



Gleniffer High School



Higher Physics

Researching Physics

Candidate Guide

There are two assessment activities for the Researching Physics Unit:

Assessment Activity 1: Literature research

Assessment Activity 2: Practical research

You can carry out the literature research and practical research activities in any order.

Information/data gathered should be recorded in a Record of Work (log book or a digital record can be kept on the school server)

Your teacher will let you know how the assessment will be carried out and any required conditions for doing it. Your teacher will provide you with the resources you need. You may be able to work in a group to do the practical work, but your teacher will need you to show that you have met the Assessment Standards including following procedures safely.

Assessment activity 1 - Literature research

You should:

- ◆ select a topic with agreement from your teacher
- ◆ make a clear statement describing the research topic
- ◆ carry out research on your chosen topic
- ◆ record at least two of the sources that you have used in your research
- ◆ make notes from these sources

You must use at least **two** sources of information, such as two different websites, and you must record these sources of information in enough detail to allow someone else to find these sources easily. You may use a referencing system.

Assessment activity 2 - Practical research

You should:

- ◆ plan your practical research investigation

Your **plan** must include:

- ◆ a **detailed** description of how you will carry out your practical research investigation (including safety where appropriate)
- ◆ the observations/measurements to be made

Checkpoint: Ask your teacher to check your plan before you start the experimental work.

You must also ensure that the experimental procedure is carried out effectively. If working as part of a group, the tasks must be shared in discussion with members of your group. It is recommended that each person within the group is allocated a particular task, where appropriate.

- ◆ You should carry out your experimental work safely
- ◆ Record your observations/measurements in an appropriate way.

This will probably be a table but could be a line graph, summary or other appropriate format.

You should include labelling, SI units and standard abbreviations.

Research Task Outcome 1

Skin Cancer – Prevention and Treatment

Select one of the Literature Research Activities below.

Research Activity 1: Prevention of skin cancer

Research brief

Skin cancer is one of the most common forms of skin cancer and causes a significant number of deaths each year. It is a growing problem.

In carrying out your research you should answer the following questions.

- What are the characteristics of UVA and UVB? In particular, you should find out about their frequency, wavelength, atmospheric absorption and energy.
- How does UV light damage skin cells? What is it about the UV that causes the problem?
- What is the difference between a sun block and a sun filter?
- What is the UV index and how can it provide information to help avoid exposure to too much sunlight?
- Sun creams are rated with a sun protection factor (SPF). What does this mean?

Research Activity 2: Treatment of skin cancer – surgery, radiotherapy and photodynamic therapy

Research brief

Photodynamic therapy is a treatment for skin cancer. It is sometimes used as an alternative to surgery or radiotherapy. Photodynamic therapy uses laser or other light sources, combined with a light-sensitive cream, to destroy cancer cells. If a laser is used, the energy required to activate the light sensitive cream is applied in a short time. By using organic semiconductors, the same total energy can be delivered over a longer time.

In carrying out your research you should answer the following questions.

- What are the advantages and disadvantages of surgery?
- What is the physics underlying radiotherapy?
- What is the physics underlying photodynamic therapy?
- Why is a laser (or other monochromatic light source) used in photodynamic therapy?
- What is an organic semiconductor and how is it used in photodynamic therapy?

Research Task Outcome 2

Select one of the Practical Research Activities below.

UV lamps can be harmful. Make sure that you read the safety leaflet supplied with the UV lamp.

Practical Activity 1: Investigating the absorption of ultraviolet light by applying different thicknesses of sun cream.

Sun creams stop harmful UV radiation reaching the skin.

Some are supplied in a tube for spreading on the skin and some can be applied from a spray. In either case, it is possible to apply a thick layer or a thin layer. Does it matter?

The aim of this investigation is to determine the absorption of UV by a layer of sun cream and find how the absorption depends on the thickness of the layer applied.

Discuss how you will carry out the investigation.

Write your plan in your record of work.

You should also include a hypothesis in your record of work. What do you think is the relationship between the thickness of the layer applied and absorption of UV?

Practical Activity 2: Investigating the shelf-life of sun cream.

Sun creams stop harmful UV radiation reaching the skin.

Does their effectiveness change with time? Can you continue to use a product for many years?

The aim of this investigation is to determine whether the effectiveness of sun cream reduces after a period of time.

Discuss how you will carry out the investigation.

Write your plan in your record of work.

You should also include a hypothesis in your record of work. Do you think that it is likely that the effectiveness of sun creams remains the same after one or more years?

Practical Activity 3: Comparing high- and low-factor sun cream.

Sun creams stop harmful UV radiation reaching the skin.

Manufacturers' products are rated with a sun protection factor (SPF). Sun creams can have SPF values from 6 to over 50.

The aim of this investigation is to determine the relationship between SPF and the absorption of UV radiation.

Discuss how you will carry out the investigation.

Write your plan in your record of work.

You should also include a hypothesis in your record of work. What do you think is the relationship between SPF and absorption of UV?

Practical Activity 4: Comparing absorption of ultraviolet light by different types of sunglass lens.

Sunglass lenses stop harmful UV radiation reaching the eyes.

What protection can wrap round glasses offer that others do not?

Manufacturers' products are rated with an eye-sun protection factor (E-SPF). Sunglass lenses can have E-SPF values from 10 to over 50; corrective clear lenses have values from 2 to 25.

The aim of this investigation is to determine the relationship between E-SPF and the absorption of UV radiation.

Discuss how you will carry out the investigation.

Write your plan in your record of work.

You should also include a hypothesis in your record of work. What do you think is the relationship between E-SPF and absorption of UV?

A basic experiment to compare distance from UV source and reading can also be carried out.

For safety reasons, the lasers found in laboratories are restricted in their power output. They are rated according to a classification system and manufacturers provide data for their products. Read the instruction manual before use. It is not recommended to use laser pointers as they are unclassified.

Practical Activity 5: Investigating the spectra of light sources.

Photodynamic therapy is a useful treatment for some types of skin cancer. The treatment involves applying a photosensitive cream to the skin. This is activated by light, which is usually a laser or other light source which produces light of a certain frequency. Finding a suitable combination of cream and light source requires that the characteristics of the light source are known. A spectrophotometer can be used to measure the intensity of light at different frequencies.

The aim of this investigation is to use a spectrophotometer (or similar equipment) to investigate the spectra of a number of light sources.

Discuss how you will carry out the investigation. You will need to consult with your teacher on the following points:

- What light sources do you wish to investigate, and what is available?
- What kind of spectrophotometer is available?

Write your plan in your record of work.

Practical Activity 6: Comparing the irradiance of laser light with the light emitted from a Light-Emitting Diode.

Photodynamic therapy is a useful treatment for some types of skin cancer. It involves using light to activate a photosensitive cream. The frequency of the light used has to be such that the energy of each photon is enough to excite the molecules of the cream so that a chemical reaction takes place.

This is usually done with a laser. However, recent research at Ninewells Hospital in Dundee has shown that it is possible to use an organic light-emitting diode (LED) and expose the cream for a longer time.

The aim of this investigation is to compare the irradiance of laser light with the light emitted from an LED.

Discuss how you will carry out the investigation.

How will you measure the irradiance of the light from a laser and an LED?

At what distance will you measure the irradiance?

Write your plan in your record of work.

Equipment available for selection

UV test rigs
UV lamps
UV detectors and multimeters
UV sensitive beads
Soltan sun cream factors 8; 15; 30; 50
Microscope slides
Sunglasses
Prescription sunglasses
Reading glasses (no tint)
Clamp stands
LASER
RAYZER
Digital camera
Spectroscope
LEDs
Variety of light sources
Rulers
Protractors
Power supplies
Leads
Safety goggles
Newspapers

Higher Physics - Researching Physics Checklist

Name: _____ Class: _____

Topic: _____

Assessment Standard	Assessment Judgements Met	Candidate	Class Teacher	Moderator
Assessment Standard 1 Gathering and recording information from two sources relating to the chosen topic	A clear statement describing the research topic is produced			
	Reference to at least two relevant sources of information/data is made. Enough detail should be given to allow a third party to retrieve the sources			
Assessment Standard 2.1 Planning/designing the practical investigation, including safety measures.	A clear aim for the practical research investigation is stated.			
	A clear and detailed description of how the practical research investigation should be carried out, including safety considerations is available.			
	All observations/measurements to be made are clearly stated.			
Assessment Standard 2.2 Carrying out the practical investigation safely, recording detailed observations/measurements correctly	The candidate has been observed to follow all procedures safely.			
	All observations/measurements are recorded correctly and results presented in an appropriate format. Where appropriate these have been repeated.			