Physics Factsheet

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Research and Referencing

So, you're going to be an engineer or theoretical physicist? Not without writing your thesis you're not, and for that you need to develop writing skills. Writing essays will help develop the writing skills you are going to need in your career, whatever it may be.

Background Reading

You need to be familiar with your topic *before* you start researching.

Example - "What does a red shifted line spectra tell us about quasars?"

Where do we start? What do you go and look up first?

If you just finished a topic about red shift, line spectra and quasars, you're probably ready to research your answer.

If you have no idea what 'red shift', 'line spectra' or 'quasars' are then forget the question. You won't understand it until you know what these words mean!

Here are some quick notes you might make:

- Red shift – Lengthening of wavelength of light, by the Doppler effect, due to relative motion of object away from observer.
- Line spectra – The frequencies and colours emitted by an atom corresponding to the differences in energy levels of the electron specific to each element of compound.
- Quasar – A distant object emitting large amounts of energy, thought to be large black holes.

Spending time reading basics will save you time writing the essay. It will look better too!

Finding the Information – Start Basic, Build Up

If the topic is totally unfamiliar start with very simple reading.

Now you should know the key words and ideas associated with the question and can do further research on those, even ones not mentioned in the question.

In our example, you might also search *Doppler effect*.

Will you explain the Doppler effect in detail in your essay? Probably not.

Would you try to write an essay on red shifted line spectra without knowing what the Doppler effect is? Please don't.

Once you grasp the idea, build up and find something more technical until you reach a useful level for your essay.

Tip:
All topics look complicated at first if you don't know anything about them. Don't be put off. Start simple and learn what you need to.

What Makes a Good Resource?

Scientific papers and journals are useful because they are peer reviewed, but are often more complex than you will need.

Look for work written by experts, with references to research.

The best way to be sure that the information you are using is correct is to see if other sources agree with it. If two or three separate sources agree, then it is more likely to be correct.

Tips:

- *Physics changes and sources can go out of date.*
- *Just because something is on television or in a book or said by someone famous, it does not mean it is correct.*
- *Newspapers and popular science books and magazines might bend facts to make a story more interesting.*
- *Online wikis can be edited by anyone. Often, they are an excellent place to begin your background reading, but don't reference one in your essay.*
- *Recent sources are better, but Newton's Laws haven't changed in a while so an old textbook would be fine for quoting basic mechanics principles, say. If you're writing about technology, a more up-to-date source is a must.*

Am I a Good Resource?

Sorry, but no, and neither is your teacher.

We know you know things. If I wrote down everything I think I know and then had someone check it, there would be a lot of misconceptions and wrong ideas in there. You can't allow these into your work, so everything needs a reliable, definite source.

Doesn't My Opinion Count?

I hesitate to use the phrase "nobody cares what you think" but…

If your essay is evaluating two methods of measuring the speed of sound, then your thoughts are valid if you prefer one method over the other. However, this is not your *opinion*, it is a reasoned statement, backed up with facts and valid information.

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I think method B is better because…

Now, I care what you've got to say because it is based on evidence in the form of research or maybe even a result of having tried both methods yourself.

I think nuclear power stations are scary.

Well, sorry, I've got to say it. Nobody cares what you think.

Question 1:

Turn the opinion about nuclear power stations into a statement a reader might care about.

Suggested Answer:

After the Fukushima accident, 47 per cent of surveyed UK residents expressed concern over nuclear power compared to 43 per cent who were not very, or not at all concerned. (Poortinga, Pidgeon, Capstick and Aoyagi, 2014)

Things to think about when choosing a source:

***Relevance** – does it help answer the question or provide useful background?*

***Date** – is it recent enough to still be considered correct and useable?*

***Author** – does the person who wrote it have any qualification or experience that makes this writing valid, or is it someone's opinion? Is it linked to a research institution?*

***Audience** – who was it written for? Information in a magazine might be less credible than that presented in a journal or textbook.*

***Bias** – does this have any reason to present a biased version of the information, is it possible there is another agenda? An article on the dangers of mobile phones written by a communications company might not be completely reliable.*

***Level** – do you understand it enough to use the information? Is the information detailed enough to be useful at the level you are writing at?*

***Evidence** – is it based on real data, or does it reference other credible sources to back up the information?*

***Triangulate** – can you fact-check and find this information somewhere else?*

Checklist for a Valid Resource

Question 2:

An article explaining how jet engines work has been published in a popular science magazine. Discuss how credible this source might be.

Suggested Answer:

It may have no references but that doesn't make it bad. Search for the author, they may be an industry expert. It is up to date, but this depends on its sources. If someone has researched old sources then it could be out of date. You should be able to find all the information in the article somewhere else and check the facts.

It is intended for an audience of non-experts. It might lack higher level terminology, but it doesn't make the information incorrect. It is an excellent place to start your own research.

Plagiarism – what is it?

- Copying word for word from a source without making it clear it is a quote.
- Copying work from a peer.
- Using ideas or information (even in your own words) without crediting the source.

Changing words around a bit to make it different to the original…
a) is still plagiarism,
b) shows a lack of understanding,
c) is going to result in an essay that looks like a dropped vase someone taped back together. Badly.

"Surely I don't have to write references when I answer questions normally?"

Actually you do, or you should. But there are concessions for school pupils explaining how batteries work, so most of the time no one expects you to reference. Sometimes you will be asked to reference just for practice.

Basic Referencing

There are a lot of different ways of referencing. If an essay needs a particular style, your essay brief will tell you what it is.

If told to use a specific system, make sure you look at some examples and match that style.

Otherwise just try to include the following information:

Author's name	Some books may only give the editor, so include "Ed." and their name instead. Some webpages do not list an author in which case you can miss this out. Surname followed by initials Surname, A. B, e.g, Nixon, K. S.)
Year it was published	In brackets. For a book, look at the latest date mentioned, there may be more than one edition. For articles or journals, you need to give the actual date it was published if this is known.
Title	In italics or quotation marks Include the edition number if it is a book with more than one version. For articles give the title of the article and the name of the magazine or journal it is from.
Place it was published	Sometimes this is a city or a country, used mostly for books.
Publisher	Mostly for books.
Full web address and accessed or retrieved date	Not just the website to the main page, but the link that takes you to the actual page you used. If you use several pages from the website, each one needs a reference. Give the date you accessed it. Websites can change and so can the information on them. Online publications that will not change may not need a date.
Journal number	Which edition of the journal is it? If it is just a magazine there may be a number, otherwise give the date or month.
Page number	These sorts of references are horribly time consuming, but sometimes necessary. Check if you need to before you go to all the extra work!

Examples

Book:

Authorsurname1, A. A. and Author2, B. B. (Year) *Title in italics*, Publisher information, location of publisher.

Muncaster, R. (1993) *A Level Physics 4th Edition*, Oxford University Press, Oxford.

E-journal:

Author, A., (Date written) *Title in Italics*, Title of Journal, Vol. ***, no. *** [Online]. Retrieved from full URL (accessed Date)

Pagliaro, M. and Meneguzzo, F., (2018, 20 November) *The driving powerofthe electron*, J. Phys Energy, vol. 1, no. 011001, retrieved from https://iopscience.iop.org/article/10.1088/2515-7655/aacd9f/pdf (accessed 3/6/2019)

Note that some systems don't require this accessed date. If in doubt check your exam board guidance for an example and if still unsure, best to include it.

Website (other than journals):

Author-if-known, A. A., (Date written if known/date last updated), Title of website, *title of page in italics*, Retrieved from full URL (accessed Date)

If the author is unknown, start with the title.

Nagaraja, M. P., (2019, June 3) *Black Holes*, NASA Science, Retrieved from https://science.nasa.gov/astrophysics/focus-areas/black-holes (accessed 3/6/2019)

Article from Newspaper or Magazine:

Author, A. (Date of publication) *Title of the article*, Title of the Newspaper

Redd, N. T., (2019, May) *The Fight Over Who Really Found The First Exoplanet*, Discover Magazine,

Quite often the titles in *italics* can also be written in 'inverted commas' instead.

These full references go alphabetically in a list at the end of your essay.

If any of the information is missing, just give what you can, e.g. the full web address, date accessed, and title if nothing else, but are you sure the source is reliable?

Citations

We also need to see which information came from which source using citations. Otherwise you risk plagiarism. There are three main ways to do this:

1) Citation after the information:

   If citations are not included in the essay, there is a risk of plagiarism even with a reference list (Nixon, 2019).

2) Refer to author(s) in the essay:

   According to Nixon, (2019) citations must be used in addition to references in order to avoid plagiarism.

3) Include a quotation

   "It is not enough just to list your sources. We need to know which idea came from which source, otherwise you risk plagiarism." (Nixon, 2019)

   Remember that the information needs to be paraphrased, or written in your own words. If you use someone's exact words this must be written as a quote.

Citing Websites

This can be tricky if the author's name and date is not known. In which case you cite the link and the date accessed, for example

Nasa (https://science.nasa.gov/astrophysics/focus-areas/black-holes (accessed 4/6/19) states that a star's core mass must be at least three times the mass of the Sun to become a black hole.

More Than One Author?

Do the same as above, but list all the surnames, up to three.

Some articles may have a lot of authors. For more than three it is acceptable to write: (Nixon, *et al*., 2019).

Note the italics and full stop and comma together.

The surname used is the first alphabetical surname of the group, not necessarily the greatest contributor or lead researcher. It might not be fair, but the rest get mentioned in the reference list.

Tip:
Make your reference list as you go. Every time you make a citation, write the reference before you forget.

Trying to find all those websites and books you used and referencing them once you've finished is a nightmare!

Referencing Individual Pages

Unless you are particularly told to, just reference the book or source as a whole. You might have to reference page numbers later on so enjoy this while it lasts.

If you use multiple pages from a single website you should really reference each one with the link to the specific page.

Different articles referenced from within the same magazine or journal should also be given separate references as they will have different authors and titles.

Quotations

In technical writing it is better to show that you can explain something. A quote shows only that someone else can and that you can read. Use them sparingly if at all. Use quotation marks and cite the source. If on a new line, indent the quotation.

"Quotes are like raisins in chocolate. A few is novelty. Too many, and it all crumbles."
(Nixon, 2019)

Question 3:

a) Find an online source that indicates what mass of star is required for the star to become a black hole. Use the checklist to ensure this is a reliable source.

b) Now find a second reliable source and triangulate your information.

c) Imagine you are making a researching help sheet and these sources will be an example. You now need to find a source that is an example of a less reliable source. List all the indicators that tell you this is a less useful source.

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Notes on answers

a) Work through the checklist:

Relevance – Your sources need to contain the actual information you need – this is around 3 solar masses.

Date – This sort of information is based on observational data as well as calculated estimates and as such can change. Ideally this would be in the last few years, no more than ten.

Author – Either the source needs to be a journal article or written by someone with some background or who has used good sources themselves.

Audience – Not that a book written for a non-expert audience would lie, but it might not be quite as precise. e.g say it is 'much bigger than the sun' rather than give a number.

Bias – This is probably not a problem in this case, but just check that the source has no obvious reason to be misleading.

Level – Make sure it is not too technical or too simple.

Evidence – Again is it based on an interview with an expert, or written by an expert, or does it reference related scientific papers? Can you check its sources?

b) Did the second reliable source give you the same information? If it did then that's good. If there was a difference in the numbers, can you tell why? Was one just more precise than the other? Or more recent?

c) Use the checklist again. Does it not actually give you a number you can use? Is it a very old source based on old research? Is it written by an author you cannot verify, for instance a blog, website or magazine not written by or aimed at experts? Is it biased? An article written by someone trying to prove the universe is only 6000 years old may not provide accurate evidence and data.

Question 4:

Write a correct reference for the sources you used in **Question 3**.

Look at the examples and make sure your references are in the same format as these.

References

Nagaraja, M. P., (2019, June 3) *Black Holes*, NASA Science, Retrieved from https://science.nasa.gov/astrophysics/focus-areas/black-holes (accessed 3/6/2019)

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Ritchie, H. (2017, July 24). *What was the death toll from Chernobyl and Fukishima?*. Retrieved from https://ourworldindata.org/what-was-the-death-toll-from-chernobyl-and-fukushima

Shellenberger, M. (2018, June 11). *If Nuclear Power Is So Safe, Why Are We So Afraid Of It?*. Retrieved from https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#17bb2b266385 (accessed 1/6/2019)

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