

Science Department

**PHYSICS**

# CRITERIA: K, IP & EC

School: **530 End of Semester 2 2011**

Subject: **Instrument 5***–***Extended Research Task**

**Topic: Unit 5: NUCLEAR ENERGY**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| **RESULTS****(transferred from criteria sheet)** | **KCU** |  | **IP** |  | **EC** |  |

**CONTEXT:**

Since the discovery of radioactivity, the role of nuclear physics has grown both in impact and in application. Apart from nuclear power as a possible solution to an energy hungry population living in a world in which global warming is becoming a global threat, radioactivity is finding a valid place in medicine, the control of microscopic organisms, archaeology and in many other areas. Associated with this is a heightened need for waste disposal and safe handling practices. There is considerable fear and suspicion about nuclear energy.

**THE GENRE:**

You are required to prepare your assignment in the persuasive exposition genre. In a ***persuasive exposition*** ERT you have to argue for a ‘thesis statement’ that you will generate and provide evidence to justify your claims.

**THE FORMAT:**

Present your response in a multi-modal seminar

* about 5-7 minutes in length (Year 11: 3-5 minutes)
* include a power point presentation of minimum 10 slides
* submit slides and script per slide (using notes section of PowerPoint)

**CONDITIONS:**

* Approx. 3 weeks of in-class time and home time.
* Individual presentation

**PHASES:**

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| Phase | Description | Due Date | Signature |
| 1. ***Research***
 | ***Ongoing Phase***Evidence of research related to topicBibliography – keep an electronic copy of references. | ongoing |  |
| 1. ***Thesis statement***
 | After initial research you should be able to generate a thesis statement and list 3 arguments that support your thesis and at least one limitation or counter-argument | Week 4 |  |
| 1. ***Draft***
 | On this date you will submit your slides and notes for comment. You will receive some written feedback via a checklist. | Week 5 |  |
| 1. ***Presentation Day***
 | You will be assigned a day for your presentation in Week 6. You will submit a copy of the slides & notes to the teacher before your presentation, one slide per page. | Week 6 |  |

**Other Information:**

* You should follow the format for a Persuasive Exposition Essay as laid out on the “How to Write a Deadly ERT” website (<http://seniorphysics.com/physics/ert.html>)
* Remember to change this so paragraphs align with slides.
* Keep an electronic log of websites visited/used.
* You may utilise BIBME for referencing (<http://www.bibme.org/>)

**STUDENT OWNERSHIP STATEMENT:**

I, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (student’s name), declare that this assignment is my own work. I have not plagiarised work from other students or other sources. Any help received has been credited in the Bibliography.

I understand the schools policy on late assessment and take full responsibility for failing to hand work in on time.

Student’s signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

**THE STIMULUS**

While the list below is not prescriptive or exhaustive it indicates a number of topics that might be considered.

You may elect another topic that relates to Nuclear Science but this should be discussed with your teacher before the end of the first week after the assignment has been issued.

1. The use of radiation for the treatment of foods is an effective and safe way to extend the shelf life of perishable foods and address an impending crisis in food shortages in the world today.
2. The application of nuclear medical technology is an important adjunct to diagnostic medicine and provides an effective means for the monitoring and treatment of disease. While in everyday life excess radiation is a hazard, there are some diseases that are readily treatable using radiation. But which form of radiation is preferable, and why this as opposed to others. Explain the relevant physics. How does this kind of exposure work, and how does it help? What are the side effects if any (remembering that this is a physics, not biology assignment)? How do the medical bods measure exposure? How does the dosage reduce with distance and depth of penetration? What are the formulas used by the medical physicist? What are they doing with the equipment used at the cutting edge of technology and how does this reduce dangers and side effect, if at all.
3. As a source of energy, nuclear energy provides a safer alternative than current fossil fuel technology for the production of energy for large-scale consumption. Compare energy outputs and fuels.
4. The biggest problem for supporters of nuclear power generation is what to do with the wastes and how to convince the public that the wastes can be disposed of safely. How long will it remain and how should it be stored or dealt with?
5. Hiroshima! Enrico Fermi found out in 1939 that uranium could be split into two fragments to release huge amounts of energy. He said it was lucky that nuclear fission had not been discovered five years earlier. What did he mean by this and what possible consequences could have arisen?
6. Nuclear power plant accidents. Research a specific nuclear accident and describe what went wrong and what we can learn from it. E.g. Chernobyl, Fukishima, Three Mile Island You could compare Fukushima Daiichi problem to Chernobyl because the nature of the problems were fundamentally different.
7. Some of the most [serious nuclear and radiation accidents](http://en.wikipedia.org/wiki/Nuclear_and_radiation_accidents_by_death_toll) in the world have involved Soviet nuclear submarine mishaps. Notable nuclear submarine accidents include:
* [*K-19*](http://en.wikipedia.org/wiki/Soviet_submarine_K-19), 4 July 1961, the reactor almost had a meltdown and exploded, resulting in 8 deaths and more than 30 other people being over-exposed to radiation The events on board the submarine are dramatized by the film [*K-19: The Widowmaker*](http://en.wikipedia.org/wiki/K-19%3A_The_Widowmaker).
* [*K-219*](http://en.wikipedia.org/wiki/Soviet_submarine_K-219), 1986, the reactor almost had a meltdown. [Sergei Preminin](http://en.wikipedia.org/wiki/Sergei_Preminin) died after he manually lowered the control rods, and stopped the explosion. The submarine sank three days later.
1. How is nuclear science like alchemy? Are there any useful transmutations to make a new, more valuable substance?
2. Out in space, the use of radiation as a power source or investigative tool is of less concern that it is on our little, mostly blue, planet, especially so given the masses of radiation and cosmic rays that are already there as a result of the action of the sun. You might investigate the quantities and type of radioactive material used in spaceships, and quantify the energy they provide, as well as the period over which this energy is provided, and might compare this to what would otherwise need to be sent out into space to achieve the same result, if indeed other options are realistic. You could compare this to using solar energy, and the effect of moving further away from Sol.
3. Our growing population means we are facing an energy crisis. If it was proposed to build a nuclear power plant here in Townsville, what would you recommend and why? There are different kinds of nuclear reactors. Each has its strengths and weaknesses. You could do a comparative analysis of these and consider any that are on the drawing board at present. Which is safest? Which is cheapest? This presentation would at least cover the basics of controlled nuclear reaction, and describe not only the components of an operating plant – control rods, fuel rods, and the way in which these interact in an actual plant – but will consider critical distances and the potential hazards.
4. Some nuclear reactions are perfectly natural and utilised around the home or in industry. What are some applications of natural nuclear decay? Radiation technology is used in medical, industrial and forensic fields. Choose one and outline how it works, the risks and recommendations of this application.
5. Using the rate of decay of Carbon 14 atoms is a useful tool, but some say it is as much art as science. Why might this be? Your presentation should include equations, scientific assumptions, and limitations of the model.
6. Nuclear fusion powers the Sun. Can we reproduce and harness this energy? The attempt to extract energy from nuclear fusion is a dream for mankind because it could power the world with hydrogen extracted from water. The magic energy bullet. But it ain’t so easy. Why? Tokomak was the first fusion reactor built, and has come ahead in leaps and bounds. But is it enough?
7. There was a lot of controversy about the first run of the LHC (Large Hadron Collider) in 2009. Was there cause for concern? What other particle accelerators are available?
8. ANOTHER TOPIC DECIDED BY YOU

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|  | **A** | **B** | **C** | **D** | **E** |
| **Establishing conducting and managing an investigative process.** |
| **IP** | 1. Formulation of justified significant questions/hypotheses which inform effective and efficient design, refinement and management of investigations  | Formulation of justified questions/hypotheses which inform design and management of investigations  | Formulation of questions and hypotheses to select and manage investigations  | Implementation of given investigations  | Guided use of given procedures  |
| **Analysis of data and discussion.** |
| **IP** | 3. Systematic analysis of secondary data to identify relationships between patterns, trends, errors and anomalies.  | Analysis of secondary data to identify patterns, trends, errors and anomalies.  | Analysis of secondary data to identify obvious patterns, trends, errors and anomalies.  | Identification of obvious patterns and errors.  | Recording of data.  |
| **KCU** | 1. Reproduction and interpretation of complex and challenging concepts, theories and principles  | Reproduction and interpretation of complex or challenging concepts, theories and principles  | Reproduction of concepts, theories and principles  | Reproduction of simple ideas and concepts  | Reproduction of isolated facts  |
| 2. Comparison and explanation of complex concepts, processes and phenomena  | Comparison and explanation of concepts processes and phenomena  | Explanation of simple processes and phenomena  | Description of simple processes and phenomena  | Recognition of isolated simple phenomena  |
| 3. Linking and application of algorithms, concepts, principles, theories and schema to find solutions in complex and challenging situations.  | Linking and application of algorithms, concepts, principles, theories and schema to find solutions in complex or challenging situations.  | Application of algorithms, principles, theories and schema to find solutions in simple situations.  | Application of algorithms, principles, theories and schema.  | Application of simple given algorithms.  |
| **Evaluation and conclusion.** |
| **EC** | 1. Analyses and evaluates complex scientific interrelationships  | Analyses complex scientific interrelationships  | Describes scientific interrelationships  | Identifies simple scientific interrelationships  | Identifies obvious scientific interrelationships  |
| 2. Explore scenarios linked to the research focus, suggesting possible outcomes, and generates justified conclusions/recommendations.  | Explains scenarios linked to the research focus, suggesting possible outcomes, and discuss conclusions/recommendations.  | Describes scenarios linked to the research focus, suggesting possible outcomes with statements about conclusions and recommendations.  | Identifies scenarios linked to the research focus or suggests possible outcomes.  | Makes statements about outcomes  |
| **Communication** |
| **EC** | 3. Discriminating selection, use and presentation of scientific data and ideas to make meaning accessible to intended audiences through innovative use of range of formats.  | Selection, use and presentation of scientific data and ideas to make meaning accessible to intended audiences in range of formats.  | Selection, use and presentation of scientific data and ideas to make meaning accessible in range of formats.  | Presentation of scientific data or ideas in range of formats.  | Presentation of scientific data or ideas.  |

**Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**