INTRODUCTION

Science is the orderly collection of scientific records (i.e., observations about the natural world made via well-defined procedures) and scientific records are archived in a standardized form, the scientific research paper. A research project has not contributed to science until its results have been reported in a standard paper, the observations in which are accompanied by complete recipes. Therefore, to be a contributing scientist, you must write scientific papers.

It has been said that science is the orderly collection of facts about the natural world. Scientists, however, are wary of using the word 'fact.' 'Fact' has the feeling of absoluteness and universality, whereas scientific observations are neither absolute nor universal. A meaningful scientific statement includes an observation and its recipe (i.e. the procedure that has been used to make the observation). The standard form for recording meaningful scientific statements is the scientific research paper.

Example

'Children have 20 deciduous [baby] teeth' is an observation about the real world, but scientists would not call it a fact. This statement is neither universal nor abstract.

Why?

- Age is not specified
- Some children have fewer deciduous teeth, and some have more when they are babies and toddlers,
- Children have less than 20 visible teeth, and as they grow older, children begin to loose their deciduous teeth, which are then replaced by permanent teeth.

What is, then, a standard statement?

"I looked in the mouths of 25 five-year-old boys and 25 five-year-old girls in the Garden Day Nursery School in Cleveland, OH, on Monday, May 24, 2008, and I found that 23 of the boys and 25 of the girls had 20 visible teeth."

The Standards of Scientific Papers

Scientific papers have a stereotyped format:

- Abstract
- Introduction
- Materials and Methods
- Results
- Discussion
- Conclusion
- References

The predictable form of a scientific paper, with its standard set of sections arranged in a stereotyped order, ensures that a reader knows what to expect and where to find specific types of information.

Short Statement on Writing a Scientific Research Paper

Writing paper will seem endless if you begin with the title until the last reference. This approach is difficult, wearing, and inefficient. Writing paper from inside out is more efficient and a time saving process. Begin with the recipes, the Materials and Methods. Next, collect your data and draft the Results. As your experiments end, formulate the outlines of a Discussion. Then write a working Conclusion. Now, go back and write the historical context, the Introduction. Only after all else has been written and tidied up, will you have sufficient perspective to write the Title and the Abstract.

Throughout the writing, your tools and techniques will be the same.

- You should use precise words and, whenever possible, numbers.
- You should write direct sentences that follow a straight line from point A to point B.
- You should fill all sections of the stereotyped skeleton of a standard scientific paper.
- Writing a paper should be an active part of your research. If you wait until your studies are finished before you begin to write, you will miss a powerful tool.

How writing papers help you assess your research?

Research is iterative: You do, you assess, and you redo, and writing a paper is a way for you to continually make the reassessments necessary for critical and perceptive research.

Your manuscript can even be a blueprint for your experiments. The empty skeleton of a scientific paper poses a set of research questions, and, as you fill in the skeleton, you automatically carry out an orderly analysis of your data and observations. Moreover, by setting new data into the draft of your paper, you can maintain perspective. You will filter out the shine of newness, as your results (even unusual results) are put into the context of your existing data and your full research plan.

As a scientist, you must write, and, as an experimentalist, writing while you work strengthens your research. Writing a paper can be an integral part of observational science.

Language of Scientific Paper

Within this stereotyped format, the language of a scientific paper aims to be clean, clear, and unemotional. Science also avoids colorful words. The essential characteristic of scientific writing is clarity. Slippery words and vague phrases are confusing, and there is no place for ambiguity, arcane language, or froth in the archives of scientific records.

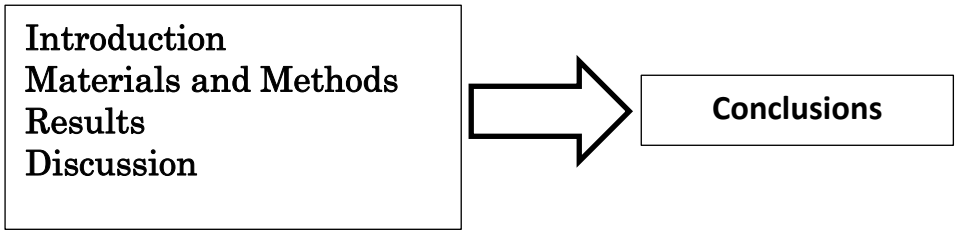
In science:

- Descriptions must be precise.
- Recipes must be complete.
- Data must be exact.
- Logic must be transparent.
- Conclusions must be cleanly stated.

A Single, Clear Direction of Your Writing

How to make your paper clear?

Beyond a stereotyped format and transparent language, a scientific paper also needs clarity of direction. Your entire paper should point inexorably toward its Conclusion.



Therefore, as you write, point the way for your reader, and remove tangents and deviations. Keep a single theme at the fore. For example, if your Conclusion is about temperature, then temperature should be ever-present in your paper. 'Temperature' should be in the Title. The Introduction should tell how your predecessors wrote about temperature. The Materials and Methods section should detail the instruments that you used and the operations that you performed involving temperature. The Results section should include data about temperature, and the Discussion section should connect your data to the existing scientific literature about temperature.

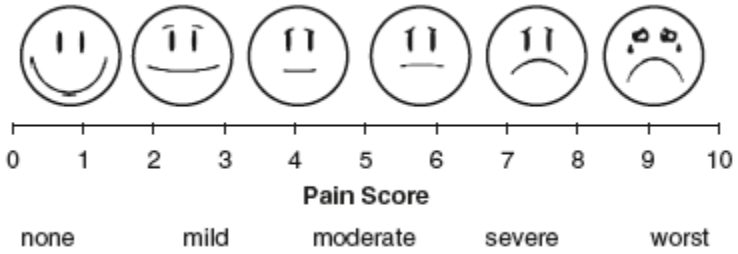
Simple and Redundant Words, and Awkward Phrases

Replace	With
a considerable amount of	many, much
absolutely essential	Essential
almost unique	rare, uncommon
completely full	Full
considered as	considered
considering the fact that	although, because
decline	Decrease
different than	different from, unlike
each and every	Each
end result	Result
exactly the same	Identical
have a tendency	Tend
in the final analysis	finally
very unique	unique

Numbers

Numbers have just the right properties for scientific writing, why? numbers are precise, objective, unambiguous, and without emotional undertones. Because quantifiable adjectives are ideal descriptors in science, try to redefine all your adjectives as numbers. 'Tall' should be defined numerically, for example, 'greater than 2 m' or 'greater than 7 km.' Likewise, 'heavy' should be 'greater than 10 kg' or 'greater than 100 kg' or, perhaps, 'greater than 105 kg.' If you use 'brief,' tell us whether it means less than a minute, less than a second, or less than a millisecond.

Even the inherently subjective adjective 'painful' should be set as a number on a scale quantifying how painful, as is done in most hospitals.



Use Objective Words

Of course, you cannot write with numbers alone. When quantifiable words are not available, you should use as precise and objective a vocabulary as possible. In science, the rule is, define all your words. Beyond this rule, a few writing habits will help to ensure good scientific text.

Examples for words that you must try to avoid while writing your paper

• Expressions with no clear limits, such as: a lot, fairly, long term, quite, really, short term, slightly, somewhat, sort of, very.

• Words of personal judgment, such as: assuredly, beautiful, certainly, disappointing, disturbing, exquisite, fortuitous, hopefully, inconvenient, intriguing, luckily, miraculously, nice, obviously, of course, regrettable, remarkable, sadly, surely, unfortunately

• Words that are only fillers, such as: alright, basically, in a sense, indeed, in effect, in fact, in terms of, it goes without saying, one of the things, with regard to

• Casual colorful catchwords and phrases, such as: agree to disagree (اتفقوا على ان لا يتفقوا), bottom line (في النهاية), brute force (القوة الغاشمة), easier said than done (القول اسهل من الفعل), fell through the cracks (يهمل), food for thought (غذاء الفكر), leaps and bounds (على قدم وساق), okay, quibble (تمحك او جدال فارغ), snafu (اللخبطة), tidbit (نبأ سار), tip of the iceberg (غيض من فيض).

Note: Remember that writing your manuscript may, sometimes, require or include using some of the above words such as fillers.

Scientific Use of Tenses

Good scientific prose uses a precise vocabulary. Scientific prose also uses verb tenses in a standardized way. When discussing research, the present tense indicates general knowledge and general principles, while the past tense indicates results of experiments.

Present Tense Is for Generalities:

Use the present tense for general knowledge statements, widely accepted statements, and statements for which you could cite textbook references; for example:

• "**Black-eyed Susan** (Rudbeckia hirta), a member of the Aster family, **is a plant** native to North America."

•"**Sun rises** from east and **sets** in the west."

• "On a protein-rich diet, **the amount of methylhistidine** in the urine **increases.**"

Past Tense Is for Specific Observations

Your results, the particular observations that you made during a research study, are bits of history, so use the past tense when you report your experimental results.

For example:

• "**Eighteen percent of the patients** in our study **developed** a mild rash."

• "**The diodes** **were compared** at regular time points during the next 75 h."

DIRECT SPEECH

Direct speech repeats, or quotes, the exact words spoken. When we use direct speech in writing, we place the words spoken between quotation marks (" ") and there is no change in these words. We may be reporting something that's being said NOW (for example a telephone conversation), or telling someone later about a previous conversation.

EXAMPLES

She says, "What time will you be home?"

She said, "What time will you be home?" and I said, "I don't know! "

"There's a fly in my soup!" screamed Simone.

John said, "There's an elephant outside the window."

INDIRECT SPEECH

Reported or indirect speech is usually used to talk about the past, so we normally change the tense of the words spoken. We use reporting verbs like **'say'**, **'tell'**, **'ask'**, and we may use the word **'that'** to introduce the reported words. Inverted commas are not used.

- ➔ She said "I saw him." (direct speech)
- ➔ She said that she had seen him. (indirect speech)

'That' may be omitted:

She told him that she was happy. → She told him she was happy.

'SAY' AND 'TELL'

Use '**say**' when there is no indirect object (مفعول به):

➔ **He said that he was tired.**

Always use '**tell**' when you say who was being spoken to (i.e. with an indirect object):

➔ **He told me that he was tired.**

'TALK' AND 'SPEAK'

Use these verbs to describe the action of communicating:

He talked to us.

She was speaking on the telephone.

Use these verbs with **'about'** to refer to what was said:

He talked to us about his parents.

Direct and Indirect speech in scientific writing

If you want to 'report', or repeat, what someone else has said or written, there are two ways of doing this:

➔ **Direct speech**

This is when you repeat exactly the original words. In writing, this would be in the form of a quotation:

➔ **Milburn (1966) stated that "attack is the best form of defence".**
➔ **Research conducted by Aggers & Blowers (1993) suggested that "laughter is by nature a social activity".**

In your academic writing it is usually best to keep direct quotations short.

Indirect speech/Reported speech

This is when the writer's or speaker's words or thoughts are summarised or paraphrased and integrated into your own writing. As well as the actual process of summarising the information in your own words, it may be necessary to change some language such as words referring to time and place and/or verb tenses.

Time and place

Imagine that in 1998 Mouskouri wrote the following about the economic situation in Greece:

"Unemployment here is likely to gradually rise over the next two years."

If you are using this information at Birmingham City University now, you would have to write:

Mouskouri (1998) reported that there would be a slight rise in unemployment in Greece between 1998 and 2000.

If you don't make changes such as this, you would be giving confusing, false information and may give your tutor the impression that you haven't understood what you have read.

Other words or phrases which may need to be changed would include: last year, three years ago, this century, next year, five years from now, nowadays; in this country, our government etc.

Verb tenses

If you are reporting general facts, opinions or theories which are still true today, these would normally be introduced in your writing with an appropriate verb in the present tense and no changes to verbs in the original may be necessary. So if Collingwood wrote in 1999:

"The importance of Elgar in the development of British music has been greatly exaggerated. His music is at best lightweight and derivative; mostly, however, it shows a complete lack of emotion or true musical form."

you would write:

Collingwood (1999) claims that Elgar's music has been overrated as it is technically lacking and devoid of feeling.

Collingwood's ideas are the same now as in 1999, and Elgar's music is the same as when it was written, so the verb tenses do not change.

If, however, you are reporting what someone actually said, or are referring to surveys, experiments, findings etc from the past, you would then introduce these with a verb in the simple past tense, and it may be necessary to change some, or all, of the verbs in the original, unless you are again referring to facts or situations which are still true. The most important thing is avoid any ambiguity.

For example, if a survey respondent said several years ago:

"I find it impossible to understand lecturers with strong regional accents."

you would write:

One respondent said that she found it impossible to understand strong accents.

As it is quite possible that her understanding has improved. However, if the survey was very recent, or if you are sure that the respondent's situation has not changed, you would probably write:

One respondent said that she finds it impossible to understand strong accents.

If the situation has definitely changed, then it is necessary to change the verb tense. If in 1987 Chandrasekar wrote:

"The education system is undergoing major developments at the moment. Some underperforming schools have been closed down and it is likely that many other schools will merge in the near future."

You would write:

Chandrasekar (1987) described the changes which were taking place, pointing out that some schools had closed and that others would probably merge.

Original wording	Reported wording
Simple present ***The government considers...***	Simple past ***The government considered...***
Present progressive ***Numbers are rising...***	Past progressive ***Numbers were rising...***
Present perfect ***The system has been changed***	Past perfect ***The system had been changed***
Simple past ***He received the letter yesterday.***	Past perfect* ***He had received the letter the day before.***
Past progressive ***The university was intending ...***	Past perfect progressive ***The university had been intending...***
Will ***"I will do it at once."***	Would ***She said she would do it at once***
Can ***Children can marry at the age of 14.***	Could ***Children could marry at the age of 14.***

The one-tense-further-back rule

There is a general rule which says that when we use a reporting verb in the past, as above, the verbs used in the original speech are usually moved one tense further back. Thus:

will / shall future = would
is going to = was going to
can / may = could / might
present progressive = past progressive
present simple = past simple
present perfect = past perfect
past simple = past perfect

This happens because the time and place where we are reporting the action are different from where the original words were spoken. See what happens in the following examples and note the pitfalls:

➔ **Present and future patterns**

The Prime Minister said: 'I shall co-operate fully with the enquiry.'

The PM told the press that he would co-operate fully with the enquiry

(Take care to use "would" when reporting future (shall / will). If we used should here, it would suggest obligation and that is not what is meant.)

'You don't look very well. You should really stay in bed today.'

I told her she didn't look very well and should really stay in bed.

I advised her to stay in bed.

(Note that there is no past form of the modal verb should, meaning obligation, so it cannot move one tense further back.)

'Are you going shopping this afternoon? Could you get me some toothpaste?'

I asked her if she was going shopping and could get me some toothpaste.

I asked her to get me some toothpaste if she was going shopping.

Similarly there is no past form of could for future requests, so it cannot move one tense further back either. The same applies to might for suggestions:

'We might go out for a drink later on, if you're free.'

They suggested we might go out for a drink later, if we were free.

Compare this with the way in which can changes to could:

'I can't read this small print without my glasses.'

He admitted that he couldn't read the small print without his glasses.

➔ Past patterns

'How did you find your way here in the dark? The paths are not marked.'

I asked her how she had found her way here as the paths are not marked.

(Note that because the lack of paths is an ongoing situation, we would probably retain the present tense even in the reported situation)

'We've met before, haven't we?' ~ 'No, I don't think we have.'

He thought we had met before, but I was quite sure we hadn't.

➔ **Past perfect remains past perfect**

Like should / might / could in the earlier examples, the past perfect used in direct speech cannot move one tense further back in indirect speech:

'If only I had taken your advice, I would have saved myself a lot of money.'

He regretted / was sorry that he hadn't taken my advice.

He admitted that had he but taken my advice, he would have saved himself money.

➔ **On-going situation: no tense change**

We have already noted an instance of this in the 'paths' example, above. Here are two further examples of where it may or may not be appropriate to change the tense:

Daughter: I'm going out now, dad.

Mother (out of earshot): What did she say?

Father: She said she's going out.

Granny: Where's Jenny?

Father: She's out.

Granny: She didn't tell me she was going out.

Father: She told me she was going out.

When reporting verb is in present or future: no tense change

Note that when we use present or future reporting verbs, the situation we are reporting has not changed, so there is no tense change:

'Where's Paul?' → She wants to know where Paul is.

'Did he phone?' → I don't know if he phoned.

'Has he left already?' → I don't think he's already left. No.

'We've got tickets for the match, so we'll be able to join you.' →

I'll tell Kevin you've got tickets and will be joining us. He'll be well pleased.

'I shall not be resigning over this issue.' →

A spokesman from the Ministry has confirmed that the Minister will not be resigning over this issue.

SCIENTIFIC PARAGRAPHS

Significance of Making Paragraphs

In a research paper, each paragraph should contain one main idea, and the space between paragraphs should be like taking a mental breath. Picture the text as, Idea #1, breathe, Idea #2, breathe, …

Most people absorb ideas in small chunks, and scientific paragraphs are those small absorbable chunks. You can assess the absorbability of a paragraph simply by counting its sentences. The ideal size for a paragraph is 3–4 sentences, and five sentences are about the upper limit. If you find that you have written six or more sentences without allowing for a mental breath, then go back and break your writing into smaller chunks.

Consider this paragraph about insulin.

• *'To keep all the cells in the body coordinated and working toward the same metabolic goals, the body uses* ***hormones****. Hormones are chemicals that are carried throughout the bloodstream, giving the same message to all the cells they meet. For sugar metabolism, the hormone messenger is* ***insulin****. Insulin is a protein that is made in the beta cells, which are clustered inside the pancreas. When the level of glucose in the blood becomes too high, the beta cells secrete insulin molecules into the bloodstream; thus, after a meal, the pancreas puts a large dose of insulin into the blood. The message that insulin then transmits throughout the body is "it's time to absorb, use, and store glucose." '*

This paragraph contains six sentences, and its length alone should send you back to your writing desk. Reading the paragraph, you can find two major ideas. First, there are sentences about hormones in general. Second, there are sentences about one specific hormone, insulin. To emphasize each of these ideas, we should break the paragraph in two: one paragraph concerning hormones in general and the other concerning the nature and the effects of insulin:

• *'The body uses hormones to coordinate the metabolism of its many far-flung cells. A hormone is a chemical that is carried in the bloodstream and that gives a message to the cells it contacts. For sugar metabolism, insulin is one of the hormone messengers, and its message is "take up, use, and store glucose."*

• *'Insulin is a protein that is made in beta cells, which are clustered inside the pancreas. When the level of glucose in the blood becomes too high, the beta cells secrete extra insulin molecules into the bloodstream. After a meal, for instance, the pancreas secretes a large dose of insulin into the blood.'*

In a literary work, where the ebb and flow of words conveys a subconscious emotional message, a page of short paragraphs can be choppy and disruptive. However, a research paper has a different goal. Scientific writing must present a clear unemotional experience. Here, the methodical form, Idea #1, breathe, Idea #2, breathe …, is an effective way to write.

The Lead Sentence in a Paragraph

A typical scientific paragraph begins by stating its point, so the lead sentence should tell us the focus of the paragraph. In the two-paragraph example above, the first lead sentence, "The body uses hormones to coordinate the metabolism of its many far-flung cells," tells us that the first paragraph is about hormones as long-distance messengers. The second lead sentence, "Insulin is a protein that is made in beta cells, which are clustered inside the pancreas," tells us that the second paragraph is about a specific hormone, insulin.

The Subsequent Sentences

The remaining 2–3 sentences in each paragraph expand on the focal point that was identified in the lead sentence. Inside the paragraph, the sentences may:

- Give examples of the focal point.
- Give more details about the focal point.
- Remind readers that the focal point is a member of a more general class of similar things.
- Highlight an implication of the focal point.

In our example above, the first lead sentence tells us that the focal point of the paragraph is:

- HORMONES = LONG-DISTANCE MESSENGERS,

The second sentence gives details of both sides of this equation:

- HORMONE = CHEMICAL
- HORMONAL MESSENGERS TRAVEL VIA THE BLOODSTREAM

Finally, the third sentence gives specific examples:

- INSULIN = HORMONE
- INSULIN'S MESSAGE = "TAKE UP, USE, AND STORE GLUCOSE"

Connect Succeeding Paragraphs

In the same fashion, you can smooth the travel between paragraphs by making the lead sentence of each paragraph refer to the previous paragraph. The flow between paragraphs is most natural if the subject of the lead sentence is a subject or an object in the last sentence of the preceding paragraph. In our example above, 'insulin' makes the bridge between the two paragraphs:

• 'The body uses hormones to coordinate the metabolism of its many far-flung cells. A hormone is a chemical that is carried in the bloodstream and that gives a message to cells it contacts. For sugar metabolism, insulin is a hormone messenger, and its message is "take up, use, and store glucose."

• 'Insulin is a protein that is made in beta cells, which are clustered inside the pancreas. When the level of glucose in the blood becomes too high, the beta cells secrete extra insulin molecules into the bloodstream. After a meal, for instance, the pancreas puts a large dose of insulin into the blood.'

ADVICE TO SPEAKERS OF OTHER LANGUAGES

Scientific logic is the same in all languages. If you are more comfortable using a language other than English, then write your paper in your own language first. After it is complete, translate it, or have someone else translate it, into English. To make the final translation clearer, try to follow these suggestions when first writing your manuscript in your native language.

1. Words

• Use simple verbs: write 'use' not 'employ.'

• Turn adjectives into numbers: write '2' not 'several.'

2. Phrases

• Don't use similes or metaphors, because they do not always translate properly.

For example, write, "the mixture could not be poured" or "beads of the mixture stuck to the sides of the tube" not "the mixture was as thick as glue."

3. Sentences

• Make each sentence short.

• Put only one idea into each sentence.

• Ignore the sound and the rhythm of the sentence in your native language, and don't try for smooth, flowing speech. Simple writing is easier to translate accurately than writing that sounds good to your ear.

4. Paragraphs

• Make paragraphs short.

• In each paragraph, arrange the sentences in direct logical order.

5. An English-Speaking Editor

• After your paper has been translated, it is important to have it edited by a scientist who speaks English comfortably.

Acknowledgement

When your paper is finished, add one last historical note, the Acknowledgements. This is a paragraph that usually comes after the Conclusion and before the References. The Acknowledgements is an addendum to the Materials and Methods. In simple complete sentences, it lists those people and institutions who gave you advice, information, assistance, and materials. It should also list all the sources of your financial support. The Acknowledgements should be brief, however, the details are almost entirely in your hands. Here are some examples to illustrate the range of Acknowledgements found in the scientific literature:

• "This study was supported, in part, by Grant RG-5920 from the National Institutes of Health."

• "I would like to express my thanks to Mr. William Kay for his invaluable assistance in counting scintillations."

• "This work was made possible by a grant from the Nuffield Foundation, for which we should like to express our gratitude. Our thanks are also due to Professor J.Z. Young for his criticism of the manuscript."

• "One of the authors (A. A. Smith) thanks D. Wang, Y.T. Liu, and A. Urisman for their technical assistance on the microarrays. B. Glaunsinger is supported by an American Cancer Society postdoctoral fellowship and D. Ganem is a member of the Howard Hughes Medical Institute. The authors have no conflicting financial interests."

• "Grateful thanks are due to J.D. Archibald, D.A. Eberth, K. Howard, J.A. Lillegraven, G.J. Retallack, and A. Sweet, all of whom reviewed earlier drafts of this manuscript and contributed immensely to its improvement. However, the viewpoints expressed here are not necessarily those of the reviewers. This work was supported in part by the Instituto de Geologia, Universidad Nacional Autonoma de Mexico, and by a Fulbright Garcia-Robles Award."

Appendix

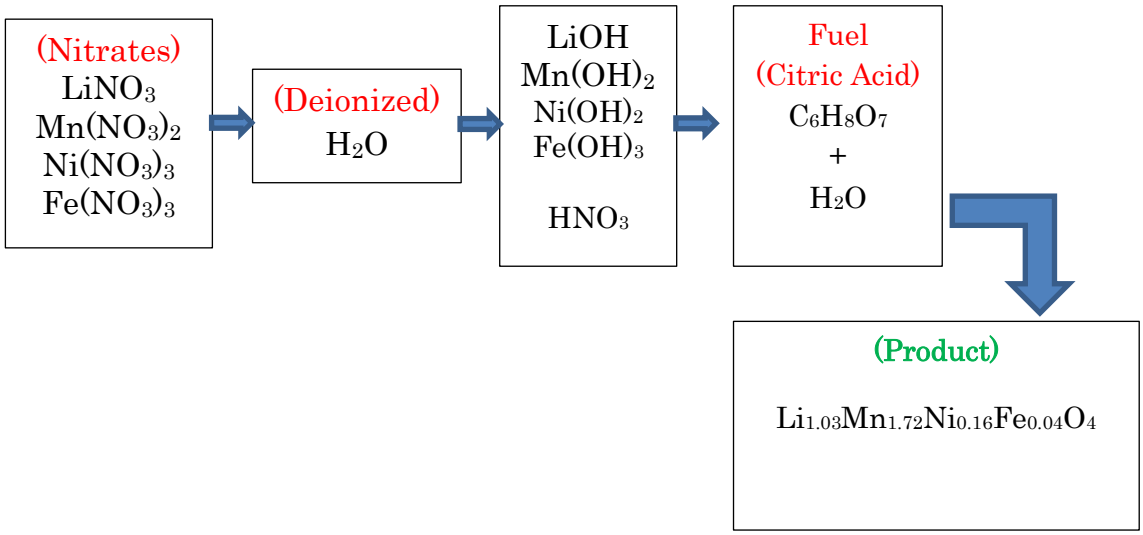
An Appendix is a self-contained addition to the Materials and Methods, although the Appendix is put separately at the end of the paper. In a scientific paper, an Appendix is not a commentary or an adjunct to the Results or the Discussion—it is a detailed explanation that is too long for the Materials and Methods section. An Appendix might contain, for example, a long recipe for a chemical preparation. It might explain a mathematical formula or its derivation, detail a computer program, or diagram the wiring or construction of an apparatus.

Appendices are lettered, and they appear after the References section in a paper. The Appendix has a title and is a stand-alone entity. This means that if an Appendix includes bibliographic citations, then those citations are listed at the end of the Appendix, not in the References section of the main paper.

Exercise

Q1. Write down a paragraph describing the experimental work pertaining to the following reaction(s) to synthesize an amount of the product material:
Type of reaction: Self-Propagating Combustion reaction
Steps performed:

1. (20 g of Nitrates + 40 milliliter H_2O + room temperature + 3 hours mixing).
2. From step 1 + citric acid + 100 ˚C + magnetic stirring for 3 hours.
3. Water vapor out due to heating for 2 hours.
4. Mixture + 400 ˚C = combustion of materials from step 1 and 2.
5. Product (very small particles) + smock + no flame



Synthesis of the material was achieved by a self-propagating combustion reaction. Stoichiometric amounts of $LiNO_3$, $Mn(NO_3)_2$.$4H_2O$, $Ni(NO_3)_2$.$6H_2O$, and $Fe(NO_3)_3$.$9H_2O$ were dissolved in deionized water at room temperature. The solution was then kept on magnetic stirring for 3 h to confirm dissolution of the nitrates. An aqueous solution of citric acid ($C_6H_8O_7$), used as fuel for the combustion reaction, was added to the homogenised mixture at 100 ˚C. Fuel amount was determined from the oxidation to reduction ratio of the reactants. Prior to the combustion, excess water was evaporated from the solution at a moderate temperature (below 150 ◦ C) until a dense solution was obtained. The temperature of the solution was finally raised at a high rate to the combustion temperature to prevent formation of impurities. The combustion reaction was a smoldering (flameless) type and self-propagating, resulting in a fine powdered precursor.

Converting nouns or adjectives to verbs

You can change nouns and adjectives into verbs by adding the suffixes **-ate, -ise, -en and -ify.** Here are some examples:

Author → authorise

Assassin → assassinate

Dark → darken

Class → classify

Remember: The usual spelling rules apply for words ending in **y** (change to **i** before adding the ending), words ending in **e** (remove the **e** before adding the ending) and words ending with a short vowel sound (double the consonant before adding the ending).

Examples: Change the following words from **nouns to verbs**:

Advert, captive, pure, computer, fright, equal, personal, active, author, real, glory, hard, scandal, intense, light, liquid, hospital, false, sad, pressure, motive, terror, simple, straight, note, central, material, legal

Words ending in -tion, -sion, -ssion and -cian

The best way to sort out which spelling to use is by looking at the root word. The most commonly used spelling is **-tion.** This is used for root words that end in **t** or **te**:

Act → action

Medicate → medication

Words will end in **-sion** if the root word ends in **d** or **se**:

Expand → expansion

Tense → tension

Words will end in **-ssion** if the root word ends in **ss** or **mit**:

Express → expression

Permit → permission

Words will end in **-cian** if the root word ends in **c** or **cs** (this ending is used mainly for people's jobs):

Music → musician

Politics → politician

Convert the following **words to nouns**:

Construct, elect, revise, hesitate, confuse, transmit, magic, erode, affect, permit, decide, optic, corrode, discuss, divide, hesitate, suspend, admit, exclude, obsess, mathematics, calculate, object, physics, explode, conclude, inject

Prepositions (حروف الجر): classification

Prepositions can be grouped into different types. Some words (such as **in, on, at**) can be classed as more than one type of preposition, but their classification depends on the rest of the sentence:

Time: **in** the morning, **at** the end of the day

Place: **on** the table, **under** the window

Direction: **to** the doctors, **towards** the edge

Agent/device (e.g. who or how): **by** myself, **with** enthusiasm

Examples: Sort these prepositions into the correct type. Remember, some prepositions belong to more than one type:

above beside upon following inside opposite toward under in without through near on since after by at beneath against with until except off during about beyond from into between as along behind past up

Time	Place	Direction	Agent / Device

Choose correct prepositions to complete these sentences:

1. I usually travel _____ work _____ train.

2. Alex asked if he could play _____ his X-Box _____ the living room.

3. Dr Who travels _____ time _____ his Tardis.

4. _____ the afternoon, we are going shopping _____ my grandparents.

5. Romeo and Juliet was written _____ Shakespeare _____ the 1590s.

6. I will go to the park _____ my friends _____ dinner.

7. _____ the rain, the sun came _____ and we saw a rainbow.

8. Once _____ a time, a beautiful princess was trapped _____ a tower.

Technical Writing

Technical writing is any written form of writing or drafting technical communication used in a variety of technical and occupational fields such as computer hardware and software, engineering, chemistry, physics, aeronautics, robotics, finance, consumer electronics and biotechnology.

Technical documents

Technical writing covers many categories and writing styles depending on the information and audience. Technical documents are not solely produced by technical writers. Almost anyone who works in a professional setting produces technical documents of a variety. Some examples of technical writing include:

Instructions and procedures are documents that help either developers or end users operate or configure a device or program. Examples of instructional documents include user manuals and troubleshooting guides for computer programs, household products, medical equipment, and automobiles.

Proposals. Most projects begin with a proposal, a document that describes the purpose of a project, the tasks that will be performed in the project, the methods used to complete the project, and finally the cost of the project. Proposals cover a wide range of subjects. For example, a technical writer may author a proposal that outlines how much it will cost to install a new computer system, and a teacher may write a proposal that outlines how a new biology class will be structured.

Emails, letters, and memoranda are some of the most frequently written documents in a business. Letters and emails can be constructed with a variety of goals; some are aimed to simply communicating information while others are designed to persuade the recipient to accomplish a certain task. While letters are usually written to people outside of a company, memoranda (memos) are documents written to other employees within the business.

Press releases. When a company wants to publicly reveal a new product or service, they will have a technical writer author a press release, a document that describes the product's functions and value to the public.

Specifications are design outlines that describe the structure, parts, packaging, and delivery of an object or process in enough detail that another party can reconstruct it. For example, a technical writer might diagram and write the specifications for a smartphone or bicycle so that a manufacturer can produce the object.

Resumes and job applications are another example of technical documents. They are documents that are used in a professional setting to inform readers of the author's credentials.

Technical reports are written to provide readers with information, instructions, and analysis on tasks. Reports come in many forms. For example, a technical writer might evaluate a building that is for sale and produce a trip report that highlights his or her findings and whether or not he or she believes the building should be purchased. Another writer who works for a non-profit company may publish an evaluation report that shows the findings of the company's research into air pollution.

Case study is a published report about a person, group, or situation that has been studied over time; also : a situation in real life that can be looked at or studied to learn about something.[38] For example, an individual's challenging situation at his or her workplace and how he or she resolved it is a case study.

Web sites. The advent of hypertext has changed the way documents are read, organized, and accessed. Technical writers of today are often responsible for authoring pages on websites like "About Us" pages or product pages and are expected to be proficient in web development tools.

Tool used in Technical Writing

The following tools are used by technical writers to author and present documents:

Desktop publishing tools or word processors. Word processors such as Scrivener, **Microsoft Word**, Apple Pages, and Open Office Writer are used by technical writers to author, edit, design, and print documents.

Image editing software. Often, images and other visual elements can portray information better than paragraphs of texts. In these instances, image editing software like **Adobe Photoshop** and **Paint** are used by technical writers to create and edit the visual aspects of documents like photos, icons, and diagrams.

Graphing software. In order to portray statistical information like the number of visits to a restaurant or the amount of money a university spends on its sporting programs, technical writers will use graphs and flowcharts. While programs like Microsoft Excel and Word can create basic graphs and charts, sometimes technical writers must produce incredibly complex and detailed graphs that require functions not available in these programs. In these instances, powerful graphing and diagramming tools like Microsoft Visio are used to effectively organize and design graphs and diagrams.

Screen capture tools Technical writers commonly use Screen Capture Tools like Camtasia Studio and Snagit to capture their desktops. When creating instructions for

computer software, it's much easier for a technical writer to simply record themselves completing a task than it is to write a lengthy series of instructions that describe how the task must be performed. Screen capture tools are also used to take screenshots of programs and software running on user's computers and then to create accompanying diagrams.