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:

Silver **Practical** Project - For Teachers

On your bike

A triathlon consists of a 1500m swim in open water, followed by a 40km cycle ride, then a 10km run. World class athletes complete it in less than two hours.

Obviously, triathletes have to be super fit.
But what difference does their kit make?

Take the cycling stage: Bikes vary in many ways, and cyclists ride their bikes differently – using gears to turn the pedals fast or slow. **So, why do bikes vary so much in style and price, and how does a triathlete choose the right one?**

HAVE YOU EVER WONDERED?

…if lots of gears make a difference when riding a bike?

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

In a triathlon there is no break between the legs of the race. Athletes need to pace themselves – they have to complete the cycle stage quickly, but they need enough energy left to run 10 km immediately afterwards. You've been asked to join the training team for a young Olympic hopeful, as a cycling specialist.

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

- the effect of bicycle gears on top speed and acceleration
- whether the gears used by an athlete affect his or her ability to run afterwards.

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 to measure speed or acceleration
  - Can speed or acceleration be measured directly or be calculated from other data?
  - What accuracy can be achieved with different methods of measurement?
- Whether or not it matters when the top speed or acceleration is achieved
  - How do gears work; how do they transfer the athlete's energy to rotation of the bicycle wheels?
  - Does the particular time/distance at which acceleration occurs affect the average speed for a race?
- Whether to investigate individual gears or combinations of gear involving gear changes
  - How do the gear/s used affect the total energy the athlete 'uses' in the cycle leg?
  - How much time does it takes to change gear? Is this relevant?
- How much the performance of a particular bike or gear setting is determined by the cyclist
  - What is the relationship, if any, between a cyclist's energy output and their stamina?
  - Do different cyclists all find the same gear 'easiest' to use, or most efficient?
- The effectiveness of the gears compared with other factors that may affect performance
  - How much variation is there in top or average speed, or acceleration, when different factors are altered?
- How could effectiveness be defined? Is this overall effectiveness affected by the 'gap' between adjacent gears, in terms of effort or energy expended?

Suggestions for supporting students

Students will need to decide whether this practical project can be completed using primarily laboratory investigations or whether facilities such as a cycling or running track are needed. Initial research may also be needed into methods available for measuring speed and acceleration. Investigation into the effectiveness of gears to alter performance, compared with other factors, may best be approached by two students undertaking their projects in cooperation with each other – one Practical, the other Research – working independently, but coming together, to share mutually useful information and activities.

It is recommended that, wherever possible, Silver Award students should have a scientist or engineer as Mentor for their project. Please contact your CREST Local Coordinator to discuss mentoring.

In this case, someone with knowledge and/or experience of sports science would be ideal. The Mentor might be involved in …

- academic or industrial research into, for instance:
  - design or development of sports equipment
  - health and fitness
  - design or development of speed measuring equipment
- scientific publishing
- measurement and management of energy
- developing or trialling human-powered vehicles
- social cycling or racing

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 'triathlon' with terms such as: Olympic, cycling, training, equipment bicycle, or design. Or try:

- How bicycle gears work
  adventure.howstuffworks.com/bicycle3.htm and adventure.howstuffworks.com/bicycle4.htm
- Triathlon equipment
  en.wikipedia.org/wiki/Triathlon_equipment
- Different types of bicycle
  en.wikipedia.org/wiki/List_of_bicycle_types
- Bikes: design factors, ideas for tests, videos
  www.engineeringeverywhere.org.uk

POSSIBLE EQUIPMENT, MATERIALS AND RESOURCES

Normal laboratory equipment for:

- measuring speed and acceleration
- measuring pulse rate changes over time
- Bicycles, with different numbers of gears, and with no gears at all
- Rig for supporting the rear wheel of a bicycle while it is ridden, so that the wheel can be turned without the bicycle moving.

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Bikes vary in many ways, and cyclists ride their bikes differently – using gears to turn the pedals fast or slow. So, why do bikes vary so much in style and price, and how does a triathlete choose the right one?

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Some things to think about…

- How to measure speed or acceleration
- Whether or not it matters when the top speed or acceleration is achieved
- Whether to investigate individual gears or combinations of gear involving gear changes
- How much the performance of a particular bike or gear setting is determined by the cyclist
- How effectiveness is defined

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.

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

(f) if any tests may lead to raised pulse or breathing rate, arrange to carry them out under the supervision of a qualified PE teacher.