**NZQA**

**Approved**

Achievement standard: 90936 Version 3

Standard title: Demonstrate understanding of the physics of an application

Level: 1

Credits: 2

Resource title: Tractors

Resource reference: Physics VP-1.2 v2

Vocational pathway: Primary Industries

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| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-90936-02-7285 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.  Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

Achievement standard: 90936

Standard title: Demonstrate understanding of the physics of an application

Level: 1

Credits: 2

Resource title: Tractors

Resource reference: Physics VP-1.2 v2

Vocational pathway: Primary Industries

Learner instructions

# Introduction

This assessment activity requires you to demonstrate your understanding of how physics is used to allow a tractor to travel over a variety of different terrain.

You are going to be assessed on how you demonstrate comprehensive understanding of the physics of how the tyres of a tractor allow it to move over different terrain. You need to show that you can process and interpret information, and prepare a report that identifies the key physics involved in driving a tractor and provides a detailed and comprehensive explanation of how the physics that has been identified is integrated within the application.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions, and modify them if necessary to suit their learners.

# Task

You drive your tractor around the farm daily to deliver feed to your livestock, till the fields for planting crops, and do general maintenance. The terrain on which your farm is situated ensures that you drive your tractor uphill, downhill, and on soft and hard ground. Sometimes you also have to travel on sealed public roads with a speed limit of 40 km/h to access parts of the farm. Driving on the slopes and public roads means that you would be accelerating, decelerating, or driving at constant speed.

Report on your understandings of how physics is used to allow your tractor to travel over a variety of different terrain by doing the following:

* Carry out research into tractor tyres. See Resources for useful websites. Use your knowledge of physics to produce a report that explains why tractor tyres make it possible for this type of vehicle to travel over different surfaces.
* Make sure your report clearly demonstrates your understanding of the way physics is used in the movement of a tractor, by investigating:
  + the force that provides the traction that makes the tractor move
  + the forces involved in driving a four wheel drive tractor compared with a two wheel drive tractor, and how traction and safety may be enhanced
  + the forces involved in accelerating and decelerating, turning and driving the tractor uphill and downhill
  + how the size of a tyre and maximum load requirements determine how powerful a tractor engine needs to be
  + how the pressure of the tyre on the ground is affected by weight distribution and the size of the tyre used
  + the designs and sizes of various types of tractor tyres and the physics of how these differences make each tyre suited for its intended purpose.

You may use measurements and calculations as part of your report.

* Produce your report, which could be:
  + a written report, including illustrations, diagrams, and graphs, if appropriate
  + a poster, including annotations or supporting notes
  + an oral presentation, with written references
  + a project booklet
  + a multi-media report, for example a recorded video report or web page with embedded video, graphics, and text
  + a computer presentation software file.
* Use your own words, unless quoting, and clearly indicate any direct quotes. Your report should be between two and four A4 pages in length, including any illustrations, diagrams, and graphs. If the work is in another format, it should be of equivalent length. All sources of information, images, diagrams, and data must be acknowledged and referenced in a format that enables them to be easily traced.
* Non-text formats, for example an oral report, must be supplemented by a written list of references.

# Resources

Useful websites include:

<http://www.physicsclassroom.com/class/newtlaws/u2l1d.cfm>

<http://www.physics4kids.com/files/motion_force.html>

<http://library.thinkquest.org/10796/ch4/ch4.htm>

<http://www.schoolphysics.co.uk/age11-14/Matter/text/Pressure_/index.html>

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to demonstrate comprehensive understanding of the physics of how the tyres of a tractor allow it to move over different terrain. The learner must prepare a report identifying the key physics used by driving a tractor and giving a detailed and comprehensive explanation of how the physics that has been identified is integrated within the application.

# Conditions

Learners need to create their report independently, and will be assessed individually.

You will need to decide on the format of the final report. You may wish to take learners’ preferences into account in deciding on the format.

# Resource requirements

Learners will require access to the internet for research.

# Additional information

None.

# Assessment schedule: Physics 90936 – Tractors

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of the physics of how the tyres of a tractor allow it to move over different terrain by:   * identifying the key physics used by driving a tractor * describing how the physics that has been identified is used   For example, the learner:   * + defines what pressure is in terms of force and area   + describes how the width of a tyre affects surface area in contact with the ground and the pressure exerted on the ground   + calculates the pressure exerted for a given force and area.   *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of the physics of how the tyres of a tractor allow it to move over different terrain by:   * identifying the key physics used by driving a tractor * explaining how or why the physics that has been identified is used   For example, the learner:   * + explains why the rear tyres of a tractor are larger   + explains an advantage of having wide tyres in terms of surface area in contact with the ground and the pressure exerted on the ground   + calculates pressure exerted on the ground at each tyre for given weight distributions and tyre contact areas   + explains the physics of how the pattern on a tractor tyre ensures greater traction   + explains why four wheel drive tractors can increase traction and safety for some situations.   *The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of the physics of how the tyres of a tractor allow it to move over different terrain by:   * identifying the key physics used by driving a tractor * giving a detailed and comprehensive explanation of how the physics that has been identified is integrated within the application. A comprehensive explanation may involve elaborating, justifying, relating, evaluating, comparing and contrasting, or analysing   For example, the learner:   * + explains why the rear tyres of a tractor are larger in terms of weight distribution   + compares advantages of different types of tractor tyres for different applications   + analyses how surface area and weight affect how far into the ground an object will sink and how this depends on soil texture and compaction   + calculates pressure and maximum traction for various tractor tyres and loadings.   *The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.