Survival Handbook in the Time of an Energy Crisis

Key Stage 4 Programme

Pupil Name	
Handbook Designed by	Dr Donglai Mao

Timetable and Assignment Submission

Timetable – Tutorials

1			
2			
3			
4			
5			
6 (Feedback)			

Timetable – Homework Assignments

Tutorial 1		
Tutorial 2		
Tutorial 3		
Tutorial 4		
Tutorial 5		

Assignment Submission – Lateness and Plagiarism

Lateness	
Submission after midnight on 9th August	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

The Brilliant Club KS4 Programme – Pupil Feedback Report

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at undergraduate level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE
3rd	40-49	Performing to a good standard at GCSE
Working towards a pass	0-39	Performing below a good standard at GCSE
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Name of PhD Tutor			
Title of Assignment			
Name of Pupil			
Name of School			
ORIGINAL MARK / 100		FINAL MARK / 100	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the PhD tutor should give an explanation in this section:

Learning Feedback Comment 1 - *Enter Key Learning Priority Here*	
What you did in relation to this Key Learning Priority *Enter feedback here*	How you could improve in the future *Enter feedback here*
Learning Feedback Comment 2 – *Enter Key Learning Priority Here*	
What you did in relation to this Key Learning Priority *Enter feedback here*	How you could improve in the future *Enter feedback here*
Learning Feedback Comment 3 – *Enter Key Learning Priority Here*	
What you did in relation to this Key Learning Priority *Enter feedback here*	How you could improve in the future *Enter feedback here*
Resilience Comment	
How you showed learning resilience during the course *Enter feedback here*	How you could build learning resilience in the future *Enter feedback here*

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Course Rationale

Where does electricity that we use every day come from? If we have run out of traditional resources for generating electricity, are there any other ways we can use to provide power for ourselves? Who are scientists? What do they do? Do you know how to carry out scientific researches? You will have answers to some of the questions by the end of this course.

This course will suit a wide range of students who are interested in energy generation and research. It will introduce the mysterious scientific research world to you to begin with. You will be guided with basic knowledge and skills for joining a being a scientist, and you will be ready for carrying out scientific research. By exploring the world of energy resources, you will develop knowledge in a broad range of potential resources we can use to generate electricity in our daily life.

With the basic idea of different energy origins, you will start investigating one of the most exciting and popular research topic in energy field: fuel cells. You will learn the working principles of fuel cells and gain insight into different types of fuel cells. You will also learn how to critically evaluate different types of fuel cells. Afterwards, you will gain insight into one of most promising types of fuel cells: Proton Exchange Membrane Fuel Cells (PEMFC). You will also learn the exciting applications of it in our modern world, the commercial process of it and the challenges we are facing.

You will then have the opportunity to visit one of the world's best universities: University of Southampton. You will be able to talk to scientists in the university and witness how fuel cell research is carried out in a real research lab. After having your toolbox filled with everything you need, you will be asked to set out on the voyage of finding better energy resources and answer the question:

How would fuel cells fit in the energy landscape now and in the future?

Mark Scheme Table

	Skills	1st (70-100)	2:1 (60-69)	2:2 (50-59)
Subject knowledge	Knowledge and Understanding	○ All content included is relevant to the specific question ○ Good understanding of all the relevant topics. ○ Scientific terms are defined and used accurately throughout ○ Clear justification on how the content included is related to the specific issues that are the focus of the assignment	○ Most of the content included is relevant to the specific question ○ Good understanding of most the relevant topics ○ Scientific terms are used accurately but not always clearly defined. ○ Adequate justification on how the content included is related to the specific issues that are the focus of the assignment	○ Some of the content included is relevant to the specific question ○ Good understanding on some of the relevant topics but occasional confusion on others. ○ Scientific terms are used mostly accurately with occasional confusion and often not defined. ○ Some justification on how the content included is related to the specific issues that are the focus of the assignment
Critical thinking	Research and Evidence	○ Inclusion of rich sources of research findings, data, quotations or other sourced material as evidence for the claims ○ Use evidence to support claims consistently clearly and convincingly ○ Evidence of further reading beyond materials provided which were used in an appropriate context ○	○ Inclusion of adequate sources of research findings, data, quotations or other sourced material as evidence for the claims ○ Use evidence to support claims mostly clearly and convincingly ○ Evidence of further reading beyond materials provided	○ Inclusion of some sources of research findings, data, quotations or other sourced material as evidence for the claims ○ Use evidence to support claims at times clearly and convincingly ○ Limited evidence of further reading beyond materials provided
	Developing an Argument	○ Argument/proof exceptionally well-developed and well-justified ○ Makes links effectively between subjects that have not previously been associated ○ Uses concepts from the tutorials in an unfamiliar context, and does so accurately and	○ Argument/proof clear and well-developed and position justified ○ Some evidence of linking subjects that have not previously been associated ○ Use some concepts from the tutorials in an unfamiliar context, but not always accurate ○ Analysis of content	○ Argument/proof clear but not well-developed ○ Limited evidence of linking subjects that have not previously been associated ○ Limited use of concepts from the tutorials in other contexts ○ Some analysis of content to support the argument

		confidently. ○ Content is analysed effectively to support the argument	to support the argument	
	Critical Evaluation	○ Moved beyond description to an assessment of the value or significance of what is described ○ Evaluative points are explicitly justified ○ Effective critiques on the reliability of sources provided	○ Mostly description but some assessment of the value or significance of what is described ○ Evaluative points are mostly explicitly justified ○ Some evidence of critiques on the reliability of sources provided	○ Only description with minimal assessment of the value or significance of what is described ○ Evaluative points are at times explicitly justified ○ Limited evidence of critiques on the reliability of sources provided
Written communication	Structure and Presentation	○ Ideas are presented in a logical structure that is appropriate for the assignment ○ The introduction clearly outlines the aim of the poster and the essay ○ The conclusion summarises all the main points clearly and concisely ○ Figures, tables and graphs are effectively constructed including appropriate headings, units and scales. ○ All sources are referenced correctly in an agreed format	○ Ideas are presented in a structure that is mostly appropriate for the assignment ○ The introduction adequately describes the aim of the poster and the essay ○ The conclusion summarises most of the main points clearly ○ Most figures, tables and graphs are well constructed ○ Most sources are referenced correctly in an agreed format	○ Ideas are presented in a structure ○ The introduction mentions the aim of the poster and the essay ○ The conclusion summarises some of the main points clearly ○ Some figures, tables and graphs are well constructed but contains some errors ○ Some sources are referenced correctly in the agreed format with occasional errors

	Language and Style	○ No spelling, grammar or punctuation errors ○ Units and significant figures are presented accurately throughout ○ Writing style consistently clear, appropriate for scientific documents and easy to follow ○ Accurate and consistent use of technical language and vocabulary	○ Minimal spelling, grammar or punctuation errors ○ Units and significant figures are presented accurately throughout ○ Writing style mostly clear, appropriate for scientific documents and easy to follow ○ Some attempts of using technical language and vocab alary, but not always accurate	○ Some spelling, grammar or punctuation errors ○ Units and significant figures are presented accurately throughout with occasional errors ○ Writing style moderately clear, appropriate for scientific documents and easy to follow ○ Use of simple language and vocabulary effectively but struggles to use technical language

Glossary of Keywords

Word	Definition	In a sentence
Hypothesis		
Renewable		
Non-renewable		
Fuel Cell		
Electrode		
Anode		
Cathode		
Catalysts		
Electrolyte		
PEMFC		

Tutorial 1 – Scientific Research: Why and How?

What is the Purpose of Tutorial 1?

- To discuss the meaning of scientific research.
- To understand scientific method and the detail of the process.

Activity 1.1

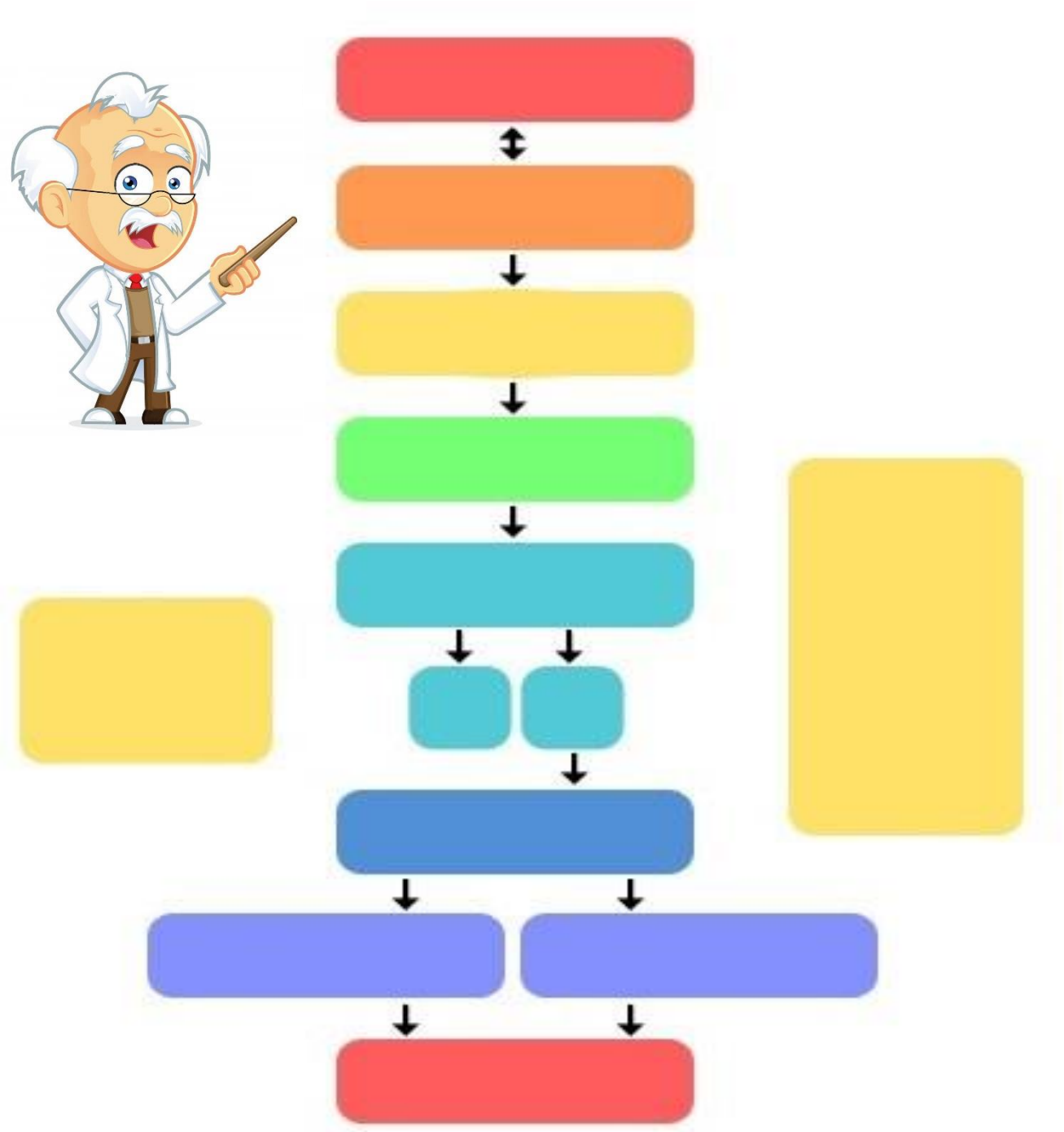
1. What is the nature of Scientific Research?

2. Who does scientific research? Why do we need to do scientific research?

Activity 1.2

1. What is Scientific Method? How many types of Scientific Method do you think exist?

2. What are the key elements of a scientific method? Look at the table below, try to fill in as many elements as possible.



3. What is the relationship between those elements? Are there more than one relationships between them?

Assignment 1

Baseline test: Research different types of energy resource, and make a review poster to summarise them. You should compare the origins, advantages and disadvantages of each type of energy resources.

There are many websites you can visit for guidance on how to make a review type poster. Below are some websites which shows you how to make a poster, examples of academic posters and assessment guidelines for poster presentations:

Instructions on poster preparation:

https://blogs.umass.edu/honors291g-cdg/literature-reviewposter-presentation-guide/

http://researchposter.blogspot.co.uk/p/poster-presentation-and-literature.html

https://www.tcd.ie/library/support/subjects/nursing-midwifery/assets/Literature%20Review%20Guidelines%202013-2014%20Final.pdf

Examples:

http://phdposters.com/gallery.php

Assessment guidelines:

https://www.sussex.ac.uk/webteam/gateway/file.php?name=assessment-criteria-poster-2012-1.pdf&site=23

Tutorial 2 – Energy resources

What is the Purpose of Tutorial 2?

- To discuss the existing non-renewable and renewable energy resources.
- To compare the advantages and disadvantages of existing energy resources.
- To explore alternative energy resources.

Activity 2.1

1. Draw every non-renewable energy resource you know around the light bulb to keep it lit.

2. What are the origins, advantages and disadvantages of each of the non-renewable energy resources? Write them down around the light bulb to help it choose which energy resource to use to stay bright.

Activity 2.2

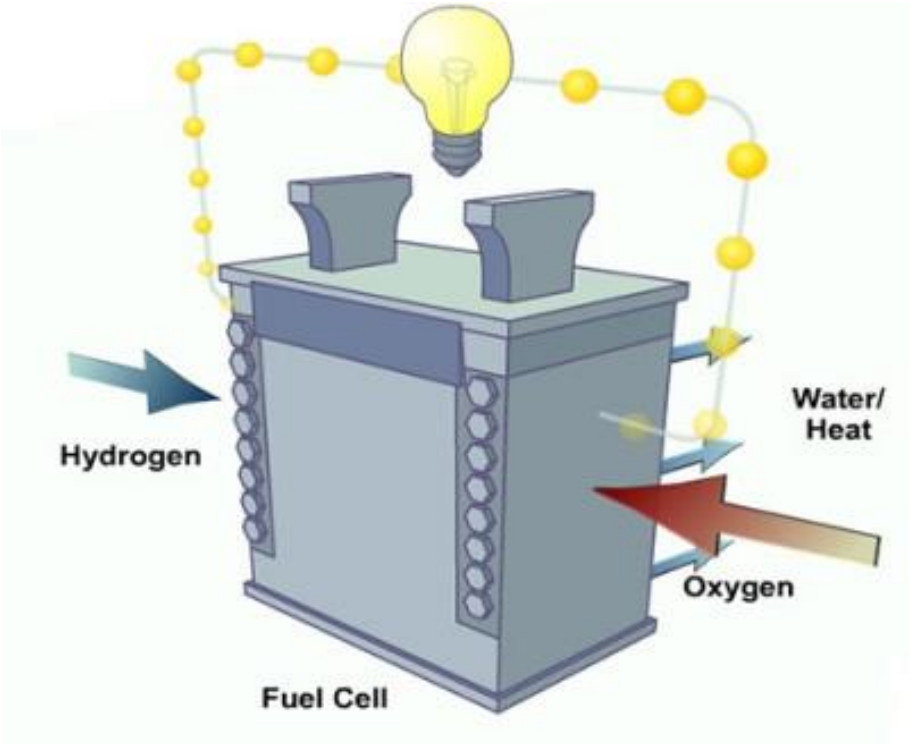
1. Draw every renewable energy resource you know around the light bulb to keep it lit.

2. What are the origins, advantages and disadvantages of each of the renewable energy resources? Write them down around the light bulb to help it choose which energy resource to use to stay lit.

Assignment 2

Research fuel cells in more detail, and write an essay of around 400 words focusing on fuel cells. This could include the history, advantages and disadvantages of fuel cells.

Tutorial 3 – Fuel Cells



What is the Purpose of Tutorial 3?

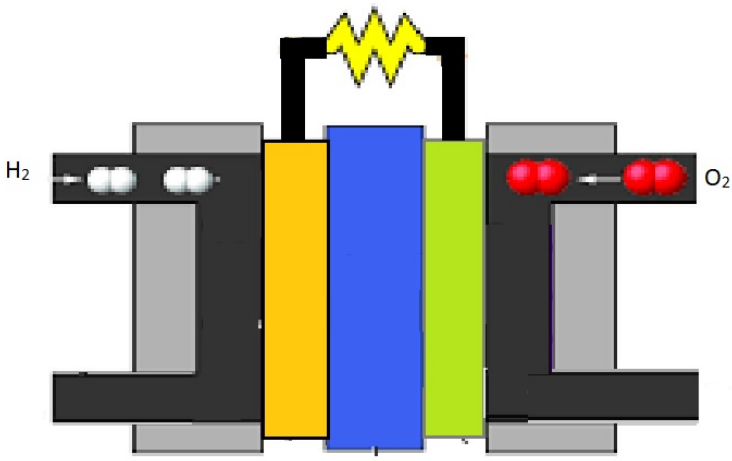
- To understand the working principles of fuel cells.
- To discuss the history, advantages and disadvantages of fuel cells.
- To learn about different types of fuel cells and their potential applications.

Activity 3.1

1. What is fuel cell?

2. What does a fuel cell consist of? Draw all necessary elements of a fuel cell below.

3. Write down what you think that happens to hydrogen and oxygen when they pass through a fuel cell? How is electricity generated in a fuel cell? You can also draw your answers on the picture on next page.



4. What are the differences between fuel cells and batteries?

Activity 3.2

1. Draw a timeline with history of fuel cells along it.

2. Write down the advantages and disadvantages of fuel cells in the table below.

Advantages	Disadvantages

Activity 3.3

How many types of fuel cells do you think that exist currently? Can you write their name down in the table?

Fuel Cell Types	
Electrolyte	
Operating Temperature	
Charge Carrier	
Prime Cell Components	
Product Water Management	
Gaseous/Liquid Water formation side	

Usable rejected Heat recovery	
Fuel	
Applications	

Assignment 3

Choose any activity in Tutorial 4, and prepare a 5-min presentation which would answer all questions in the corresponding activity.

Tutorial 4 – Proton Exchange Membrane Fuel Cells (PEMFC or PEM)

What is the Purpose of Tutorial 4?

- To learn material requirements for different parts of PEMFC.
- To discuss PEMFC application in industry.
- To introduce current research status and challenges of electrode material for PEMFC.

Activity 4.1

1. What are the basic components of PEMFC?

2. What is the function of each component of PEMFC?

3. Based on the function of each component, what properties should a material have in order to serve as certain part of PEMFC?

Activity 4.2

1. Have you ever heard about fuel cell car? Do you know what role PEMFC plays when it comes to powering a car?

2. Have you ever heard about Coradia iLint? What does PEMFC do in Coradia iLint?

3. Write down other applications you know about PEMFC.

Activity 4.3

1. What challenges are PEMFC facing in terms of commercialisation?

2. Write down common electrode material candidates for PEMFC and their problems.

3. Think out of box, can you think of any other candidates that can be used as electrode material for PEMFC?

Assignment 4

Send me your first draft poster and essay for the final assignment before tutorial 5.

Tutorial 5 – Visiting University of Southampton

What is the Purpose of Tutorial 5?

- To understand how PEMFC research is carried out.
- To listen to academic research presentation to learn about current research trend of PEMFC and to improve presentation skills.
- To visit university and be inspired about higher education.

Final Assignment Title:

How would fuel cell fit in the energy landscape now and in the future?

Details of final assignment:

Final assignment consists of two parts: an academic poster (A2 in size, 60%) and an essay (800-1000 words, 40%). You will produce both work as though you are a part of research group solving energy problems for our planet from a scientific point of view. Both parts should include elements of your own research. You should demonstrate good understanding of fuel cells and the ability to carry out literature review in order to form your own opinion in order to answer the question in an analytical and scientific manner.

You can choose a specific type of fuel cell of your interest to answer the above question. You can also compare different types of fuel cells at the same time and discuss how they would develop to fit in the energy landscape from now on. You should show awareness of the latest research developments in fuel cells. Questions you could look into to help you develop your own opinion:

- What is the current situation of energy resources?
- What kind of problems are we facing using the current energy resources?
- What are fuel cells?
- What are the advantages of fuel cells?
- What are the disadvantages of fuel cells?
- What is the current situation for fuel cells in industry and academia?
- What challenges are we facing for fuel cell industrialisation?
- Are there any researches or actions being carried out to overcome those challenges?
- Do you think fuel cells can be the future energy for our planet? Why?
- How can you justify your opinion?

Follow the assessment guidelines on page 14 to help you prepare your poster to the highest possible standard.

The essay must include title, your full name, school, keywords, page numbers and references. For the main content of your essay, the font should be Times New Roman, size 12.

Tutorial 6 – Feedback tutorial

What is the Purpose of Tutorial 6?

- To receive feedback on final assignments.
- To share examples of best practice with the other pupils in your group.
- To write targets for improvement in school lessons.
- To reflect on the programme including what was enjoyed and what was challenging.

Final assignment feedback

What I did well…	What I could have improved on…
•	•
•	•
•	•

My target for future work is…

Reflecting on Uni Pathways

What did you most enjoy about Uni Pathways?
• • •

What did you find challenging about the programme?	How did you overcome these challenges?
• • •	• • •

Appendix 1 – Referencing correctly

When you get to university, you will need to include references in the assignments that you write, so we would like you to start getting into the habit of referencing in your Brilliant Club assignment. This is really important, because it will help you to avoid plagiarism. Plagiarism is when you take someone else's work or ideas and pass them off as your own. Whether plagiarism is deliberate or accidental, the consequences can be severe. In order to avoid losing marks in your final assignment, or even failing, you must be careful to reference your sources correctly.

What is a reference?

A reference is just a note in your assignment which says if you have referred to or been influenced by another source such as book, website or article. For example, if you use the internet to research a particular subject, and you want to include a specific piece of information from this website, you will need to reference it.

Why should I reference?

Referencing is important in your work for the following reasons:

- It gives credit to the authors of any sources you have referred to or been influenced by.
- It supports the arguments you make in your assignments.
- It demonstrates the variety of sources you have used.
- It helps to prevent you losing marks, or failing, due to plagiarism.

When should I use a reference?

You should use a reference when you:

- Quote directly from another source.
- Summarise or rephrase another piece of work.
- Include a specific statistic or fact from a source.

How do I reference?

There are a number of different ways of referencing, and these often vary depending on what subject you are studying. The most important to thing is to be consistent. This means that you need to stick to the same system throughout your whole assignment. Here is a basic system of referencing that you can use, which consists of the following two parts:

1. **A marker in your assignment**: After you have used a reference in your assignment (you have read something and included it in your work as a quote, or re-written it your own words) you should mark this is in your text with a number, e.g. [1]. The next time you use a reference you should use the next number, e.g. [2].
2. **Bibliography**: This is just a list of the references you have used in your assignment. In the bibliography, you list your references by the numbers you have used, and include as much information as you have about the reference. The list below gives what should be included for different sources.

    a. **Websites** – Author (if possible), title of the web page, website address, [date you accessed it, in square brackets].

    E.g. Dan Snow, 'How did so many soldiers survive the trenches?', http://www.bbc.co.uk/guides/z3kgjxs#zg2dtfr [11 July 2014].

    b. **Books** – Author, date published, title of book (in italics), pages where the information came from.

    E.g. S. Dubner and S. Levitt, (2006) *Freakonomics*, 7-9.

    c. **Articles** – Author, 'title of the article' (with quotation marks), *where the article comes from* (newspaper, journal etc.), date of the article.

    E.g. Maev Kennedy, 'The lights to go out across the UK to mark First World War's centenary', Guardian, 10 July 2014.

Appendix 2 – Using the VLE

VLE username	
VLE password	

Please remember the following key details…

- You are able log into the VLE either through the link on our website (www.thebrilliantclub.org) or going directly to the VLE site at (https://portal.thebrilliantclub.org/sign-in).
- Please update your profile with your full name and email address- this will allow you to retrieve forgotten passwords or usernames
- If you forget your log-in details you can request them to be emailed to you by clicking the link on the VLE home page. (If you are still having problems you can email: schools@thebrilliantclub.org)

What is the VLE?

The VLE is a virtual learning environment for all pupils on Uni Pathways it is used for:

- messaging your tutor
- submitting homework
- submitting your final assignment
- accessing resources for your tutorials
- finding out more information about university and careers

How should I use the VLE?

The VLE is a professional academic environment in which pupils are able to message their PhD Tutor. Here are a few things to consider:

- Ensure you keep a professional tone in the messages you send to your tutors.
- Ensure you always reply to your tutors in a timely manner.
- Thank your tutor for the effort they are putting in to give you your feedback etc.
- Submit all homework to your tutor on time.

IMPORTANT: Final assignment

- When you submit your final assignment, please remember that you need to do so through the 'My Activities' tab and not as an attachment to a message.

Notes

Notes

Notes

Survival Handbook in the Time of an Energy Crisis

researchersinschools.org