TRIATHLON

Practical Project
For Teachers **p2&3**, for Students **p4**

HEALTH AND SAFETY

Students should be encouraged to make their own risk assessment before they carry out any activity, including surveys. In all circumstances this must be checked by a competent person.

For surveys and other activities on open water, the PE department or local water sports clubs may be able to help with risk assessments and ways to avoid risks. Students using specialised equipment should be supervised at all times.

Students may want to set up unorthodox experiments and you may need to seek specialist advice. In particular:

- Any investigations into the actual effect on real people of immersion in cool or cold water must only be done with medical supervision and appropriate medical resources on hand in case of emergency
- Any activity associated with open water will require specialised risk assessment.

Organisations such as CLEAPSS are able to help.

TRIATHLON:
Bronze **Practical** Project - For Teachers

What makes a good wetsuit?

The swimming leg of the 2009 world triathlon championships took place in an outdoor lake in Hyde Park, London. We all know that Britain can be a bit cold, even in the summer. Imagine how cold it must be jumping into a lake with only a swimming costume to keep you warm! That's why, if the water temperature drops below 20˚C, triathletes are allowed to wear wetsuits instead of a swimming costume.

HAVE YOU EVER WONDERED?

...what material makes the 'best' wetsuit?

You might like to imagine yourself in a situation such as...

Your local water sports club has asked you for advice about choosing wetsuits.

Triathletes only wear wetsuits when the water temperature is below 20˚C, so part of the purpose of a wetsuit is to keep athletes warm when swimming in cold water.

You should **undertake practical experiments** to investigate:

- how well different materials can keep an athlete warm
- other properties of the materials you choose, to find out their advantages or disadvantages for a swimmer.

POSSIBLE EQUIPMENT, MATERIALS AND RESOURCES

Normal laboratory equipment for:

- measuring temperature and conduction of heat energy
- weighing materials, with a range of maximum weights and degrees of precision
- measuring small thicknesses

Some natural and synthetic fabrics and rubber based materials, and a range of different thicknesses of neoprene material. Means of cooling water to below room temperature, or access to pre-cooled water at a range of temperatures

Prompts

The **Student Brief** gives some triggers to start students thinking. They will not have time to investigate all of these, and must decide on which aspects to focus.

Each trigger could lead to various lines of investigation. Students should be encouraged to identify possibilities for themselves, and think about which are likely to lead to feasible practical investigations. However, if necessary, prompts such as those below might be given, to point students in suitable directions.

- What properties make a material poor at transferring heat energy (a good thermal insulator)
  - How does heat energy transfer through solids, liquids and gases?
  - Are there any common features present in most thermal insulators?
- How heat energy is transferred through the wetsuit
  - Is the heat energy transferred by conduction, convection, radiation?
  - Evaporation can cause cooling. Is this relevant?
- How the thickness of the wetsuit may affect the way heat is transferred
  - What factors would you need to keep constant, and to vary, to obtain useful information?
  - What are the practical limitations on the thicknesses, for this investigation?
- Whether or not the wetsuit material absorbs water, and what effect this has
  - Does absorbed water affect the way heat energy is transferred through the material?
  - Do all materials absorb similar amounts of water? How could this be measured?
  - How does absorbed water affect the weight of material? Will this affect an athlete?
- Whether the temperature of the water (or athlete) affects how quickly an athlete cools down
  - What is a realistic range of water temperatures (and athlete skin temperatures) to investigate?
  - Will the size or shape of an athlete affect the rate of heat energy transfer?
- How other properties of the material, such as weight or flexibility, affect its suitability for a wetsuit
  - What properties should wetsuit material have?
  - Which properties are most important for a swimmer?
  - Is it possible to do practical investigations, into these properties, that will yield meaningful results?

NOTE: Mention the practical aspects of whether or not a given investigation is possible/meaningful, only if students do not think of this within a reasonable time.

Suggestions for supporting students

Though primarily based on laboratory investigations, the Practical project will probably require some initial research into the temperature of open water in the UK, and also heat energy transfer. One possibility is for two students to undertake their projects – one Practical, the other Research – working independently, but coming together, to share mutually useful information and activities.

Although Bronze Award students are not expected to have an official mentor for their project, access to expert advice makes students feel their work is important. Also, if the topic is not in your area of expertise, you may find a Mentor valuable. Your CREST Local coordinator may be able to suggest suitable contacts.

Depending upon the investigation undertaken, someone with knowledge and/or experience of thermal properties of materials would be ideal:

- academic or 4industrial research into
  - development of new materials
  - thermal insulation or heat flow
- scientific publishing
- design or development of thermal insulation of any kind
- developing or trialling sportswear

Discuss with students how they will manage their time (after school clubs, working during lunch hours, homework). Agree a completion date with them.

- Students should decide their focus, although this may alter in the light of experience as the project progresses.

Internet search

Combine 'wetsuit' with terms such as: warmth, insulation, swimming, triathlon or neoprene, Or try:

- Basics of how wetsuits work
  explainthatstuff.com/howwetsuitswork.html
- Factors to consider when buying a wetsuit
  swimming.about.com/od/triathlon/a/buy_a_wetsuit.htm
- Cold water safety and survival
  ussartf.org/cold_water_survival.htm
- One suggestion for comparing thermal insulation of different materials
  all-science-fair-projects.com/science_fair_projects/58/389/0ba9cd31504bfa691fc0fb1cc2b1d08b.html

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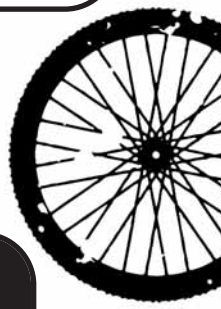

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Some things to think about...

- What properties make a material poor at transferring heat energy (a good thermal insulator)
- How the thickness of the wetsuit may affect the way heat is transferred
- Whether or not the wetsuit material absorbs water, and what effect this has
- Whether the temperature of the water affects how quickly an athlete cools down

Health and Safety

Before you carry out any experiment:

(a) find out if any of the substances, equipment or procedures are hazardous

(b) assess the risks (think about what could go wrong and how serious it might be)

(c) decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on)

(d) make sure your teacher agrees with your plan and risk assessment

NOTE: Your teacher will check your risk assessment against that of your school. If no risk assessment exists for the activity, your teacher may need to obtain special advice. This may take some time.