Resource pack

# Instructions for candidates

# This assessment applies to the assignment for National 5 Physics.

**This assignment is worth 20 marks. This is 20% of the overall marks for the Course assessment. The Course will be graded A–D.**

The assignment assesses the following skills, knowledge and understanding:

* applying knowledge of physics to new situations and interpreting information
* selecting information and presenting information appropriately in a variety of forms
* processing the information (using calculations and units, where appropriate)
* drawing valid conclusions and giving explanations supported by evidence/justification
* communicating findings/information

**In this assessment, you will have to investigate a relevant topic in physics and communicate your research findings in a report. The topic must have an application with an effect on the environment/society. This must relate to a key area of the National 5 Physics Course. Your assessor will let you know how the Assignment will be carried out and any required conditions for doing it. Your report must be completed independently.**

**The assignment has two stages:**

* a research stage
* a communication stage

**In the course of your assignment, you are required to:**

* **choose, with support, a relevant topic in physics that has an effect on the environment and/or society**
* **devise an appropriate aim**
* **describe the relevant application(s) of physics and explain the effect on the environment/society**
* **research the topic by selecting, processing and presenting relevant data/information**
* **draw a conclusion**
* **describe underpinning physics knowledge and understanding and explain its relevance to the topic researched**
* **communicate the findings of the research in a report**

### Research stage

You need to choose a relevant topic in physics to investigate. The topic must have an application which has an effect on the environment/society. Your assessor will help you to choose a suitable topic.

Once you have chosen your relevant topic, you need to decide the specific aspect which you want to research. This will become the aim of your assignment. The aim may change during the research stage of your assignment depending on what information you find.

Most of the work in this stage is to gather data/information. This could come from the internet, books, published articles or extracts, journals, experiments/practical activities, or any other appropriate source.

Your information/data could include, for example: statistical, graphical, numerical or experimental data/information; notes taken from a visit or talk; notes taken from a written or audio visual source; or extracts from publications.

Downloads directly from the internet or copying directly from books may suggest to the assessor that you have not understood the physics involved. This may be considered as plagiarism unless you acknowledge the sources carefully. It is always best to put things in your own words to make sure you really understand them.

**You must**

* Use at least two sources of information/data and be able to explain why you chose them. You could think about:
* Relevance: how useful they are for your topic
* Reliability of sources: who wrote them? who published them? Similar/different perspectives: do they agree or disagree with each other?
* Select relevant data/information from your sources. This could include raw data from an experiment/ practical activity, extracted tables, graphs, diagrams and text.
* Record the sources you have used with enough detail to allow someone else to find them again. If one of the sources is an experiment/practical activity, then you need to record the title, aim and the raw data.

If you use an experiment/practical activity as one of the sources of information/data, your assessor will give you instructions for this. The experiment/practical activity will not be assessed and you may carry out the experiment/practical activity as part of a group.

If you are working in a group to gather data/information, you must take an active part in this and choose your own sources of data/information.

**Checkpoint**: Inform your teacher that you have finished the research stage

### Communication stage

In this stage of your assignment you need to select, process and present information/data from the sources you have gathered, and produce your report.

This stage will be conducted under a high degree of supervision. This means that:

* You will be in direct sight of the assessor during the period of the assessment
* You must not discuss your work with other candidates

In this stage of your assignment you can only use information/data that you have collected from your research. This may include, for example: statistical, graphical, numerical or experimental data; data/information from the internet; published articles or extracts; notes taken from a visit or talk; or notes taken from a written or audio-visual source. It cannot include a prepared draft report.

As a guide, your report should be 500-800 words, excluding tables, charts and diagrams. There is no penalty for being outwith this range.

The table below shows how many marks are available for each aspect of your report.

|  |  |
| --- | --- |
| **Skills, knowledge and understanding** | **Marks allocation** |
| The aim of the investigation | 1 |
| Application/effect on the environment/society | 2 |
| Selection of sources of data/information | 2 |
| Selection of relevant Information from sources | 2 |
| Processing and presentation of data/information | 6 |
| Drawing a valid conclusion | 1 |
| Applying knowledge and understanding of physics | 3 |
| Report structure | 3 |

### Guidance on producing your report

Your report should:

* Have an appropriate structure with an informative title and headings where necessary
* Be clear and concise

Your report should include the following

* Aim
* Application
* Research
* choice of sources
* data/information
* Conclusion
* Underlying physics
* References

**Aim**

The aim must describe clearly what is to be investigated

**Application**

Here you must describe the application of physics and explain its effect on the environment/society. Your explanation must make clear how the application affects the environment/society. This could be a positive or negative effect, or both.

**Research**

**Choice of sources**

Here you **must** give reasons for your choice of sources of raw data/information.

You must explain your choice of sources in terms of at least two of the following:

* Relevance: how useful they are for your topic?
* Reliability of sources: who wrote them? who published them? and so on
* Similar/different perspectives: do they agree or disagree with each other?

**Data/information**

Here you **must** include the data/information from your sources that is relevant to your investigation. This must include data/information that you have processed from at least two of your sources. This can include, for example, performing calculations, plotting graphs from tables, populating a table from other sources, summarising referenced texts, etc.

It must be clear where the raw or extracted data/information that you processed came from. For example you could:

* Include raw data from an experiment/practical activity
* Include tables, graphs, diagrams, text taken from your sources
* Explain clearly where the data/information came from (reference your sources)

You **must** present your processed data/information in at least two different formats from: summary, graph, table, chart or diagram. One must be a graph, table, chart or diagram.

Think carefully about the format you choose because it must be suitable for the information you are presenting.

Check that you have included, as appropriate:

* Suitable scales
* Units
* Headings
* Labels

You should also compare the data/information from at least two sources. For example how they agree/disagree or describe other similarities/differences.

**Conclusion**

You **must** clearly state the conclusion(s) of your investigation. Your conclusion(s) must relate to your aim and be supported by what you have found out.

**Underlying physics**

Here you should explain how the underlying physics relates to your topic.

You should include a statement of the physics principles involved.

**References**

At the end of your report you must record the sources you have used with enough detail to allow someone else to find them. If one of the sources is an experiment/practical activity, then you need to include the title and the aim.

Before submitting your report, check that you have included everything you need.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Title of**  **Investigation** | **Crumple Zones** | **Name** |  | |
| **Skills, knowledge and understanding** | **Additional guidance** | **Evidence** | | **Mark** |
| **Aim** | Describe clearly what is to be investigated | **Aim** | | **1** |
| **Describe** an application and explain effect on environment/society | Statement of characteristics and/or features of the application  Relationship between the aapplication and its effect on the environment/society | **What is the application?**  **What does the application do for the environment/society?** | | **1**  **1** |
| **Select** relevant sources  **Select** relevant info from sources | Quality of sources; at least two from: relevance  reliability of sources  similar/different perspectives | **1 criterion**  **referenced /explained**  **2 criteria** | | **1**  **or**  **2** |
| Relevant data/info from two or more sources e.g. raw data from experiment, extracted tables, graphs, diagrams/text, or processed data/info from two/more sources | **1 source info**  **selected**  **2 sources info** | | **1**  **or**  **2** |
| **Process** and **Present** data/info | Processing/extracting data/info from at least two sources:  e.g. calculations, plotting graphs from tables, populating tables from other sources, summarising referenced text (references essential) | **1 source**  **processed**  **2 sources** | | **1**  **or**  **2** |
| Presenting processed data/info in at least two different formats from:  **summary**, **graph**, **table**, **chart** or **diagram** (one must be from italics) | **1 source**  **presented**  **2 sources** | | **1**  **or**  **2** |
| Labelling  Comparison of data/info from at least two sources | **Axes, labels, units, numberline**  **Valid comparison** | | **1**  **1** |
| **Conclusion** | Supported conclusion related to aim and/or evidence from research | **Relevant and evidenced** | | **1** |
| **Knowledge** and **Understanding** | Good understanding | ***logical explanation of Physics inc. formulae,***  ***Nat 5 Physics mostly correct*** | | **3**  **or**  **2**  **or**  **1** |
| Reasonable understanding | ***statement(s) using Physics,***  ***some Nat 5 Physics, mostly correct*** | |
| Limited understanding | ***a little Physics (poss. wrong)***  ***mostly not Nat 5, or wrong Physics*** | |
| **Structure** of report | Title  2 references (inc. title, aim, data from practical if used)  Clear and concise | **Title**  **2 references**  **Clear and concise** | | **1**  **1**  **1** |
| **Total out of 20** |  |  | | **/20** |

## Possible Topics

|  |  |  |  |
| --- | --- | --- | --- |
| |  | | --- | | **Topic** | | |  | | --- | | **Key area** | |
| Car safety | Newton’s laws |
| |  | | --- | | Electricity generation using nuclear sources | | Nuclear radiation |
| Electrical generation- wind turbines | Electricity and energy, Conservation of energy |
| Electrical generation- hydroelectric power | Electricity and energy, Conservation of energy |
| Hybrid vehicles | |  | | --- | | Conservation of energy | |
| |  | | --- | | Space exploration | | |  | | --- | | Space exploration | |
| Electromagnetic Spectrum | Medical Uses of Electromagnetic Radiation |
| Thermistors | Practical Electricity and Electronics |
| Solar Cells | Practical Electricity and Electronics / Space Exporation |
| LEDs | Practical Electricity and Electronics |
| Space Exploration |  |
| Telescopes |  |

# National 5 Physics: Assignment

Resource pack: Car safety

This resource pack gives details of areas that are suitable for an assignment task.

Car safety research/investigation supports:

### Unit: Dynamics and Space

#### Key area: Newton’s laws

* Calculations involving the relationship between unbalanced force, mass and acceleration for situations where more than one force is acting
* Calculations involving the relationship between work done, unbalanced force and distance/displacement

## Background information

Road vehicle safety is a continuous process to find improvements which will reduce the number of road accidents and the severity of any injuries, making road travel safer for everyone.

## Research

Car manufacturers research and develop safety features for their vehicles then promote the improvements in order to reassure buyers that their cars are safe. European and government agencies also carry out research in all areas connected with car safety.

Governments carry out vehicle tests to ensure that the cars produced by manufacturers perform safely and meet required standards. Government testing allows the public to compare the safety performance of different cars by using the same standard tests.

Euro NCAP is a European agency set up by the UK and other European governments to investigate vehicle safety, and publish their findings. Euro NCAP organises crash-tests and provides motoring consumers with a realistic and independent assessment of the safety performance of some of the most popular cars sold in Europe.

## Energy

Cars have kinetic energy when moving. During braking, the kinetic energy is transferred into heat energy by the brakes. The brakes heat up and then transfer the energy to the surroundings. During collisions, the kinetic energy will not be completely transferred into heat energy in the brakes, but may cause damage to the car and occupants during the collision.

Modern cars have safety features that dissipate kinetic energy during collisions to reduce injury to car occupants.

## Assignments

The following areas of car safety research are suitable for an assignment task. Your choice of research topic could be based on one (or more) of these areas

* The operation and benefit of seat belts. Since the introduction of seat belts, improvements such as the three-point seat belt, inertia-reel seat belts and pre-tensioning seat belts have been adopted by car manufacturers.
* The operation and benefit of car ‘safety cages’. The ‘safety cage’ provides a safe area for passengers in the event of an accident. It has features which protect passengers from certain injuries.
* The improvement of vehicle braking systems. Antilock braking systems and electronic stability control have improved car braking.
* The improvement of steering wheel design. Steering wheels have been designed to reduce driver injuries during a crash.
* The use of side-bars to reduce injury. These have been developed to protect passengers from side impacts.
* The operation and design of crumple zones. The front and rear parts of cars have been designed to steadily collapse during a collision to reduce injury to the car occupants.
* The design and operation of air bags to reduce injury. Air bags reduce injury to the driver and passengers during collisions.
* The design and use of pedestrian air bags to reduce injury. Car manufacturers are developing these to help protect pedestrians who are struck by cars.
* The use of dynamic car data to minimise injuries when an accident is happening. Car manufacturers are developing systems which detect whether emergency action is being taken by the driver, and then apply measures to reduce injuries (for example, taking the slack out of seat belts by using reversible tensioners or closing windows and the sunroof if the car is likely to roll over) .

## Websites

The following websites contain information about research which has been carried out into car safety.

<http://hyperphysics.phy-astr.gsu.edu/hbase/carcr.html#cc1>

<http://www.nhtsa.gov/Research/Databases+and+Software>

<http://www.theaa.com/allaboutcars/ncap/ncap_car_results.jsp?make=Fiat&modelYear=Doblo:2004&publicationDate=2004-06-01>

<http://www.theaa.com/motoring_advice/euroncap/crash_tests.html>

<http://www.thatcham.org/safety/pdfs/bumper_test_development.pdf>

<http://www.euroncap.com/Content-Web-Page/c6f9d381-1889-4c66-bfcd-c5c0a69a364d/technical-papers.aspx>

<http://education.ufl.edu/gjones/files/2013/04/teachers_guidePhysics.pdf>

## Unit Waves & Radiation

# Nuclear Radiation used in Medicine

### Key Areas



#### Nuclear Radiation

* Types of radiation
* Background radiation
* Half Life
* Dosimetry
* Penetration of Radiations

## Background information

Radiotheraphy is a recognised treatment for cancer. It has to be specifically chosen to have the right half life and produce the correct dose per patient. Radiation can also be used in detection of cancers and other problems for example as a tracer for bowel problems or circulatory problems

## Research

## Dosimetry

Chemicals are mixed together in the right proportions to produce a nuclear reaction.

Half Life

Dosimetry

Detection

## Assignments

The following areas of nuclear medicine are suitable for an assignment task. Your choice of research topic could be based on more than one of these areas

* The different ways in which nuclear medicine is used in hospitals and research
* The half- life of the by-products of these materials and how they can be safely stored
* The exposure of people to radiation and the equivalent dose values received by people exposed to the radiation.

## Resources

The following websites contain information about research which has been carried out into nuclear power.

* Energy Foresight DVD
* Physics Through Application
* <http://www.doseinfo-radar.com/RADAR-INT-NM.html>
* <http://www.doseinfo-radar.com/RADAR-INT-Occ.html>
* <http://wdc.engl.iastate.edu/radiation_therapy/>
* <http://ozarkscommunityhospital.wordpress.com/2011/10/05/10-things-you-didnt-know-about-nuclear-medicine/>
* <http://science.howstuffworks.com/nuclear-medicine.htm>
* <http://www.howstuffworks.com/nuclear-science-quiz.htm>
* <http://www.hps.org/publicinformation/ate/faqs/radiationtypes.html>
* <http://hps.org/hpspublications/radiationfactsheets.html>
* <http://hps.org/documents/background_radiation_fact_sheet.pdf>
* <http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/radiation/treatmentrev3.shtml>
* <http://www.nature.com/news/radioisotopes-the-medical-testing-crisis-1.14325>
* <http://indico.cern.ch/getFile.py/access?contribId=9&resId=0&materialId=slides&confId=215087>
* <http://nuclearchem.wikispaces.com/Radioisotopes+in+Medicine>
* <http://www.radiochemistry.org/nuclearmedicine/radioisotopes/ex_iso_medicine.htm>

## Unit Waves & Radiation

# Electromagnetic Spectrum: Medical Uses of Electromagnetic Radiation

### Key Areas



#### Electromagnetic Spectrum

* Order of EM spectrum
* Medical Uses of each type of radiation
* Dangers of each type of radiation
* Wavebands
* Energy and frequency

## Background information

The electromagnetic spectrum is a range of waves with similar properties and also some different uses and properties. Many of these waves are used for various cures and diagnoses in the Medical industry. For example IR can be used to detect cancers using thermograms but is also used to heal strained muscles in damaged tissue. X-rays are used to detect broken bones and are also used in more detailed CT scanners. Gamma rays are used to detect abnormalities in circulatory and digestive systems

## Research

Chemicals are mixed together in the right proportions to produce a nuclear reaction.

Half Life

Dosimetry

Detection

## Assignments

The following areas of medicine are suitable for an assignment task. Your choice of research topic could be based on more than one of these areas

* The different ways in which gamma radiation is used in hospitals and research including the half life of the by-products of these materials and how they can be safely stored.
* Keeping people safe from the effects of radiation
* X-rays and how they have improved over the last decade including the use of CT scanners
* IR as a detector or tumours and a cure for strained muscle

## Resources

The following websites contain information about research which has been carried out into nuclear power.

* Energy Foresight DVD
* Physics Through Application
* <http://agni.phys.iit.edu/~vpa/medical%20applications.htm>
* <http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/waves/theelectromagneticspectrumrev4.shtml>
* <http://www.britannica.com/EBchecked/topic/161094/diagnostic-imaging>
* <http://www.doseinfo-radar.com/RADAR-INT-NM.html>
* <http://www.doseinfo-radar.com/RADAR-INT-Occ.html>
* <http://wdc.engl.iastate.edu/radiation_therapy/>
* <http://ozarkscommunityhospital.wordpress.com/2011/10/05/10-things-you-didnt-know-about-nuclear-medicine/>
* <http://science.howstuffworks.com/nuclear-medicine.htm>
* <http://www.howstuffworks.com/nuclear-science-quiz.htm>
* <http://www.hps.org/publicinformation/ate/faqs/radiationtypes.html>
* <http://hps.org/hpspublications/radiationfactsheets.html>
* <http://hps.org/documents/background_radiation_fact_sheet.pdf>
* <http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/radiation/treatmentrev3.shtml>
* <http://www.nature.com/news/radioisotopes-the-medical-testing-crisis-1.14325>
* <http://indico.cern.ch/getFile.py/access?contribId=9&resId=0&materialId=slides&confId=215087>
* <http://nuclearchem.wikispaces.com/Radioisotopes+in+Medicine>
* <http://www.radiochemistry.org/nuclearmedicine/radioisotopes/ex_iso_medicine.htm>

## Unit Waves & Radiation

# Electrical Generation Using Nuclear Sources

### Key Areas

#### Nuclear Radiation

* Types of radiation
* Background radiation
* Half Life
* Dosimetry
* Penetration of Radiations

## Background information

The consumption of energy in the UK and across the world is constantly increasing. New and improved ways need to be found to generate the required energy without damaging the environment

## Research

In the last few years the politicians have suggested new nuclear power stations be built in the UK to meet the increasing demand for energy but without generating the greenhouse gases that pollute the environment.

Currently the nuclear power stations are using nuclear fission reactions that occur in the fuel rods.

## Energy

Fission reactions occur in the nuclear fuel rods and a chain reaction can maintain these. The nuclear power station is designed to maintain a constant power in its structure. The energy from the fission is much greater than that from other sources. However there are problems with nuclear fuel in that the waste products of the reaction has to be stored for a long time due to its high half life, also if there are problems with the reaction then things can go dramatically wrong like it did at Chernobyl and Fukishima. In both these incidents people were exposed to high doses of radiation with potential harmful effects. The disaster of Chernobyl even affected the farms around Dumfries and Galloway.

## Assignments

The following areas of nuclear power generation are suitable for an assignment task. Your choice of research topic could be based on more than one of these areas

* The generation of power by chain reactions in fuel rods and what are the nuclear fuels used.
* The different types of nuclear radiation and how it is produced and what the structure is
* The containment vessels for preventing release of the materials
* The half-life of the by-products of these materials and how they can be safely stored
* The exposure of people to radiation and the equivalent dose values received by people exposed to the radiation.

## Websites

The following websites contain information about research which has been carried out into nuclear power.

<http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>

<http://www.technologystudent.com/energy1/nuclear1.htm>

<http://www.world-nuclear.org/Nuclear-Basics/How-does-a-nuclear-reactor-make-electricity-/>

<http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/Radioactive-Waste-Management/>

<http://www.euronuclear.org/info/encyclopedia/n/nuclear-power-plant-world-wide.htm>

<http://www.euronuclear.org/info/encyclopedia/f/fuelcomparison.htm>

<http://www.howstuffworks.com/nuclear-science-quiz.htm>

<http://hps.org/hpspublications/radiationfactsheets.html>

<http://hps.org/documents/background_radiation_fact_sheet.pdf>

<http://hps.org/documents/uranium_fact_sheet.pdf>

<http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/radiation/treatmentrev3.shtml>

<http://nuclearchem.wikispaces.com/Nuclear+Fission>

<http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>

## Unit Waves & Radiation

# Electrical Generation Radiotherapy

## Background information

Many people in the UK and across the world find that they get cancer sometime during their life. Some people have no hope of treatment but in the last few decades radiotherapy has formed a part of many people’s treatment.

## Research

In the last few years the politicians have suggested new nuclear power stations be built in the UK to meet the increasing demand for energy but without generating the greenhouse gases that pollute the environment.

Currently the nuclear power stations are using nuclear fission reactions that occur in the fuel rods.

## Unit Dynamics & Space

# Reentry

## Background information

Returning space vehicles to the Earth is one of the most dangerous parts of any space exploration. Over many years there have been many disasters and fatalities, although some were not human.

## Research

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