complex system of base and foundation design was derived by conducting extensive seismic and geotechnical studies which gave the skyscraper *stringent* structural measures against earthquakes.





A. Recalling Information. Choose the best option for the following items.

1. Sabiha International Airport is one of the largest seismically isolated structure in the world as
 - a) its base isolators can reduce lateral seismic loadings by 80 percent.
 - b) it was designed to hold few base isolator systems to resist maximum earthquakes.
 - c) the structure strikes the earthquake at a great magnitude causing it to sway.
 - d) its unique truss system is located above the first level with central frames.
2. The Transamerica Pyramid is resistant to torsional movements due to the
 - a) undamaging earthquake forces
 - b) use of the complex combination of the structural systems
 - c) attributed force of the shear resistance of the steel
 - d) free movement of the seismic loadings
3. To what factors can the earthquake resistance feat be attributed?
 - a) structural systems and large horizontal base
 - b) free movements and the magnitude of seismic loadings
 - c) The 52-foot-deep steel and concrete foundation
 - d) absorbed forces and combined systems

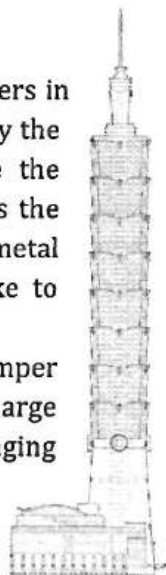
B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 Located near the North Anatolian plateau, Sabiha Gökçen is one of the two active faults in Turkey.
- 2 As an iconic structure, the Transamerica Pyramid hosts the Californian city beside the San Andreas and Hayward faults.
- 3 Due to the high-tech designing, Burj Khalifa is argued to be extremely firm in both lateral and torsional directions.

II. Taipei 101

Taipei 101 is perhaps one of the most mesmerizing supertall skyscrapers in the world. The architectural *exterior* design, by C.Y. Lee, was inspired by the Asian mentality "we climb in order to see further". Putting aside the architecture, the mind-blowing fact about Taipei 101 is that it houses the biggest tuned mass damper (TMD) in the world! It is basically a gigantic metal ball that counteracts big *transient* loadings like wind and earthquake to reduce the sway of the supertall tower.

The TMD is supported by hydraulic *viscous* damper arms and a bumper system which function in the same way as a car's shock absorber. When large forces act upon the tower, the TMD sways in the opposite direction bringing the entire building in equilibrium by damping out the transient forces using the ball's mass. It is amazing to know that this earthquake damper system is located between the 87th floor up until the 92nd one.



/ɪk's

/'træ

/'vis

I. Philippine Arena

The Philippine Arena is the world's largest domed arena and is the most amazing earthquake-proof structure. The arena was designed by the Australian architecture firm Populous and the elite engineering firm Buro Happold. You can *appreciate* the greatness of this structure by learning more about its susceptibility to earthquakes and how it was designed to resist large seismic loadings.

The Philippine plate sits along the Pacific ring of fire, the world's most *notorious* and active chain of earthquake fault lines. Previous earthquakes in the country have surmounted up to 8 on Richter scale and have claimed thousands of lives. The seismic activities were also responsible for igniting volcanic *eruptions* and tsunamis. Philippine Arena's vast stadium roof, spanning 165m in the shortest direction, was engineered to withstand severe transient loadings such as earthquakes, winds, and typhoons.

Buro Happold cleverly used an independent base design for the entire structure, which means that the main structural body of the arena is isolated from its base and foundation. The gap between the main structure and base foundation system is composed of lead rubber bearings (LRB) which are a *flexible* arrangement of materials with high energy *dissipation* properties. This allows the base and foundation system to freely move with the earthquake force while the top structure remains stationary during dynamic actions.

/ə'p

/nou

/'trʌ

/'fle

/dɪs.



A. Recalling Information. Choose the best option for the following items.

1. How does Taipei 101 stand against strong forces of wind and earthquake?
 - a) By shaping a ball-like structure
 - b) Through counteracting big transient loadings
 - c) By means of reducing the height of the supertall tower
 - d) Via a simple car's shock absorber metal ball

2. In Taipei 101, when large forces act upon the tower,
 - a) the ball's mass damps out the equilibrium forces
 - b) the bumper system supports the whole hydraulic system
 - c) the TMD power in the opposite way keeps the structure in equilibrium
 - b) hydraulic viscous damper arms and a bumper system counteract each other

3. How has Philippine Arena become resistant to earthquakes?
 - a) With an independent base design for the entire structure
 - b) by isolating the main body from the base of the structure and its foundation
 - c) Through allowing the base and foundation system to freely independently move
 - d) All of the above

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 The Asian mentality inspired by C.Y. Lee has made Taipei 101 the most mesmerizing supertall skyscraper in the world.
- 2 The arms of the hydraulic viscous damper function the same as a shock absorber in a car.
- 3 Siting along the Pacific volcanic ring, the Philippine plate is home to the world's largest chains of fault lines.

Practice A. Match each of the words given below on the left with the right definition on the right.

- | | |
|---------------------------|---------------------------------------|
| 1. infrastructure | a. able to keep out something harmful |
| 2. take into account | b. consider to be the cause of |
| 3. -proof | c. gradually diminish or weaken |
| 4. crust | d. twisting; reacting torque |
| 5. attribute to | e. basic framework; vital resources |
| 6. lateral | f. defenselessness; frailty |
| 7. isolate | g. separate; quarantine |
| 8. torsional | h. located on the side; on the side |
| 9. susceptibility | i. the hardened exterior surface |
| 10. damp out | j. consider; pay attention to |

Practice B. Using the words in Practice A, fill in the blanks below with the correct form of the words.

- After the long lasting crisis, all the social and economic of the nation were damaged, paralyzing almost all sectors.
- The volcanic eruption made a big fault in the Earth's, rendering the whole area uninhabitable.
- Many view holders believe that the North Pole is a vast area which is from the rest of the world due to the extremely harsh conditions.
- At the end the pipe, there is a filter which is installed by the technicians to the poisonous effects of the wastes!
- While designing and constructing a building, different safety precautions should be so that it won't yield easily when a natural force is applied to it.
- The changes in his behavior are claimed to be the recent economic achievements he has made.
- The stress which is produced when we apply the twisting moment to the end of a shaft and about its axis is known as stress.
- When the seams are all covered with pitch and the cracks are completely soldered in a way that not even a drop can get into, we say that the structure is water
- The plant takes up water not just through its main root but via many tiny roots it has at the end.

10. In today's people's lifestyle, lack of exercise and the overuse of junk food increase their to mainly heart diseases.

Practice C. Complete the sentences with the correct word from the table.

Verb	Noun	Adjective	Adverb
destroy	destruction	destructive	destructively
isolate	isolation	isolated	---
attribute	attribution	attributive	attributively
radiate	radiation	radiative	---

1. The emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles which causes ionization is referred to as
2. To our surprise, he the firm's success to the efforts of the managing director and gave no role to the staff!
3. In the chemistry laboratory, the main difficulty will be to safely the factors which are most significant from the compound.
4. The physical phenomenon of energy transfer in the form of electromagnetic emission is called transfer.
5. The main unreality of this novel is the of complicated emotions to their unstable character.
6. A child's from his family and friends may also result in different degrees of anxiety.
7. Many viewers argue that the criticism raised against the director was not fair.

LANGUAGE FUNCTION: REDUCED ADJECTIVE CLAUSES IN A NUTSHELL



Reduced Adjective Clauses

Subjective adjective clauses can be reduced to adjective phrases. A present participle (-ing form) is used when the adjective clause is active and a past participle (-ed form) when the adjective clause is passive, i.e., when the relative pronoun is in the subject position.

Example: The man *who teaches English* is my brother. (active)

Reduced: The man *teaching English* is my brother.

Example: They received a letter *which was posted last month*. (passive)

Reduced: They received a letter *posted last month*.

In cases where the adjective clause contains a 'linking verb + adjective' structure or a prepositional phrase, the modifying adjective phrase starts with the adjective or the prepositional phrase.

Example: The company, which was doubtful to make a decision, decided to postpone it until the following year.

Reduced: The company, doubtful to make a decision, decided to postpone it until the following year.

Example: The book which is over there is about geography.

Reduced: The book *over there* is about geography (prepositional phrase).

If the action in the adjective clause has happened before the verb in the main clause, a perfect participle is used in the reduced form.

John, *who had received the main prize*, decided to devote it to the charity. (active)

John, *having received the main prize*, decided to devote it to the charity.

The students, *who had been accepted* for the course, took a placement test. (passive)

The students, *having been accepted for the course*, took a placement test.

LANGUAGE FUNCTION



Practice A. Choose the option which best completes the following sentences.

- The criminal the bank last week was arrested today.
a. robbed b. robbing c. having been robbed
- John, as a volunteer firefighter when he was young, knew how to put out the fire.
a. having worked b. worked c. having been worked
- Do you know the man to the prison by the police?
a. taking b. having taken c. taken
- I started my paper with a summary the whole idea in a few words.
a. explaining b. explained c. having explained
- Medicine, by a small infant, must not exceed a particular dosage.
a. taking b. taken c. having been taken

6. The student admission for Oxford University has worked on his proposal for two years.

a. gets

b. got

c. getting

Practice B. Change the following sentences into reduced form.

1. Factories which are located near the city produce a lot of air pollution.

2. Ali walked to the post office which was at the corner of Bahar Street.

3. Albert Einstein, who was a prominent physicist, contributed to the development of modern astronomy too.

4. The clock, which has been made of glass, is very beautiful.

5. The man who is sitting next to you is my cousin.

6. The runner who is in the lead of the marathon match won an Olympic gold medal last year.

7. The author, who has already written 10 books, is now working on her new book.

8. When you work on a project which lasts more than a year, you need to cooperate with a team.

9. These poems, which were composed by an anonymous writer last century, are going to be published now.

10. Students who had passed the course in another university do not need to repeat it here.



WRITING ESSENTIALS

Initial Steps in Writing About a Topic

The biggest mistake most beginner writers make is to start writing on the topic they have been given without doing the mental work necessary to ensure a successful outcome. Experienced writers, however, know that before they can begin writing they have to examine the topic carefully to make sure they understand what is being asked. They must then narrow the topic;

determine the writing context (which includes deciding on purpose, audience, and tone); formulate a main idea; and, finally, generate supporting ideas for developing the topic successfully.

Narrowing the Topic

Usually, you will be given a writing topic, or a choice of topics, to write about. It is your job to think carefully about the topic and find an area of the topic that you can write about.

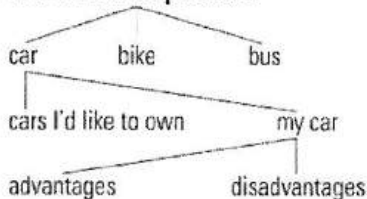
If you are given a general topic such as "modes of transportation," you will want to narrow the topic to a subject you can develop in a paragraph or short essay. There are brainstorming techniques for narrowing the topic which help you get your mind working. Use scrap paper to record your ideas, and do not worry about what you write down. This is a process or exploration, so nothing is right or wrong. Just relax, focus on the topic, and explore what you know and discover what you want to write about.

WRITE IT UP (SELF PRACTICE)

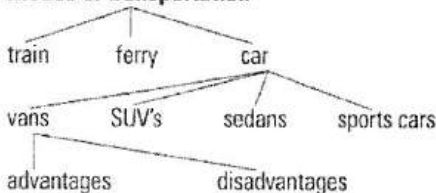
The Use of a Narrowing Tree

We use a narrowing tree to divide a general topic or subject into more specific parts until we find a specific topic of interest. Look at the following examples for narrowing down the above topic using the narrowing tree technique.

Modes of transportation



Modes of transportation



Remember that different people may narrow the same topic in different ways. What is important is to come up with enough ideas that can be developed into a good paragraph.

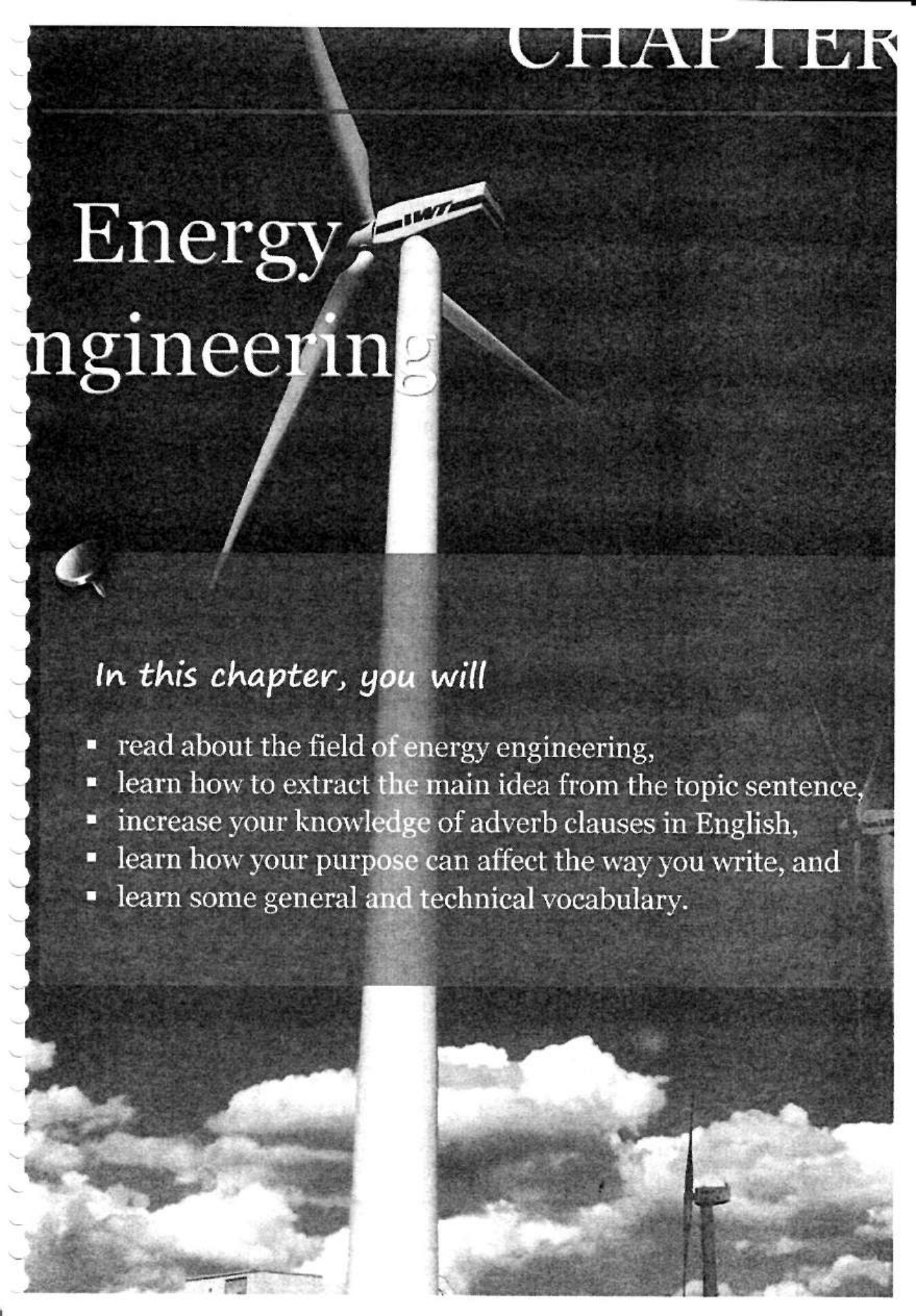
➤ **Now try to narrow down the following topics using the narrowing tree technique.**

- ✓ *Education*
- ✓ *Poverty*
- ✓ *Power*

امیر کبیر
رک دریا روبه روی بانک ملت
پنت دانشجویی
64542287 091203



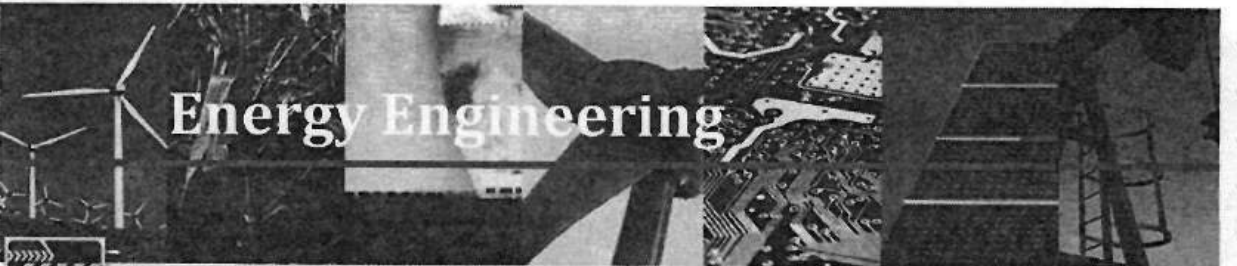
word		pronunciation	word		pronunciation
arena	n.	/ə'ri:nə/	lateral	adj.	/'læt.ə.əl/
attribute	v.	/ə'trib.ju:t/	lithosphere	n.	/'liθ.ə.sfiə/
conduct	v.	/kən'dʌkt/	manifest	v.	/'mæn.ə.fest/
contribute	v.	/kən'trib.ju:t/	mesmerizing	adj.	/'mez.mə.raɪ.zɪŋ/
convection	n.	/kən'vek.fən/	mind-blowing	adj.	/'maɪnd.bləʊ.ɪŋ/
countdown	n.	/'kaʊnt.daʊn/	notorious	adj.	/nou'tɔ:ri.əs/
crust	n.	/krʌst/	occasionally	adv.	/ə'keɪ.ʒən.əl.i/
destructive	adj.	/dɪ'strʌk.tɪv/	release	v.	/rɪ'li:s/
derive	v.	/dɪ'raɪv/	roam	v.	/ru:m/
dissipation	n.	/dɪs.ə'pei.fən/	seismic	adj.	/'sɑ:z.mɪk/
dome	n.	/dəʊm/	strike	v.	/straɪk/
elite	n.	/i'li:t/	stringent	adj.	/'strɪŋ.dʒənt/
equilibrium	n.	/i:kwə'lib.ri.əm/	susceptibility	n.	/sə'sep.tə'bɪl.ə.ti/
eruption	n.	/ɪ'rʌp.fən/	sway	v.	/sweɪ/
exceptionally	adv.	/ɪk'sep.fən.əl.i/	temblor	n.	/'tem.blə/
exemplar	n.	/ɪg'zəm.plɑ:r/	torsion	n.	/'tɔ:r.fən/
fault	n.	/fɔ:lt/	toss	v.	/tɔ:s/
feat	n.	/fi:t/	transient	adj.	/'trænz.i.ənt/
firm	n.,adj.	/fɜ:m/	tremor	n.	/'trem.ə/
foundation	n.	/faʊn'deɪ.fən/	trigger	v.	/'trɪg.ə/
gigantic	adj.	/dʒaɪ'gæntɪk/	tsunami	n.	/'tsu:nɑ:mi/
host	v.	/həʊst/	typhoon	n.	/taɪ'fu:n/
iconic	adj.	/aɪ'kɔ:nɪk/	violent	adj.	/'vaɪələnt/
ignite	v.	/ɪg'nait/	withstand	v.	/wɪð'stænd/



Energy Engineering

In this chapter, you will

- read about the field of energy engineering,
- learn how to extract the main idea from the topic sentence,
- increase your knowledge of adverb clauses in English,
- learn how your purpose can affect the way you write, and
- learn some general and technical vocabulary.



Energy Engineering

UNDER

TUNE IN FOR THE READING

Reading Strategy 3: EXTRACTING MAIN IDEA FROM TOPIC SENTENCES

The main idea of a paragraph is the author's message about the topic. It is often expressed directly, but it may also be implied in some cases. Topic sentences are often found at the beginning of paragraphs. The topic sentence, containing the main idea of the paragraph, explains the subject being discussed in the passage. Main ideas are also found in the concluding sentences of a paragraph.

The main idea is not always clearly stated. It is more difficult to identify a main idea when it is inferred or implied. It can be implied through other words in the paragraph. Several sentences in a paragraph can imply the main idea by introducing facts about the topic before actually stating the topic. Implied ideas can be drawn from facts, reasons, or examples that give hints or suggestions concerning the main idea. These hints will be clues leading you to discover the main idea in the selected text.

Before You Read

Now check Part 2 in the following text. Focus on the first and the third paragraphs. First identify the topic sentence, and then tell what the main idea for each paragraph is.

Paragraph 1

Topic sentence:

Main idea:

Paragraph 3

Topic sentence:

Main idea:



Part 1

What is Energy Engineering?

Some of the most interesting and productive developments in engineering have taken place at the *interfaces* between conventional engineering disciplines, for example bio-engineering which crosses the boundaries between medicine and engineering. These are called the interdisciplinary majors. Another good example is Energy Engineering. This is usually taken to mean the application of a mix of engineering disciplines, such as mechanical and electrical engineering, to solve the problems of extracting, collecting and *utilizing* energy resources to satisfy human needs without destroying the environment.

Energy has been called the *Ultimate* Resource for two reasons: Firstly, without energy all the other resources on the planet are unobtainable. Secondly, unlike water or carbon, energy cannot itself be re-cycled. In the industrial countries, people have come to depend heavily on large amounts of energy to support their way of life, and they usually expect that it will always be there at *affordable* prices.

/ˈɪn.ʃ

/ˈjuː.

/ʌl.tɪ

/əˈfɔːl

TECHNICAL CHECK 1



A. Recalling Information. Choose the best option for the following items.

1. Which of the following is **NOT** true about energy engineering?
 - a) It aims at extracting environment to address human needs.
 - b) It aims at solving the problem of energy extraction and use.
 - c) Its goal is using energy resources without destroying the environment.
 - d) It applies the potentials of mechanical and electrical engineering.

2. Interdisciplinary engineering majors
 - a) have not been as fruitful as the conventional ones.
 - b) emerge from a mix of conventional engineering disciplines.
 - c) aim at recycling energy sources.
 - d) cross the boundaries between engineering and medicine.

3. Energy is called the Ultimate Resource because
 - a) it is unobtainable and not usually available at affordable prices.
 - b) it is unrecyclable and without it other resources cannot be achieved.
 - c) it facilitates the process of recycling other resources such as water or carbon.
 - d) it provides access to all the other resources on the planet.

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 Energy engineering indicates the intersect between conventional disciplines
such as medicine and mechanical engineering.
- 2 In industrial countries, it is expected that energy will remain to be available at
affordable prices.
- 3 Interdisciplinary fields have contributed to some of the great accomplishments
and achievements in engineering.

Part 2

Problems and Solutions

However, two major energy problems are looming. The first is *depletion*. About 90% of the world's energy comes from the fossil fuels (coal, oil and gas) which are finite. It seems likely that oil and gas will be virtually exhausted within one human lifetime from now. Coal could last much longer, perhaps several hundred years, but that brings us to the second major problem. As a result of burning carbon based *fossil* fuels, we are forcing global climatic changes at an unprecedented rate. It is possible that we may have to leave most of the remaining fossil fuels in the ground.

The only *alternatives* to fossil fuels appear to be nuclear power and the renewable energy sources such as solar and wind power. Nuclear power already supplies about 10% of the world electricity but seems to have slowed down, with increasing concern about costs and environmental impact, in *particular* the question of how to deal with the growing accumulation of nuclear waste material. There is a growing demand for greener, safer renewable energy sources. Sun, wind, water, biomass, waves and tides, and the heat of the soil, all provide

alternatives to non-renewable energy. Renewables look promising and some are making rapid progress. For example, wind power is now the fastest growing energy technology in the world, with an *annual* growth rate of about 30%. However, they still have a long way to go to match the contribution of the fossil fuels.

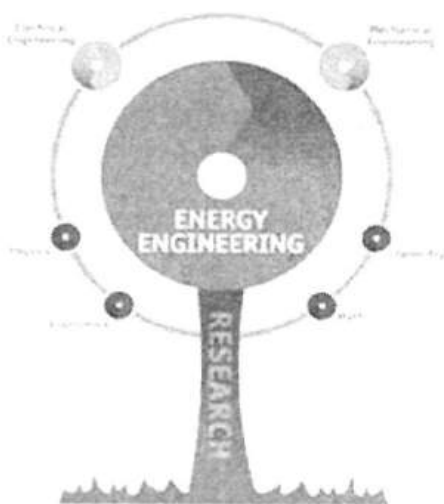


Figure 3.1. Energy Engineering; A multidisciplinary field

TECHNICAL CHECK 2



A. Recalling Information. Choose the best option for the following items.

- It is suggested that most of the remaining fossil fuels should be left untouched since
 a) this energy source is limited.
 b) fossil fuels last for a long time.
 c) 90% of fossil fuel resources have been used up.
 d) fossil fuels slowly bring about climatic changes.
-, biomass, and heat of the soil are all examples of renewable energy sources.
 a) Oil b) Waves and tides c) Gas d) Coal
- Which of the following sentences correctly restates the meaning of this sentence: "They still have a long way to go to match the contribution of the fossil fuels."
 a) Renewable energy sources last longer than fossil fuels.
 b) Renewable energy sources are not in use as much as fossil fuels are.
 c) Renewable energy sources match in use with fossil fuels.
 d) Renewable energy sources still need to find ways for contribution like fossil fuels.

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 It seems likely that oil and gas will be virtually exhausted by the end of 22nd Century.
- 2 The increasing concerns regarding the accumulation of nuclear waste has resulted in design and development of a special nuclear waste management technology.
- 3 The wind power has the highest rate of growth among green renewable energy sources.

Part 3

An Energy Engineer's Main Responsibilities

With the world population still growing and demand for energy still rising, we could be facing a real energy crisis. This is where energy engineering comes in. Energy engineering or energy systems engineering is a broad field of engineering dealing with energy *efficiency*, energy services, facility management, plant engineering, environmental compliance and alternative energy technologies. Energy engineering is one of the more recent engineering disciplines to emerge and combines knowledge from the fields of physics, math, and chemistry with economic and environmental engineering practices.

Energy engineers apply their skills to increase efficiency and further develop renewable sources of energy. The main job of energy engineers is to find the most efficient and sustainable ways to operate buildings and manufacturing processes. Energy engineers audit the use of energy in those processes and suggest ways to improve the systems. This means suggesting advanced lighting, better *insulation*, more efficient heating and cooling properties of buildings. Although an energy engineer is concerned about obtaining and using energy in the most environmentally friendly ways, their field is not limited to strictly renewable energies like hydro, solar, biomass, or geothermal. Energy engineers are also employed by the fields of oil and natural gas extraction.

Besides the "typical day" things that energy engineers do, they perform energy modeling, measurement, and verification. They might also manage the development, design, or construction of energy conservation projects to ensure acceptability of budgets and time lines. In addition, they review architectural, mechanical, or electrical plans and specifications to evaluate energy efficiency or determine economic, service, or engineering *feasibility*.

/i'fɪʃ.ə

/,ɪn.sə

/,fi:zə



A. Recalling Information. Choose the best option for the following items.

1. As a broad field, energy engineering deals with
 - a) conforming to environmental laws and standards.
 - b) power and electrical stations' engineering.
 - c) managing facilities and offering energy services.
 - d) all of the above.
2. Which of the following is **NOT** a part of the main job of an energy engineer?
 - a) assessing the application of energy in manufacturing processes.
 - b) determining sustainable strategies for constructing buildings
 - c) proposing new and better ways for improving systems
 - d) applying their skill to insulate the buildings and structures
3. Energy engineering is a newly emerged field which draws on knowledge from all the following disciplines **EXCEPT**
 - a) bio-engineering
 - b) economics
 - c) mathematics
 - d) environmental engineering

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 The budget and time issues can be managed by means of energy conservation projects.
- 2 As a broad field, energy engineering encompasses the effectiveness and management of energy and related services.
- 3 Energy engineering focuses on the innovative and entrepreneurial aspects of the society, especially with regard to how new innovations can be brought to market in different countries.

VOCABULARY PRACTICE

Aa

Practice A. Match each of the words given below on the left with the right definition on the right.

- | | |
|----------------------|--|
| 1. verify | a. traditional and ordinary |
| 2. accumulate | b. almost |
| 3. interface | c. the act of covering something to stop heat, sound, or electricity from escaping or entering |
| 4. conventional | d. reduction in number or quantity of something |

- | | |
|-----------------------|--|
| 5. depletion | e. to gradually increase in number or amount |
| 6. virtually | f. to prove that something exists or is true |
| 7. insulation | g. never done or known before |
| 8. unprecedented | h. a situation, way, or place where two things come together and affect each other |

Practice B. Using the words in Practice A, fill in the blanks below with the correct form of the words.

- Unemployment has reached a/n level.
- The approach to management based on analytical problem solving can no longer cope with change, complexity, and uncertainty of modern approaches.
- Improper attic and ventilation allow heat to escape, turning rooftop snow into an ice-dam.
- Increased expenditure has caused a in our funds.
- Everyone on the show has a high income, and most of them have had that high income for long enough to a good deal of wealth.
- The lecturer noted that a clearer between management and workforce is needed for more efficient outcome.
- No scientific and independent sources have so far the claims of either side.
- You will need a car to get around Idaho as public transport is non-existent.

Practice C. Complete the sentences with the correct word from the table.

Noun	Verb	Adjective	Adverb
alternative	alternate	alternative	alternatively
compliance	comply	compliant	compliantly
emergence	emerge	emerging / emerged emergent	emergently
affordance	afford	affordable	affordably

- Some of my friends have been giving money but I could not it because I have just bought my own place.
- The company expects to be reclassified as soon as its factories are fully with the National Workplace Law.
- In the absence of any better, we will have to proceed with the original plan.
- The project may help Iran as Asia's number one tourist destination.
- Studies indicate that many physicians demonstrate poor with recommended treatment guidelines.
- Hotel rooms in this city are priced to attract more tourists and visitors.

7. We have the flexibility to adjust our rates to meet customer needs.
8. We could go to the Indian restaurant, or, we could try that new Italian place.

LANGUAGE FUNCTION: ADVERB CLAUSES IN A NUTSHELL



What is an adverbial clause?

Adverbial clauses are dependent clauses that function as the adverb of the sentence. A clause must have some properties to be considered adverbial:

1. It can be removed from the sentence without making it grammatically wrong.
2. It must start with a subordinating conjunction such as *when, until, because, if, or although*.
3. It must contain a subject and a verb.
4. It must be a dependent clause, which means it needs to be used with another clause.

Where do adverbial clauses appear?

Adverbial clauses can appear in one of the three places inside the sentence:

1. Before an independent clause:

***When I was a little baby,** I was afraid of dark places.*

2. Inside an independent clause:

*My brother, **when he is angry,** becomes red in face.*

3. After an independent clause:

*We will start skiing **as soon as you put on your goggles.***

رکبیر
- دریا روی بانک ملت
ن دانشجویی
64542287 0912

What are different types of adverbial clauses?

Adverbial clauses can be of eight main types. The following table summarizes different types of adverbial clauses.

Table 3.1. Different Types of Adverbial Clauses

Type:	Function	Subordinating Conjunctions
Time	highlights when/how often something happens	after, as, as long as, soon, as soon as, before, sin until, when, whenever, while, by the time
	<ul style="list-style-type: none"> The dog started chasing the cat <i>once he saw her coming out of the house.</i> <i>When you finish planting that bush, wash your hands.</i> 	
Place	highlights where something happens	where, wherever
	<ul style="list-style-type: none"> <i>Wherever you see a rainbow, there has been rain.</i> 	
Manner	highlights how something happens	as, as if, as though
	<ul style="list-style-type: none"> She looks <i>as if she had seen a ghost.</i> In California, we can enjoy the beach <i>as we used to in Florida.</i> 	
Reason	highlights the reason something happens	because, since, as
	<ul style="list-style-type: none"> <i>Since the weather is so polluted in this city, we are going to move.</i> 	
Purpose	highlights the purpose behind a happening	so that, in order that
	<ul style="list-style-type: none"> I left home early <i>so that I could be on time for the meeting.</i> 	
Condition	highlights a condition for a happening	if, in case, as long as, unless, provided (that)
	<ul style="list-style-type: none"> I will become proficient enough in English <i>provided that I spend some time practicing it every day.</i> 	
Results	highlights the result of a happening	so ... that, such ... that
	<ul style="list-style-type: none"> Mathematics is <i>so complicated for me that I can't imagine studying it at university.</i> Mathematics is <i>such a complicated subject that I can't imagine studying it at university.</i> 	
Contrast	highlights a contrast with the idea in the main clause	though, although, even though, while, whereas, spite of the fact that
	<ul style="list-style-type: none"> <i>Even though I gave it my best effort, I couldn't pass the test.</i> <i>While I never miss the polluted air in the city, I will surely miss my friends.</i> 	

Determining the Writing Context (I)

Determining the writing context means examining your **purpose** in writing, your **audience**, and the **tone** you wish to use.

Purpose

Your purpose includes why you are writing, what your goals are, and what you hope to accomplish. Understanding your purpose will help you determine what to include and what to leave out of your writing and will help you shape your topic sentence. The purpose of most college writing is to inform, to persuade, or to entertain.

If, for example, your topic is “a place of business” and your purpose is to inform, you might provide factual information on a particular business such as a restaurant and provide its name, location, type of food, hours of operation, and prices. Look at the following example.

Topic: Place of business

Purpose: To inform

Ernesto's Restaurant¹

Ernesto's Restaurant, located at 2100 South University Avenue, specializes in Mexican food. Some of the most popular dishes are fajitas, burritos, chimichangas, and chiles rellenos, and the prices for entries range from four to six dollars. Ernesto's also offers a children's menu (priced two to three dollars) with items such as chicken bites, hamburgers, and grilled cheese sandwiches. The restaurant is decorated with tropical plants and travel posters of Mexico. The atmosphere is casual, and the clientele is mostly students and families.

If your purpose, however, is to persuade, you might wish to convince your audience that the restaurant you have chosen is a good or bad place to go. You might include much of the same information, but you would also include details that slant the information as either positive or negative.

¹ Adopted from *Robitaille & Connelly* (2007)



Read the following paragraph and determine the author's purpose. Pay attention to the way he/she has made use of adjectives and adverbs.

Topic: Place of business

Purpose:

A Great Mexican Restaurant²

Ernesto's Restaurant, located at 2100 South University Avenue, offers superb Mexican cuisine. Ernesto's specializes in authentic south-of-the-border dishes such as sizzling fajitas, ample burritos, succulent chimichangas, and flavorful chiles rellenos. The portions are large and delivered to the table piping hot. All entrées are reasonably priced, between four and six dollars. In addition, the kids' menu, priced between two and three dollars, offers traditional kid favorites such as chicken bites, hamburgers, and grilled cheese sandwiches. The restaurant is tastefully decorated with lush tropical plants and travel posters of exotic Mexican locations; mariachi music completes the atmosphere. Ernesto's casual atmosphere makes it a popular spot with both students and families. Word of mouth has quickly spread about this great dining establishment.

VOCABULARY SELF-STUDY



Word		Pronunciation	Word		Pronunciation
accumulation	n.	/ə.kju:.mjə'lei.fən/	kinetic	adj.	/kɪ'net.ɪk/
affordable	adj.	/ə'fɔ:r.də.bəl/	loom	v.	/lu:m/
alternative	n.,adj.	/ɔ:l'tɜ:.nə.tɪv/	manifest	v.	/'mæn.ə.fest/
annual	adj.	/æn.ju.əl/	potential	n.	/pou'ten.ʃəl/
biomass	n.	/'baɪ.ou.mæs/	recycle	v.	/'ri:'saɪ.kəl/
capacity	n.	/kə'pæs.ə.ti/	renewable	n.,adj.	/'rɪnu:.ə.bəl/
compliance	n.	/kəm'plai.əns/	resource	n.	/'ri:.sɔ:rs/
conservation	n.	/kən.sə'veɪ.fən/	satisfy	v.	/'sæt.ɪs.fai/

² Adopted from *Robitaille & Connelly (2007)*

contribution	n.	/ˌkɒn.trɪˈbjʊː.ʃən/	supply	n.,v.	/səˈplaɪ/
conventional	adj.	/kənˈven.ʃən.əl/	sustainable	adj.	/səˈsteɪ.nə.bəl/
depletion	n.	/dɪˈpliː.ʃən/	thermal	adj.	/ˈθɜː.məl/
designate	v.	/ˈdez.ɪɡ.neɪt/	tide	n.	/taɪd/
discipline	n.	/ˈdɪs.ə.plɪn/	transfer	v.	/ˈtræns.fɜː/
exhaust	v.	/ɪɡˈzɔːst/	ultimate	n.	/ʌl.tə.mət/
extract	v.	/ɪkˈstrækt/	unobtainable	adj.	/ˌʌnəbˈteɪ.nə.bəl/
feasibility	n.	/ˌfiː.zəˈbɪl.ə.ti/	unprecedented	adj.	/ˌʌnˈpres.ə.den.tɪd/
finite	adj.	/faɪ.naɪt/	utilize	v.	/ˈjuː.tɪl.aɪz/
fuel	n.	/ˈfjuː.əl/	various	adj.	/ˈver.i.əs/
geothermal	adj.	/ˌdʒiː.ouˈθɜː.məl/	verification	n.	/ˌver.ə.fəˈkeɪ.ʃən/
insulation	n.	/ˌɪn.səˈleɪ.ʃən/	virtually	Adv.	/ˈvɜː.tʃu.ə.li/
interface	n.	/ˈɪn.ʃəˈfeɪs/			

امیر کبیر

بارک دریا رو به روی بانک ملت

رینت دانشجویی

64542287

0912036

Biomedical Engineering

In this chapter, you will

- read about the field of biomedical engineering,
- be familiar with restatement questions in reading,
- improve your knowledge of the adverb clauses,
- learn about the role of 'audience' in writing a paragraph, and
- learn some general and technical vocabulary.

Biomedical Engineering



TUNE IN FOR THE READING

Reading Strategy 4: IDENTIFYING RESTATEMENTS

One of the important reading skills is the ability to identify "synonymous sentences". These sentences are different in form but similar in meaning. In these cases, the focus must be on the identification of the similarities in meaning among the given sentences.

Pay attention that restatement is different from making inferences. Restatement means stating the same idea using different words, but inferencing means what can be understood from a sentence which is not directly stated.

Look at the following example and decide which of the two choices is a restatement and which one is an inferencing.

Example: "The United States set the goal of landing the first man on moon in 1961 and accomplished it in 1969".

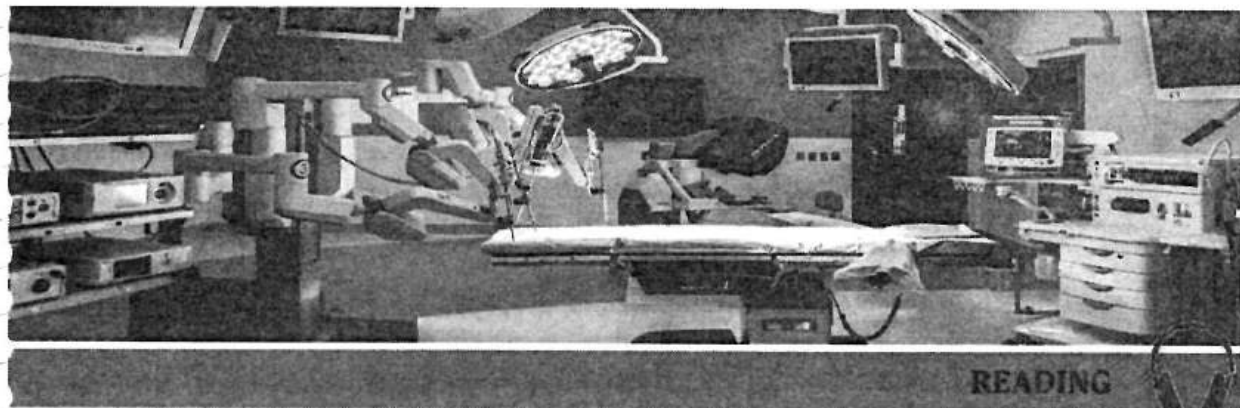
- a) It took 8 years for the U.S. to land its first astronauts on moon during 1960's.
- b) Before 1969, no man had been able to step on moon.

Before You Read

Read the following sentence and choose the option which best restates the given sentence.

"Without his help, the job would have been impossible."

- a) Even though he was very helpful, we were still unable to complete the project.
- b) Since he wasn't able to give us a hand, we didn't believe we would be able to finish the job.
- c) There's no way the task could have been done if he had not provided assistance.
- d) The assignment proved quite easy, even though he refused to give us aid.



Part 1

The Interface of Technology and Life Sciences

Biomedical engineering is a two-sided practice: solving problems in life sciences including biology and medicine using an engineering approach and developing technology based on the *paradigms* and patterns existing in living things. Biomedical engineers apply engineering principles to research and development of medical applications, including diagnostic, treatment and recovery technologies related to *acute* or chronic medical conditions. They can also work on technologies which are inspired by the systems and capabilities existing in the body of living things as in artificial intelligence, stem cell engineering, *synthetic* biology, etc.

Biomedical engineers may specialize in medical devices, sports medicine, stem cell research, biomarkers, *genomics*, nanotechnology, etc. They differ from other engineering disciplines that have an influence on human health in that they use and apply an *intimate* knowledge of modern biological principles in their engineering design practices. Aspects of mechanical engineering, electrical engineering, chemical engineering, materials science, chemistry, mathematics, and computer sciences and engineering are all integrated with human biology in biomedical engineering to improve human health.

Background

Although biomedical engineering, as a field, did not exist 50 years ago, it can be traced back to centuries ago. This included *prosthetic* devices, designed to replace missing body parts. Mummies with wooden digits have been found in Egyptian tombs.

The new developments started in the late 1700s, when Galvani's experiments led to the exploration of the link between electricity and animal physiology and

/ˈpæɪ

/əˈkjuː

/sɪnˈθ

/dʒəˈn

/ˈɪn.tə

/praːs

the use of electrical *impulses* of the body as diagnostic indications of health, such as in electrocardiology. Galvani's student Volta invented the first battery early 18th century, which almost immediately led to the application of electricity to therapeutic purposes. The discovery by Roentgen of x-rays in the 19th century led to the use of electromagnetic radiation for diagnostic purposes and how the rays could be used, with the *eventual* result being the common X-ray, one of the most frequently used tools for diagnosing medical problems.

The time after the World Wars was also an incredible *era* for medical innovations and breakthroughs, with many universities beginning to offer specialized programs for biomedical engineering and find ways to treat conditions that limit a patient's quality of life. This led to many discoveries, especially regarding the convergence of mechanical, electrical, and chemical engineering processes into complex medical systems. These technological advances included *dialysis*, the pacemaker and ultimately the artificial heart, prosthetic devices that could respond, and the DNA testing that underlies a range of genetic technologies. Clinical engineers worked to ensure that medical equipment was safe and *reliable* for use in clinical settings.

/ɪm.p

/ɪ'ven.

/ 'er

/daɪ'æ

/rɪ'laɪ.



A. Recalling Information. Choose the best option for the following items.

- According to the text
 - The first cases of using technology in medicine happened after the World Wars.
 - The experiments of Galvani paved the way for electrocardiology.
 - It took a long time for electricity to be applied for curing purposes.
 - Clinical engineers try to find ways to limit patients' quality of life
- What is the difference between biomedical engineers and other groups of engineering?
 - They need knowledge of biomaterial and chemistry.
 - Bioengineering uses technology for health purposes.
 - Bioengineers need and use a comprehensive knowledge of biology.
 - Bioengineers need to know nanotechnology in order to make extremely small devices.
- What is the main idea of the second paragraph under the heading 'Background'?
 - The first applications of technology in medicine during history
 - The first inventions in physics used for medical purposes
 - The importance of Galvani's experiments regarding the link between electricity and animal physiology
 - Pioneers of applying modern technology for medical purposes

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 A mummy is brought in this text as an example of ancient prosthetic objects used
in human body.
- 2 The modern bioengineering began in 18th century.
- 3 At the first half of the 20th century, bioengineering was taught at some
universities.

Part 2

Today's Advances and Innovations

Today, biomedical engineering projects include a wide range of innovations from computer-assisted procedures and treatments to neuromodulation and gene modulation devices up to very sensitive nanocameras and *cellular* scanning devices. Advances in computer design and the ability to translate medical imaging such as magnetic *resonance* imaging (MRI) or ultrasound to digital models that can be read by three dimensional (3D) printers are expanding its applications in health care.

Tissue and stem cell engineers are working towards artificial recreation of human organs, aiding in transplants and helping millions around the world live better lives. A related breakthrough is 3D printing technology. Additive manufacturing or 3D printing uses a digital model to build an object of any size or shape — by adding successive layers of biomaterial in a single continuous run. This layering capability allows the manufacturing of complex shapes, such as the *intricate* structure of bones or vascular channels that would be impossible to create by other methods. 3D and 4D printing as well as synthetic biology are opening new *horizons* of amazing possibilities, such as bioprinting living tissues, organs and even beings using biological ink, biomaterials and nanosensors.

TECHNICAL CHECK 2



A. Recalling Information. Choose the best option for the following items.

1. Which sentence is **NOT** true?
 - a) Bioprinting is the use of digital technology and biomaterials in the recreation of some organs.
 - b) The most intricate tissues such as bones cannot be recreated by 3D printing.
 - c) Additive manufacturing is the addition of successive layers of material in a single continuous run.
 - d) The layering of materials makes the creation of complex structures possible.

2. In line 6, what does its refer to?
 - a) 3D printing
 - b) medical imaging
 - c) ultrasound
 - d) computer design

3. What is the best title for the second paragraph?
 - a) The process of creating organs and tissues through 3D printing
 - b) How 3D printing has changed the life of orthopedic patients
 - c) What is medical 3D printing and how it works
 - d) Medical 3D printing has replaced transplant operations

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 Stem cell engineers have recreated heart, kidney and other organs.
- 2 Studying the genes has no relationship with the area of bioengineering.
- 3 The problems of transplanted organs have made bioengineers recreate them artificially.

Part 3

New Trends in Biomedical Science: The Promises and the Threats

The frontier of biomedical science has rarely been as exciting and as full of incredible opportunities and challenges as it is today. Can you imagine a world wherein *augmented* human beings through high-tech microchips implanted in their brains, manipulated and modified genes or cloning have turned to uncontrollable monsters which could *exploit* "ordinary, unaugmented" beings? The opposite scenario is for these new "beings" to be fully at the service of and controlled by human beings in such critical cases as providing transplants, providing food for an ever-increasing population, doing hard labors like mining or travelling to space where *cosmic* rays

/a:g'

/ɪk'st

/'ka:

are dangerous to ordinary humans, cleaning hard-reaching parts of oceans and seas from pollution, and even doing usual works such as identifying medical symptoms and doing housework and factory labor.

These ideas may seem frightening to you or funny and fantastic as scenes of sci-fi movies, but these are ideas that are now under serious investigation and debate as new developments in biomedical science are unfolding and *evolving*. Some scholars believe that augmented beings will always remain simple and *humble* assistants to human beings. In contrast, others express their concerns towards the unpredictable effects of new developments such as the misuse of synthetic biology, the misuse of data gathered through computational biology and bioinformatics available to artificial intelligence for criminal acts such as killer robots, behavior pattern analyzers, bioterrorism and man-made or manipulated micro-organisms, used for threatening and eliminating human beings and humanity. Moreover, the *ethical* worries about these breakthroughs will always be the most important challenge biomedical sciences are going to face – even regarding the rights of cloned or augmented humans.

/i'va:

/'hʌn

/'eθi



TECHNICAL CHECK 3

A. Recalling Information. Choose the best option for the following items.

1. Augmented humans may be created through all of the following ways **EXCEPT**
 - a) manipulation of their genes
 - b) microchips implanted in their heads
 - c) prosthetics used in their bodies to promote their body strength
 - d) simulation of human beings through the process of human cloning
2. It can be inferred from the passage that
 - a) There is an ethical concern regarding the rights of cloned humans.
 - b) The idea of superhumans is now displayed in science-fiction movies.
 - c) There are disagreements over the future of the developments in biomedical engineering.
 - d) Humans are able to control all the possible effects of gathering data about human genome.
3. Which of the following is among the threats that new developments in biomedical sciences can bring about?
 - a) exposing humans to cosmic rays
 - b) cleaning the oceans from dirt and pollution
 - c) providing food for the growing population
 - d) revealing bio-information of human beings for criminal acts

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 Animal cloning is a way to solve food problem of the growing population.
- 2 Augmented human beings can never take control of ordinary human beings.
- 3 Bioterrorism is one of the threats that humans may face as a result of their biological data being available to artificial intelligence.

VOCABULARY PRACTICE

Aa

Practice A. Match each of the words given below on the left with the right definition on the right.

- | | |
|----------------------|--|
| 1. chronic | a. to remove or take away |
| 2. augment | b. one after the other; happening in a step-by-step order |
| 3. successive | c. way of doing sth; actions needed for performing sth |
| 4. breakthrough | d. continued for a long time; cannot be easily cured or solved |
| 5. intricate | e. intensify; adding to the quality, amount or degree of sth |
| 6. procedure | f. advance; an important discovery |
| 7. exploit | g. morally right |
| 8. ethical | h. to develop gradually, |
| 9. eliminate | i. complicated; detailed |
| 10. evolve | j. to use sb or sth unfairly for one's own advantage |

Practice B. Now, read the following sentences carefully and replace the underlined word(s) or phrase with an appropriate synonym from the text.

- 1 After the accident he left the city to remove painful memories.
- 2 He received a new kidney from another person, but his body rejected it.
- 3 For information that can be trusted about present national boundaries, consult an up-to-date atlas.
- 4 Media have always tried to handle and control public opinion.
- 5 In his speech, the politician warned of upcoming trouble or chaos as a result of the government's economic reforms.
- 6 He has built a huge business empire from a simple and modest beginning.
- 7 When the artificial fabric is contrasted with the natural one, the difference is very apparent.
- 8 There is much debate on the issue of "advertisements" placing false ideas in the heads of the audience.

Practice C. Complete the sentences with the correct word from the table.

Noun	Verb	Adjective	Adverb
diagnosis	diagnose	diagnostic	diagnostically
manufacturer	manufacture	manufactured manufacturing	---
therapy therapist (therapeutist)	---	therapeutic	therapeutically

- The announced that the new product must be collected from the market due to a malfunction.
- Psychologists have long emphasized the effects of music on the healing of mental disorders
- The specialist his disease as some type of blood disorder.
- The companies which are active in the area of electronics have had a very successful financial year.
- You need to use a test software to find the problem of your computer.

LANGUAGE FUNCTION: REDUCED ADVERB CLAUSES IN A NUTSHELL

Reduced Adverb Clauses

When we reduce a longer group of words into a shorter word group, it is called a reduction. Reduction is done with the purpose of simplifying a word group.

What types of adverbial clauses can be reduced?

- Only when the subjects of both the independent and dependent clauses are the same, we can reduce an adverbial clause.
- Only adverbial clauses of **time**, **reason**, **contrast**, **condition**, **manner**, and **place** can be reduced to adverbial phrases.

How to reduce an adverbial clause!

Active Sentences:

- If the adverb clause contains a continuous form of the verb, omit the subject and any form of the *be* verb but keep the present participle (ing).
 - When I was crossing the street, I saw John.
 - (When) crossing the street, I saw John.

2. If there is the "subj + be verb + adj" structure in the adverb clause, omit the subject and the *be* verb but keep the adjective. Or you can use the "being + adj" structure. The word *because* is also omitted.
 - Because she was late for the meeting, she had to apologize to everyone.
 - Late for the meeting, she had to apologize to everyone.
 - Being late for the meeting, she had to apologize to everyone.
3. If the verb in the adverb clause is not in the continuous form or passive form, omit the subject and change the main verb into an *ing* form.
 - After I graduate from college, I will apply for a job.
 - After graduating from college, I will apply for a job.

Passive Sentences:

4. In passive sentences, omit the subject and *be* verb in the adverb clause but keep the past participle.
 - If the oil is heated too much, it will lose its viscosity.
 - If heated too much, the oil will lose its viscosity.

Notes:

1. In cause and effect sentences, we omit '*as, since, and because*' and use '*Ving/having P.P.*'
 - Because she is a mother now, she has more responsibilities.
 - *Being a mother now*, she has more responsibilities.
2. If an adverbial clause mentions an event which happened before the event in the main clause, we prefer the '*having + P.P.*' structure.
 - Because I injured my back yesterday, I now have difficulty in walking.
 - *Having injured my back yesterday*, I now have difficulty in walking.
3. If there is a '*to be + adjective*' structure in the adverbial clause, we can use '*(being) + adjective*' instead.
 - As/Because/Since she is suitable for the vacant post, she is lucky.
 - *Being suitable for the vacant post*, she is lucky.
 - *Suitable for the vacant post*, she is lucky.
4. In negative reductions, we use '*not + Ving*' or '*not having P.P.*'
 - Because I don't know her phone number, I can't call her.
 - *Not knowing her phone number*, I can't call her.
 - Because she hadn't studied well, she failed in the exam yesterday.
 - *Not having studied well*, she failed in the exam yesterday.
5. We can make reductions with '*if, unless, and as if*.'
 - If they were treated fairly, they wouldn't lose the game.

- *If treated fairly*, they wouldn't lose the game.

Dangling Structures:

A dangling structure happens when we have a reduction in sentences in which the subject of the main clause and the subject of the adverb clause are not the same.

Example 1: After they worked on the project for months, it finally finished.

Dangling: * After working on the project for months, it (the project) was finally finished.
(it means the project was working rather than the workers).

Correct: After working on the project for months, they finally finished it.

Example 2: While she was talking on the phone, her lunch burnt.

Dangling: * While talking on the phone, her lunch burnt.
(it means her lunch was talking on the phone).

Correct: While talking on the phone, she burnt her lunch.

LANGUAGE FUNCTION



Practice A. Choose the option which best completes the following sentences.

- to drive a car, he always uses public transportation.
a) He is unable c) Be unable
b) Being unable d) Because unable
- Marry always drinks a cup of tea after the dinner.
a. having b) had c) to have d) has
- While home from work, I met my colleague.
a) I walking b) walked c) walking d) to walk
- Before the exam, I reviewed my notes.
a) took b) taking c) I taking d) to take
- After the test, he hired a tutor.
a) passed b) passing c) not to pass d) not passing

Practice B. Reduce the following adverbial clauses into adverbial phrases.

- While she was baking the cake, she asked Tim to make some coffee.
.....
- Though he had a very good resume, he didn't get the job.
.....
- Since he arrived late, he started his lecture with a 10-minute delay.
.....

4. As Mrs. Lee used very difficult words in the test, she let the students use dictionaries.
.....
5. Unless we are paid fairly, we will go on a strike.
.....
6. I didn't speak English very well before I came to Australia.
.....
7. Because Sue was in a hurry, she left home without eating breakfast.
.....
8. When you are doubtful about the meaning of a word, look it up in a dictionary.
.....
9. The machine will stop functioning if it is heated to a high degree.
.....
10. Since the tourist did not know the city, he was lost in the busy streets of downtown.
.....

Practice C. The following sentences were incorrectly reduced. Find the mistakes and correct them.

1. While having drunk a glass of milk, Johnny spilled it on his dress.
.....
2. Having passing the entrance exam, John was admitted to the course.
.....
3. After left, she remembered meeting him at a conference once.
.....
4. Before went to bed, we put out our campfire completely.
.....
5. Viewing from distance, the trees looked like tall buildings.
.....

Practice D. Each of the following sentences contains a **dangling** structure. Correct them.

1. When only a child, Beethoven's artistic talent was apparent.
.....
2. Complete with references, Mina submitted her thesis to her supervisor.
.....
3. Collecting references as she worked on her thesis, identifying the relevant ones became a challenge to Mina.
.....
4. Having been busy with the children, two hours passed without her noticing.
.....
5. Considerably developed, John believes his project will be ready next week.
.....



Determining the Writing Context (II)

Determining the writing context means examining your **purpose** in writing, your **audience**, and the **tone** you wish to use.

Audience

Your audience is the reader(s) with whom you are communicating. We tend to be more aware of audience when we speak than when we write because the audience for the spoken word is right in front of us. We make decisions unconsciously about what to say and how to say it, tailoring our statements to the person or group to whom we are speaking. Good writers tailor what they have to say and how they say it to fit what they know about their audience. Keep in mind your audience's interests, concerns, values, educational backgrounds, and attitudes in determining what information to include and how to present it.

WRITE IT UP (SELF PRACTICE)



Suppose that you have been given the topic “technological training for employees” and that your purpose is to persuade your audience of its importance. Which five items would be most likely to persuade the given audience that technological training is important?

Audience 1: Business Managers

1. more stable society
2. higher potential employee salaries
3. reduced cost of prisons
4. increased competitiveness
5. more stable workforce
6. increased profits
7. increased product innovation
8. greater employee accountability
9. greater chance of being hired
10. reduced cost of social services

Audience 2: Educators

1. more stable society
2. higher potential employee salaries
3. increased enrollment
4. increased competitiveness
5. reduced cost of social services
6. increased profits
7. reduced cost of prisons
8. education relevant to workplace
9. greater chance of student being hired
10. ease of adjustment to workplace

Word		Pronunciation	Word		Pronunciation
accelerate	v.	/ək'sel.ə.ɪt/	integrate	v.	/ˈɪn.tə.ɡreɪt/
acute	adj.	/ə'kju:t/	intimate	adj.	/ˈɪn.tə.mət/
additive	adj.	/ˈæd.ə.tɪv/	intricate	adj.	/ˈɪn.trə.kət/
application	n.	/ˌæp.lə'keɪ.fən/	manipulate	v.	/mə'nɪp.jə'leɪ.fən/
approach	n.	/ə'prəʊtʃ/	medium	n.	/ˈmi:di.əm/
augment	v.	/ɑ:g'ment/	misuse	n.	/mɪs'ju:s/
bioinformatics	n.	/ˌbaɪəʊɪnfər'mætɪks/	modify	v.	/ˈmɑ:deɪ.fai/
bioterrorism	n.	/ˌbaɪəʊˌterərɪzəm/	modulation	n.	/mə'dʒə'leɪ.fən/
breakthrough	n.	/ˈbreɪkθru:/	monster	n.	/ˈmɑ:nstər/
capable	adj.	/ˈkeɪ.pə.bəl/	paradigm	n.	/ˈpærədɑɪm/
chronic	adj.	/ˈkrɑ:nɪk/	permeate	v.	/ˈpɜ:mi.ɪt/
clinical	adj.	/ˌklnɪ.l.kəl/	physician	n.	/ˈfɪzɪ.ən/
cloning	n.	/ˈkləʊ.nɪŋ/	procedure	n.	/prə'si:dzə/
computational	adj.	/ˌkɒmpjə'teɪʃənəl/	prosthetic	adj.	/prə'sθetɪk/
continuous	adj.	/kən'tɪn.ju.əs/	recovery	n.	/rɪ'kʌv.ə.i/
convergence	n.	/kən'vɜ:dʒəns/	recreation	n.	/ˌrek.rɪ'eɪ.fən/
cosmic	adj.	/ˈkɑ:zmɪk/	relatively	adv.	/ˈrel.ə.tɪv.li/
criminal	adj.	/ˈkrɪmɪnəl/	reliable	adj.	/rɪ'laɪ.ə.bəl/
critical	adj.	/ˈkrɪtɪkəl/	replace	v.	/rɪ'pleɪs/
diagnostic	adj.	/ˌdaɪ.əɡ'nɑ:stɪk/	resonance	n.	/ˈrez.ən.əns/
dynamic	adj.	/daɪ'næm.ɪk/	sci-fi	adj.	/saɪ'faɪ/
eliminate	v.	/ɪ'lɪməneɪt/	single	adj.	/ˈsɪŋ.gəl/
emerge	v.	/ɪ'mɜ:dʒ/	specialized	adj.	/ˈspeʃ.ə.laɪzd/
era	n.	/ˈɪr.ə, 'ɪər.ə, 'er.ə/	stem cell	n.	/ˈstem.səl/
ethical	adj.	/ˈeθɪkəl/	successive	adj.	/sək'sesɪv/
eventual	adj.	/ɪ'ven.tʃu.əl/	surgeon	n.	/ˈsɜ:dʒən/
exploit	v.	/ɪk'splɔɪt/	symptom	n.	/ˈsɪmptəm/
fascinating	adj.	/ˈfæsəneɪtɪŋ/	synthetic	adj.	/sɪn'thetɪk/
frequently	adv.	/ˈfri:kwənt.li/	therapeutic	adj.	/ˌθer.ə'pjʊ:tɪk/
frontier	n.	/frʌn'tɪr/	threaten	v.	/ˈθreɪn/
genomics	n.	/dʒə'noʊm.ɪks/	tissue	n.	/ˈtɪʃ.u:/
health care	n.	/ˈhelθˌkeər/	tomb	n.	/tu:m/
horizon	n.	/hə'raɪ.zən/	transplant	n.	/træn'splænt/
humble	adj.	/ˈhʌmbəl/	ultimately	adv.	/ˈʌl.tə.mət.li/
impulse	n.	/ɪm.pʌls/	ultrasound	n.	/ˈʌl.trə.saʊnd/
incredible	adj.	/ɪn'kred.ə.bəl/	underlie	v.	/ˌʌn.də'laɪ/
indication	n.	/ˌɪn.də'keɪ.fən/	unpredictable	adj.	/ˌʌnpri'dɪktəbəl/
inspire	v.	/ɪn'spaɪr/	vascular	adj.	/ˌvæs.kjə.lə/

Electrical Engineering

In this chapter, you will

- read about the field of electrical engineering,
- study how to determine the referent to a pronoun,
- increase your knowledge of noun clauses in English,
- learn about the role of tone in writing, and
- learn some general and technical vocabulary.

Electrical Engineering

A Broad Science of Boards



TUNE IN FOR THE READING

Reading Strategy 5: IDENTIFYING REFERENTS TO PRONOUNS

One of the needed skills in reading comprehension is the ability to find the **referent** to certain words (for example, this, that, it, he, their, one, who, which, this problem, the question, etc.). In English, the referent could be something which has already been mentioned or something which appears after the pronoun or the specified word or phrase.

Example 1: The Greek geometers took many ideas from their Oriental predecessors.

Example 2: Taking many ideas from their Oriental predecessors, the Greek geometers learned a lot about architecture.

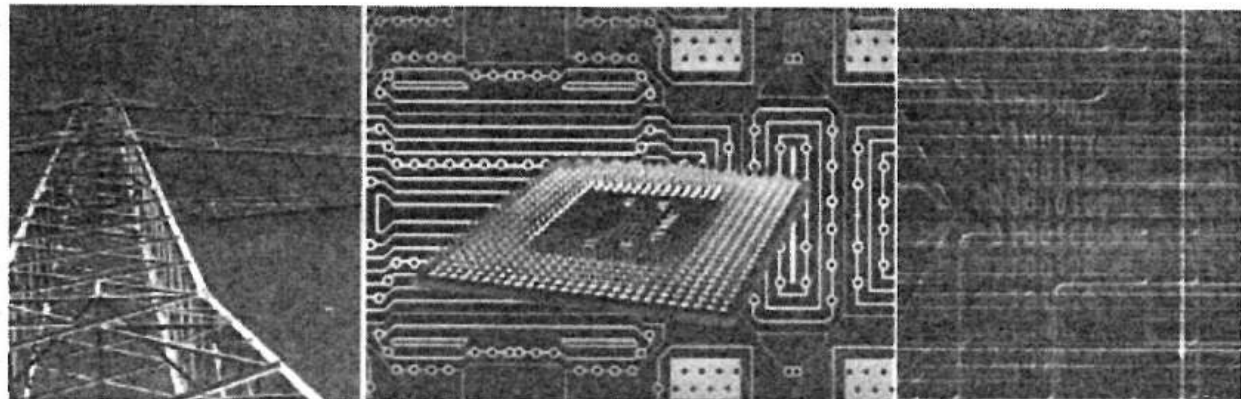
In both cases, "their" refers to the Greek geometers, but with the difference that in the first case, "their" refers backward while in the second, it refers forward.

Before You Read

Now read the following texts and find the referents of the underlined words.

Scientists have done experiments on bilingual surgical patients with electrical stimulation and found that their first and second languages share some cortical area but also have some separate zone. The second language occupies more cortex than the first. They speculate that as the new language becomes familiar, the cortical area devoted to it becomes less.

Eight basic practices have been found to be the characteristics of successfully managed companies. One of these is management's bias toward action. This is manifest in a willingness to experiment and take risks. In such a company, all new ideas which are proposed by staff get tested and then stored rather than discarded if they do not work right away.



READING

Part 1

Electrical Engineering

Electrical engineering is one of the branches of engineering which dates back to the late 19th century and deals with the technology of electricity. Some of the most prominent *pioneers* in electrical engineering include Edison (electric light bulb), Westinghouse (alternating current), Tesla (induction motor), Marconi (radio) and Farnsworth (television). These innovators turned ideas and concepts about electricity into practical devices and systems.

The field of electrical engineering has branched into a number of specialized categories including electronics (*analogue* and digital), communications (waves and fields, broadcast and communications systems, and satellites), power generation and transmission (power plant systems, motors, batteries, and generators), control systems, and mechatronics (mechanical electronics, robotics). Today, nearly all electric devices, from the generators at an electric power plant to the microprocessors in your cell phone, are moving toward becoming smart. They are dependent on a few basic electronic equipment such as switches, resistors, capacitors, inductors, and *transistors*. To be smart means being programmed in a way that all functions are performed automatically and most problems are solved without any need for external involvement of a human being. For example, a smart traffic light, using *recognition* devices is able to measure the amount of traffic on either side of a junction and manipulate the waiting time based on that amount.

/ˈpaɪə

/ˈæn.ə

/trær

/ˌrek.ɪ

A. Recalling Information. Choose the best option for the following items.

- In the second paragraph, what does **they** refer to?
 - microprocessors
 - electric devices
 - generators
 - power plants
- Electric devices are moving toward becoming smart. To be smart means being
 - able to manage itself
 - accessible remotely
 - part of a network
 - manipulated externally
- Which sentence is **NOT** mentioned in this text about a smart traffic light?
 - It uses recognition devices
 - It measures the traffic on a junction
 - It is connected to other lights on other junctions
 - It manipulates the waiting time on the roads of an intersection.

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- Electric devices are dependent on a wide variety of electronic equipment.
- Power plants can be a possible place for electrical engineers to work.
- Designing robots and their movements have no relationship with electrical engineering.

Part 2

Smart homes

The idea of controlling your home in an automated way has now come true *via* smart home or home automation systems. A smart home is a convenient home setup where appliances and devices are automatically controlled remotely from anywhere in the world using an *accessible* central point – an application installed on a smartphone or other networked devices such as tablets, laptops, or even game console.

This *residence* has its devices interconnected through the Internet, which controls functions such as security access to the home (door locks, fire sensors, surveillance systems and cameras), temperature (thermostats), lighting (light bulbs), home *theaters* and TV sets, and even refrigerators and cookers. As part of the internet of things (IoT), smart home systems and devices often operate together, sharing consumer usage data among themselves and automating actions based on the residents' preferences.



A. Recalling Information. Choose the best option for the following items.

- Which of the following is **NOT** mentioned about a smart home?
 - It is a way to use less energy.
 - You can turn your lights on and off when you are away.
 - You have access to the fire sensors and ovens.
 - Everything is controlled from your cell phone
- The devices connected in a smart home network automate their actions according to
 - data gathered through the Internet
 - what the residents have preferred
 - information by cameras and surveillance systems
 - data gathered by the installed application
- Which one is **NOT** a necessary part of a smart home?
 - an accessible central point
 - a set of interconnected appliances and devices
 - a connecting network
 - a surveillance or security system

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- Devices in a smart home are able to learn the owners' modes and preferences.
- Internet of things is an example of smart homes.
- A smart fridge can tell you that you have run out of some food.

Part 3

Smart grids

The issue of electric *current* consumption and loss in electric grids has led many countries to switch to new ideas. Grid refers to the electric grid, a network of transmission lines, substations and transformers that delivers electricity from the power plants to your home or *business*. It is what you plug into when you flip on your light switch or power up your computer.

Although the electric grid is considered an engineering marvel, its disorganized and top-down expansion has moved far beyond its capacity. To move forward, we

/ˌkɜːrɪ.ə

/ˈbɪz.nɪs

need a new kind of electric grid, one that is built from the bottom up to move in line with digital and computerized technologies and one that can *automate* and manage the increasing complexity and needs of electricity in the 21st century.

/ˈɑːtə.

A smart grid is an electricity supply network that uses digital communications technology to detect and react to local changes in usage and to respond digitally to our quickly changing electric demand. Today, an electricity *disruption* such as a blackout can have a domino effect—a series of failures that can affect banking, communications, traffic, heat, and security. A smarter grid makes our electric power system better prepared to address emergencies such as severe storms, earthquakes, fires, and terrorist attacks.

/disˈrʌ

While the *potential* benefits of the smart grid are usually discussed in terms of economics, national security, and renewable energy goals, it has the potential to help people save money by helping them to manage their electricity use, generate their homely-made electricity (via photovoltaic panels) when it is not available from utilities or it is too expensive and store it and choose the best time to purchase and sell electricity using "smart meters". It is a way to address energy efficiency, make consumers aware of the connection between electricity use and environment, and bring increased national security to energy systems.

/pouˈt

If you manage activities such as personal banking from your home computers now, imagine managing your electricity in a similar way. Once *mature*, the smart grid will bring the same kind of transformation that the Internet has already brought to the way we live, work, play, and learn.

/məˈtu



A. Recalling Information. Choose the best option for the following items.

1. It can be inferred about the smart grids that
 - a) they collect electricity from customers and do not produce it at power plants.
 - b) in a smart grid, there is no need for governmental utilities.
 - c) the bottom-up structure of a smart grid causes less dependence on public utilities.
 - d) the ordinary electric grids provide electricity from power plants to the consumers.
2. According to the text, smart grids are particularly important in
 - a) emergency cases
 - b) blackouts
 - c) energy loss in high-voltage cables
 - d) banking and communication
3. All of the following are among the reasons mentioned in this text for the need for a smart grid **EXCEPT**

- a) electricity consumption
- b) energy efficiency

- c) electric current loss
- d) economic progress

B. Statement Accuracy. Decide if the following statements are True (T), False (F), or Not Given (NG).

- 1 In a smart grid, people produce electricity using photovoltaic panels or cells.
- 2 Electricity disruptions have no effect on national security.
- 3 Smart grids cannot work without the use of the Internet.

VOCABULARY PRACTICE

Aa

Practice A. Under the heading "Smart grids", there are 5 paragraphs. Match the paragraphs with the best main ideas below. There is one extra main idea in the right column.

Paragraphs

Main ideas

- | | |
|---------|---|
| 1. | a. The reasons of using a smart rather than an ordinary electric grid |
| 2. | b. How a smart grid works |
| 3. | c. The future of smart grids |
| 4. | d. Why a smart grid is economically helpful |
| 5. | e. Definition of an electric grid |

Practice B. Match each of the words given below on the left with the right definition on the right.

- | | |
|-------------------------|---|
| 1. instrumentation | a. people who inhabit a particular place; inhabitants |
| 2. mature | b. a piece of electrical equipment, such as a cooker or washing machine, used in people's homes |
| 3. surveillance | c. power cut; a period of darkness caused by a failure of the electricity supply |
| 4. photovoltaic | d. a service such as gas or electricity provided for people to use on-demand |
| 5. renewable | e. the set of instruments used to help in controlling a machine |

- | | |
|--------------------|--|
| 6. utility | f. to connect one piece of electrical equipment to another, or to be connected |
| 7. blackout | g. can be replaced very easily |
| 8. residents | h. developed enough |
| 9. plug into | i. watching and controlling |
| 10. appliance | j. able to produce electricity from light |

Practice C. Now, read the following sentences carefully and replace the underlined word(s) or phrase with an appropriate synonym from the text.

- This lecture is useful for everybody who is interested in home automation.
- Because of communication difficulties, we have not received today's stock prices.
- The wonders of modern technologies and sciences are now emerging in very short intervals.
- In recent years, the movie industry has undergone a dramatic change.
- Mandela played an important role in the fight against discrimination.
- Because the workers were fixing the road, there was some interruption in the traffic.

Practice D. Complete the sentences with the correct word from the table.

Noun	Verb	Adjective	Adverb
transmission	transmit	---	---
efficiency inefficiency	---	efficient inefficient	efficiently inefficiently
application	apply	applied applicable	---
automation	automate	automatic automated	automatically

- Using different types of monitoring devices, the company has the security of the building.
- The highest speed at which a stress can be through any substance is usually the speed of sound in that substance.
- The new regulation is only to the first-year-students of the university.

4. Energy is regarded as one of the main causes of air pollution and climate change.
5. The of genetic engineering in agriculture has faced many oppositions.
6. The company is equipped with poor facilities and infrastructures.

LANGUAGE FUNCTION: NOUN CLAUSES IN A NUTSHELL



A Noun Clause

A noun clause plays the role of a noun in a sentence. Noun clauses contain a subject and a verb, but they cannot stand alone in a sentence. That is why a noun clause is a dependent clause. They must always be paired with an independent (main) clause.

Noun clauses begin with words such as *how, that, what, whatever, when, where, whether, which, whichever, who, whoever, whom, whomever, and why*. Noun clauses can act as subjects, direct objects, indirect objects, predicate nominatives, or objects of a preposition.

Noun Clauses May Function as:

The Subject:

- *Whichever restaurant you pick* is fine with me.
- *That he is famous* is none of my business.

The Direct Object:

- Do you know *how the weather will be*?
- I didn't know *that he was a famous author*.

The Indirect Object:

- Be sure to send *whoever interviewed you* a thank-you note.

The Object of the Preposition:

- Choose a gift for *whomever you want*.
- The teacher talked about *where he went on his vacation*.

The Predicate Nominative:

- The focus of our work is *how we can satisfy customers most effectively*.
- My greatest asset is *that I am a hard worker*.

Practice A. Underline the noun clause in each sentence below and mention what its function is.

1. The students were in trouble for what they did in the hall.
2. What my brother enjoys most is playing soccer.
3. She explained why she couldn't come to the party.
4. Mrs. Scott assigned whoever was late extra homework.
5. The club will give whoever wins the race a gold cup.

Practice B. Write a sentence using a noun clause as indicated.

1. a noun clause as a subject
.....
2. a noun clause as the object of a preposition
.....
3. a noun clause as a direct object
.....
4. a noun clause as a predicate nominative
.....
5. a noun clause as an indirect object
.....

Practice C. Fill in the blanks with the most suitable conjunction.

1. The poor boy couldn't ever learn killed him.
2. You'll be surprised to learn phone I've found on the shelf.
3. I really want to find out is you've made this mistake on purpose.
4. You should have guessed she would surely let you down even at the most unexpected occasions.
5. It's clearly understood he took the trouble to help you in the garden.
6. It is not difficult to understand different people speak different languages.
7. People, at times, can be so blind that they don't even see is in front of their eyes.
8. he will stay is confidential.
9. I can't rely on you tell me.
10. I'm convinced John cheats on every exam.



Determining the Writing Context (III)

Determining the writing context means examining your **purpose** in writing, your **audience**, and the **tone** you wish to use.

Tone

Tone means the writer's attitude toward the subject or audience. We tend to be more aware of tone when we are speaking or listening to other people than when we are writing. Their tone of voice tells us a lot about their meaning. For example, if someone says, "Nice weather," in the middle of a blizzard, we know he or she is being sarcastic. Tone can range from serious to sarcastic or from angry to humorous. Writers should consider the effect their tone will have on the intended audience.

WRITE IT UP (SELF PRACTICE)



Compare the tone in the following two paragraphs and determine which one has a serious tone and which one has a sarcastic tone. What does the writer wish to accomplish when using each type?

How to Carve a Jack-o'-Lantern

The process of carving a jack-o'-lantern is a relatively simple one. The first step is selecting and preparing the perfect pumpkin. Choose a deep orange, uniformly shaped fruit that fits the look you have in mind. Then cut a hole in the top of the pumpkin large enough to fit your hand through and remove the seeds. The next step, creating a design for your pumpkin, is the most artistically challenging. I recommend experimenting on a sheet of paper until you are satisfied with your design. Once you have perfected your design, transfer it to the surface of the pumpkin by tracing the outline with a pencil or a knife, making sure that the design is imprinted on the pumpkin. The final step, actually carving the pumpkin, requires a steady hand and lots of patience. Insert the knife along your design line and use a sawing motion to cut away the sections to be removed. When you are finished, place a lighted candle inside the pumpkin, and stand back and admire your masterpiece.

The process of carving a jack-o'-lantern is a relatively simple one. The first step is selecting the perfect pumpkin from the hundreds you will find piled in small mountains outside of most grocery stores. While you're at it, you might want to bring home a couple dozen extras in case your first few prototypes have design flaws. The next step, creating a design for your pumpkin, is the most artistically challenging. Do you want your pumpkin to look like Minnie Mouse or an M. C. Escher print? You should probably experiment on a sheet of paper until you are satisfied with your design—that is, unless you want to have a few hundred ruined pumpkins littering your kitchen. Next comes the simple task of transferring your two-dimensional design to the irregular, curved surface of the pumpkin. For this step, I strongly recommend a degree in design engineering. Before you begin the final step of actually carving the pumpkin, you may want to take out an insurance policy that covers severed fingers. To execute your design, simply insert the knife into the rock-hard pumpkin and carve away the sections to be removed. What could be easier? When you are finished, have friends and family come admire your work, and assure them there was nothing to it.

VOCABULARY SELF STUDY



Word		Pronunciation	Word		Pronunciation
accessible	adj.	/ək'ses.ə.bəl/	involvement	n.	/ɪn'vɑ:l.v.mənt/
address	v.	/ə'dres/	junction	n.	/'dʒʌŋk.tʃən/
advent	n.	/'æd.vent/	loss	n.	/lɑ:s/
alternating	adj.	/'ɑ:l.tə.neɪ.tɪŋ/	manipulate	v.	/mə'nɪp.jə.leɪt/
appliance	n.	/ə'plai.əns/	manufacture	n.	/'mæn.jə'fækt.tʃə/
automated	adj.	/'ɔ:tə.meɪ.tɪd/	mark	v.	/mɑ:rk/
automatically	adv.	/'ɑ:tə'mætɪ.kəl.i/	marvel	n.	/'mɑ:r.vəl/
automation	n.	/'ɔ:tə'meɪ.ʃən/	mature	adj.	/mə'tʊr/
beyond	prep.	/'bi:jə.nd/	misconception	n.	/'mɪs.kən'sep.tʃən/
blackout	n.	/'blæk.aʊt/	nearly	adv.	/'nɪr.li/
bottom-up	adj.	/'bɑ:təm'ʌp/	operate	v.	/'ɑ:pə.reɪt/
branch	n., v.	/'bræntʃ/	photovoltaic	adj.	/'fəʊ.təʊ.vɑ:l'teɪ.ɪk/
broadcast	n., v.	/'brɑ:d.kæst/	pioneer	n.	/'paɪə'nɪr/
capacity	n.	/'kæ'pæs.ə.ti/	plug into	v.	/'plʌg 'ɪn.tu:/
charge	n., v.	/'tʃɑ:rdʒ/	potential	adj., n.	/'pəʊ.ten.ʃəl/
console	n.	/'kən'səʊl/	power station	n.	/'paʊ.ə 'steɪ.ʃən/
construction	n.	/'kən'strʌk.tʃən/	preference	n.	/'pref. ə. ɜns/
consumer	n.	/'kən'su:.mə/	primitive	adj.	/'prɪm.ə.tɪv/
consumption	n.	/'kən'sʌmp.tʃən/	process	n., v.	/'prɑ:səs/
convenient	adj.	/'kən'vi:.ni.ənt/	prominent	adj.	/'prɑ:mə.nənt/

data	n.	/ˈdeɪ.tə; ˈdæt.ə/	proportional	adj.	/prəˈpɔːr.ʃən.əl/
date back	v.	/deɪt ˈbæk/	purchase	v.	/ˈpɜː.tʃəs/
deliver	v.	/dɪˈlɪv.ə/	recognition	n.	/ˌrek.əɡˈnɪʃ.ən/
demand	n., v.	/dɪˈmænd/	remotely	adv.	/rɪˈmout.li/
detect	v.	/dɪˈtekt/	renewable	adj.	/rɪˈnuː.ə.bəl/
disorganized	adj.	/dɪˈsɔːr.gə.naɪzd/	residence	n.	/ˈrez.ə.dəns/
disruption	n.	/dɪsˈrʌpʃən/	resident	n.	/ˈrez.ə.dənt/
efficiency	n.	/ɪˈfɪʃ.ən.si/	robotics	n.	/rouˈbɑː.tɪks/
emergency	n.	/ɪˈmɜː.dʒən.si/	setup	n.	/ˈsetʌp/
encompass	v.	/ɪnˈkɑːm.pəs/	severe	adj.	/səˈvɪr/
expansion	n.	/ɪkˈspæn.ʃən/	share	v.	/ʃer/
external	adj.	/ɪkˈstɜː.nəl/	signal	n.	/ˈsɪɡ.nəl/
failure	n.	/ˈfeɪ.ljə/	static	adj.	/ˈstæt.ɪk/
flip	v.	/flɪp/	substation	v.	/ˌsʌbˈsteɪ.ʃən/
generation	n.	/ˌdʒen.əˈreɪ.ʃən/	supply	n., v.	/səˈplaɪ/
generator	n.	/ˈdʒen.ər.eɪ.tə/	surveillance	n.	/səˈveɪ.ləns/
grid	n.	/ɡrɪd/	switch	n., v.	/swɪtʃ/
implementation	n.	/ˌɪmplɪmenˈteɪʃn/	top-down	adj.	/ˌtɔːpˈdaʊn/
induction	n.	/ɪnˈdʌk.ʃən/	transformation	n.	/ˌtræns.fəˈmeɪ.ʃən/
innovator	n.	/ˈɪn.ə.veɪ.tə/	transmission	n.	/ˌtrænsˈmɪʃ.ən/
integrated	adj.	/ˌɪn.tə.ɡreɪ.tɪd/	usage	n.	/ˈjuː.sɪdʒ/
interconnected	adj.	/ˌɪn.tə.kəˈnek.tɪd/	utility	n.	/juːˈtɪl.ə.ti/

امیر کبیر

ینت دانشجویی

یگان به خوابگاه و دانشکده ها

64542287

091203

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100