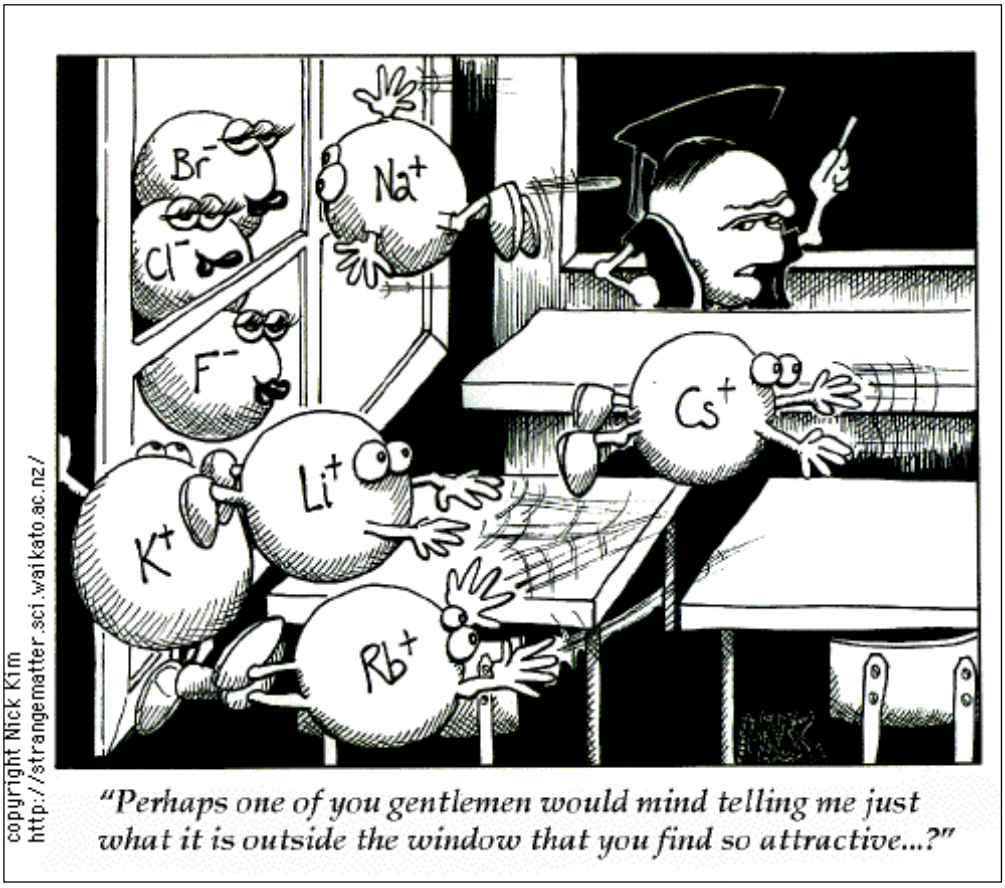
CHEMISTRY



X31 ENGLISH HANDOUT

Université de Nantes
2020-2021

X31A030
cecile-marie.lereste@univ-nantes.fr

PROGRAM

1	Reading: Practical Chemistry	Reading
2	Note taking and summarizing	Reading/Writing/Listening
3	Literature review: methodology	Listening
4	Process Descriptions	Reading/Writing
5	Technical vocabulary: the chemistry of Breaking Bad	Reading/Speaking
6	Video: Percy Julian, a forgotten genius	Watching/Speaking
7	Reading: Science on the Edge	Reading/Speaking
8	Points of view: Cosmetics Video / Presentation skills / Language test	Watching/Speaking
9	In-Class preparation	
Project Presentations		
	Sessions 10 to 12, 9 to 12 if necessary.	

ASSESSMENT: The module is assessed through 100% continuous assessment. You will be assessed on

- two written tests (50% of the final grade)
  - One multiple-choice language test for which you will prepare using the distance learning activities on MADOC. This will count for 10% of the final grade (20% of the written grade) and will be taken on MADOC. Your group teacher will tell you when to take the test.
  - One written test that will combine listening comprehension and writing. You will be given an audio document that will be between 15 and 30 minutes long. You will have to write a summary on the contents of the document in your own words (250 words, +/- 10%). The document will be made available on MADOC at a date your group teacher will specify. You will have two days from then to upload your text on the submission space on MADOC. (40% of the final grade, 80% of the written grade)
- your presentation (see opposite page) (50% of the final grade)

ATTENDANCE

Attendance is, of course, **compulsory**. Please remember to **notify your group teacher** (preferably in advance) if you cannot attend a lesson **AND to fill in the questionnaire on MADOC**. Please note that, if unaccounted for, **absences will lead to direct penalty** on your grade.

VERY IMPORTANT: TESTS AND JUSTIFIED ABSENCES

For any justified absence you will **have to take a resit** (or get zero for the corresponding mark).

To make sure you attend that resit, it is **your responsibility** to justify your absence on MADOC AND get in touch with the head of the module when you miss a test (cecile-marie.lereste@univ-nantes.fr).

MADOC DISTANCE LEARNING ACTIVITIES

The distance learning activities are compulsory and **must be completed by session 6** at the latest.

IMPORTANT: A NOTE TO NON-ATTENDEE STUDENTS (*étudiant-e-s dispensé-e-s d'assiduité*)

Assessment procedures for non-attendee students are specific. If you have or acquire this status in the course of the semester, **you cannot be assessed through continuous assessment**. If you have or acquire this status in the course of the semester and wish to **audit** the lessons, you must contact christine.foucat@univ-nantes.fr as early as possible to discuss your situation. This cannot be arranged directly with your group teacher.

TOEIC PREPARATION DISTANCE LEARNING COURSE

If you are considering taking the TOEIC test this semester, a training course is available on MADOC.

SCIENCE IN ENGLISH PROJECT

ASSIGNMENT

In groups of three, you will be asked to prepare a LITERATURE REVIEW on a topic of your choice.

1. You will prepare and present an oral presentation on a topic of your choice related to your field of study: your presentation should give an overview of the question, putting various sources in perspective. It should be structured, documented and personal (i.e. in your own words).

   You will have approximately 15 minutes (per group) to present your work and will be expected to use appropriate presentation tools.

   Following your presentation, you will be expected to answer questions from the audience.

   According to the "Dublin descriptors" that define international standards for learning outcomes at university, completion of a Bachelor's degree means that students should be able to "communicate information, ideas, problems and solutions to both specialist and nonspecialist audiences." Your presentation should therefore be clear even to non-specialists.

2. You will be asked to ask questions after one of your fellow students' group presentation. You will not present yourselves but should be sufficiently prepared to react to the proposed presentation.

3. For all oral presentations: you will have to make notes during the presentations and ask questions.

AIM & LEARNING OBJECTIVES

Language and communication:

- Developing your knowledge of specific vocabulary in context
- Improving oral and presentation skills

Scientific communication

- Practicing oral synthesis
- Interacting with a speaker/an audience

ASSESSMENT

Presentations will take place in the last 3 to 4 sessions.

You will receive individual marks based on your oral presentation (assessing content, communication, and language) as well as on your involvement in questioning.

INTERNATIONAL PHONETIC ALPHABET

Key to phonetic symbols for English

RP	Gen Am	Consonants	
•	•	p	pen, copy, happen
•	•	b	back, bubble, job
•	•	t	tea, tight, button
	•	ɾ	city, better
•	•	d	day, ladder, odd
•	•	k	cup, kick, school
•	•	g	get, giggle, ghost
•	•	tʃ	church, match, nature
•	•	dʒ	judge, age, soldier
•	•	f	fat, coffee, rough
•	•	v	view, heavy, move
•	•	θ	thing, author, path
•	•	ð	this, other, smooth
•	•	s	soon, cease, sister
•	•	z	zero, zone, roses, buzz
•	•	ʃ	ship, sure, station
•	•	ʒ	pleasure, vision
•	•	h	hot, whole, behind
•	•	m	more, hammer, sum
•	•	n	nice, know, funny, sun
•	•	ŋ	ring, long, thanks, sung
•	•	l	light, valley, feel
•	•	r	right, sorry, arrange
•	•	j	yet, use, beauty
•	•	w	wet, one, when, queen

In foreign words only:

•	•	x	loch, chutzpah
•		ɬ	Llanelli, Hluhluwe

RP	Gen Am	Vowels	
•	•	ɪ	kit, bid, hymn
•	•	e	dress, bed
•	•	æ	trap, bad
•		ɒ	lot, odd, wash
•	•	ʌ	strut, bud, love
•	•	ʊ	foot, good, put
•	•	iː	fleece, sea, machine
•	•	eɪ	face, day, steak
•	•	aɪ	price, high, try
•	•	ɔɪ	choice, boy
•	•	uː	goose, two, blue
•		əʊ	goat, show, no
	•	oʊ	goat, show, no
•		ɒʊ	*variant in* cold
•	•	aʊ	mouth, now
•		ɪə	near, here, serious
•		eə	square, fair, various
•	•	ɑː	start, father
	•	ɑː	lot, odd
•	•	ɔː	thought, law, north, war
•		ʊə	cure, poor, jury
•		ɜː	nurse, stir
	•	ɜˠː	nurse, stir, courage
•	•	i	happy, radiation, glorious
•	•	ə	about, comma, common
•			father, standard
•	•	u	influence, situation, thank you
•	•	ɪ	intend, basic
•		ʊ	stimulus, communist

In foreign words only:

•		ɒ̃	grand prix, chanson
	•	ɑ̃ː	grand prix, chanson
•	•	æ̃	vingt-et-un
•		ɜ̃ː	vingt-et-un

Source: Longman Pronunciation Dictionary

READING

SAMPLE VIDEO: MAGNESIUM

Starter: What do you know of the characteristics of magnesium and its chemistry?

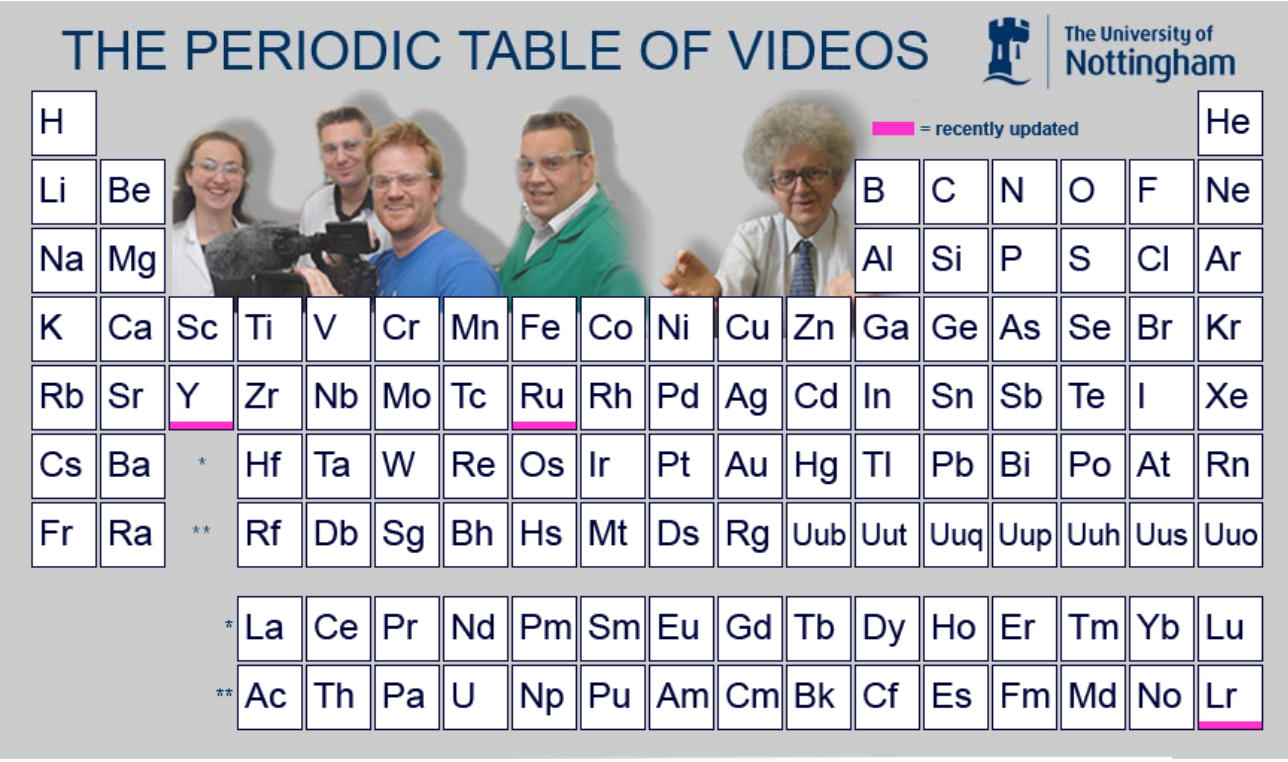
Now watch the video and find the answers to the questions or fill in the blanks when necessary:

Source: http://www.periodicvideos.com/videos/012.htm

1. Fill in the blanks: *It [magnesium] is the _____ of the _____ metals you can _____.*
2. What is the problem with using lithium and sodium as a metal?
3. What is the problem with using beryllium as a metal?
4. What other advantage is there with choosing magnesium rather than the 3 other elements mentioned?
5. Why was magnesium used for photographic flashlights? What proves the intensity of the reaction?
6. Fill in the blanks: *It's one of the few metals which is meant to burn in _____. In theory, you can take a piece of magnesium, _____ to it in air so it's burning well and then _____ it into nitrogen gas and it should continue _____.*
7. What's the difference between theory and practice for the professor concerning this experiment?
8. What elements form chlorophyll?

THE PERIODIC TABLE

Pick 4 elements from the table below. Name them and use the phonetic alphabet on page 4 to transcribe them.



Follow up: visit the website where you can watch videos about EACH ELEMENT!

http://www.periodicvideos.com

READING

Practical chemistry By Abraham Mendoza & Phil S. Baran, *Nature*, Vol 492, 13 Dec 2015

Source: https://practical-chemistry.com/practical-work/chemistry/quantitative-chemistry/

Since the birth of synthetic chemistry about 180 years ago, society has loved the wonders bestowed by the field, such as life-saving medicines, pest control and molecules that light up telephone displays, yet has harshly criticized it as being solely responsible for pollution and environmental harm. Synthetic biology emerged as an alternative for constructing molecules only about ten years ago, but some have already proclaimed that it will supplant chemical synthesis. No one should doubt the usefulness of synthetic biology, or its potential to shorten synthetic routes and reduce waste in chemical production. But we are convinced that synthetic chemistry will continue to dominate for the foreseeable future (…), for three main reasons.

The first reason is that chemical synthesis is the best way to solve supply problems. For decades, synthetic chemistry has provided sufficient quantities of agrochemicals, medicines, perfumes and materials for society's needs. The pharmaceutical industry in particular relies on chemical methods for the large-scale production of most small-molecule drugs. The majority of these compounds are based on molecular structures not found in nature, which means that they cannot be prepared through enzymatic processes and are likely to be toxic to the host organisms used in synthetic biology. Synthetic biology has had a crucial impact on the commercial production of some medicines derived from complex natural products, such as artemisinin and the anticancer drug paclitaxel (Taxol) But natural products are essentially the only compounds for which biological syntheses can compete with chemical ones, because evolution has optimized the biosynthesis of those products over time.

So the supply of chemicals is best addressed by synthetic chemistry, unless a specific natural product is required in large quantities — and even then, semi-synthetic strategies involving a few chemical steps are often required. In fact, total chemical syntheses of natural products are becoming increasingly efficient and scalable, as demonstrated by the impressive routes used to make tetracycline antibiotics and the anticancer agent eribulin. A practical chemical synthesis of artemisinin has also now emerged that could form the basis of an industrial-scale process for making the drug, and a large-scale synthesis of Taxol is being developed.

Optimizing the properties of useful compounds, or adapting their functions to new applications, often requires modification of their molecular structures. The second reason that synthetic chemistry will endure is that chemical methods provide a reliable set of tools to do this in many fundamentally different cases. Moreover, unlike biological syntheses, chemical syntheses can often be developed and implemented rapidly, which is a great advantage.

The third reason is that chemistry excels in the invention of unnatural molecules that have desirable physical properties — such as dyes for printable organic solar cells, fluorescent probes for biological research or radiolabelled drugs used in medicine. The molecular needs of vibrant modern fields such as supramolecular chemistry, chemical biology and nanotechnology can be addressed only by synthetic chemistry.

Abraham Mendoza and Phil S. Baran are in the Department of Chemistry, The Scripps Research Institute, La Jolla, California 92037, USA.

READING

Read the text on the previous page and say whether the following statements are true or false.

1. According to the authors, synthetic chemistry has more drawbacks than advantages.
2. Synthetic chemistry emerged earlier than synthetic biology.
3. The authors think that synthetic biology will replace synthetic chemistry.
4. Synthetic chemistry is used to prepare compounds that are hard to obtain from natural sources.
5. Compounds used in the pharmaceutical industry are not dangerous for living organisms.
6. The synthesis of a natural compound necessarily involves a biological approach.
7. Synthetic biology is often quicker than chemical synthesis.
8. One advantage of synthetic chemistry is it can quickly and efficiently adapt to innovative technologies.

Choose the best answer to the following questions

1. What advantage of synthetic biology over synthetic chemistry is acknowledged by the authors?
    a. It is more eco-friendly
    b. It is cheaper
    c. It is safer
    d. It is more competitive
2. Which industry using chemical synthesis is NOT mentioned by the authors?
    a. drugs
    b. agriculture
    c. fragrances
    d. clothing

Fill in the following table with words or expressions from the text that correspond to the definitions.

Line	Synonyms/definitions	Words from the text
	presented	
	a destructive insect or other animal that attacks crops, food or livestock	
	not involving anyone or anything else	
	predictable	
	stock of a resource	
	a living cell in which a virus multiplies.	
	measurable	
	a device used to carry out a particular function	
	put into practical effect	
	substance used to add a color to or change the color of something	

NOTE-TAKING AND SUMMARIZING

SUMMARIZING METHODOLOGY

There is a good chance you will get to attend trade conferences in the future. If participants come from a large array of countries, the medium of expression will probably be English.

Credit: www.worldcitiessummit.com.sg

If you want to take anything away from such an event, you will have to write many things down. Taking notes during a live event like a lecture or speech requires method… especially if the lecturer is speaking in a language that is not yours. Below you will find a few tips and you will apply them by watching a Ted talk video and producing a summary of it from the notes you took while watching it. This will also be a practice exercise for the written test.

Tips on taking notes:

1. **Prepare in advance**
2. **Follow a note-taking method**
3. **Don't capture everything**
4. **Review and summarize your notes**

TED Ideas worth spreading

Credit: Ted.com

1. Prepare in advance:

Look at the title of the video you are about to watch and try to anticipate what it is going to be about.

→ What content do you expect from this title?

→ Do you have any previous personal knowledge or experience of the subject?

→ Do you have any personal interest in the subject? If so why?

→ Do you know some of the questions and problems related to the subject that scientists and engineers are still conducting research on right now?

You can use the following prompts to help you talk about your expectations:

I'm expecting the talk to be about…

I guess the speaker is going to offer/present/demonstrate…

Personally, I'm interested in the subject, mainly because…

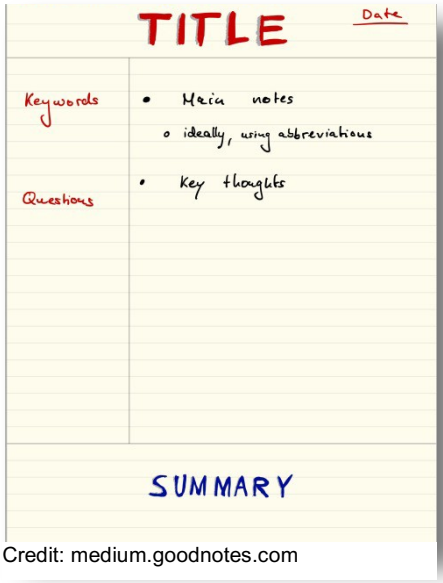
I have read/watched a number of things on this, my takeaway (= conclusion) is that…

What I especially would like to learn more about is…

I'm hoping they're going to say they have solved…

2. Follow a note-taking method

One critically acclaimed method is the **Cornell Note-Taking method**. It is a system for taking, organizing and reviewing notes and was devised by Prof. Walter Pauk of Cornell University in the 1950s.



Credit: medium.goodnotes.com

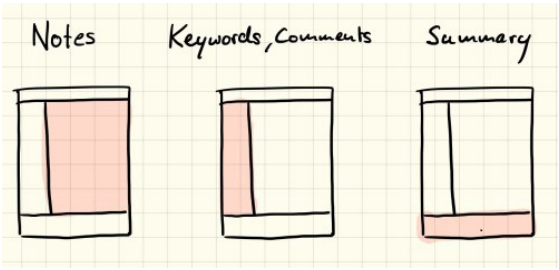
The page will be divided into 4 — or sometimes only 3 — different sections: Two columns, one area at the bottom of the page, and one smaller area at the top of the page.

The idea behind this is very easy. All actual notes from the lecture go into the main note-taking column.

The smaller column on the left side is for questions about the notes that can be answered when reviewing and keywords or comments that make the whole reviewing and exam preparation process easier. When reviewing the notes, a brief summary of every page should be written into the section at the bottom.

There is a pdf on MADOC with more examples of Cornell notes if you want to explore the system a little bit more.

- Use your answers to the previous exercise to write down items in the "Keywords and questions" section on the following page. This will help you check whether your expectations were correct, limited or incorrect while you are watching the video.



Credit: medium.goodnotes.com

3. Don't capture everything

- Now watch the video and jot down notes along the way.

→ You cannot write down full sentences.

→ You must select the 2-3 words that will enable you to produce a whole sentence again, once the video is over

→ Ideally, you should use abbreviations

4. Review and summarize your notes

- Once you have watched the video, review your notes and add keywords, comments, and a very general summary.
- **Using all this, write an organized 250-word text summarizing the talk. Make sure that your summary follows the instructions below.**

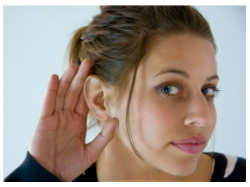
The aim of your summary is to give the readers a condensed, structured, and objective account of the original document. After reading your text, readers should know what the overall point of the discussion is and should be able to identify the general ideas that run through the entire discussion. Those ideas must be expressed using precise and specific language. You must rephrase the audio/video using your own words and you must give an overview of the points raised in the discussion while avoiding overly general, vague language. Your summary must be structured, which means you may have to reorganize your notes. You do not have to follow the order in which the key ideas are mentioned in the audio/video. You must also decide which ideas are not important enough to warrant inclusion, so it is important to establish a clear hierarchy between the ideas discussed while you are taking notes.
The format of your summary must include a mention of the source of the audio/video in the first sentence. You must also establish the central concept at the beginning of your summary. Because your summary is an objective account of the discussion, you must not include your own opinions in the text. In general, you will use the present tense to summarize the central points of the discussion.

Adapted from medium.goodnotes.com, https://advice.writing.utoronto.ca/researching/summarize/, https://www.thoughtco.com/summary-composition-1692160

KEYWORDS / QUESTIONS	**MAIN NOTES**
SUMMARY	

NOTE-TAKING AND SUMMARIZING

IMPLEMENT YOUR COMPREHENSION SKILLS



Credit: img.bhs4.com

Understanding the meaning of spoken English is just like understanding the meaning of written English. When you encounter words you do not know, you can apply the same methodology:

- ✓ Make a hypothesis, i.e. try to guess
- ✓ Decompose to find the root
- ✓ Skip the word and use a broader context
- ✓ Use a dictionary properly, i.e. check which meaning is the correct one
- ✓ Understand the word's relation to the rest of the sentence by noting its grammatical nature and function

This video, like any other, offers an opportunity to learn some new vocabulary. In the list below there may well be a few words or expressions you do not know. Using the methodology described above, make an educated guess as to their meaning.

1'54 without further ado:

.....

3'43 "ice fireball" [*careful*, *this is what the script mentions, but is this really the correct word*?]:

.....

4'41 bungee cord:

.....

5'10 toroidal vortices:

.....

6'23 displacement reaction:

.....

7'31 distress flares:

.....

7'50 heat sensitive:

.....

8'18 blob:

.....

Useful resources:

Good general online dictionaries include https://www.macmillandictionary.com/, https://www.lexico.com/, or https://www.wordreference.com/. It is good practice to look up words in English-to-English dictionaries as well as English-to-French dictionaries.
If you need to look up more specialized vocabulary, you can use http://gdt.oqlf.gouv.qc.ca/ (Le grand dictionnaire terminologique), or https://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng&index=alt (Termium Plus), which are both Canadian resources.
If you want to practice summarizing texts, you can have a look at the tips and examples on the following website: http://www.uefap.com/reading/notetake/summary.htm

CREATING A REVIEW

VIDEO: CITING SOURCES RESEARCH GUIDE: LITERATURE REVIEWS

This video from NCSU Libraries gives a helpful overview of literature reviews. Even though it says it's "for graduate students," the principles are the same for undergraduate students too!

1. DEFINING A REVIEW

   a. There are several contexts in which you might be requested to create a literature review. Can you **match the ones mentioned in the video** with the appropriate definition?

	They usually take the form of written pieces of work that are set by your course tutors. They also usually contribute towards your final course mark or grade. The types depend on the course you are studying. The most common are essays or reports. However, it is also possible that you will be set other kinds such as a group project or an oral presentation in your subject area, which may also be assessed. (adapted from prepareforsuccess.co.uk)
	Also called culminating project, or senior exhibition, among many other terms, it is a multifaceted assignment that serves as a culminating academic and intellectual experience for students, typically during their final year of high school or middle school, or at the end of an academic program or learning-pathway experience. (..) It is generally designed to encourage students to think critically, solve challenging problems, and develop skills such as oral communication, public speaking, research skills, media literacy, teamwork, planning, self-sufficiency, or goal setting. (adapted from edglossary.org)
	A document submitted in support of application for an academic degree or professional qualification presenting the author's research and findings. Depending on context, the terms can be used to refer either to part of a bachelor's or master's course, or to a doctorate. (adapted from Wikipedia.org)

   b. What are the **3 main functions** of a literature review as part of the research process?

.....

.....

   c. What is “the literature”?

Can you think of other sources of information on a given topic, besides those mentioned in the video?

.....

.....

   d. The literature needs to be seen as “a continuously evolving network of works that interact with each other”.

Can you explain what this means? Why is the interaction process important?

.....

.....

   e. How can you ensure coherence?

.....

.....

CREATING A REVIEW

2. HOW?

Make notes on the different steps of the review process:

TOPIC	*RESEARCH AND INFORMATION COLLATION*	*BRAIN*	*CITATIONS*	*FINAL REVIEW*

3. A PRACTICAL APPROACH TO CREATING A REVIEW

a. Which of the listed skills correspond to each learning outcome?

DESCRIBE, SUMMARIZE, COMPARE AND CONTRAST, CRITICALLY EVALUATE, ANALYSE, ORGANIZE

Learning outcome	**Skills involved**
Collect and read relevant literature	
Provide an overview of relevant literature	
Highlight key concepts and papers	

b. Looking for links and relations between documents: what can they be?

……

……

c. Some sources can come in support of an argument. Some refute it. Can you think of examples of sources based on the following topics?

TOPIC	ARGUMENT	SOURCES THAT MIGHT SUPPORT THE ARGUMENT	SOURCES THAT MIGHT REFUTE THE ARGUMENT
Vaccines	Vaccines cause autism		
Nuclear energy	Nuclear power is a clean and sustainable energy		

d. What is the main pitfall you want to avoid?

But don't fall into the trap of making your review a larger list of …….. of the works you read. A literature review is not an annotated …….. Your goal should be to go one step further and …….. and …….. what you find in that literature into …….. . Ideally, you will create your own conceptual map or outline of the literature on …….. .

e. To conclude: what does your review need to consist in besides direct use of sources?

……

……

CREATING A REVIEW

EXAMPLE: THE PRESS REVIEW

An exercise similar to the literature review is the very French Revue de Presse*, or Press Review*

Watch the following video from France 24 and answer questions about it.

- General comprehension

Which French papers are mentioned by the journalist?

What can you say about the general structure of the presentation?

What types of issues did the journalist choose to report about? Why?

- Creating coherence

About the budget crisis: how many papers are mentioned regarding that issue? How are they put in perspective?

About the Nice jewellery shooting: what types of articles from *Liberation* does the journalist report on? Why choose such articles for a press review?

About the power crisis inside the UMP: what is the connection/ transition with the previous item? How is the article about Alain Juppé brought up by the journalist?

About prostitution: in what way is the treatment of that issue different from the three previous ones? What is the main purpose here for the journalist / benefit for viewers?

About ducks in Villotran: what would you call that sort of news item? Why include it in the report?

- Transcript

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PROCESS DESCRIPTIONS

BRAINSTORMING: *How many instrumental analysis techniques can you name? Can you briefly explain how they work?*

PROCESS DESCRIPTIONS

Read the following text and answer the questions

Thin Layer Chromatography (TLC)

TLC is a simple, quick, and inexpensive procedure that gives the chemist a quick answer as to how many components are in a mixture. TLC is also used to support the identity of a compound in a mixture when the R_f of a compound is compared with the R_f of a known compound (preferably both run on the same TLC plate).

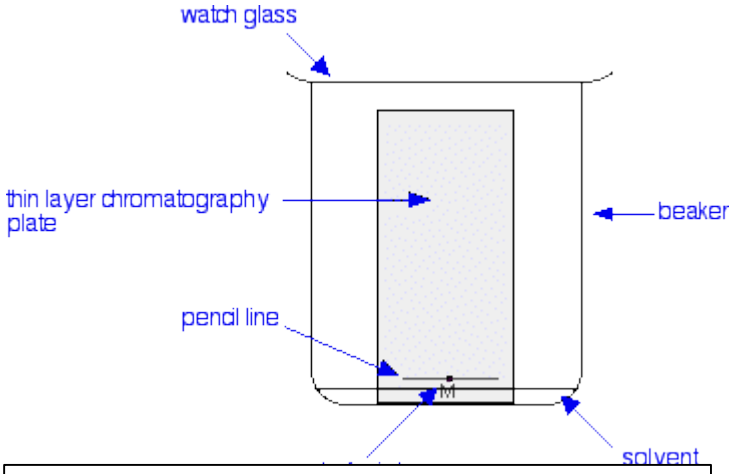


Image from *ChemWiki: The Dynamic Chemistry E-textbook*, http://chemwiki.ucdavis.edu

A TLC plate is a sheet of glass, metal, or plastic which is coated with a thin layer of a solid adsorbent (usually silica or alumina). A small amount of the mixture to be analyzed is spotted near the bottom of this plate. The TLC plate is then placed in a shallow pool of a solvent in a developing chamber so that only the very bottom of the plate is in the liquid. This liquid, or eluent, is the mobile phase, and it slowly rises up the TLC plate by capillary action.

As the solvent moves past the spot that was applied, an equilibrium is established for each component of the mixture between the molecules of that component which are adsorbed on the solid and the molecules which are in solution. In principle, the components will differ in solubility and in the strength of their adsorption to the adsorbent and some components will be carried farther up the plate than others. When the solvent has reached the top of the plate, the plate is removed from the developing chamber and dried, and the separated components of the mixture are visualized. If the compounds are colored, visualization is straightforward. Usually the compounds are not colored, so a UV lamp is used to visualize the plates. (The plate itself contains a fluorescent dye which glows everywhere *except* where an organic compound is on the plate.)

Text from http://orgchem.colorado.edu/Technique/Procedures/TLC/TLC.html

1. Skim the text and focus on the verbs. Which tense is mostly used in process descriptions?
2. Focus on the second paragraph.
    a. What is the subject of the first and last sentences of the paragraph?
    b. Is it the first time these have been mentioned?
    c. Could you replace either of these expressions with the word “it”? Why or why not?
    d. Consider the following way of writing the beginning of the last sentence of the paragraph: “The mobile phase is this liquid, or eluent.” Which option do you think is better and why?
3. Continue focusing on the second paragraph.
    a. Which verbs are in the passive voice (ignore infinitives)? Put them into the active voice.
    b. Why do you think the passive voice is used in these cases?
4. Link words and logical connectors.
    a. Look at the following sentence from the last paragraph: “If the compounds are colored, visualization is straightforward.” How could you rephrase it using “unless”? Why is the original sentence better?
    b. Now rephrase the following sentence first using “if” and then using “unless”: “Usually the compounds are not colored, so a UV lamp is used to visualize the plates.”

PROCESS DESCRIPTIONS

c. Choose one of the following link words to complete the sentences below. (*Source*: Sue Blattes, Véronique Jans & Jonathan Upjohn. Minimum Competence in Scientific English. EDP Sciences: 2003.)

doubtless – whereas – besides – thereby – namely – despite – obviously – as a rule – nevertheless

i. _____ using rechargeable batteries, what other ways are there of storing energy?

ii. The combustion of methane can produce an undesirable product, _____ carbon dioxide, which is responsible for global warming.

iii. _____ its numerous spectacular successes, magnetic resonance imaging is not entirely satisfactory when applied to proteins.

iv. The evidence has often been contradictory. _____, hypnosis is finding numerous medical uses.

v. _____, animals who survive in desert habitats tend to be small.

vi. Oral administration of insulin does not reduce blood sugar, _____ orally administered corosolic acid can.

vii. _____, when dealing with toxic and hazardous material, robots offer great advantages.

viii. The gas containers are kept underground, _____ minimising temperature changes.

ix. Environmental concerns will _____ be heightened in the years to come.

WRITING PRACTICE: *Work in groups of three. Using the diagram below, write a text that describes the operation of a mass spectrometer.*

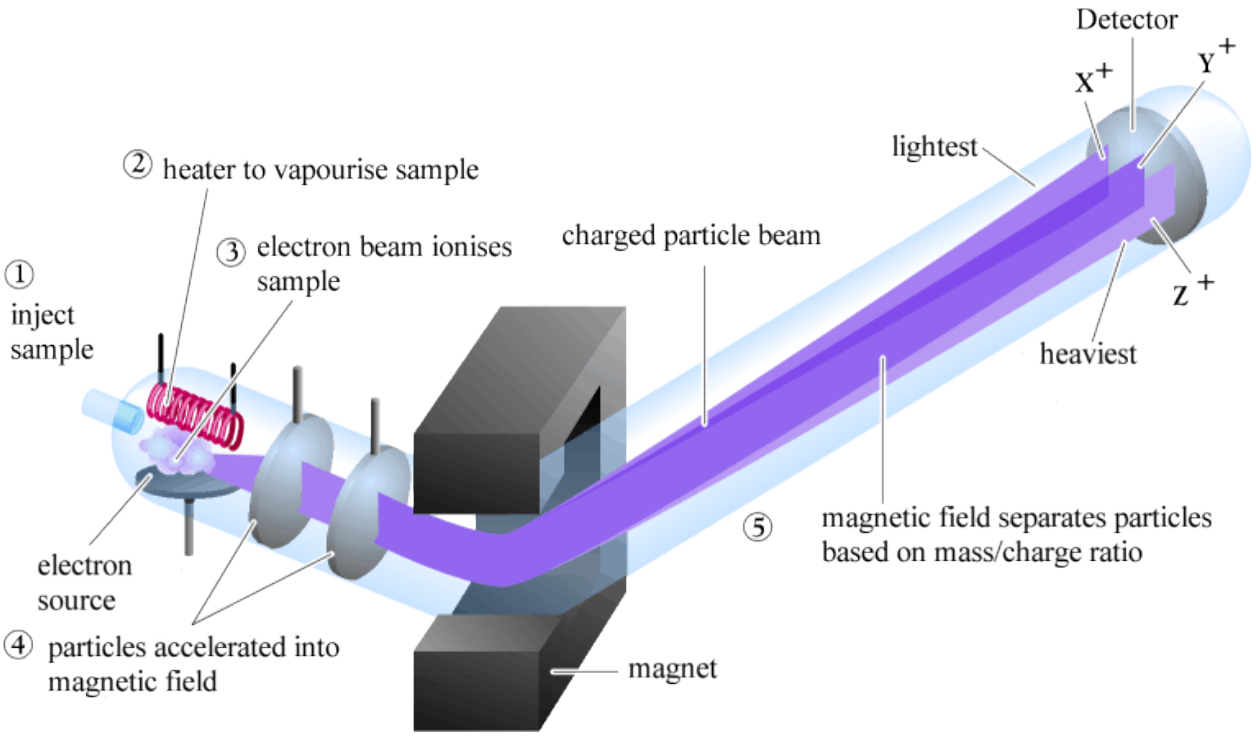


Image from
http://www.mhhe.com/physsci/chemistry/carey/student/olc/ch13ms.html

TECHNICAL VOCABULARY

THE CHEMISTRY OF 

STARTER: Give simple definitions in English for the following words:

Synthesis	
Alkaloid	
Stereochemistry	
Racemate	
Isomer	

READING: Answer the questions about the text on the following page.

1. What is 'grey literature' (l.17)?

2. What are the drawbacks of the first method?

3. What is the paradox stressed by the authors concerning the second method?

4. If the reduction isn't stereospecific, how can the product be enantiometrically pure?

5. Why is the colour blue considered a 'dramaturgical instrument' (l.43-44) by the authors?

6. How do the authors assess the scientific validity of the chemistry in *Breaking Bad*?

7. Do you agree with the conclusion of the article?

TECHNICAL VOCABULARY

'The Chemistry of Breaking Bad'. By Falk Harnisch and Tunga Salthammer. *Chemistry Views,* December 3rd, 2015.

Walter H. White: hero or anti-hero? Driving force or driven by other forces? Chemist! Welcome to *Breaking Bad*. (…) Walter H. White is the protagonist of the multi-award-winning American TV series *Breaking Bad*, which runs for a total of five seasons and is especially popular among young audiences.

At the beginning of the series, he is diagnosed with lung cancer and, in face of his seemingly unavoidable and imminent death, he searches for a way to establish financial security for his heavily pregnant wife, Skyler, and his handicapped son, Walter Jr. On hearing how much money can be made in the narcotics business, he accompanies his brother-in-law, Hank Schrader, who works for the DEA (Drug Enforcement Agency) on a raid. He recognizes his former student, Jesse Pinkman, fleeing the scene.

With a mixture of cool calculation and pure desperation, Walter decides to get involved in the narcotics business and to synthesize crystal meth (*N*-methylamphetamine) to a very high quality. He forces Jesse into a partnership by mentioning his connections to the DEA in order to establish the contacts necessary for the sales and distribution of the meth (…)

Crystal Meth – The "Chemical Star of the Show"

N-methylamphetamine ((S)-N-methyl-1-phenyl-propane-2-amine), also known as meth, crystal, or pervitin, is the drug at the center of Breaking Bad. Scientific literature details many different means of synthesis, which are all to be found to varying extents in grey literature and blogs. As the authors do not have practical knowledge in synthesizing crystal meth, they can only rely on such sources.

Throughout the story, two different methods of synthesis are used (Figure 3).

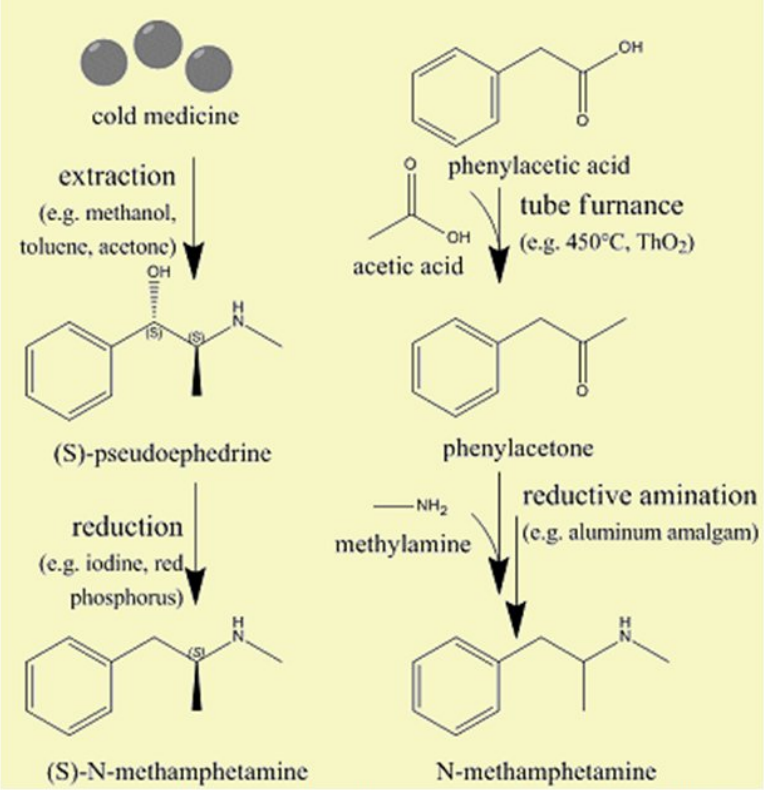


Figure 3. The synthesis routes (standard left, blue-meth right) probably taken in *Breaking Bad*.

Standard Synthesis

At the beginning, Walter pursues synthesis using pseudoephedrine. This is used in the real world, as well as in *Breaking Bad* by many meth cooks. However, by applying his knowledge of chemistry, his experimental abilities, and a half-way professional lab set-up, Walter is able to achieve much better results.

TECHNICAL VOCABULARY

The base substance, pseudoephedrine is a plant-based phenyl ethylamine alkaloid and is used commercially in treatments for nasal and sinus congestion and can be extracted from these treatments. Due to the restrictions on sale, an extensive procurement network is required, which generally means involving a large number of drug addicts, in order to secure the necessary quantities. As the drug addicts can really only acquire the smallest of quantities each time by this "smurfing", which involves either getting prescriptions for it or stealing it, the availability of this base substance is always a critical factor.

Blue-Meth Synthesis

Walter proceeds to develop a synthesis method based on methylamine, acetic acid, and phenyl acetic acid, although acquiring this brings its own, new challenges. It is, however, not entirely clear which sources Jesse gets certain ingredients for the new synthesis from (e.g., the thorium oxide catalyst) – not from the neighborhood pharmacy for sure.

As can be seen from the synthesis route in Figure 3 and by considering the stereochemistry, the alternative synthesis route most likely involves the production of the less intoxicating racemate. Unfortunately, this makes the remarkable effect of the product, which is often emphasized in the series, rather inconceivable.

The fact that the (*S*)-*N*-methylamphetamine is pharmacologically considerably more effective than the *R* isomer should lead us to assume that the racemate has a weaker effect. The characters – or at least the minds behind the story – seem, however, to be aware of this discrepancy. Walter asks a rhetorical question to save himself from a desperate situation by

demonstrating his superior knowledge and thus that he is indispensable: "If our reduction isn't stereospecific, how can our product be enantiomerically pure?" (Episode IV-1).

Another key characteristic of Walter's product is its blue color, which leads to it being referred to as "Blue Meth." It remains unclear, however, where this blue color comes from and can likely be assumed to be a dramaturgical instrument. It can only be speculated that characteristic impurities, e.g., from the base substance or by-products of the synthesis, could cause such blue coloring. It has already been shown that such a signature from different synthesis routes or producers can generally be analytically identified.

Statements about the purity of the crystal meth are generally made throughout the series on a very phenomenological level (Episode I-1) or only the analytical result is announced (Episode I-4). The analytical methods are not really explained except for a few vague exceptions. For example, a gas chromatograph is used in a Mexican drug lab without further explanation (Episode IV-10). In *Breaking Bad*, the chemistry is, thus clearly depicted as a manufacturing science and not as an analytical science.

WRITING. Choose one of the two 'routes' to produce meth on Figure 3 and write a short paragraph in English explaining it.

.....

.....

.....

.....

.....

.....

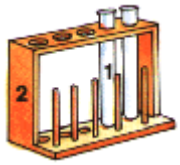
.....

.....

FOLLOW UP ACTIVITY: watch the video 'Getting the Science Right in Breaking Bad' available on MADOC. *Source:* http://www.openculture.com/2013/09/the-science-of-breaking-bad.html

VIDEO: PERCY JULIAN, A FORGOTTEN GENIUS

LEXICAL WORK: *Which of the following tools can you name?*

VIDEO

Can you explain what these phrases refer to?

1. A methyl group
2. Melting point
3. Total synthesis
4. Elegant synthesis

Now watch the documentary and find the answers to these questions:

1. When and by whom was the Calabar bean brought back from Africa? What interesting substance does it contain?
2. Why was the synthesis of this substance an important challenge for Percy Julian?
3. Who was Robert Robinson? What was Percy Julian's attitude towards him?
4. How does molecular synthesis work?
5. What techniques can be used to build a molecule?
6. What is a combustion train? Why did Julian use it?
7. Why did their 1934 paper increase the pressure on Julian and his colleague Pikl?
8. How did Julian determine that Robinson had the wrong molecule?
9. How does a chemist determine a melting point?
10. How was Percy Julian's work received?

Source: http://www.pbs.org/wgbh/nova/physics/forgotten-genius.html

VIDEO: PERCY JULIAN, A FORGOTTEN GENIUS

PHONOLOGY

EXERCISE 1: SYLLABLE STRESS:
Identify the stressed syllable in these words and underline it.

adorn	jester	cushion	
even	rugged	protest	people
support	parent	appeal	kidnap

EXERCISE 2: INTONATION GROUPS:
Underline the nucleus in the following sentences, as spoken in a neutral way.

My name's Fred.

I'm a tourist.

What do you mean?

What's your name?

Is it time to go?

How do you do?

Can I come in?

Would you like some tea?

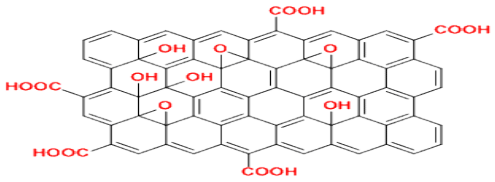
What would you like to drink?

Source: Ray Parker & Tim Graham. *The Phonology of English: An Introduction for Teachers of ESOL*. ELB Publishing: Brighton, 2009 (First published 1994).

READING

Freshmen-level chemistry solves solubility mystery of graphene oxide films

ScienceDaily, 5 January 2015. *www.sciencedaily.com/releases/2015/01/150105125910.htm Picture:* Representative structure of graphene oxide *http://www.tcichemicals.com/en/li/support-download/tcimail/application/167-06.html*



For many years, researchers did not understand why graphene oxide remained stable in water. Now a research team finds that it's due to a common contaminant introduced during filtration.

A Northwestern University-led team recently found the answer to a mysterious question that has puzzled the materials science community for years -- and it came in the form of some surprisingly basic chemistry.

Like many scientists, Jiaxing Huang did not understand why graphene oxide (GO) films were highly stable in water. When submerged, the individual GO sheets become negatively charged and repel each other, which should cause membrane to disintegrate. But earlier papers noted that instead of disintegrating, the films stabilized.

"It doesn't make any sense," said Huang, associate professor of materials science and engineering at the McCormick School of Engineering. "Many scientists have been very puzzled by this."

Graphene oxide, a product of graphite oxidation, is often used to make graphene, a single-atom-layer thick sheet of carbon that is remarkably strong, lightweight, and has high potential in electronics and energy storage. Within the past three years, however, more scientists have become interested in GO itself, partially because of its potential for molecular separation applications.

After studying the material for many years, Huang realized that the secret of GO's mysterious insolubility was the unintentional introduction of a common contaminant. To make a GO film, many scientists pass the acidic dispersion of individual sheets through porous anodized aluminum oxide filter discs, which are popularly used for preparing membranes of many nanomaterials. Huang's team found that during filtration, the aluminum filter discs corrode in acidic water to release a significant number of aluminum ions, Al3+. The positively charged ion bonds with the negatively charged GO sheets to stabilize the resulting membranes.

"We have solved the puzzle using essentially freshman-level inorganic chemistry," Huang said. "Now we know that graphene oxide films are indeed soluble in water. It's just a matter of sample purity."

Other multivalent metal ions, such as manganese, which is a byproduct from the synthesis of GO, can also crosslink the sheets.

Huang's research is described in "On the origin of stability of graphene-oxide membranes in water," published in Nature Chemistry on January 5. Other authors of the paper include graduate student Che-Ning Yeh, postdoc Kalyan Raidongia, former visiting graduate student Jiaojing Shao, and Shao's former adviser Quan-Hong Yang from Tianjin University in China. The National Science Foundation and Office of Naval Research funded different parts described in the paper.

Huang's finding also indicated that GO films are not as strong as researchers once thought. The aluminum ions make the film much stiffer. Without the ions, GO is three to four times weaker.

"This is a wake-up call for anyone using aluminum oxide filter discs," he said. "People have used it for sample preparation in many areas of materials science and biology. Now we know it's not as clean as we think."

READING

Synonym match: Find words in the text that correspond to the following definitions

Line	*Words from the text*	*Synonyms*
		a first-year student at university
		perplexed
		a sheet, quantity, or thickness of material covering a surface or body
		made of thin material and weighing less than average
		are destroyed or damaged by chemical action
		joins
		a specimen taken for scientific testing or analysis
		a secondary result, unintended but inevitably produced
		more rigid
		less strong

Choose the correct answer

1. Which advantage of graphene is **NOT** mentioned in the text?
   a. It is thin
   b. It is not heavy
   c. It is tough
   d. It is cheap
2. Aluminium filter disks are … used in materials sciences and biology.
   a. widely
   b. little
   c. rarely
   d. sometimes

True or false? Justify your answers.

1. The mystery of graphene oxide films was solved using very complex chemistry.
2. Researchers demonstrated that the presence of impurities made graphene oxide stable in water.
3. Previous research showed that putting GO sheets in water did not give the expected results.
4. Graphene is a very thick material with great properties.
5. Pr. Huang only became interested in graphene oxide recently.
6. He proved that someone deliberately put the contaminant in the solution.
7. Other specific atoms can go through the same process.
8. The researchers also found the presence of the contaminant modified graphene oxide's rigidity.

SPEAKING: PhD SUPPORT

STUDENT A: Your friend is working on his/her PhD thesis and is feeling really low: things are not coming together as well as they wish and they fear not to be able to meet the hand-in deadline. Talk to them about what they have already achieved and try to cheer him/her up!
STUDENT B: You are a PhD student and feeling really low: hand-in deadline is looming and you feel there is no way you will be able to meet it. You confide in one of your good friends explaining your worries and discouragement and letting them cheer you up!

THE STORY OF COSMETICS

BEFORE YOU WATCH
How many personal care products do you use everyday? Do you know what's in them?

What do you know about 'organic' cosmetic products and what do you think about them?

What do you know about the regulation on organic products in Europe? What about the US?

VIDEO *Source:* http://storyofstuff.org/movies/story-of-cosmetics/

TRANSCRIPTION EXERCISE
At the very beginning of the document, write down what you hear, even if you're not sure of the exact words.

This is a story ……

……

……having fun.

PART 1 *Answer the following questions*

1. What is Annie Leonard's shampoo mainly composed of and what is the problem with these substances?
2. What are the other examples mentioned?
3. Fill in the following chart with appropriate figures:

Number of care products used daily by the average US woman	
Number of care products used daily by the average US man	
Average number of substances contained in each product	
Number of substances tested by the industry for safety panels	

4. What substances were found in Annie Leonard's body?
5. What seems paradoxical about the examples of the Procter&Gamble shampoo and the Estee Lauder product?
6. Can you trust a product labeled 'organic', 'natural' or 'herbal'?
7. What is the "1950s mindset"?
8. What's the problem with the "harmless doses of poison" in the products?
9. What kind of "government action" would be helpful?
10. What is the best action we can take?

SPEAKING

How convinced are you by this video? Is the speaker partial? Do you believe the situation is so bad?

PRACTICAL SKILLS!

Work as a group to discuss the safety of your favorite cosmetic products! Each member of the group should take out his/her product and read the label while the other members check out the safety of its ingredients in the Skin Deep database http://www.ewg.org/skindeep/

PHONOLOGY

EXERCISE 1: CONTENT WORDS vs FUNCTION WORDS

*GENERALLY **STRESSED***
***Content** words (also called lexical words)*
- Nouns
- Verbs
- Adjectives
- Adverbs

*GENERALLY **NOT STRESSED***
***Function** words (also called structure words)*
- (most) Determiners
- (most) Auxiliaries
- (most) Prepositions
- (most) Conjunctions
- (most) Pronouns

Read the following sentences and decide if the words are CONTENT or FUNCTION words (circle the content words). Then listen to the audio track and check your answers.

1. Put the flowers on the table.
2. The meeting ended with a vote.
3. The worst problem was the matter of status.
4. The effect of these gases is growing daily.
5. I had never spoken to her before.

EXERCISE 2: WEAK vs STRONG FORMS

Normal meaning + normal situation = probably unstressed (weak form) Normal meaning + emphatic situation = probably stressed (strong form) Special meaning = almost inevitably stressed (strong form)

For the following featured words, decide, in each pair, which one is weak (unstressed) and which one is strong (stressed). Read the sentences and mark your answers, then listen to the audio track and check.

1. THAN
    a. She's better than I am.
    b. 'Than' comes between 'texture' and 'thanks' in my dictionary.
2. THERE
    a. Is there any milk left?
    b. There's an old mill by the stream, they tell me.
3. OF
    a. He's the only one I've ever heard of.
    b. A box of matches please.
4. WAS
    a. Bobby Charlton was a marvellous striker.
    b. "Was there anything else, Sir?"
5. CAN
    a. "YOU CANNOT BE SERIOUS!"
    b. I can see clearly now the rain has gone.
6. AND
    a. I ate a full English breakfast, a five course lunch and a substantial dinner.
    b. I love fish and chips but I'm on a diet.
7. FROM
    a. Where's he coming from?
    b. He came from a long line of aristocrats.
8. US
    a. Give us this day our daily bread…
    b. He didn't give it to us, he gave it to them.
9. SOME
    a. Some hope!
    b. I'd love some cream on these strawberries.
10. TO
    a. He came to the party after all.
    b. After the party he was some time coming to.

Source: Ray Parker & Tim Graham. *The Phonology of English: An Introduction for Teachers of ESOL*. ELB Publishing: Brighton, 2009 (First published 1994).

HOW TO DELIVER EFFECTIVE PRESENTATIONS

EFFECTIVE PRESENTATION DELIVERY

The following examples are taken from the excellent website *http://www.ruf.rice.edu/~comcoach/.*

We will not cover everything that they do, so you should visit the website to get more advice on delivering great presentations.

1. Eye contact: In which video does the presenter use eye contact most effectively? Why?
2. Gestures: In which video does the presenter use gestures most effectively? Why?
3. Nonverbals: In which video does the presenter use nonverbals most effectively? Why?
4. Voice: In which video does the presenter use his voice most effectively? Why?
5. Visual aids: In which video does the presenter use visual aids most effectively? Why?

CRITERIA FOR PRESENTATION ASSESSMENT

The following table summarizes the main points you will be graded on in your end-of-term presentations. Make sure you apply what we've discussed today!

CONTENT	
Structure	Your presentation has to be structured AND your structure has to be made apparent (announcing outline in intro, using transitions)
Thoroughness	Even if you do not have much time, you can and should be thorough: focus on the most important things you have to say and be straightforward
Accuracy	Do not assume that your audience is ignorant: be precise and accurate.
COMMUNICATION	
Body language	When standing in front of an audience, remember your body says as much as your tongue: do not slouch, fidget, or keep your back to the board. Engage in communication with the whole group!
Volume and speed	Do not read/ hide behind your notes! Articulate and speak loud enough. Remember you WANT (remember TO want!) your message to be understood!
Eye contact	Look at everyone!
Visual aid	Communication tools may include ppt slideshows, diagrams, or other props (experimental setup). Either way, they remain TOOLS that need to be fully integrated in your communication plan. Simple approaches can help enhance the quality of your work!
LANGUAGE	
Grammar	Even though grammar mistakes are more acceptable in an oral than written context, basic errors must be eliminated
Pronunciation	It is crucial to check the pronunciation of new vocab as well as key (and therefore recurring) elements in your presentation: not only will mistakes hinder communication, they also discredit your performance
Vocabulary	Use simple language (both in terms of syntax and lexis). But make sure you DO have the right lexical references.

HOW TO DELIVER EFFECTIVE PRESENTATIONS

SPEAKING PRACTICE: Impromptu speeches (Groups of 4)

Each group member picks up a statement card from the pile. You will then get 5 minutes to plan a 2-minute speech in support of the statement on the card.

After the preparation time, you will each deliver your speeches to the rest of the group. At the end of each round, you vote on whether or not you were convinced by each presentation.

DISTANCE LEARNING ALTERNATIVE (Individual practice)

Follow the “Impromptu Speech Topic Generator” link on MADOC to generate a list of topics. Choose one and give yourself five minutes to plan your 2-minute presentation. You will then deliver your speech in front of a mirror or webcam, trying to use your intonation and body language to deliver a convincing presentation.

TRANSLATION EXERCISES

GRAMMAR: Translate the following sentences from French into English

1. Cette augmentation de 70% s'explique par le fait qu'aucune vaccination systématique n'a été effectuée pendant cette période.

2. Ce montage comprend 5 parties. Les différents éléments sont reliés à un ordinateur, équipé/muni d'un scanner.

3. Ce nouvel appareil de détection de fumée sera bientôt commercialisé.

4. Ce robot, qui a la forme d'un être humain et qui résiste à l'eau, a une intelligence artificielle qui s'adapte rapidement.

5. Les données sont en train d'être traitées, mais il semble que l'érosion est restée stable depuis près d'un siècle.

6. Regarde-le ! Pourquoi porte-t-il un T-shirt « Einstein avait tort » ? – C'est parce qu'il écrit une thèse sur le sujet.

7. Les scientifiques travaillent sur ce projet depuis deux ans, mais n'ont fourni aucun résultat fiable.

8. Les ventes d'ordinateurs portables ont augmenté de façon spectaculaire ces trois dernières années, tandis que les ordinateurs de bureau se vendent de moins en moins dernièrement.

9. Il s'est spécialisé dans l'étude du mode de reproduction de cette espèce en voie de disparition.

10. L'expérience de Miller, qui est censée expliquer l'origine de la vie, est très controversée.

11. Ils seraient capables de comprendre la physique quantique s'ils pensaient à acheter les bons livres.

12. Nous sommes heureux de vous annoncer que vous avez réussi à découvrir un nouvel élément.

13. Les scientifiques de la NASA se sont peut-être trompés ; ils n'auraient pas dû publier leurs résultats aussi tôt.

14. D'ici 2020, la température de l'océan aura augmenté de 0,5°, ce qui risque de provoquer des disparitions d'espèces marines.

15. Beaucoup de fausses informations ont circulé sur les implications de ces recherches.

16. De moins en moins d'étudiants choisissent d'étudier les mathématiques fondamentales ; l'attrait des mathématiques appliquées s'explique en partie par les nombreux débouchés de ces filières, notamment dans la finance. Pourtant, l'expérience prouve que peu de ces étudiants toucheront beaucoup d'argent.

FURTHER PRACTICE

Choose the best answer to complete the following sentences.

1. The deadline for … an abstract was in November.
   a. submit
   b. sustaining
   c. submitting
   d. submitted
2. Did they comment … her performance?
   a. on
   b. about
   c. Ø
   d. to
3. They wished to participate … the conference.
   a. to
   b. with
   c. at
   d. in
4. More than two … people attended the conference.
   a. thousands
   b. thousand of
   c. hundreds
   d. hundred
5. The aim of my presentation is to describe … our process for recycling polymers.
   a. you
   b. at you
   c. to you
   d. with you
6. I am going to present … an overview of the physics of smart materials.
   a. you
   b. at you
   c. to you
   d. you to
7. Let me show … this graph.
   a. you
   b. at you
   c. to you
   d. you to
8. I would like to introduce … a new approach.
   a. you
   b. at you
   c. you to
   d. you at
9. We had been requested to limit one slide … one main idea.
   a. for
   b. at
   c. to
   d. on
10. Don't leave a slide on the screen after … its subject.
    a. discussing
    b. discussed
    c. to explain
    d. to discuss
11. Each poster session author will be provided … a horizontal poster board and chair.
    a. of
    b. on
    c. Ø
    d. with
12. Use duplicates if you need to refer … the same slide at several different times in your talk.
    a. at
    b. to
    c. back
    d. for
13. This course is a general introduction … the history of science.
    a. to
    b. in
    c. at
    d. on
14. This course is designed to provide … an overview of the theory of Fourier transform.
    a. with
    b. over
    c. Ø
    d. by
15. He undertook a … undergraduate course in 2005.
    a. two-year
    b. two-yeared
    c. two years
    d. two year's
16. She had been admitted … ISIA in 1991.
    a. at
    b. Ø
    c. to
    d. for
17. They entered … Cambridge University in 2013.
    a. at
    b. into
    c. in
    d. Ø

FURTHER PRACTICE

18. They had pursued studies … Computer Science.
    a. of
    b. for
    c. in
    d. to
19. I was advised … Physics.
    a. not choose
    b. choose not
    c. not to choose
    d. not choosing
20. Our training … 5 months ago.
    a. has started
    b. has begun
    c. started
    d. begin
21. They requested … before the end of the academic year.
    a. us to get in touch with them
    b. us get in touch with them
    c. that we'll get in touch with them
    d. we got in touch with them
22. This course will introduce students … the phenomenon of light scattering.
    a. over
    b. Ø
    c. at
    d. to
23. This course will end … a general discussion.
    a. at
    b. with
    c. by
    d. into
24. Attendance … the first class meeting is mandatory.
    a. at
    b. for
    c. in
    d. to
25. Enrollment is limited … 60 students.
    a. at
    b. on
    c. to
    d. by
26. For more … about the program, please contact the administration office.
    a. informations
    b. detail
    c. items
    d. information
27. Before …, make sure you have chosen the right program.
    a. enrolling
    b. you enrolled
    c. to enroll
    d. you'll enroll
28. Your chance of getting into a good school is very dependent … how you score on the Graduate Management Admission Test (GMAT).
    a. of
    b. over
    c. on
    d. by
29. Pr Dupont has been teaching cellular biology … over 12 years.
    a. in
    b. on
    c. during
    d. for
30. Dr Durand among others will acquaint students … the principles of computing.
    a. on
    b. about
    c. to
    d. with

Source: Lydie Navard, *Scientifically Yours: 400 tests d'anglais appliqués à la communication scientifique internationale,* Tec & Doc Lavoisier: Paris, 1999.

THE PRINCIPLES OF CLEAR WRITING

In the following pages, you will find some information to keep in mind when writing in English. Those principles will (hopefully) help you write clear, effective, and logical sentences and texts.

Make characters subjects and actions verbs

Compare the following sentences:

> *A: Researchers have identified the AIDS virus but have failed to develop a vaccine to immunize those at risk.*
>
> *B: Attempts by economists at defining full employment have been met with failure.*

Sentence A is clearer for two reasons:

- The characters in sentence B are not the subject. The subject is attempts but the characters are *economists*.
- The actions in sentence B are not verbs but abstract nouns (*attempts*, *failure*) and the verb (*have been met with*) expresses little meaning.

=> Sentence A is clearer because the characters are subjects and the actions are verbs. Also, the subjects are short, specific, and concrete.

So, when you match characters to subjects and actions to verbs in most of your sentences, readers are likely to think your prose is clear, direct, and readable.

Using that principle, sentence B could be rewritten as follows:

> *Economists have attempted but failed to define full employment.*

It does not follow that all nominalizations are bad, but French speakers tend to use too many of them, so keep that in mind when writing in English.

Old information goes before new information

We depend on the beginning of a sentence to give us a context of what we know before we read what's new. A sentence confuses us when it opens with information that is new and unexpected. For example, in this next passage, the subject of the second sentence gives us new and complex information (**boldfaced**), before we read more familiar information that we recall from the previous sentence (underlined):

> *We must decide whether to improve education in the sciences alone or to raise the level of education across the whole curriculum.* ***The weight given to industrial competitiveness as opposed to the value we attach to the liberal arts*** *will determine our decision.*

We could read the second sentence more easily if it were passive, because the passive would put the short, familiar information first and the newer, more complex information last:

> *We must decide whether to improve education in the sciences alone or to raise the level of education across the whole curriculum. Our decision will be determined by the weight we attach to industrial competitiveness as opposed to the value we attach to the liberal arts.*

So remember that sentences are cohesive when the last few words of one set up information that appears in the first few words of the next. That is what gives us our experience of flow. And in fact, that's one of the biggest reasons the passive is in the language: to let us arrange sentences so that they flow from one to the next easily.

In every sentence that you write, you have to balance principles that make individual sentences clear and principles that make a passage cohesive. But in that tradeoff, give priority to helping readers create a sense of cohesive flow. Fortunately, the principle of old before new cooperates with the principle of characters as subjects. Once you mention your main characters, readers take them as familiar information. So when characters are up front, so is familiar information.

Pay attention to the beginning of your sentences

Readers are more likely to judge as clear a unit of writing that opens with a short segment that they can easily grasp and that frames the longer and more complex segment that follows.

There are two rules of thumb about beginning a sentence: (1) Get to the subject quickly and (2) get to the verb and object quickly.

THE PRINCIPLES OF CLEAR WRITING

- Get to the subject quickly:

Avoid beginning more than a few sentences with long introductory phrases and clauses. When you find a sentence with a long introductory clause, try moving it to the end. If it doesn't fit there, try turning it into a sentence of its own.

Because of the growing use of computers to store and process corporate information, industrial spying is increasing rapidly.

=> Industrial spying is increasing rapidly because of the growing use of computers to store and process corporate information.

It is, however, a fact of English style that clauses beginning with *if*, *when*, and *although* tend to appear before main clauses rather than after. So if you cannot avoid opening with a subordinate clause, keep it short.

- Get to the verb and object quickly:
  - Avoid long, abstract subjects: revise long subjects into short ones.

The possibility that some termini have a base composition different from that of DNA simply because they are the nearest neighbors of termini specifically recognized by the enzymes can be checked by comparing the experimental results with those expected from the nearest neighbor data.

=> If we compare the experimental results with those expected from the nearest neighbor data, we can check the possibility that some termini have a base composition different from that of DNA simply because they are the nearest neighbors of termini specifically recognized by the enzymes.

  - Avoid interrupting the subject-verb connection: move the interruption to the beginning or end of its sentence, depending on whether it connects more closely to what precedes or follows it. However, short interruptions (for instance, one-word adverbs) are not a problem.

The continued and unabated emission of carbon dioxide gas into the atmosphere, unless there is a marked reduction, will eventually result in serious changes in the climate of the world as we know it today.

=> If we do not reduce our emissions of carbon dioxide, the current climate will be seriously changed//affected. OR Unless we reduce our emissions of carbon dioxide, the current climate will be seriously changed.

  - Avoid interrupting the verb-object connection: Move the interrupting element to the beginning or end of its sentence, depending on what comes next.

The Institute launched, in partnership with the University of Lisbon, a new Ecodynamics Award.

=> The Institute launched a new Ecodynamics Award in partnership with the University of Lisbon.

<u>Pay attention to the end of your sentences</u>

The first few words of a sentence are especially important because they state its topic, what the sentence is about or comments on. The last few words of a sentence are also particularly important because they receive special emphasis. This is what we will call the sentence stress. How you manage the emphasis in that stress position helps establish the voice readers hear in your prose. If you end a sentence on words that have little meaning, your sentence will seem to end weakly.

Three tactical revisions:

- Trim the end:

Sociobiologists claim that our genes control our social behavior in the way we act in situations we are in every day.

THE PRINCIPLES OF CLEAR WRITING

=> Sociobiologists claim that our genes control our social behavior.

- Shift peripheral ideas to the left:

The data offered to prove ESP are weak, for the most part.

=> For the most part, the data offered to prove ESP are weak.

Job opportunities in computer programming are getting scarcer, it must be remembered.

=> It must be remembered that job opportunities in computer programming are getting scarcer.

- Shift new information to the right:

Questions about the ethics of withdrawing intravenous feeding are more difficult [than something just mentioned].

=> More difficult [than something just mentioned] are questions about the ethics of withdrawing intravenous feeding.

Sources: Joseph M. Williams and Joseph Bizup, *Style: Lessons in Clarity and Grace,* Pearson: Boston, 2013.

https://cgi.duke.edu/web/sciwriting/index.php?action=lesson3#examples

https://owl.english.purdue.edu/owl/resource/600/01/