

The cover features a series of vertical bars at the top: a white bar, a red bar with a geometric pattern, a white bar, a grey bar, a blue bar with a geometric pattern, a white bar, and another white bar. To the right of these bars are several interlocking gears of different sizes and colors (white, grey, black).

ae.edu.pl

John Speller
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ACADEMIC ENGLISH FOR ENGINEERS

Coursebook



Politechnika Łódzka



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ACADEMIC ENGLISH FOR ENGINEERS

Coursebook

Lodz University of Technology 2017

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Unit 1: Introductions

After completing this unit you will be able to:

- Structure presentation openings
- Differentiate between language for academic presentations and writing
- Make an effective presentation opening

Pre-Task

Awareness-raising activity

Step 1

This course focuses on developing presentation skills through practical tasks.

- Why are presentation skills in English important for scientists and engineers?
- In what situations do scientists and engineers need to make presentations?
- How can practising presentations develop your English language skills more generally?
- What **21st century skills** can you learn by practising presentation skills in English?

21st century skills are skills considered necessary to succeed in the information age. Examples include research skills, working in groups, problem solving skills and ICT literacy.

Step 2

How can scientific presentations be made more interesting and engaging, especially for non-experts? Think about:

- Presentation techniques
- Using technical language (jargon)
- Slide design

Step 3

What makes a good scientific presentation? Think about the relationships between each of the following. Discuss your choices with a partner, using the useful language.

Content	
Structure	Audience
Delivery	Purpose
Slides	

Useful Language

Reflect
Relate to
Reinforce
Determine
Depend on
Correspond to / with

Step 4

Write 3 more true sentences based on your discussions.

[1] *The audience determines the purpose.* [3] _____

[2] _____ [4] _____

Task 1

Structure presentation openings

Step 1

Read the beginning of a presentation below. Divide the presentation into 5 sections, depending on their functions, using different coloured highlighter pens or dashes (/).

About me | Adding interest | Simplifying and explaining
Stating the purpose | Outlining the structure

"Hello everyone. My name's Weronika and I'm a student at Lodz University of Technology, studying Mechanical Engineering. Today, I'd like to tell you about some research we're doing on a new method for measuring pulsating flows in pipes. What do I mean by pulsating flows in pipes? Well, it's a bit like when your heart beats, and there's a surge of blood through your veins. But engineers are most interested in it because it can help us understand how fluids are transported around engines and pipelines. My presentation will be divided into three parts. First, I'll describe the experimental rig that was used to measure the pressure, temperature and mass flow rate. Then I'm going to outline the main assumptions that were used for the simulation algorithm in Matlab/Simulink. Finally, I'll show the plots as 3D images, which we'll compare to models of wave propagation, boundary conditions and fluid mechanics. Don't worry if you don't understand everything, there will be some time for questions at the end."

@Phrasebank for presentations

Section [1]	Function:
Section [2]	Function
Section [3]	Function:
Section [4]	Function:
Section [5]	Function:

Step 2

Look at the *Phrasebank for presentations: Introductions* on aee.edu.pl. Find the phrases used in the presentation opening above in the *Phrasebank*.

Post-Task

Consolidation activity

Can you add any more phrases to the *Phrasebank*? Exchange your ideas with the class.

Pre-Task

Awareness-raising activity

Step 1

This course also focuses on developing scientific and technical writing skills.

- Why are writing skills in English important for scientists and engineers?
 - In what situations do scientists and engineers need to write in English?
 - How can practising writing help develop your English language skills more generally?
 - What **21st century skills** can you learn by practising writing in English?
-

Task 2

Differentiate between language for presentations and writing

Step 1

Read the abstract below, which has been split into sections [1-5]. The sections are in the correct order.

[1] This study focuses on the influence of adding iodide (KI) and compost in different soil/compost ratios on the efficiency of Hg phytoextraction by *Lepidium sativum* L..

[2] Plant growth and non-enzymatic antioxidants are studied to understand metabolic plant adaptations to Hg stress during soil reclamation and their relations to Hg accumulation.

[3] Due to the use of relatively high chelant dosages in current plant-based soil remediation techniques and associated environmental risks, it is necessary to explore alternative approaches to the phytoextraction of Hg from contaminated soils.

[4] The results show a coordinated increase in non-enzymatic antioxidants in plants cultivated in growing media containing polluted soil, compost and KI. This indicates that the non-enzymatic antioxidative defence system of *L. sativum* L. is involved in its strategy to survive conditions of mercury-induced stress.

[5] Adding compost and iodide to Hg polluted soil also increases the total accumulation of Hg by *L. sativum* L. and the translocation of pollutants to aerial plant tissues. Simultaneous application of compost and KI promoted the Hg accumulation by *L. sativum* L. in a pot experiment.

(Smolinska and Leszczynska, 2015)

[A] *I'll also discuss how adding compost and potassium iodide to soil can help increase how much mercury is accumulated by these plants, by reducing the stress caused by mercury, and we'll look at the results of our pot experiment. If you have any questions, I'll be happy to answer them at the end.*

[B] *Good afternoon, thanks for coming. This talk is going to be about my research on phytoextraction – that's when plants are used to get rid of poisonous substances like heavy metals from polluted soil.*

[C] *It's a serious issue nowadays, what with all the pollution from cities, mining, agriculture and everything, which degrades land that could be used to grow things on. Luckily, you can grow plants on that land and they will absorb the mercury in their upper parts, which you can then cut down and use as biofuel, for example.*

[D] *Usually, lots of chemicals or 'chelants' are used to make the pollutants easier to absorb, but this can damage the environment. So we've been trying to find a better way to extract mercury from contaminated soil, using a mixture of compost and iodide.*

[E] *The plant we studied is called *Lepidium sativum* L – more commonly known as garden cress. We'll look at the plant's non-enzymatic antioxidative defense system, how it responds to mercury contamination, and at the effects of adding compost and iodide to the soil.*

@ Style guide

Step 2

Now read the text of a presentation on the same topic, which has also been split into sections [A-E]. The sections are not in the correct order.

Step 3

Put the sections of the presentation opening [A-E] into the correct order by matching them to the sections of the abstract [1-5].

Step 4

Compare the abstract to the presentation opening. Is there any information included in the presentation opening that is not included in the abstract? Is there any information in the abstract that is not included in the presentation opening? Can you explain these differences?

Step 5

Identify language in sections [A-E] that is appropriate for presentations but would be considered poor style if used in formal scientific writing. Use the **Style guide** available at aee.edu.pl to help you.

Post-Task

Verification of learning

Complete the test your teacher will give you or online at aee.edu.pl.

Task 3

Make an effective presentation opening

Step 1

Use the university library resources to find the abstract to a scientific article related to your discipline. Alternatively, your teacher will do this for you.

Step 2

Transform the abstract into a 30 second to 1 minute presentation opening, using the language and techniques studied in this unit.

First plan your opening carefully. Take notes or write it in full in the space provided.

Notes

Step 3

Work with a partner. Take it in turns to present your opening. Do not read from your notes.

Use the *Make an effective presentation opening* rubric on aee.edu.pl to evaluate your partner's presentation and provide constructive feedback.

Post-Task

Self-assessment

- Were you able to make a presentation opening?
- What did you find most useful about this activity?
- Is there anything you would do differently next time?

Extension task

Record yourself making the presentation opening from **Task 3, Step 3**. Use your mobile phone or computer with microphone or webcam. Upload your video or sound file to your university Learning Management System or third party file-sharing website (make sure appropriate privacy settings are selected). If you have any technical difficulty with this task or would like to discuss the use of your recordings contact your teacher.

Alternatively, prepare to deliver your presentation in front of the whole class.

Optional activity

Do you agree to share your voice and video recordings with your teacher and other students as part of this course? It will enable your teacher to provide better feedback and you will be able to learn from each other.

Please make sure you understand the permissions slip on aee.edu.pl and sign it if you agree to the use of your video and sound recordings for educational purposes.

Follow-up task

Watch some of the videos of your classmates making their presentation openings from Unit 1. Do you understand and agree with the teacher's feedback? What did they do well?

Your teacher may now ask students to make 'live' presentations in front of the class, to practice speaking to a larger audience. This could also provide an opportunity for students to improve their grades.

Use the *Make an effective presentation opening* rubric on aee.edu.pl to take notes and provide constructive feedback.

Spend some time thinking about how your own opening could be improved, based on your feedback and the performances of your peers.



Unit 2: Titles and abstracts

After completing this unit you will be able to:

- Select keywords for abstracts
- Write titles for scientific articles
- Write abstracts

Pre-Task

Awareness-raising activity

The topic of your scientific or technical writing should be clear from the *title*. Many articles and reports also include an *abstract*. The abstract should explain the *background* of the research, its *purpose*, the *methods* and the *results/conclusions*. *Keywords*, often listed after the abstract, distinguish the most important concepts and terms used in the study. They also enable the text to be searchable online.

Step 1

Decide which of the possible titles for the same study is better according to the **3Cs**.

Detecting moving objects using bionic compound eyes

Bionic compound eye moving object detection imaging system

Imaging system for moving object detection using bionic compound eyes

Imaging system for detecting moving objects using bionic compound eyes

3Cs

Clear
Complete
Concise

Grammar focus: Compound nouns and adjectives → Page 56

Step 2

Based on the title, try to predict the topic of the study. Answer these questions:

- What general problem will the article address?
- What will be the specific research focus?
- How will the research be conducted?
- What will be the outcome of the research?

Step 3

Where would you expect to find the answers to the questions in **Step 2** – in the *background*, the *purpose statement*, the *methods* or the *results/conclusions*?

Step 4

Now read the abstract from the article. Highlight the *background*, *purpose statement*, *methods* and *results/conclusions* of the study, in different colours if possible. Does the abstract correspond to your predictions in Step 2?

Abstract—Systems for tracking moving objects have a wide variety of applications, such as for video surveillance, monitoring, augmented reality and robotics. Bionic compound eyes, inspired by insect eyes, offer several advantages over single lens cameras, including small size, light weight and wide viewing fields. In this paper, we present a mathematical model for data acquisition and object detection using bionic compound eyes. The model is based on simulations of the target detection mechanism in insect compound eyes. The process of compound eye imaging was simulated using real data from an unmanned aerial vehicle. The novel approach described here effectively overcomes some of the common difficulties associated with detecting moving targets, concerning the field of vision, resolution and real-time processing.

Keywords: moving object detection; bionic compound eyes; imaging system

@Phrasebank for writing: Abstracts

Step 4

Find and circle the keywords in the abstract and in the title you selected in **Step 1**.

Task 1

Select keywords for abstracts

Step 1

Use the university library resources to find the abstract (with the title and keywords) to a scientific article related to your discipline. Print the abstract. Alternatively, your teacher will do this for you.

Step 2

Fold the page so that the keywords are invisible. Exchange abstracts with a partner.

Step 3

Select keywords from the abstract and title, and write them beneath the abstract.

Post-Task

Peer and self-assessment

Compare your keywords with the original, with your partner or teacher.

Task 2

Write titles for scientific articles

Step 1

Fold the page of the abstract from **Task 1** so that the title is invisible.

Step 2

Exchange abstracts with a new partner.

Step 3

Write a title for your partner's abstract, using the keywords to help you.

Post-Task

Peer and self-assessment

Compare your title with the original, with your partner or teacher. Which is better?

Task 3

Write abstracts

Step 1

Take notes on your abstract from **Task 2, Step 3**, using the template below. Alternatively, use the model abstract notes on the next page.

Step 2

Write a full abstract based on your notes (max. 200 words). Use the *Phrasebank for writing: Abstracts* on aee.edu.pl to help you.

Post-Task

Verification of learning

Submit your work to your teacher for language feedback.

Title:

Research Background:

Purpose:

Methods:

Results / Conclusion:

Keywords:

Title: *Imaging system for moving object detection using bionic compound eyes*

Research background:

Bionic compound eyes inspired by insect eyes; better than single lens cameras; lightweight, wide viewing fields, various applications (video surveillance, monitoring, augmented reality and robotics).

Purpose:

Present a mathematical model for data acquisition and object detection

Methods:

*Model based on simulations of target detection mechanism in insect compound eyes
Process simulated using real data from unmanned aerial vehicle*

Results / Conclusions:

effectively overcomes some of common difficulties associated with detecting moving targets:

-field of vision

-resolution

-real-time processing

Keywords: *moving object detection; bionic compound eyes; imaging system*

Extension tasks

Find phrases from the *Phrasebank for writing: Abstracts* in the abstract from **Pre-Task Step 3**. Are there any alternative phrases that could replace those used in the abstract?

Write another title for an abstract from a different partner.

Write another abstract from notes prepared by a different partner.

Unit 3: Visuals and signposting

After completing this unit you will be able to:

- Design effective slideshows
- Use signposting language
- Communicate with body language

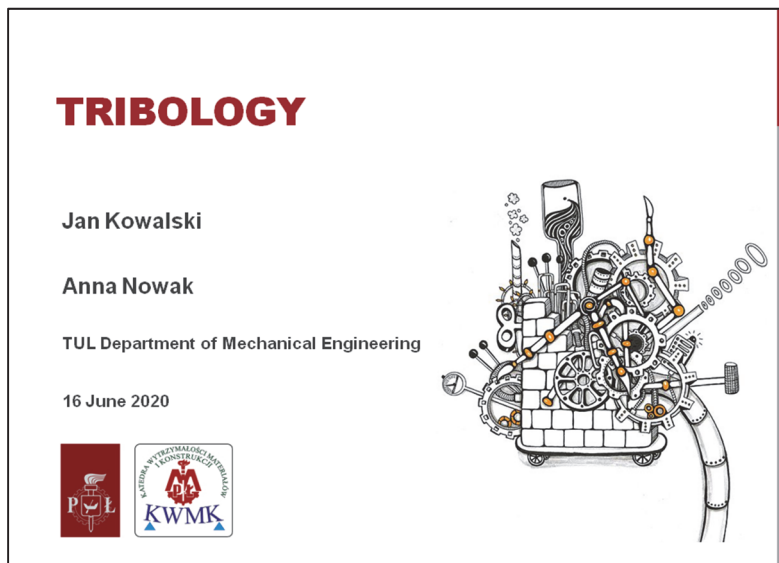
Pre-Task

Awareness-raising activity

Step 1

Your teacher will show you slides from different presentations on the same topic. Alternatively, download the presentation from aee.edu.pl and discuss it in pairs.

Which slides are better? Consider the criteria in the box



Design Criteria

Use of animations
Use of transitions
Use of text
Use of images
Use of examples
Background colour
and contrast

Image by Emma Marie Andersson (2016_machine_doodle_49)

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The rules on the re-use of images are if anything stricter than those for text.

Unless they are specifically labeled as available for re-use, you must contact the creator or owner of any images and films you find on the web if you wish to use them in your presentations or reports.

Check the preferred method of attribution. Some sites will specify that you should link back to the host site. Others will provide a ready-made attribution text.

Step 2

Would you be able to reproduce all the slides in the presentation? Check with a partner if you can both do the following (different software applications may be necessary):

- ✓ Crop images
- ✓ Make graphs
- ✓ Apply transitions
- ✓ Take screenshots
- ✓ Apply animations
- ✓ Re-colour images
- ✓ Insert mathematical equations
- ✓ Download and embed videos and GIFs
- ✓ Change the Slide Master design and layout
- ✓ Search for works in the public domain and creative commons

Useful vocabulary

Highlight
Right click
Apply a style
Drag and drop
Click on an icon
Copy and paste
Select an option
Drop-down menu
Go to a tab/website

If you are unsure how to do any of the above ask your teacher or others in the group. You can also look for tutorials using a web search engine.

Task 1

Design effective slideshows

Step 1

Choose an article from a popular science magazine on a subject related to your discipline. Identify three or four main points of interest for a mixed audience of specialists and non-specialists. Alternatively, your teacher will do this for you.

Step 2

Write three or four assertion statements for the main points you identified in Step 1.

Assertion statements should not be questions, topics or titles. They should be full sentences of no more than around 10-12 words, which provide a readable summary of the main message of each slide, to help your audience to make sense of the facts and evidence. This approach was developed by Michael Alley in *The Craft of scientific presentations* (2013) and is supported by research. For more about the assertion-evidence approach, visit assertion-evidence.com.

Step 3

Create a slideshow comprising a title slide, a slide for your presentation outline and three or four slides with assertion statements. You do not need to make a conclusion slide. Select images, videos and additional text to support each assertion.

Post-Task

Peer assessment

Work with a partner. Briefly describe the topic of your article from **Step 1** and the main points you will make with each slide. Explain your choice of slide design (including layout, text, images).

Your partner should evaluate your slides and suggest improvements.

Task 2

Use signposting language

Step 1

Complete the extract of the tribology presentation you looked at in **Pre-Task 1**, using the signposting language in the box.

Here we can also mention | Let me begin by defining what tribology is | First I'll discuss
My final point today concerns | Thirdly I'll focus on | Then we'll look at | And finally we'll address
The topic of today's presentation | The first reason is that | As you can see in the graph
As shown in the picture | Moving on

[1] _____ is tribology. [2] _____ tribological issues in transport. [3] _____ microtribological issues in HDI.

[4] _____ tribological and static interfacial forces in microelectromechanical systems (MEMS). [5] _____ some of the consequences of failures in tribology and highlight the importance of tribological understanding.

[6] _____ Tribology is the study of interacting moving surfaces, involving friction, wear and lubrication. Why is it important?

[7] _____ understanding tribology can help us to design more efficient vehicles, and reduce wear and tear.

[8] _____ advances in tribology have also benefitted modern computing, enabling for example the development of modern hard drives.

[9] _____ that tribological and static interfacial forces are an important factor in microelectromechanical systems (MEMS), including microelectromechanical systems chips,

[10] _____, sometimes called the "lab on a chip".

[11] _____ the force per unit area increases as the surface separation distance gets smaller.

[12] _____ the engineering failures that can occur due to tribological issues. You may have heard about the Hatfield high-speed train crash in 2000 in the UK, in which four passengers lost their lives, or the loss of Alaska Airlines flight 261, when 288 people died. And tribology presents great challenges for the international space programme. Just consider the problem of liquid lubrication in space.

@Phrasebank for presentations

Step 2

Write one or two sentences for a presentation to accompany each of the slides you made in **Task 1**.

- You do not need to prepare a full introduction (start with the plan of your presentation) or a conclusion.
- Use signposting language from Step 1 and the *Phrasebank for presentations* on aee.edu.pl.
- Write your sentences in the 'notes' section beneath each slide.

Step 3

Work with a new partner and take it in turns to present your slides. Do not read from your notes or from your slides.

Post-Task

Assessment activity

Use the *Use signposting language* rubric on aee.edu.pl to take notes on your partner's presentation and provide constructive feedback.

Upload your finished slides with notes to your university's Learning Management System.

Pre-Task

Awareness-raising activity

Slides are not the only visuals in a presentation. As the presenter, you are also on show. And it's not just the words you use that count. Your body language may be even more important than what you say. Effective body language should reinforce, and not distract from, your message and slides.

Give 5 examples of effective body language for scientific presentations, and 5 examples of ineffective or distracting body language. Use a dictionary to help you.

EFFECTIVE

[1] _____

[2] _____

[3] _____

[4] _____

[5] _____

INEFFECTIVE OR DISTRACTING

[1] _____

[2] _____

[3] _____

[4] _____

[5] _____

Discussion activity

How much of communication do you think is body language, how much is the tone of voice, and how much is the actual words spoken? Do you think it possible to put a percentage figure on each?

Task 3

Communicate with body language

Step 1

Use a video sharing platform to search for videos of presentations related to your field of study. Share interesting videos with the group.

Alternatively, your teacher will do this for you.

- Watch the videos with the sound off in small groups or as a whole class.
- Discuss examples you can see of effective or ineffective or distracting body language.
- Match them to the examples you identified in the **Pre-Task**. Add more examples to your lists.

Step 2

Selected students deliver their presentations from **Task 2**, paying attention to body language. While you are watching, take notes using the *Communicate with body language* rubric on aee.edu.pl.

Post-Task

Feedback activity

Students receive feedback from their peers and teacher.



Unit 4: Trends and data

After completing this unit you will be able to:

- Write captions and descriptions for figures and tables
- Describe trends
- Describe data

Pre-Task

Awareness-raising activity

Step 1

Use your university library resources to look up a selection of figures and tables in journal articles related to your discipline. Alternatively, your teacher will do this for you. Answer these questions:

- What is the difference between a *table* and a *figure*?
- What do you notice about the positions of the captions for tables and figures?
- What phrases are used to introduce the descriptions of the tables and figures in the text?
- What do you notice about the language used in the captions?

All scientists and engineers need to be able to describe and explain a variety of figures and tables. Which are the most common kinds of graphical image in your field of study?

Task 1

Write captions and descriptions for figures and tables

Step 1

Match the captions [1-5] to the descriptions [A-E].

Step 2

Decide whether the captions [1-5] refer to figures or tables. Write *Figure* or *Table* next to the numbers to complete the captions.

Step 3

Complete the descriptions [A-E] with different phrases to refer to the tables and figures (1-5). Use the *Phrasebank for writing: Describing graphs* at aee.edu.pl to help you.

_____1. Energy efficiency measures by type of eco-home, showing which are supported by policy and which are not (source: Jones 2008b).

_____2. Quality changes in soft drinks associated with common spoilage microorganisms.

_____3. Schematic structure (a) and scanning electron microscope image (b) of an ambipolar transistor integrating two graphene-based vacuum transistors.

_____4. pH and Hg concentrations in soil and soil substrates (mean ($n = 4$) \pm standard deviation). No significant differences were detected between variants of the experiment ($p > 0.07$)
nd* – below level of detection (concentration $< 0.07 \mu\text{g kg}^{-1}$).

_____5. Model of the elastic transmission system. Motor pulley radius r , joint pulley radius R , spring rest length l_r , spring pre-stretched deflection l_p , maximum spring deflection l_{max} .

[A] _____ a schematic drawing and _____ a scanning electron microscope image of the integration of two GBVTs with shared gate and collector electrodes.

[B] Eco-renovated properties, taken collectively, feature an extensive range of technically possible interventions, and not just measures supported by government grants and advice services (_____).

[C] _____ the most important microorganisms and their typical effects on contaminated soft drinks.

[D] _____ the important parameters for the single joint elastic tendon actuator.

[E] _____ the Hg concentrations used to calculate phytoextraction efficiency.

Post-Task

Feedback activity

Check your answers with other students and as a class.

Pre-Task

Awareness-raising activity

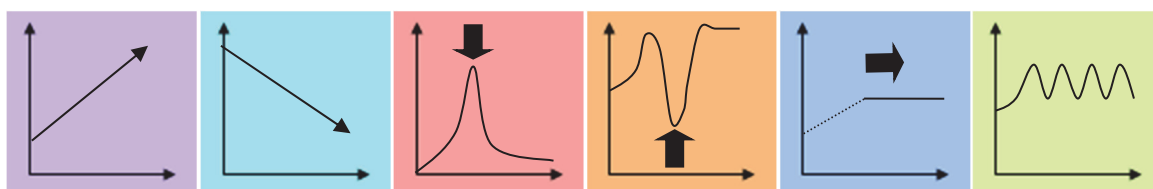
Step 1

Complete the text with: Independent variable / Dependent variable / x / y

In a physical test, the input is the _____. The result of the test, or output, is the _____. The _____ is almost always plotted on the horizontal axis (_____ axis), while the _____ is plotted on the vertical axis (_____ axis). A significant exception is the stress strain curve, where an applied load (input = stress) causes the test specimen to stretch (output = strain). When you graph A vs. B, A is the _____, and B is the _____.

Step 2

Brainstorm all the phrases you know already to describe the following graphs.



Step 3

Look at the *Phrasebank for writing: Describing graphs*. Did you include all of the phrases in your brainstorming? Add any other phrases you come up with to the list.

Step 4

Work with a partner. Decide which of the options fit each expression. There may be one or two correct answers.

- [1] A **steady / sharp / fast** fall
- [2] The number fell **slightly / dramatically / over five times**
- [3] A significant **raise / rise / rice**
- [4] The number **grew up / grew / increased**
- [5] An increase **of / in / by** the number of...
- [6] A gradual **increase / decline / plummet**
- [7] To reach a **peak / plateau / level off**
- [8] The number **oscillated / vacillated / palpitated**...
- [9] The number is **projected / prognosticated / predicted** to...
- [10] The number **rose / raised / raced**

Task 2

Describe trends

Step 1

Analyze the figure below. What is the main conclusion you can draw from it?

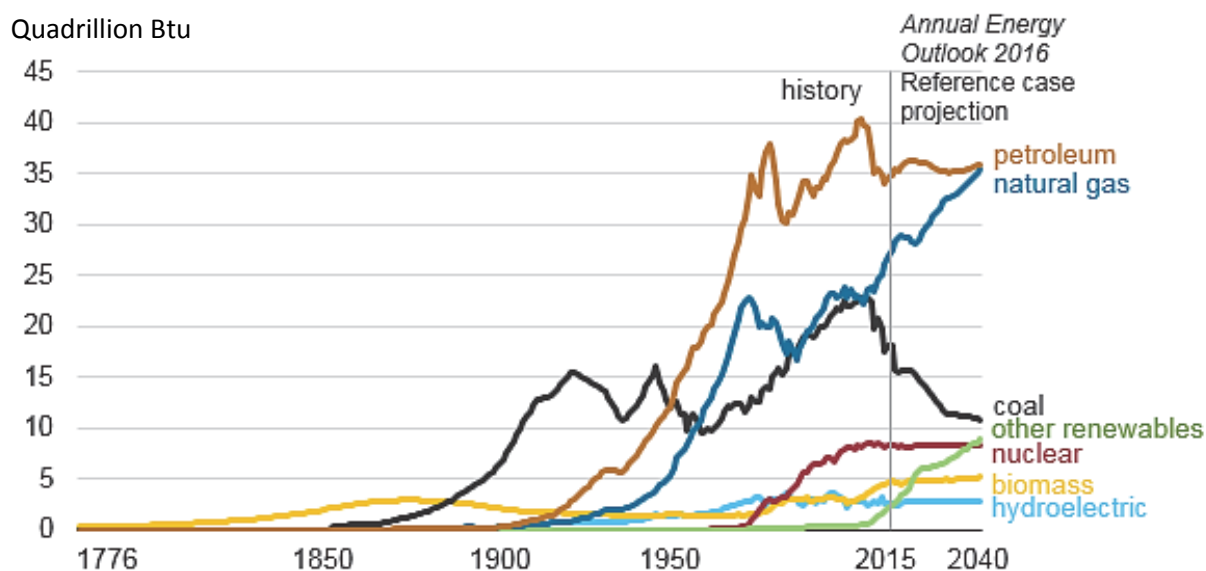


Figure 1. Energy consumption in the United States (1776-2040). Source: U.S. Energy Information Administration (July 2016) [Public domain].

Step 2

Work with a partner and take it in turns to describe the trends for each fuel source.

Post-Task

Consolidation activity

Selected students present the trends from the screen at the front. Your teacher will provide language-focused feedback.

Grammar focus: Past tenses → Page 58

Extension task

Write a short paragraph to do the following:

- [1] Describe the overall trend shown by the figure.
- [2] Compare the historical and projected trends for coal, petroleum and natural gas.
- [3] Describe the historical and projected trends for nuclear, biomass, hydroelectric and other renewables.

Upload your text to your university's Learning Management System.

Discussion activity

Energy sustainability is one of the grand challenges facing all fields of engineering. How is your discipline contributing to the search for more sustainable energy solutions?

Pre-Task

Awareness-raising activity

Research data are pieces of factual information that has been gathered in the course of scientific investigation. *Data* can also refer to statistics and specifications collected for reference or analysis. As a scientist or engineer, you will often have to describe data in both writing and presentations.

Step 1

Complete the sentences, including the numerical information in brackets. More than one correct answer may be possible.

- [1] House prices in London _____ [x3] in other parts of the UK.
- [2] Between meals _____ [x4] the amount of bacteria in saliva.
- [3] The proportion of engineers who are out of work _____ [x4] in the last three decades.
- [4] The density of aluminium _____ [$\approx 1/3$] of steel.
- [5] The number of cancer-related deaths due to tobacco _____ [25-30%].
- [6] The new CPU requires _____ [$<75\%$] of the power needed by chips from 3 years ago.
- [7] The number of cells _____ [$-1/2$] over the course of the experiment.
- [8] Enzyme activity in the bacteroids was _____ [$\times 2-3$] than in the plant cell cytoplasm.
- [9] The mercury level was _____ [$<$] the level of detection.
- [10] The organic carbon content, total nitrogen and available phosphorus were 5.47 ± 0.02 , 0.52 ± 0.03 and 0.38 ± 0.01 _____ [organic carbon content = 5.47 ± 0.02 ; total nitrogen = 0.52 ± 0.03 ; available phosphorus = 0.38 ± 0.01] (g kg^{-1} soil dry weight).

Task 3

Describe data

Step 1

Look at Figure 2 below. Complete the description using words to describe data.

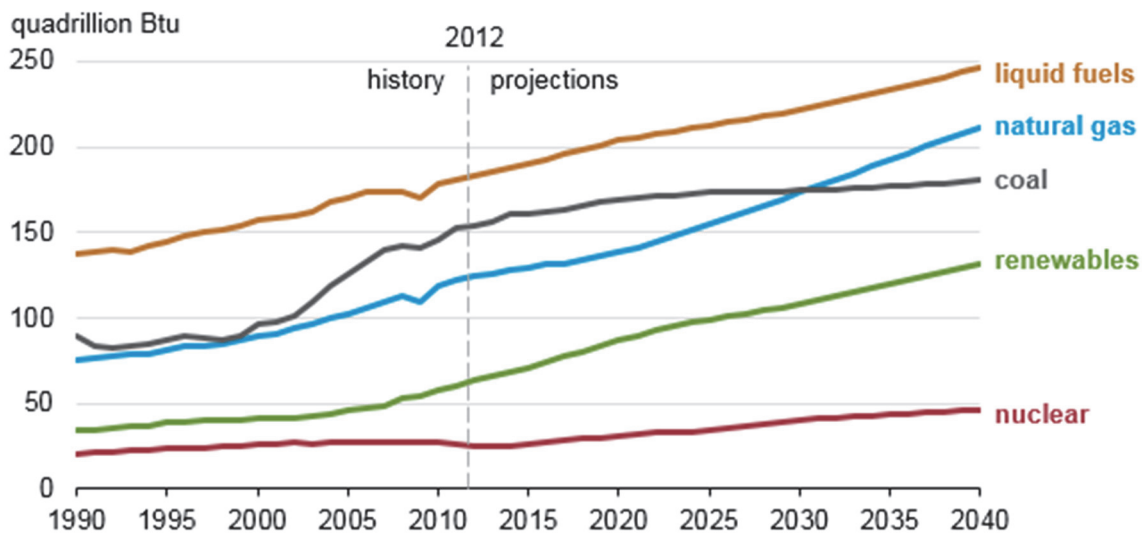


Figure 2. World energy consumption by source, 1990-2040. Source: U.S. Energy Information Administration (May 2016) [Public domain].

Figure 2 shows world energy consumption by source 1990-2012, and projections to 2040.

Overall, the EIA predicts a 48% rise in world energy consumption by 2040, with the most significant contributors being liquid fuels and natural gas.

Consumption of liquid fuels is set to _____ [+2/3] compared to 1990, from _____ [<] 150 to 250 quads in 2040.

Consumption of coal _____ [+1/2] between 1990-2012, from around 100 to 150 quads, but is projected to level off over the coming decades.

Natural gas consumption is predicted to overtake that of coal in around 2030, and will have almost _____ [x3] by 2040 compared to 1990, from around 75 to 225 quads.

Despite a sharp increase in the proportion of renewables in the energy mix, consumption of liquid fuels will still be _____ [x2] that of renewables by 2040, at 250 and 125 quads _____ [liquid fuels = 250; renewables = 125].

By 2040, the proportion of energy supplied by nuclear will be _____ [x2] that in 1990. However, the contribution of this power source will remain rather negligible in comparison to the others. By 2040, consumption of liquid gas will be _____ [x5] than that of nuclear.

In summary, the graph shows that the world will remain reliant on fossil fuels into the foreseeable future.

Discussion activity

Are you concerned by the projections for world energy consumption shown in the graph?
 What do you think governments should do to make sure that the world's energy needs are met?
 Do you think that renewables and/or nuclear should play a larger part in the energy mix?

Task 4

Describe data and trends

Step 1

Analyze Figure 3. What are the main conclusions that can be drawn from the graphs?
 Identify any patterns in the data.

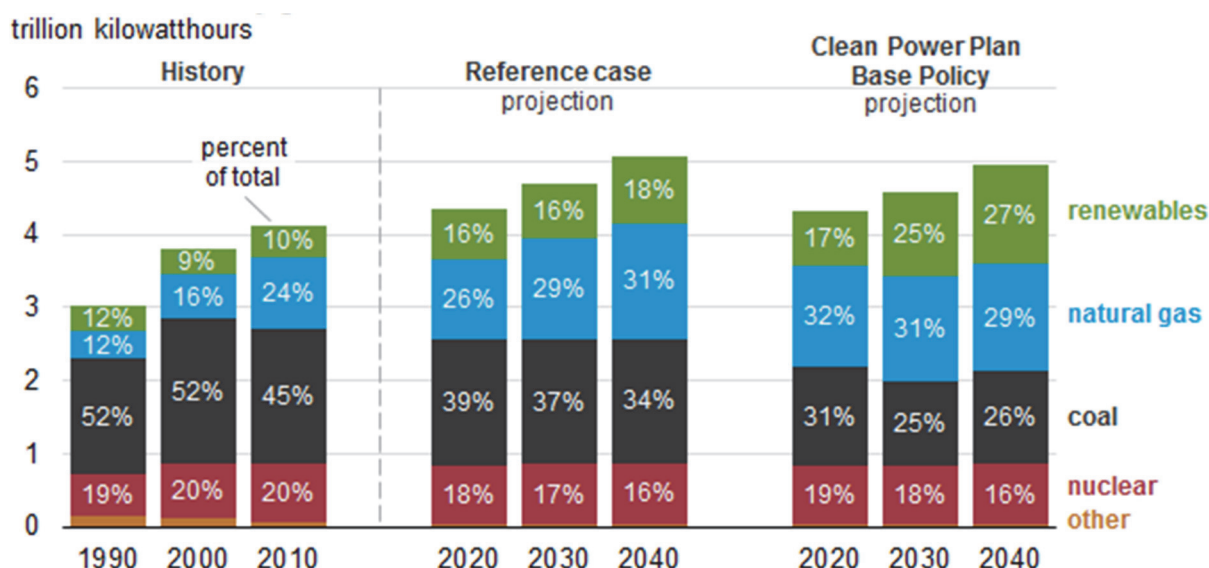


Figure 3. U.S. total energy generation in two cases, 1990-2040. Source: U.S. Energy Information Administration (May 2015) [Public domain].

Step 2

Write a 150 word summary comparing the data shown in Figure 3. Use the writing framework provided.

Introduction: Say what the Figure shows / presents / illustrates etc.

.....

.....

Overview: Identify the most important point(s) or feature(s) in the graphs

.....

.....

Compare the data for renewables in 2000 with the 2040 projections for the reference case and the CPP.

.....

.....

.....

Compare the data for coal in 1990/2000 to coal in 2040 with and without CPP.

.....

.....

.....

Compare the historical data for natural gas in 1990, 2000, 2010.

.....

.....

.....

Describe the trends for natural gas projections with and without CPP.

.....

.....

.....

Describe the historical trends and projections for nuclear and other.

.....

.....

.....

Conclusion: Summarize the main point(s) or feature(s) in the graphs again.

.....

.....

.....

Post-Task

Feedback and assessment

Upload your text to your university's Learning Management System.
Your teacher will provide language-focused feedback.



Unit 5: Maths

After completing this unit you will be able to:

- Name and explain common mathematical symbols
- Explain common mathematical operations
- Present mathematical problems and solutions

Pre-Task

Awareness-raising activity

Step 1

Why is mathematics important in science and engineering?

What mathematical equations, formulae, theories etc. are important in your discipline?

Mathematics (AmEng *Math*, BrEng *Maths*) is the study of numbers, shapes, space and structure. *Algebra* is the representation of numbers as *formulae* and *equations* using letters and other symbols. *Formulae* are not necessarily *equations*, which state that two mathematical *expressions* are equal. Formulae show the relationship between two or more *variables*.

Task 1

Name and explain common mathematical symbols

Step 1

Match the symbols below to their names or meanings in the box. Some symbols may require more than one term. Other terms may be possible.

Fraction | Percent | Radical sign | Sigma | Open interval | Parentheses | Denominator | Greater than or equal to | Composition of f with g | Numerator | Infinity | a to the power of b | n factorial | Function of x | Index | Radicand | First derivative | Integral from f | Logarithm with base a calculated from b | Set | Less than or equal to | Braces

Σ

$\{ \}$

$()$

$\frac{a}{b}$

$\log_a b$

\geq

\leq

$\%$

$f \circ g$

∞

a^b

$n!$

$f(x)$

$\sqrt[n]{x}$

y'

$\int f(x) dx$

Step 2

Your teacher will give you some flash cards with the symbols and functions from **Step 1**.

Put the cards face down. Take a card and without showing the card to your partner, explain the symbol or function. Your partner should try to give the terms in the box.

Post-Task

Consolidation activity

If neither you nor your partner were able to explain or name the symbols or functions, refer to the table in **Step 1** or ask another pair when you have finished the task. Note any symbols and explanations you need to revise again in the box below. Which were the most difficult to explain?

Notes

Task 2

Explain common mathematical operations

Step 1

Match the following algebraic transformations with the explanations of the operations.

$$3x^2y + xy - 7xy = 3x^2y - 6xy,$$

We cancel x from the numerator and denominator.

$$2x^2 - 3xy = x(2x - 3y),$$

We rationalize the denominator.

$$\frac{2xy}{3x^4} = \frac{2y}{3x^3},$$

We combine like terms.

$$\frac{a}{b} = \frac{c}{d} \Rightarrow ad = bc,$$

We cross-multiply.

$$\frac{1}{\sqrt{a} - \sqrt{b}} = \frac{\sqrt{a} + \sqrt{b}}{a - b}.$$

We take out the common factor.

Post-Task

Consolidation activity

Spend one minute memorizing the explanations. Cover the explanations and re-write the operations next to each algebraic transformation.



Awareness-raising activity

Read the problem below. Then listen to Dr Anna Olek from Lodz University of Technology explain the problem and solution.

A store has requested a furniture company to produce two types (A and B) of bookshelf. For materials, the company has 750m² of milk oak chipboard and 1,000 m² of wenge chipboard. Each bookshelf of type A needs 1m² of milk oak chipboard and 2m² of wenge chipboard. Each bookshelf of type B needs 1.5m² of milk oak chipboard and 1m² of wenge chipboard. The price is fixed at £50 and £40 for types A and B, respectively.

How many bookshelves of type A and type B must the company produce for the store, so that the items are of maximum value?

Discuss the problem and its solution (shown in the picture above) with a partner and the class. Why was the solution constructed in this specific way?

on a **vertex** (plural: vertices or vertexes) | a value is **attained by** f | **on** a plane |
the **feasible region** | **polygon** | to **maximize** f | **constraints** | we **obtain** a solution

Listen to Dr Olek again, giving some more general comments on the solution.

Task 3

Present mathematical problems and solutions

Step 1

Work individually or in pairs. Your teacher will assign you either **Problem 2** or **3**. Solve the problem using the same method described by Dr Olek.

Problem 2

A company makes two types of ink cartridge, GR100 and UH200. Because of limitations on production capacity, no more than 200 GR100 ink cartridges and 170 UH200 ink cartridges can be produced daily. To satisfy a contract, a total of at least 200 ink cartridges must be shipped each day.

If each GR100 ink cartridge sold results in a \$2 loss and each UH200 ink cartridge produces a \$5 profit, how many of each type should be made a day to maximize profits?

Problem 3

You have exactly 32 units of ethanol and 54 units of water. You plan to mix as many units as possible of ethanol solution in water to concentrations A and B. Each unit of liquid with concentration A requires 4 units of ethanol and 1 unit of water. Each unit of liquid with concentration B requires 1 unit of ethanol and 6 units of water.

Find the maximum number of units you can mix.

Notes

Step 2

Work with a new partner who was given the same problem. Do your answers agree? Did you use the same method to arrive at your solution?

If you did not successfully solve your problem, ask your partner for help.

Step 3

Work with a partner who was given the other problem (if you had **Problem 2**, work with someone who had **Problem 3**). Present your problem and your solution.

Post-Task

Peer and self assessment

Tips for presenting at the board

- Make sure your handwriting is legible.
- Be aware of different conventions for writing numbers and decimal points.
- Try not to turn your back on your audience. In particular, do not speak to the board. If you are writing on the board, finish writing and turn before you speak.
- If you are referring to something you have written, gesture to it with your hand or a pointer.
- Make sure your voice is loud enough for all to hear.
- Make eye contact with different members of your audience.
- Smile!

Step 1

Selected students present **Problem 2**.

Step 2

Watch Dr Olek explaining the solution to **Problem 2**. Whose explanation was easier to understand? Why? If you were presenting, what would you do differently next time?

Step 3

Selected students present **Problem 3**.

Step 4

Watch Dr Olek explaining the solution to **Problem 3**. Whose explanation was easier to understand? Why? If you were presenting, what would you do differently next time?

Additional activities

[1] How would you pronounce the following formulae? What are they used for?

$$\lim_{x \rightarrow a^-} f(x)$$

$$g \circ f$$

$$\binom{n}{k}$$

[2] Translate the following into your language:

Billion

Trillion

Quintillion



Unit 6: Processes

After completing this unit you will be able to:

- Describe processes
- Draw a flowchart
- Write a process description

Pre-Task

Awareness-raising activity

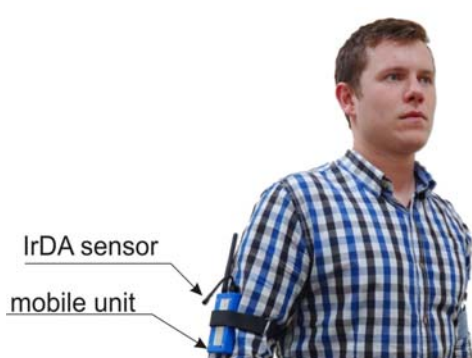
Which processes are important in your discipline? Describe some processes related to your field to a partner and your teacher.

Task 1

Describe processes

Step 1

Read the text and look at the picture below describing research conducted at the Institute of Electronics, Lodz University of Technology (Januszkiewicz et al., 2016). Check your understanding of the words in **bold**.



The system consists of a mobile unit that is attached to the arm of the moving person and a set of base units that are located inside the building. The base units are equipped with short range **IrDA transmitters** that emit infrared signals containing the base unit identifier. The mobile unit can only receive an infrared signal if the person is within a small and controlled region in the **vicinity** of a base unit. The mobile unit uses **accelerometers** and **gyroscopes** to measure the **linear** and **axial** acceleration of the person and sends this data via radio waves (2.4 GHz ISM band) to the base units and from there to the monitoring computer. To limit **error accumulation**, when the mobile unit detects an IrDA signal, the position of the user is **updated** to the centre of the zone associated with the nearest base unit. The data gathered by the sensors are processed by the monitoring computer using an **inertial localization algorithm**.

Grammar focus: Present and future forms → Page 60

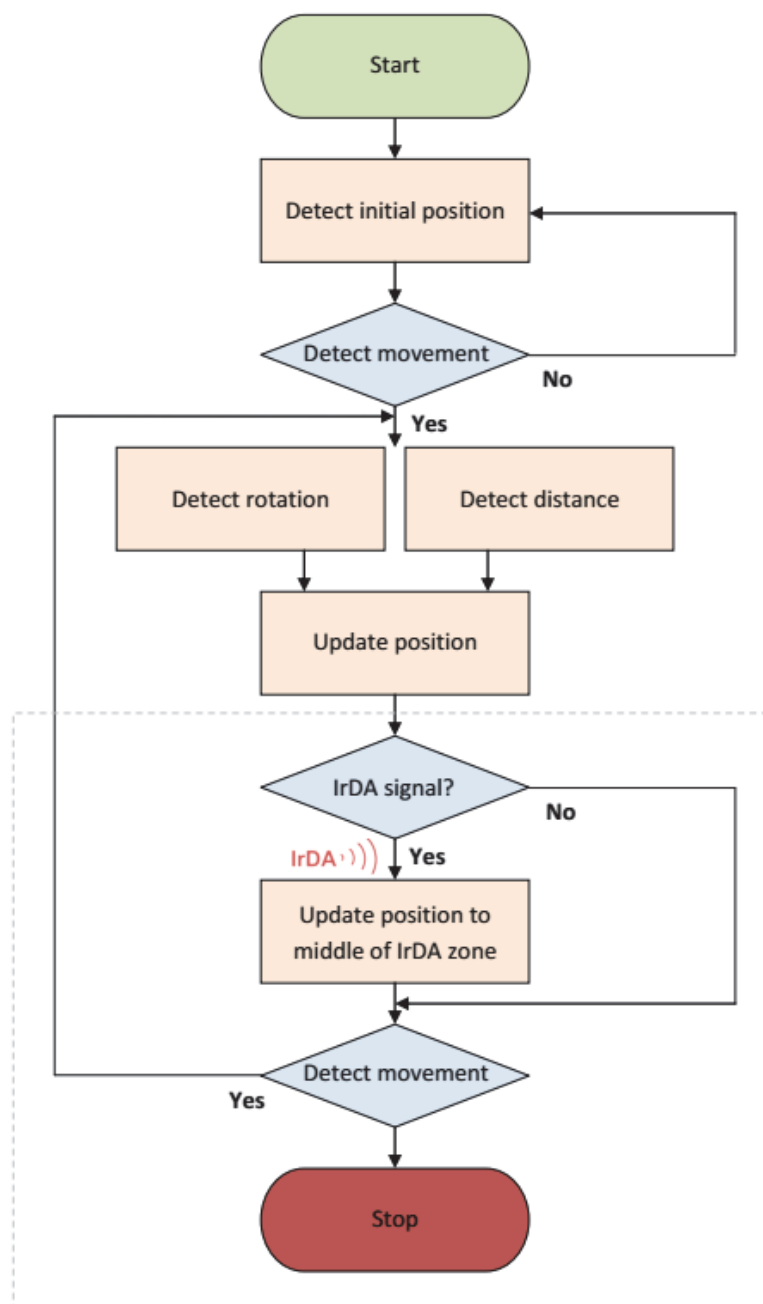
Extension activity

Brainstorm possible applications for this technology. Alternatively, research applications for indoor positioning systems (IPS) on the internet, using a popular search engine and video sharing platforms. Are there any applications related to your discipline? Report back to the class.

Step 2

Look at the flowchart below, which describes the **inertial localization algorithm**. With a partner, describe the process of wireless indoor positioning shown in the flowchart.

- Student A, describe the first 5 steps (up to 'update position')
- Student B, describe the remaining 4 steps.
- Help your partner if necessary and provide feedback.



Step 3

Read two versions of a written descriptions of the process you described in **Step 2**.

Underline or highlight differences between the two texts. Then answer these questions:

- What changes have been made to the structure of the sentences?
- Which words have been added, or changed?
- How have these changes improved the process description?

The monitoring computer detects the initial position of the user. It then detects movement. If it does not detect movement, the user's position is determined. If movement is detected, any rotation and the distance covered are measured. It updates the position of the user. The computer next verifies whether there is an IrDA signal. If yes, the position of the user is updated to the middle of the IrDA zone. If no, the computer again attempts to detect movement. If movement is detected, it repeats the process. If it does not detect movement, the process stops.

The monitoring computer first detects the initial position of the user. It then detects any movement. If it does not detect movement, the user's position is again determined. If movement is detected, the computer measures any rotation and the distance covered. The position of the user is updated. The computer next verifies whether an IrDA signal is being received. If so, the position of the user is updated to the middle of the IrDA zone. If not, the computer again attempts to detect movement. If movement is detected, the process is repeated. If no movement is detected, the process stops.

Post-Task

Consolidation activity

Without looking back at the improved text, improve the process description by re-writing each sentence using the word in brackets. Then check your answers by comparing your text with the original.

[1] The monitoring computer detects the initial position of the user. (**FIRST**)

.....

[2] It then detects movement. (**ANY**)

.....

[3] If it does not detect any movement, the user's position is determined. (**AGAIN**)

.....

[4] If movement is detected, any rotation and the distance covered are measured. (**COMPUTER**)

.....

[5] It updates the position of the user. **(IS)**

.....

[6] The computer next verifies whether there is an IrDA signal. **(RECEIVED)**

.....

[7] If yes, the position of the user is updated to the middle of the IrDA zone. **(SO)**

.....

[8] If no, the computer again attempts to detect movement. **(NOT)**

.....

[9] If movement is detected, it repeats the process. **(IS)**

.....

[10] If it does not detect movement, the process stops. **(NO)**

.....

Pre-Task

Awareness-raising activity

Step 1

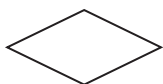
Match these flowchart symbols to their most common uses.



INPUT /OUTPUT



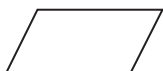
DECISION



PROCESS



TERMINATOR



SUBPROCESS

Step 2

Discuss the software options you know for drawing flowcharts, with the teacher and the class.

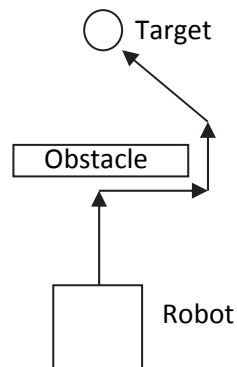
Notes

Task 2

Draw a flowchart

Step 1

Work with a partner. Plan an algorithm to enable a simple robot to detect and avoid obstacles on route to a pre-programmed destination.



Step 2

Draw a flowchart for the algorithm using computer software. Ensure that your flowchart is properly formatted.

Post-Task

Feedback activity

Your teacher will provide language-focused feedback.

Task 3

Write a process description

Step 1

Write a short paragraph describing the process in your flowchart from **Task 2**.

Step 2

Check your work, making any changes necessary.

Post-Task

Feedback activity

Your teacher will provide language-focused feedback.

Alternative / Extension task

Research a process related to your field. Draw a flowchart or diagram of the process. Write a short paragraph describing the process.



Unit 7: Methods

After completing this unit you will be able to:

- Describe methods
- Develop a research project
- Present a research project

Pre-Task

Awareness-raising activity

The Methods section of a paper or report explains the procedures you performed to obtain your results. This enables your readers to evaluate and possibly to replicate your investigation.

Step 1

Which methods are important in your discipline? Describe some methods to a partner and your teacher.

Task 1

Describe methods

Step 1

Read the following excerpt from the 'Materials and Methods' section of an article written by researchers at Lodz University of Technology, entitled 'Simultaneous Saccharification and Fermentation of Sugar Beet Pulp for Efficient Bioethanol Production' (2016).

The fermentation experiments were carried out in 1L glass flasks, each containing approximately 0.5L of wort. Fermentation was initiated using 1g of Ethanol Red distillery yeast (*S. cerevisiae*) per 1L of wort. The yeast was first hydrated and acid-washed (15 min incubation of cells suspended in water with the addition of 25% w/w sulfuric acid solution, pH 2.5, at room temperature). The flasks were closed with stoppers equipped with fermentation pipes, filled with glycerol, and kept in a thermostat-regulated room at $37 \pm 1^\circ\text{C}$. Fermentation was continued over 24 hours, at the end of which the specimens were inoculated with the *Pichia stipitis* yeast strain (0.5g/L). In selected fermentation trials, after inoculation with *P. stipitis*, the effect of aeration was evaluated using a 0.3vvm constant air supply. Fermentation was resumed for a further 48 hours, the entire process time amounting to 72h. (...) When the fermentation was complete, samples were collected to determine the ethanol, hexose, and pentose sugar concentrations.

Grammar focus: Passives → Page 62

Step 2

Highlight all the **procedural verbs** which describe the actions taken by the researchers.

Highlight the **time words** and **sequencing words** which indicate the order in which actions or results occurred. What tense and voice (active or passive) are used predominantly?

Step 3

Which verbs from the *Phrasebank for writing: Methods and processes* collocate with the following nouns? Some verbs may collocate with more than one noun.

Verbs

Observe
Select
Note
Monitor
Evaluate
Quantify
Calculate
Perform
Conduct
Estimate

Nouns

Cell numbers
Procedure
Standard deviation
Flow rate
Changes
Responses
Results
Research
Samples
Processes

Notes

Step 4

Can you think of any more procedure verbs? With which nouns do they collocate? Add at least one more verb and noun collocation to the list and share your ideas with the class.

Step 5

Although very useful, the verbs *analyze* and *determine* can be overused in scientific and technical writing, and may not be the most precise words possible. Which words from your lists in **Step 3** could be used as synonyms?

Step 6

Complete the following modified excerpt from the 'Analytical Methods' section of the same article with suitable verbs from **Step 3** in the correct form.

The sugar beet pulp was analyzed following methods recommended for the sugar industry. The amount of solid substance _____ in a Radwag WPS-30S weighing dryer. Reducing sugars and total sugars (after inversion with hydrochloric acid) _____ according to the Miller method, in g of invert sugar per kg of thick juice. The concentration of saccharose _____ as the difference between the quantities of total sugars and reducing sugars (with a conversion coefficient of 0.95). Cellulose content was determined according to the Kürschner-Hoffer method, hemicellulose content _____ using the Ernakow method, and lignin content _____ following the method recommended by the National Renewable Energy Laboratory (NREL). The pH _____ using a digital pH meter.

Step 7

Rewrite each of the following sentences as a single sentence. Each new single sentence should include the capitalized word in brackets at the end.

[1] Fresh sugar beet pulp (SBP) was obtained from the Dobrzelin Sugar Factory (Poland). It was stored at -20°C . Then we used it. **(UNTIL)**

[2] The biomass was centrifuged. It was washed twice with sterile physiological saline. It was centrifuged again. **(THEN)**

[3] All samples were filtered through $0.45\mu\text{m}$ PES (polyethersulfone) membranes. Then the samples were analyzed. **(PRIOR)**

[4] The medium was maintained at a temperature of 40°C for 6h. The medium was stirred continuously. It was then inoculated with yeast. **(BEFORE)**

[5] The worts were pre-treated. Then they were adjusted to pH 4.8 using 25% (w/w) sodium hydroxide. **(AFTER)**

[6] The biomass was suspended in saline. The biomass yield was then determined by drying the sample to a constant weight at 105°C . **(FOLLOWING)**

[7] An analogous fermentation trial was subjected to 6 h of enzymatic activation and then inoculated with yeast. The ethanol concentration after fermentation increased by 16.8%. **(WHEN)**

[8] The investigation next focused on pre-treatment of the ground pulp. Did it improve the release of fermentable sugars? **(STAGE)**

Post-Task

Consolidation activity

Step 1

What do you know about the scientific method? What are the 6 steps usually included in the scientific method?

[1]

[2]

[3]

[4]

[5]

[6]

Extension activity

Research the scientific method using a popular search engine or video sharing platform.

Task 2

Develop a research project

Step 1

Work in pairs. Think of a research topic related to your discipline. This could be a current project you are working on, or another topic of which you already have some knowledge.

Examples of possible topics include the 'wireless indoor positioning system' or 'obstacle detection mechanism for robots' described in **Unit 6: Processes**.

Step 2

Develop a precise hypothesis and research question related to the topic from **Step 1**. What would you like to improve, and how do you think it could be improved?

Step 3

Suggest a suitable methodology for testing the hypothesis. Consider all or some of the following:

- Data to be collected
- Comparisons to be made
- Research procedures to be used
- The controls / baselines / benchmarks you will use
- Scientific instruments and / or software to be employed
- Initial observations / simulations / lab experiments / field trials to be conducted

Step 4

Write a project outline including a full title and a single-sentence purpose statement. Use bullet points and simple headings for the rest of your outline.

Post-Task

Feedback activity

Your teacher will provide language-focused feedback.

Task 3

Present a research project

Step 1

Take it in turns with another student to present your research projects.

Step 2

When listening to each other's presentations, take notes using the *Present a research project* rubric available at aee.edu.pl.

Post-Task

Peer appraisal

Summarize your partner's presentation based on your notes. Then discuss these questions:

- Does your partner agree with your summary?
- Have you left out any points?
- Is there anything in your partner's presentation you didn't understand?
- Ask your partner questions for clarification or further information.

Extension tasks

Selected students present their research projects to the class.

Write a short account of their research project, using as much of the language in this unit as possible. Since the research has not been conducted yet, you should use the future tense (will + verb / will be + verb + -ed).



Unit 8: Referencing

After completing this unit you will be able to:

- Write reference lists
- Use author-prominent in-text citations
- Use information-prominent in-text citations

Pre-Task

Awareness-raising activity

Step 1

Why is it important to cite your sources? What is the most common referencing style in your discipline? Do you know about any software tools for managing references?

The most common referencing style in engineering is the author-date (Harvard) system. Some disciplines, universities and lecturers require different styles. There are also variations within styles. Check your course profile or ask your lecturer. If you are submitting a paper for publication, check the journal's Instructions for Authors. In all cases, it is important to be consistent in your referencing style.

Task 1

Write reference lists

Step 1

Look at the reference list below. Match the references [1-4] with the sources [A-D].

- [1] Alley, M. (2013) *The Craft of scientific writing*. 3rd edn. New York: Springer.
- [2] Amanda Everaert (2007) *Referencing*. Available at:
<http://www.monash.edu.au/lls/llonline/writing/engineering/technical-report/7.xml> (Accessed: 7 April 2017).
- [3] Gebiski, M., Dems, M., Wasiak, M., Lott, J. and Czyszanowski, T. (2015) 'Monolithic subwavelength high-index-contrast grating VCSEL', *IEEE Photonics Technology Letters*, 27(18), pp. 1953–1956.
- [4] Panajotov, K., Dems, M. and Czyszanowski, T. (2016) 'Photonic-crystal VCSELs', in De La Rue, R., Lourtioz, J. and Yu, S. (eds.) *Compact semiconductor lasers*. Weinheim: John Wiley & Sons, pp. 149–94.

[A] A chapter of an edited book

[B] A page from a website

[C] An article in a journal

[D] A book

Step 2

Each of the references in **Step 1** contains ONE inconsistency with respect to the others. Can you identify the inconsistency in each reference? Correct the reference list.

Step 3

Use a scholarly web search engine to find references for the following works. Write the full references in the same style as that used on page 44 and in the other reference lists in this book. Some modifications to the references you find on-line may be necessary

Author(s)	Title	Year
Rod Ellis	Task-based language learning and teaching	2003
Andreas Müller-Hartmann, Marita Schocker-V. Ditzfurth	Research on the use of technology in task-based language teaching	2010
Tim Bowen	Teaching approaches: Task-based learning	2010
Robert J Mislevy, Linda S. Steinberg, Russell G. Almond.	Design and analysis in task-based language assessment.	2002

Post-Task**Self-assessment**

Compare your references to those in the bibliography on Pages 74-75.

Pre-Task**Awareness-raising activity****Step 1**

Compare the in-text citations below with the corresponding reference list entries in **Task 1, Step 1**. What do you notice about how in-text citations are written?

Step 2

Write in-text citations for the works in **Task 1, Step 3**.

Task 1 | Step 1

(Alley, 1996)
(Everaert, 2016)
(Gębski et al., 2015)
(Panajotov et al., 2014)

Task 1 | Step 3

The in-text citations above are called “information prominent”. These are placed after the information given, to refer to its source. If the same information is contained in several sources, cite them all in the same pair of brackets, in chronological order, separated by semi-colons (Alley, 1996; Everaert, 2016).

You can also use “author-prominent” in-text citations. Use the name(s) of the author(s) as part of the sentence, followed by the date of publication in brackets:

Gębski et al. (2015) showed that ...

Most references in science and engineering texts are the information-prominent type.

Discussion activity

Under what circumstances do you think it would be better to use the information-prominent form of citation, as opposed to the author-prominent type?

When might using the author-prominent style be more appropriate?

Task 2

Use author-prominent in-text citations

Step 1

Work with a partner. Brainstorm common reporting verbs and phrases used in scientific and technical writing to introduce the findings of other researchers. Write as many as you can in 2-3 minutes.

Notes

Step 2

Compare your list with the *Phrasebank for writing: Reporting*. Are any verbs in the *Phrasebank* unfamiliar? Look them up in a dictionary or ask your teacher to explain their meaning.

Step 3

Are there any verbs in your list that do not appear in the *Phrasebank*? Discuss with your teacher and the class whether they should be added, based on their suitability for scientific and technical writing.

Step 4

Transform the following information-prominent citations into the author-prominent type, using a suitable reporting verb. Other changes may be necessary. There is an example at the beginning.

[0] The application of a top-mounted diamond heat spreader can have considerable influence on the thermal crosstalk between array emitters (Kuc et al., 2013).

Kuc et al. (2013) showed that the application of a top-mounted diamond heat spreader can have considerable influence on the thermal crosstalk between array emitters.

[1] The antioxidant activity and reducing potential of beers vary depending on the type of beer and the processing steps involved in its production (Ditrych et al., 2015).

[2] This may explain the increased level of acetaldehyde in distillates from ozonated media (Dziugan et al. 2016).

[3] An initial design inquiry into the nature and context of the task resulted in the identification of several possible solutions (Franjic and Woźniak, 2014).

[4] The maximal positioning error obtained with this algorithm did not exceed 2 m (Januszkiewicz et al., 2016).

[5] The proposed CBD model enabled the creation of 3D maps, which could be used to estimate the influence of vehicle energy efficiency on the emission of waste heat from the cooling and exhaust systems of a compression ignition engine (Pałczyński, 2016).

Post-Task

Peer and self-assessment

Compare your answers with a partner and the class. Have you used in-text citations correctly? Which other verbs could be used in each sentence? Would the use of other verbs change the sense of your sentences?

Reflection activity

As discussed previously, the in-text and author-prominent forms of citation are not usually simply interchangeable. How has the sense and/or focus of the sentences in **Step 4** been modified by changing the form of citation?

Pre-Task

Awareness-raising activity

Under what circumstances is it unnecessary to provide a citation?

- When you make a direct quotation.
- When you have paraphrased the original source.
- When you knew what the source said already.
- When your source cites a source (you can just cite the same source).
- When what you're writing is common sense or common knowledge.
- When you are presenting your own ideas or findings.

Discussion activity

Have you heard of any examples of food fraud or adulteration in the news? What kinds of food do you think are most often adulterated?

Task 3

Use information-prominent in-text citations

Step 1

Decide if and when it is necessary to provide references in the following text. Insert references from the list as necessary, using information-prominent citations in the author-date (Harvard) system.

Dairy products are an important part of the diet in most parts of the world.

This food group is often subject to adulteration, as producers try to maximize profit.

Chemometric methods are a useful tool for verifying the quality and authenticity of dairy products.

Chemometric methods have been used to analyze the presence of adulterants such as chlorine, formol, hydrogen peroxide, starch and urine in Brazilian UHT milk.

Urine, added to disguise the addition of water, was detected in 45% of samples.

Partial least squares regression combined with FTIR spectroscopy has also been used to estimate cholesterol content in dairy products, with an R^2 value of 0.99.

Reference list

- [1] Kamal, M. and Karoui, R. (2015) 'Analytical methods coupled with chemometric tools for determining the authenticity and detecting the adulteration of dairy products: A review', *Trends in Food Science & Technology*, 46(1), pp.27-48.
- [2] Paradkar, M.M. and Irudayaraj, J. (2002) 'Determination of cholesterol in dairy products using infrared techniques: 1. FTIR spectroscopy', *International Journal of Dairy Technology*, 55(3), pp.127-132.
- [3] Souza, S.S., Cruz, A.G., Walter, E.H., Faria, J.A., Celeghini, R.M., Ferreira, M.M., Granato, D. and Sant'Ana, A.D.S. (2011) 'Monitoring the authenticity of Brazilian UHT milk: A chemometric approach', *Food Chemistry*, 124(2), pp.692-695.
- [4] Wikipedia (2016) *Dairy product*. Available at: https://en.wikipedia.org/wiki/Dairy_product (Accessed: 16 October 2016).

Post-Task

Peer and self-assessment

Compare your changes with a partner and as a class. Have you correctly identified where references were required? Have you written the information-prominent citations correctly in the author-date (Harvard) system?



Unit 9: Paraphrasing

After completing this unit you will be able to:

- Identify plagiarism
- Use techniques for paraphrasing
- Paraphrase effectively

Pre-Task

Awareness-raising activity

Paraphrasing is a key skill in technical and scientific writing, which rarely uses direct quotations from sources. To avoid plagiarism, paraphrasing should be used in conjunction with referencing (see Unit 8). Plagiarism is copying words and ideas and presenting them as your own.

Step 1

What is your university's policy on plagiarism? Do you have any experiences of plagiarism?

Task 1

Identify plagiarism

Step 1

Take this quiz to check your understanding of plagiarism.

Is it plagiarism if...?

[1] you copy from an unpublished work (e.g. a previous student's work) without a reference.

[2] you copy/paste a paragraph from someone else's work but provide a reference.

[3] you copy/paste a sentence from someone else's work but provide a reference.

[4] you copy/paste but use inverted commas and provide a reference.

[5] you paraphrase and provide a reference.

[6] you use some of the same words or expressions when you paraphrase and provide a reference.

[7] you paraphrase but use some of the same technical keywords and provide a reference.

Post-Task

Feedback activity

Compare your answers with a partner and the class.

Pre-Task

Awareness-raising activity

Step 1

Compare these excerpts from an original text [A] (Low et al, 2017) and its paraphrase [B].
Match each pair to one of the techniques for paraphrasing in the box below.

Summarize by deleting | Change word order | Use synonyms | Combine / divide sentences
Change word class (e.g. verb to adjective, adverb to noun, etc.)

[A] The past 10 years have seen considerable advances in AM technology

[B] The last decade has seen significant progress in AM technology

[A] allowing greater control, resolution and precision.

[B] allowing greater precision, resolution and control.

[A] The use of AM in separation membrane printing is an exciting new area of research. [...] However, the technique still has several limitations that need to be addressed.

[B] Although the technique still has several limitations that need to be addressed, the use of AM in separation membrane printing is an exciting new area of research.

[A] The use of AM in separation membrane printing

[B] The use of AM to print separation membranes

[A] AM complements conventional techniques, such as the phase inversion method (non-solvent induced and thermally induced), enabling the production of membranes in different shapes, types and designs which can be more precisely designed, fabricated and controlled than by any other membrane fabrication method available.

[B] AM complements conventional techniques, enabling membranes to be more precisely designed, fabricated and controlled than by any other method available.

Reflection activity

Read the original text and the paraphrase from the **Pre-Task** again. Do you think that using these techniques for paraphrasing individually would be enough to avoid plagiarism?

Original text

The use of AM in separation membrane printing is an exciting new area of research. The past 10 years have seen considerable advances in AM technology, allowing greater control, resolution and precision. Recently, it has become possible to fabricate separation membranes using this increasingly important and flexible manufacturing technique. AM complements conventional techniques, such as the phase inversion method (non-solvent induced and thermally induced), enabling the production of membranes in different shapes, types and designs which can be more precisely designed, fabricated and controlled than by any other membrane fabrication method available. Additionally, almost uniquely AM allows both the micro- and macro-structures of the membrane to be fabricated in one piece, in a single machine/process. This provides unprecedented combined and integrated design possibilities for improving membrane separation at both the materials and process architecture levels. However, the technique still has several limitations that need to be addressed.

Paraphrase

The last decade has seen significant progress in AM technology, allowing greater precision, resolution and control. Although the technique still has several limitations that need to be addressed, the use of AM in separation membrane printing is an exciting new area of research. AM complements conventional techniques, enabling membranes to be more precisely designed, fabricated and controlled than by any other method available. Moreover, it enables the micro- and macro-structures of the membrane to be designed and fabricated simultaneously. This gives unprecedented combined and integrated design possibilities for improving membrane separation at both the materials and process architecture levels.

Now read an improved paraphrase of the text. Discuss why it is better with a partner and the class.

Improved paraphrase

Recent advances in 3D printing technology, also known as additive manufacturing (AM), have created new possibilities for the fabrication of separation membranes. Used alongside more established methods such as phase inversion (thermally or non-solvent induced), AM enables the design and production of membranes to very precise specifications, by allowing greater control and accuracy. Moreover, using AM membranes can be fabricated at both the macro- and micro-structural levels simultaneously, providing new opportunities in terms of materials and design. Of course, some difficulties remain, but all this makes using AM for fabricating membranes a promising avenue for research (Low et al., 2017).

Another effective technique for paraphrasing is to first take notes in your own words or your native language. Then, without looking at the original source, write your text. Compare your text to your source to make sure there has been no inadvertent plagiarism, and that the sense of the original has not been lost. Remember to always provide a reference. Good paraphrasing shows understanding of the source text.

Task 2

Use techniques for paraphrasing

Use the techniques presented in the **Pre-Task** to paraphrase a modified excerpt from an article on how 3D printing is changing business innovation (Rayna and Striukova, 2016).

Step 1

Use synonyms

Originally used mainly for rapid prototyping, 3D printing technologies have progressively taken on a more important role in manufacturing processes.

Step 2

Change word order

As the technology improved, it became possible to use 3D printers not only to prototype, but also to manufacture tools and moulds used for 'traditional' manufacturing.

Step 3

Combine / divide sentences

It then became possible and economical, in some cases, to entirely manufacture end-products with 3D printers. It even became possible to directly manufacture at home. With the advent of Personal 3D Printers, the (physical) distribution stage could thereby be omitted.

Step 4

Change word class (e.g. verb to adjective, adverb to noun, etc.)

Yet, the 3D printing 'revolution' is likely to differ quite significantly from previous digital revolutions.

Step 5

Summarize by deleting

Indeed, while movies and music are nowadays predominantly transferred over the Internet to be 'manufactured' at home, it is unlikely that all manufacturing will follow this path, with every single object being fabricated at home on a personal 3D printer.

Post-Task

Peer and self-assessment

Compare your changes with a partner and as a class.

Pre-Task

Awareness-raising activity

Step 1

Discuss these questions with a partner and the class.

- Do you agree that the 3D printing may not be as revolutionary as other technologies?
- What techniques for 3D printing do you know about?
- What applications for 3D printing do you know about?
- Are there any applications for 3D printing relevant to your discipline?

Task 3

Paraphrase effectively

Step 1

Combine all the techniques for paraphrasing to rewrite the whole paragraph as fully as possible. Include an appropriate in-text citation.

Originally used mainly for rapid prototyping, 3D printing technologies have progressively taken on a more important role in manufacturing processes. As the technology improved, it became possible to use 3D printers not only to prototype, but also to manufacture tools and moulds used for 'traditional' manufacturing. It then became possible and economical, in some cases, to entirely manufacture end-products with 3D printers. It even became possible to directly manufacture at home. With the advent of Personal 3D Printers, the (physical) distribution stage could thereby be omitted. Yet, the 3D printing 'revolution' is likely to differ quite significantly from previous digital revolutions. Indeed, while movies and music are nowadays predominantly transferred over the Internet to be 'manufactured' at home, it is unlikely that all manufacturing will follow this path, with every single object being fabricated at home on a personal 3D printer.

Reference list

Rayna, T. and Striukova, L. (2016), 'From rapid prototyping to home fabrication: How 3D printing is changing business model innovation', *Technological Forecasting and Social Change*, 102, pp. 214-224.

Post-Task

Feedback activity

Compare your changes with a partner and as a class.



Unit 10: Conclusions and feedback

After completing this unit you will be able to:

- Present conclusions
- Write a conclusion
- Give feedback

Pre-Task

Awareness-raising activity

Presenters can generally expect to have the attention of their audiences at the start of the presentation and at the end. Often, readers will read the abstract and conclusions before they read the rest of the paper. Just like the introduction, the conclusion can leave a lasting impression, whether negative or positive.

Discuss with a partner whether you agree with the following advice for delivering an effective conclusion to a scientific presentation. Why/why not?

Point to areas requiring further research	YES	NO
Sum up the overall purpose and/or main message of your presentation	YES	NO
Provide a summary of your main points	YES	NO
Make recommendations	YES	NO
You don't need a conclusion – by that time you've said all you needed to say	YES	NO
Use a cartoon with a humorous caption	YES	NO

Extension activity

Brainstorm other possible advice for presenting conclusions. Report back to the class.

Task 1

Present conclusions

Step 1

Read the transcript of a presentation conclusion on the next page and look at the accompanying slide. Answer these questions:

- Does the conclusion follow the advice you discussed in the **Pre-Task**? Identify the sections in the script which perform each function.
- How does the conclusion correspond to the accompanying slide?

IN SUMMARY, TRIBOLOGICAL UNDERSTANDING IS CRUCIAL FOR ALL FUTURE ENGINEERS

Friction

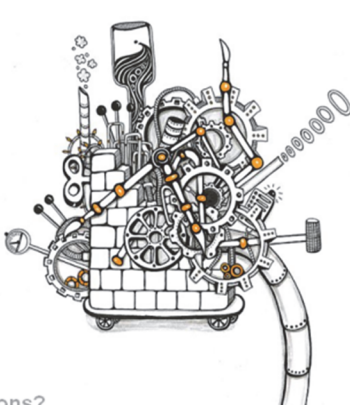
Wear

Lubrication

Design

Manufacture

Maintenance



Any Questions?

Image by Emma Marie Andersson (2016_machine_doodle_49) [CC BY-SA 2.0 (<http://creativecommons.org/licenses/by-sa/2.0>)], via Wikimedia Commons

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"To sum up, tribological understanding is crucial for all future engineers. In this presentation, we've seen how tribological phenomena occur in most modern engineering processes and many manufacturing systems, involving friction, wear and lubrication, with implications for design, manufacture and maintenance. Unfortunately, we've also seen how many engineering failures have tribological origins, with sometimes tragic consequences. Although our ability to model these phenomena has improved over the last 50 years, predicting the effects of friction and wear remains a major challenge. What is clear is that tribology needs to be at the core of education for tomorrow's engineers. Thank you for your attention, if you have any questions I'll be happy to answer them."

Step 2

Prepare a similar conclusion slide for the presentation you made in **Unit 3** and write the accompanying text in the speaker's notes section.

Step 3

Make notes on a sheet of paper of the main points in your conclusion text from **Step 2** and take it in turns to present your conclusion with a partner. You may refer to your notes, but do not read while presenting. Use the *Make an effective conclusion* rubric on aee.edu.pl to evaluate your partner's conclusion.

Post-Task

Feedback activity

Give feedback to your partner based on your notes from **Step 3**. Your teacher will discuss additional language points with the class.

Extension activity

Selected students present their conclusions for whole-class feedback.

Task 2

Write a conclusion

Step 1

Read the concluding section below, adapted from an article on additive manufacturing (AM) (Low, 2017). What does it tell you about the content and structure of the article?

Conclusion

Current printing materials are limited, restricted to specific AM technologies and have little overlap with the current materials used for membrane fabrication. This is not necessarily a problem, considering that AM membranes are likely to be used initially for niche applications that would be optimised for the printing resolutions and materials currently available. Future development in the AM field should not only focus on the development of new printing materials, but also on expanding the use of existing printing materials. The range of printing materials needs to be expanded to include common materials for membranes such as polyethersulfone, polyamide, polyimide and potentially microporous organic polymers. Composite materials with sufficient mechanical strength are required to ensure that the membrane produced remains stable as the thickness is reduced. The printing material can also be used to prepare the printed part for further post-modification. The development of printing materials and AM techniques are both equally important to drive the application of AM techniques in membrane fabrication. We hope that this review has provided a clear insight into how AM techniques could be employed in the area of membrane science and technology. The use of 3D printing in membrane systems should see continued growth in the near term. Either alone or in combination with other manufacturing methods, it is clear that AM has the potential to provide a unique set of membranes that will extend the possibilities of membrane-based separations beyond the current state of the art.

Step 2

Does the conclusion perform the same functions as you identified in the presentation opening in **Task 1**? Identify the sections in the script which perform each function.

Step 3

What differences can you notice between this conclusion to an article and the presentation conclusion in **Task 1, Step 1**?

Step 4

Re-write your presentation closing from **Task 1, Step 2** in the style of the conclusion to a scientific article or report.

Post-Task

Feedback activity

Your teacher will provide language-focused feedback.

Pre-Task

Awareness-raising activity

You will often be required to give feedback, in both at university and in your professional life. This will include both formal, structured feedback (often written) and informal, more spontaneous feedback (often oral). Sometimes, your teachers will ask you to provide feedback to your peers. You may also be asked to provide feedback to your teachers on the quality and suitability of their courses.

Step 1

Discuss with a partner your experiences of giving and receiving feedback.

- What do you find most difficult about giving and receiving feedback?
- Have you ever given or received negative feedback?
- What was the most useful feedback you have received?

Share your experiences with the class.

Task 3

Give feedback

Step 1

Read the advice below for giving and receiving feedback. What do you think is the best piece of advice?

When giving feedback

Ask permission
Be specific
Avoid negative language
Choose the right moment
Focus on behaviour not the person
Invite feedback in return

When receiving feedback

Respect the other person's opinion
Ask questions
Assume good intent
Invite feedback
See negative feedback as an opportunity to improve
Offer feedback in return

Step 2

Imagine you are giving feedback to a colleague on a presentation task. Use the advice from **Step 1** to write alternatives to the feedback comments below.

It was great. Nothing could be improved.

I saw your presentation and I'll tell you what I thought of it.

That was rubbish.

You're a weak presenter.

I know you're really busy, but I'm going to give you some feedback.

Step 3

Use the advice from **Step 1** to suggest alternatives to the feedback responses below.

I don't know what you're talking about.

Who do you think you are?

Keep your comments to yourself.

I'm a failure.

You obviously don't like me.

Post-Task

Peer and self-assessment

Compare your suggested answers with a partner and the class. Add any more alternatives to your list.

Extension activity

Work with a partner. Take it in turns to play the role of the teacher or a student of the course *Academic English for engineers*.

- As the teacher, elicit feedback based on the form below. Ask follow-up questions. Take notes.
- As the student, give true answers to the questions.

Report back to your teacher with your most constructive feedback.

ACADEMIC ENGLISH FOR ENGINEERS

Feedback form

- What was good about this course?
- What could be improved?
- Was there anything you did on this course that you didn't need to do?
- Was there anything you didn't do that you think should be included on the course?

Follow-up activity

Complete and submit your university's official end-of-course feedback form.

Compound nouns and adjectives

Compound nouns are nouns made up of two or more parts. They are often used in technical writing.

Compound nouns are sometimes one word, like *database*, or two words, like *computer science*. They can also include hyphens, like *four-seater*, although there are no clear rules for when to use hyphens in compound nouns. If two or more words are used to modify a noun (or a compound noun) these are usually hyphenated, as in *billion-dollar particle collider*. This is called a compound adjective.

A compound noun is usually a noun + a noun or an adjective + a noun, but it can also be made with a verb and noun: *washing machine*; a noun and verb: *self-test*; or a verb and preposition: *set-up*. Verbs may also be transformed into nouns.

The first part of a compound noun or adjective is usually singular, even if it refers to something plural. For example:

- A provider of Internet services → *an Internet service provider*.
- A building one hundred meters high → *a one-hundred-meter building*.

However, in some cases the noun modifier remains plural. There are no simple rules here either. Sometimes it is important to stress that the noun modifier refers to more than one thing. Sometimes the original noun is used most commonly or only in the plural. Sometimes the two versions are interchangeable. For example:

- *Skills training*: more than one skill will be taught.
- *Data analyst*: the singular form *datum* is rare in most contexts.
- *System(s) administrator*: the *s* is optional.

To make compound nouns plural, *s* is added to the dominant noun (the headword). In most compound nouns used in technical English, this is the last part of the compound:

- *Car engines*.

Any implied prepositions, verbs, articles, relative pronouns, adjectives or nouns are omitted.

- A printer for the fabrication of 3D objects → *a 3D printer*.

The main category word appears last in compound nouns. This usually (but not always) the reverse of that if the phrase were written out in full. For example:

- Process for pre-treating waste → *waste pre-treatment process*.

This order may change for emphasis or accuracy (identify the category word, think about the best noun for each classifying adjective to modify, and put the most important information first).

Compound nouns and adjectives can be built up into strings, but care should be taken not to make them too “heavy”, as this can cause ambiguity:

- *Bionic compound eye moving object detection imaging system.*

A good rule of thumb is to restrict noun phrases to a maximum of three words, and to replace the prepositions etc. that clarify their meaning. For example:

- *Imaging system for moving object detection in bionic compound eyes.*

When introducing a new or unfamiliar compound noun, or if there is any ambiguity, describe the noun in full the first time it appears. Texts often begin with a subject verb structure and then nominalize subsequent references:

- *This report presents a control system for a robotic arm. The robotic arm control system...*

Exercise: Re-write as compound nouns and compound adjectives.

[1] A pipe made of copper with a diameter of 10 mm.

[2] The capacity of cells to adhere.

[3] Equipment used in laboratories for research in the life sciences.

[4] A robot for guiding tourists which is autonomous and interactive.

[5] Production of energy on a large scale using decentralized sources which are renewable.

Past tenses

Past simple is used to describe actions that happened at a given moment in the past and have no connection with the present. It is often used for actions that took place one after another or which occurred for a period of time in the past.

- “At the start of this presentation, *we saw* how tribological phenomena occur in most modern engineering processes.”
- The flasks *were closed* with stoppers equipped with fermentation pipes, *filled* with glycerol, and *kept* in a thermostat-regulated room at $37 \pm 1^\circ\text{C}$.
- Fermentation *was continued* over 24 hours.

Past continuous is used to describe a continuing action, something that was happening at some point in the past or to indicate that something took place when something else was happening.

- “*I was studying* for the exam all day yesterday.”
- Penicillin was discovered accidentally, while Alexander Flemming *was investigating* the properties of staphylococci.

Present perfect is used to describe an action completed at an unspecified time, change over time, actions which may have been expected but haven’t occurred, achievements, and multiple actions that occurred in the past with implications for the present.

- “In this presentation (*note: we don’t say when, exactly*), *we’ve seen* how tribological phenomena occur in most modern engineering processes.”
- Our ability to model tribological phenomena *has improved* over the last 50 years.
- “Scientists still *have not / haven’t found* a cure for the common cold.”
- Researchers at Lodz University of Technology *have developed* a novel technology for producing graphene.
- Many experimental laboratory studies *have been conducted* on this topic.

Present perfect continuous is used to describe an action that has just stopped or started some time ago and is still going on.

- “*She’s been / has been writing* her essay for three hours.”

Past perfect is used to describe an action that happened before another action.

- Prior to our main study, preliminary research *had shown* that laser-based measurements were a promising method for the assessment of osteoporosis.

Exercise: Provide the correct form of the verb in brackets. Use past simple, past continuous, present perfect, present perfect continuous or past perfect forms.

[1] Solar energy generation capacity in Germany remained almost steady in 2014 and 2015, but (PLUMMET) _____ rapidly since then.

[2] For the last year, I _____ (RESEARCH) the effects of psilocybin mushrooms, also known as magic mushrooms, and I'm still finding out more about them.

[3] While we _____ (CARRY OUT) our research, we noticed that there were huge errors in our data.

[4] The consumption of organic foods in Germany (REACH) _____ a peak in the year 2015 with \$2 million turnover.

[5] At the end of the experiment, we noticed a dark brown sediment _____ (FORM) in the conical flask, which we removed for further testing.

Present and future forms

Present simple is used for states, regular actions and timetables:

- "My name *is* Weronika and *I'm / am* a student at Lodz University of Technology."
- "When your heart beats, *there's / is* a surge of blood through your veins."
- "The lecture on Friday *starts* at 8.30, not 8.15."

Present continuous is used for actions taking place at the moment of speaking, plans for the near future and complaints about things that may irritate the speaker.

- "*We're / are researching* a new method for measuring pulsating flows in pipes."
- "*Are you coming* to the conference on Monday?"
- "I don't like my physics lecturer. *He's / is rambling* all the time!"

Present tenses are used for describing processes which always occur the same way. Present simple is used to describe discrete actions or states:

- The robot *turns* left.
- The robot *moves* forward until it reaches the target.
- The robot *is* a four-legged quadruped.

Present continuous can be used with time words and in conditional sentences to describe two actions that occur simultaneously:

- The robot *moves* forward for as long as it *is detecting* the obstacle.
- If an IrDA signal *is being received*, the computer updates the location of the user to the middle of the IrDA zone.

We use *will* for decisions and promises and *going to* + infinitive for future plans, whether realistic or not:

- "First, *I'll / will describe* the experimental rig that was used to measure the pressure, temperature and mass flow rate."
- "Then *I'm / am going to* outline the main assumptions that were used for the simulation algorithm in Matlab/Simulink."
- "Sue says she *is going to* study Mechanical Engineering."

Both *will* and *going to* are used for predictions about the future:

- "This lecture sounds like it *ll / will* be interesting."
- "This course *is going to* be interesting."

However, *going to* is rather informal and should be avoided in technical and scientific writing.

Exercise: Complete the sentences with the correct form of a suitable verb. Use present simple, present continuous, future simple or 'going to' + infinitive. More than one correct answer may be possible.

- [1] In the future, transportation _____ the second leading source of greenhouse gas emissions in the U.S.
- [2] Currently, energy consumption in the U.S. _____, although it is predicted to level off in the near future.
- [3] The fermentation process generally _____ 40-50 hrs.
- [4] "If you _____ any questions, please wait until the end."
- [5] "In this presentation, I _____ three main points. First..."
- [6] While you _____ lectures, it is important to take notes.
- [7] Hydraulic pistons _____ the robot legs back and forth.

Passives

Passive voice is used when we want to highlight the action in the sentence than who or what performs it (the agent), such when describing processes and methods.

- Water *is drawn* through a 20 cm suction pipe and discharged through a 10 cm pipe.

Sometimes, the agent can be included in the sentence for clarity and flow, to provide additional information or cite the source of your information.

- Backflow *is prevented* by an automatic check valve.
- The experiment *was monitored* using a computer programme written using LabSEE software.
- Anti-cancer drugs *have been found* to target the enzyme (Smith, 2017).

Passive voice can also be used to produce more formal, impersonal statements for orders and instructions.

- Protective clothing must *be worn* at all times.

Passive voice is often used in scientific and technical writing. However, it should not be over-used, as this can make our writing monotonous and uninteresting.

Exercise: Rewrite these sentences in the passive, making the underlined words the subject and deciding whether the agent needs to be mentioned.

[1] Jones et al. (1997) found a link between stress and aging.

[2] We used the Miller method to weigh the reducing sugars and total sugars in g of invert sugar per kg of thick juice.

[3] Many universities have not yet realized the potential of eLearning.

[4] We centrifuged the biomass then washed it twice with sterile physiological saline.

[5] The monitoring computer processes the data using an inertial localization algorithm.

[6] You're not permitted to use laptops in the library.

[7] If the computer is receiving an IrDA signal, the position of the user is updated.

Articles

There are two types of article in English: indefinite articles (a /an) and the definite article (the). There is also the zero article.

Indefinite articles (a /an)

Indefinite articles are used for nouns in the singular which are not defined.

When introducing a noun for the first time (subsequent references will be to *the* noun).

- This report presents *a* control system for *a* robotic arm. The control system...

When referring to one of several members of a class or category.

- Tribology is *a* branch of mechanical engineering and materials science.

A is used before nouns beginning with consonants. *An* is used before vowels *a, e, i, o, u* except for *eu* and *u* when they sound like /ju:/.

- *An* engineer.
- *An* unidentified flying object.
- *A* university.
- *A* UFO.

The definite article (the)

The definite article is used for nouns which are specified, in the singular or plural.

- ✓ When the noun has been introduced previously (see above).
- ✓ When the thing referred to is unique, famous or obvious.
- ✓ When the noun is defined by the context.

The is also used with some countries, e.g. *the United States, the United Kingdom, the Philippines, the Netherlands*.

Zero article (–)

No article is used for undefined plural or uncountable nouns, with most singular proper nouns, abstract nouns, single years (e.g. 1888, 1990) and most countries.

Exceptions

Use a good learner's dictionary or grammar reference to help with exceptions.

Exercise 1: Explain the use of articles in the following sentences.

- [1] (–) Chinese is **the** most widely spoken language in **the** world.
- [2] (–) Recognition accuracy of 98% was attained during (–) lab navigation tests.
- [3] **The** recognition accuracy of **the** system was 98%.
- [4] **The** plain bearing is **the** simplest type of (–) bearing.
- [5] (–) Watson, **the** supercomputer, won (–) *Jeopardy!* against **the** human champions in (–) 2011.
- [6] (–) Biotechnology is **a** fast-growing sector in (–) Poland.
- [7] Finding **a** theory of (–) everything is **a** major unsolved challenge in physics.
- [8] **The** theory of (–) relativity was developed by Albert Einstein at **the** start of **the** twentieth century.
- [9] Copernicus was not **the** first person to claim that **the** earth orbits **the** sun.
- [10] Hawaii is **the** 50th state in **the** United States and **the** only state not located in (–) North America.

Exercise 2: Complete the sentences using a / an / the / –.

- [1] In this study, we evaluate _____ novel method for imprinting and scraping paper with _____ cotton applicator.
- [2] This process flow diagram shows _____ basic steps in _____ production of _____ ethanol from _____ cellulosic biomass.
- [3] _____ remaining 30% should be allocated to _____ other two components in _____ ratio of 3 : 1.
- [4] In _____ 2000, _____ percentage of patients using _____ food supplements remained fairly static at approximately 10%.
- [5] _____ most scientists agree that _____ global warming is caused in part by _____ greenhouse gasses.

Unit 1: Vocabulary builder

21ST CENTURY SKILLS

RELATE TO

REINFORCE

DETERMINE

DEPEND ON

CORRESPOND TO / WITH

PULSATE

SURGE

EXPERIMENTAL RIG

ASSUMPTION

PLOT

PROPAGATION

BOUNDARY CONDITIONS

FLUID MECHANICS

RATIO

PHYTOEXTRACTION

RECLAMATION

REMEDICATION

CONTAMINATE

COORDINATE

ACCUMULATION

TRANSLOCATION

BIOFUEL

GARDEN CRESS

CHELANT

MERCURY

HEAVY METALS

PEER

Unit 2: Vocabulary builder

KEYWORD

ABSTRACT

TITLE

BACKGROUND

BIONIC

COMPOUND EYE
IMAGING
SURVEILLANCE
AUGMENTED REALITY
LENS
WEIGHT
VIEWING FIELD
DATA ACQUISITION
SIMULATION
UNMANNED
AERIAL
RESOLUTION
REAL-TIME

Unit 3: Vocabulary builder

ANIMATIONS
TRANSITIONS
CONTRAST
RE-USE
ATTRIBUTION
READY-MADE
SLIDE
SELECT AN OPTION
DROP-DOWN MENU
GO TO A TAB/WEBSITE
A MIXED AUDIENCE
ATTENTION GRABBER
SLIDESHOW
LAYOUT
TRIBOLOGY
HEAD DISK INTERFACE (HDI)
MICROELECTROMECHANICAL SYSTEMS (MEMS)
STATIC
INTERFACE
FRICTION
LUBRICATION

WEAR AND TEAR
SIGNPOSTING
BODY LANGUAGE
TONE OF VOICE

[illegible]

Unit 4: Vocabulary builder

TABLE
FIGURE
CAPTION
GRAPHICAL IMAGE
FIELD OF STUDY
ECO-HOME
SOFT DRINKS
SPOILAGE
SCHEMATIC
AMBIPOLAR
TRANSISTOR
VARIANT
ELASTIC
TRANSMISSION
PULLEY
RADIUS
SPRING
STRETCH
DEFLECTION
ELECTRODE
RENOVATED
GRANT
CONTAMINATE
PARAMETER
TENDON
ACTUATOR
INDEPENDENT VARIABLE
DEPENDENT VARIABLE
x AXIS
y AXIS

[illegible]

DRAW A CONCLUSION	-----
OVERALL	-----
PROJECT	-----
BIOMASS	-----
RENEWABLES	-----
RESEARCH DATA	-----
GATHER	-----
SPECIFICATIONS	-----
SALIVA	-----
DENSITY	-----
CPU (CENTRAL PROCESSING UNIT)	-----
(MICRO-) CHIP	-----
IN/OVER THE COURSE OF	-----
LEVEL OF DETECTION	-----
ENERGY CONSUMPTION	-----
NATURAL GAS	-----
ENERGY MIX	-----
NEGLIGIBLE	-----
RELIANT	-----
FORESEEABLE	-----
-----	-----
-----	-----
-----	-----
-----	-----
-----	-----

Unit 5: Vocabulary builder

MATHEMATICS (AmEng Math, BrEng Maths)	-----
ALGEBRA	-----
FORMULA	-----
EQUATION	-----
EXPRESSION	-----
VARIABLE	-----
FRACTION	-----
PERCENT	-----
RADICAL SIGN	-----
SIGMA	-----
OPEN INTERVAL	-----
PARENTHESIS	-----
DENOMINATOR	-----
GREATER THAN OR EQUAL TO	-----

COMPOSITION OF f WITH g	-----
NUMERATOR	-----
INFINITY	-----
a TO THE POWER OF b	-----
n FACTORIAL	-----
FUNCTION OF x	-----
RADICAND	-----
FIRST DERIVATIVE	-----
INTEGRAL FROM f	-----
LOGARITHM WITH BASE a CALCULATED FROM b	-----
SET	-----
LESS THAN OR EQUAL TO	-----
BRACES	-----
FLASH CARDS	-----
CANCEL x FROM THE NUMERATOR AND DENOMINATOR	-----
RATIONALIZE THE DENOMINATOR	-----
COMBINE LIKE TERMS	-----
CROSS-MULTIPLY	-----
TAKE OUT THE COMMON FACTOR	-----
ALGEBRAIC TRANSFORMATION	-----
BOOKSHELF	-----
CHIPBOARD	-----
VERTEX	-----
ATTAIN	-----
FEASIBLE REGION	-----
POLYGON	-----
MAXIMIZE	-----
CONSTRAINT	-----
OBTAIN	-----
INK CARTRIDGE	-----
PRODUCTION CAPACITY	-----
SHIP	-----
ETHANOL	-----
HANDWRITING	-----
LEGIBLE	-----
DECIMAL POINT	-----
GESTURE	-----
-----	-----
-----	-----
-----	-----
-----	-----
-----	-----

INVERSION

RENEWABLE ENERGY

CENTRIFUGE

STERILE

SALINE

FILTER

MEMBRANE

CULTURE MEDIUM

STIR

PRETREATMENT

ANALOGOUS

CONTROL SAMPLE

BASELINE

BENCHMARK

FIELD TRIAL

Unit 8: Vocabulary builder

REFERENCE LIST

AUTHOR-PROMINENT CITATION

IN-TEXT CITATION

INFORMATION PROMINENT CITATION

REFERENCING STYLE

SOFTWARE TOOL

AUTHOR-DATE (HARVARD) SYSTEM

COURSE PROFILE

SUBMIT

JOURNAL PAPER

INSTRUCTIONS FOR AUTHORS

INCONSISTENCY

WITH RESPECT TO

SEARCH ENGINE

BRAINSTORM

FINDINGS

ARRAY

EMITTER

DISTILLATE

MAXIMAL

EXHAUST	-----
COMPRESSION	-----
IGNITION	-----
QUOTATION	-----
PARAPHRASE	-----
SOURCE	-----
COMMON SENSE	-----
COMMON KNOWLEDGE	-----
FOOD FRAUD	-----
ADULTERATION	-----
DAIRY PRODUCTS	-----
CHEMOMETRICS	-----
STARCH	-----
URINE	-----
CHOLESTEROL	-----
-----	-----
-----	-----
-----	-----
-----	-----
-----	-----

Unit 9: Vocabulary builder

PLAGIARISM	-----
PARAPHRASE	-----
IN CONJUNCTION WITH	-----
REFERENCING	-----
INVERTED COMMAS	-----
ADDITIVE MANUFACTURING (AM)	-----
RESOLUTION	-----
PRECISION	-----
MEMBRANE	-----
LIMITATION	-----
3D PRINTING	-----
ECONOMICAL	-----
OMIT	-----
-----	-----
-----	-----
-----	-----
-----	-----
-----	-----

Unit 10: Vocabulary builder

FEEDBACK

LASTING IMPRESSION

DESIGN

MANUFACTURE

MAINTAINANCE

AT THE CORE

OVERLAP

NICHE

POROUS

IN THE NEAR TERM

STATE OF THE ART

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Academic English for engineers is a task-based coursebook designed to develop the language and communication skills required by scientists and engineers for success at university and beyond.

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