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.

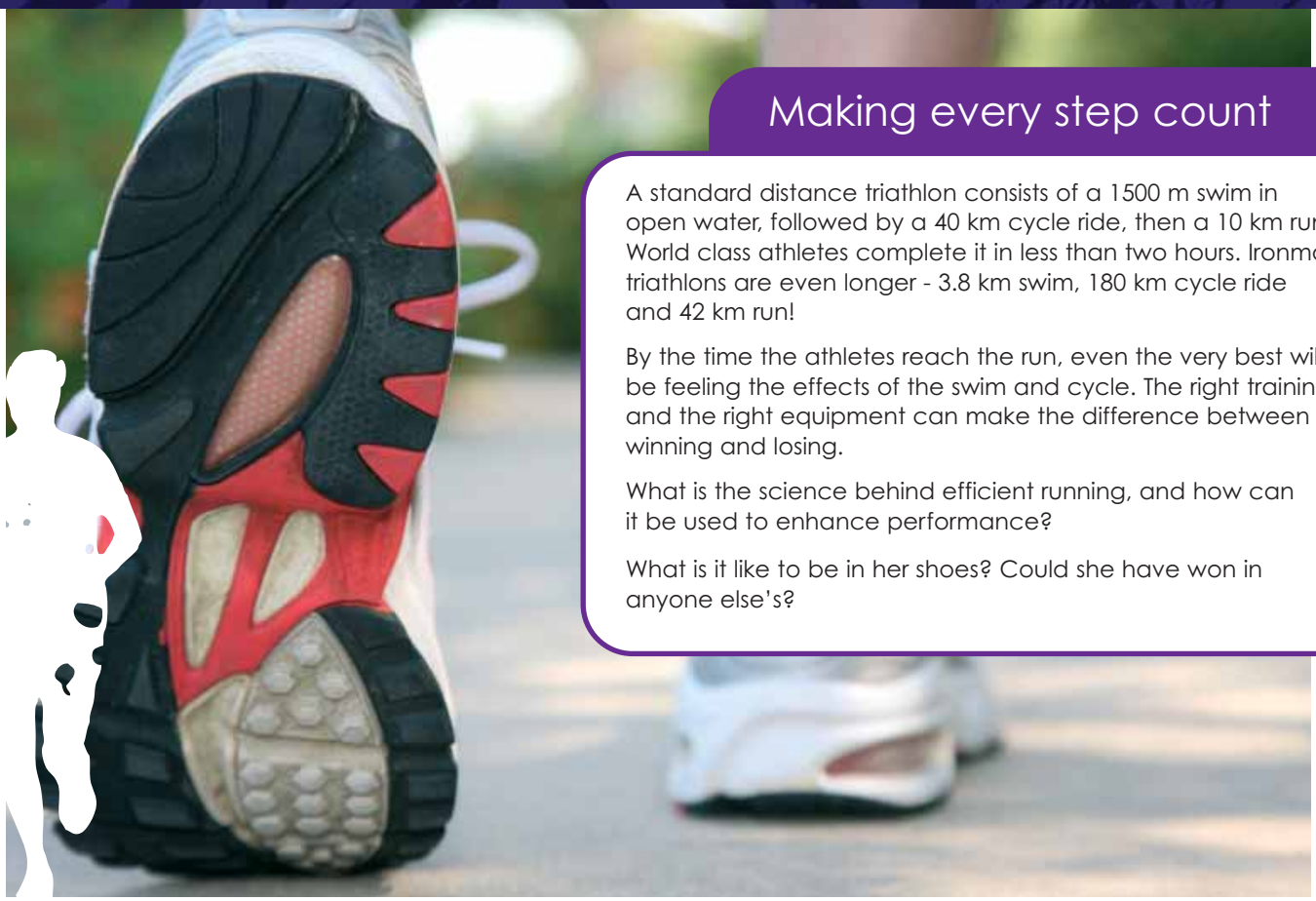
For surveys and other activities on open water, the PE department or local water sports clubs may be able to help with risk assessments and ways to avoid risks. Students using specialised equipment should be supervised at all times.

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:
Gold **Practical** Project - For Teachers



Making every step count

A standard distance triathlon consists of a 1500 m swim in open water, followed by a 40 km cycle ride, then a 10 km run. World class athletes complete it in less than two hours. Ironman triathlons are even longer - 3.8 km swim, 180 km cycle ride and 42 km run!

By the time the athletes reach the run, even the very best will be feeling the effects of the swim and cycle. The right training and the right equipment can make the difference between winning and losing.

What is the science behind efficient running, and how can it be used to enhance performance?

What is it like to be in her shoes? Could she have won in anyone else's?

HAVE YOU EVER WONDERED?

...how the design of running shoes can maximise running performance?

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

Runners use sports equipment to reduce the energy required to run any given distance - and to reduce the 'wear and tear' on their bodies while doing so. A well-designed running shoe can be a great help. You work for a leading manufacturer, in the research department. You have been asked to **undertake practical experiments** to investigate:

- how running shoes can reduce strain injuries caused by running on hard surfaces
- how running shoes can improve the energy efficiency of running.

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.

- How the muscles in the foot and the leg work during running
  - Do different muscles have different purposes, for example, providing power or stability?
  - Are tendons and ligaments as important, or more important, than muscles?
- What stresses are experienced by different parts of the foot and leg during running
  - What running injuries commonly occur due to these stresses?
  - How can impulses be measured or compared?
- How energy is used or wasted during each step when running
  - What are the energy transfers that take place during each running step?
  - What are the factors that may affect these energy transfers?
- What are the practical limitations on what it might be possible to model or to test?
- What factors determine the choice of materials used in running shoes?
- How do the shock absorbency and the energy efficiency relate to one another?
  - Can the 'best' energy efficiency or shock absorbency be obtained by using one material for the running shoe sole, or is a range of different materials in different places 'better'?

Suggestions for supporting students

Though primarily based on laboratory investigations, the Practical project will probably require some initial research into the way the leg is used during running, and also properties of materials.

Gold Award students are required to have an external Mentor (normally a scientist or engineer) for their project. The Mentor's role is to provide guidance and support.

A Mentor with knowledge and/or experience of structures, with particular reference to the human body, could be ideal. The Mentor might be involved in…

- academic or industrial research into, for instance:
  - sports equipment
  - running
  - sporting injuries
  - properties of materials
- scientific publishing
- measurement and understanding of stresses and Momentum
- developing or trialling sports equipment or training methods

Contact your Local Coordinator for guidance.

Internet search

Combine 'running shoe' with terms such as: performance, physics, impulse, materials, technology or sports medicine. Or try:

- Features of a running shoe that a designer considers
  madsci.org/posts/archives/2007-01/1169069607.Ph.r.html
- How a running shoe is made
  answers.com/topic/running-shoe-2
- Basic introduction to the design and technology of running shoes
  www.design-technology.org/sportsshoes1.htm
- Basic introduction to the physics of running
  ehow.com/about_4672395_physics-of-running.html
- How the legs, feet and body move during running
  en.wikipedia.org/wiki/Running

POSSIBLE EQUIPMENT, MATERIALS AND RESOURCES

Normal laboratory equipment for:

- measuring forces, times, distances, masses
- determining energy and efficiency

Means of comparing or measuring elasticity and rigidity of different materials.

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Some things to think about...

- How the muscles in the foot and the leg work during running
- What stresses are experienced by different parts of the foot and leg during running
- How energy is used or wasted during each step when running
- How the efficiency of a running shoe, or running shoe sole, could be altered, and measured
- Other properties of running shoe materials that need to be considered
- If it is possible to optimise both shock absorbency and energy efficiency, or if a compromise must be reached?

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 that you can carry out your project safely 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.

(e) if special tools or machines are needed, arrange to use them in a properly supervised design & technology workshop

(f) if an experiment involves physical activity, you may need the support and supervision of a P.E. teacher.