Collaborative learning in Physics

Adele Hudson
Lisa Milili
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ahudson@aitkencollege.edu.au
lmililli@student.unimelb.edu.au

Resources can be found at www.edudesign.com.au

Why collaborative learning?

- In meta-analyses, students in cooperative learning had higher achievement, higher-level reasoning, more frequent generation of new ideas and solutions, and greater transfer of knowledge than competitive or individualistic structures (Barkley, et al, 2005: p.17-18)

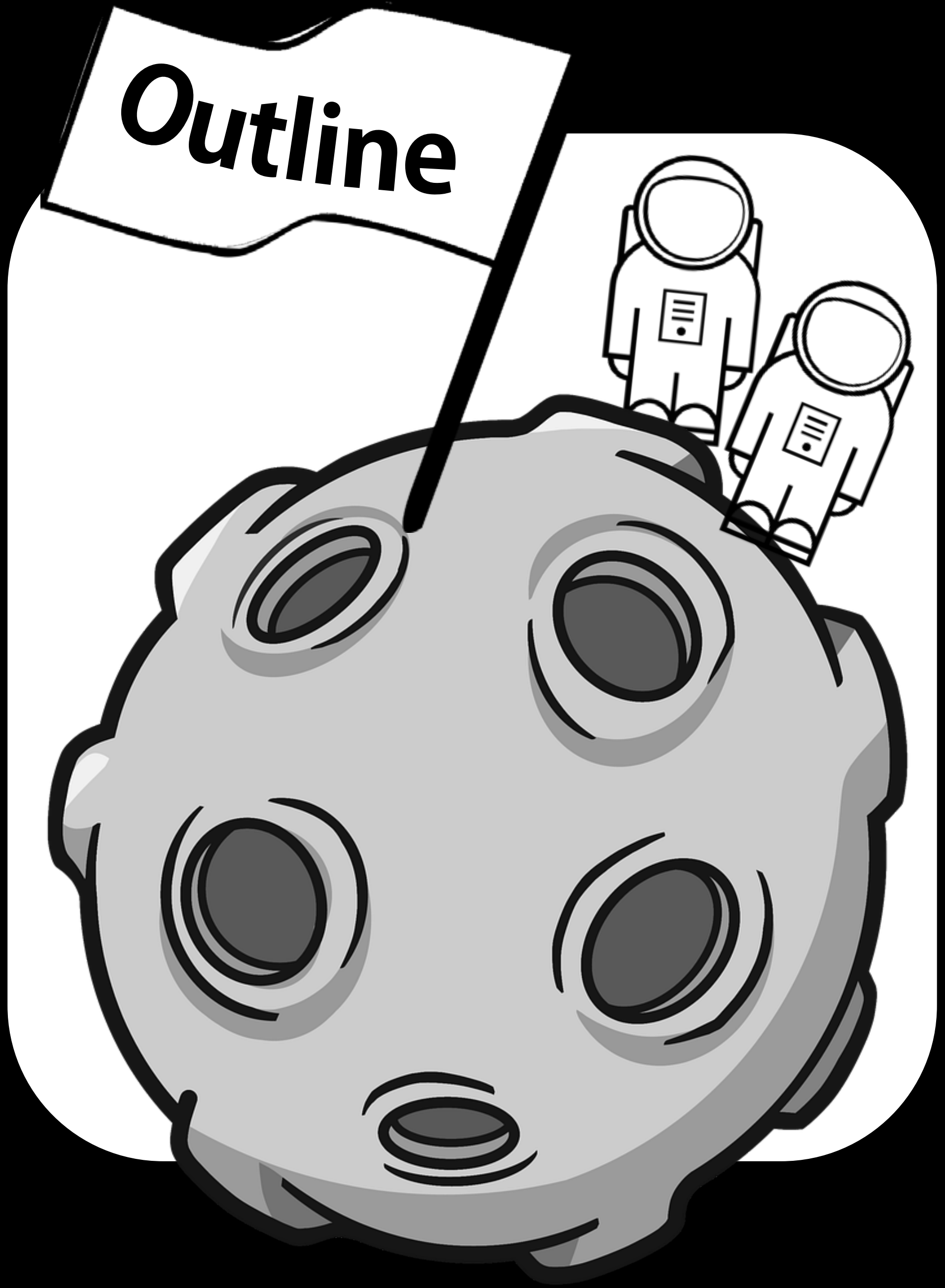
Why collaborative learning?

- cooperative learning has also been observed to enhance achievement of female students and other groups often unrepresented in a number of disciplines (Herreid, 1998).

Why collaborative learning?

- 61% of the cooperative-learning classes achieved significantly higher test scores than traditional classes
- effective classes stressed group goals and individual accountability. (Slaven, 1991)

- our aims
- benefits
- essential elements
- sample projects

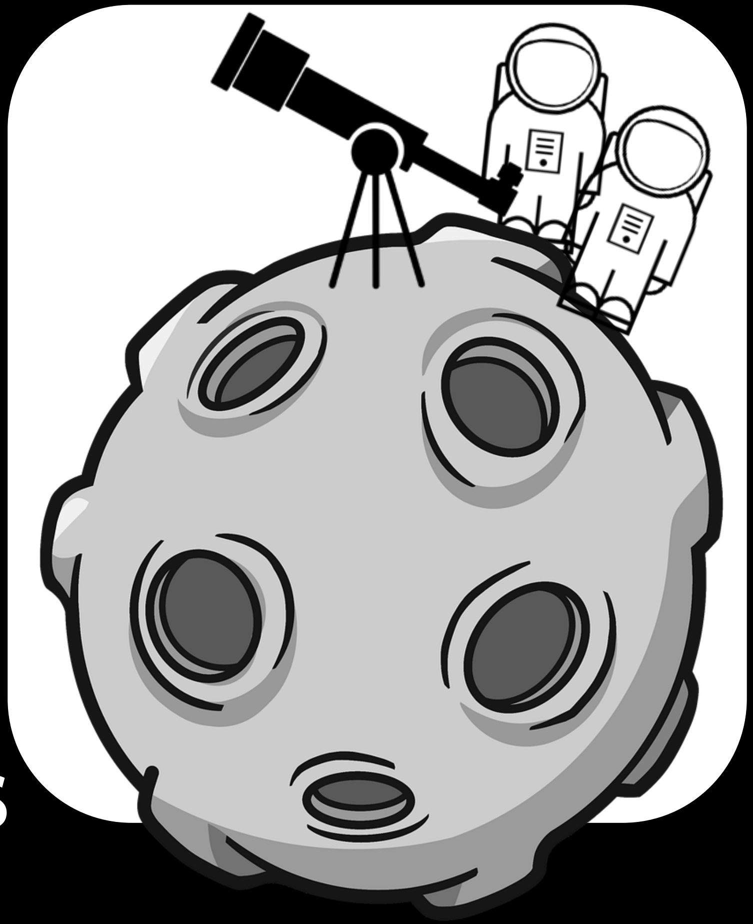


what are we about?

- embed collaborative learning
- physics is accessible

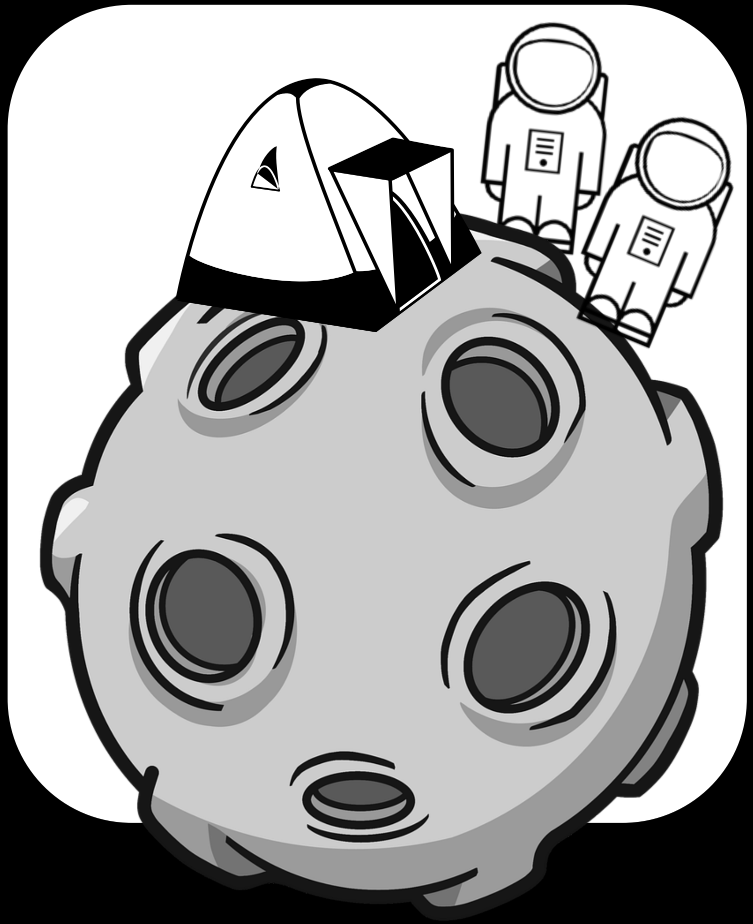
benefits

- increased numbers in VCE Physics
- greater participation of girls
- students transition from 11 to 12



essential elements

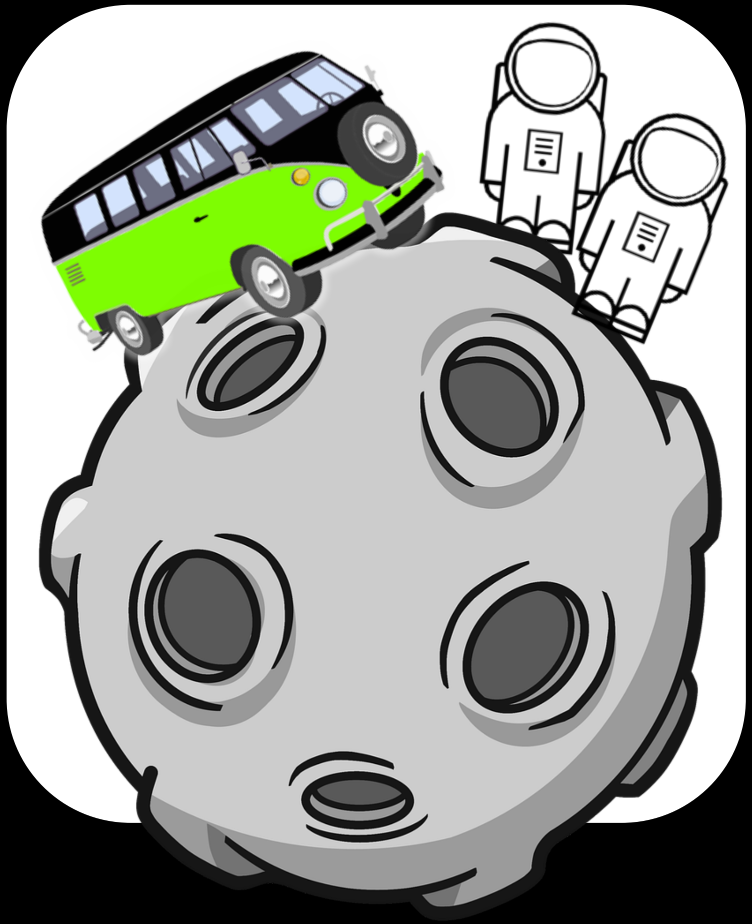
- student choice
- purposeful
- individual accountability
- connection with other students
- provide milestones
- provide regular feedback



U1AOS2 Transducer Investigation

Task Outline: To investigate how transducers work and explain how it is used in a household appliance.

You will choose to investigate either a thermistor, a light dependent resistor or a potentiometer.



U1AOS2 Transducer Investigation

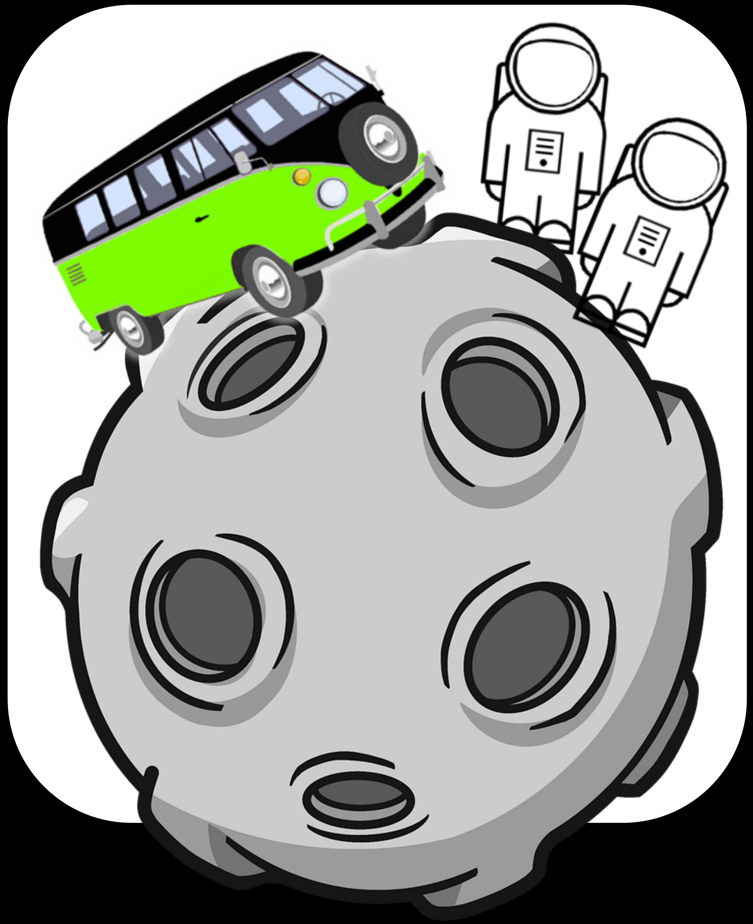
Task Timeline

Lesson 1: Section A Voltage divider experiment

Lesson 2: Section B Transducer experiment

Lesson 3: Section C Transducers in home appliances; complete on A3 sheet

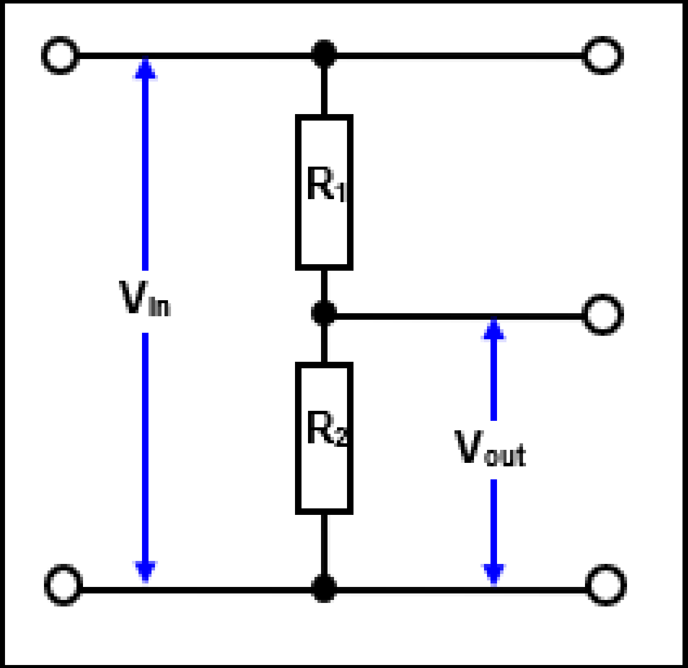
Lesson 4: Section C Transducers in home appliances; complete on A3 template.



U1AOS2 Transducer Investigation

SECTION A: Voltage divider experiment

In this experiment, you will make a voltage divider. A voltage divider is used to reduce a voltage to a value needed for a part of the circuit. Voltage dividers are used to control many appliances, such as turning on heating in a home when the temperature drops.

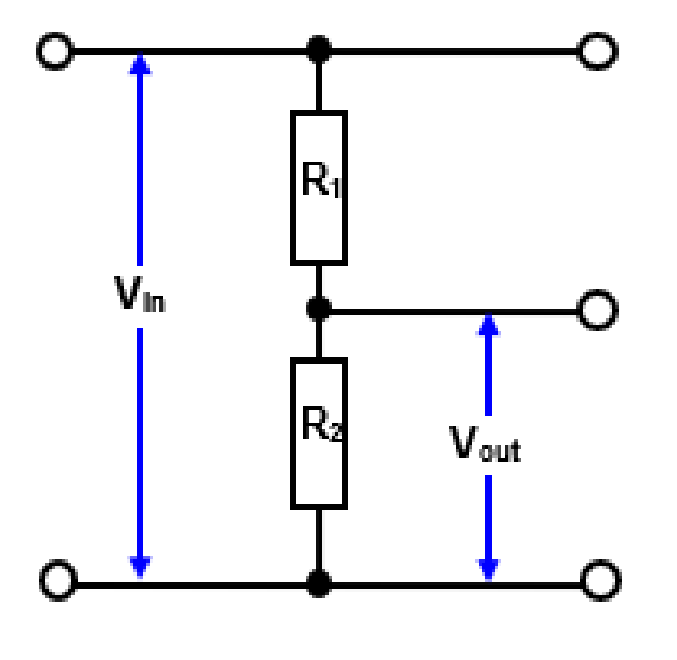


U1AOS2 Transducer Investigation

SECTION B: Transducer experiments

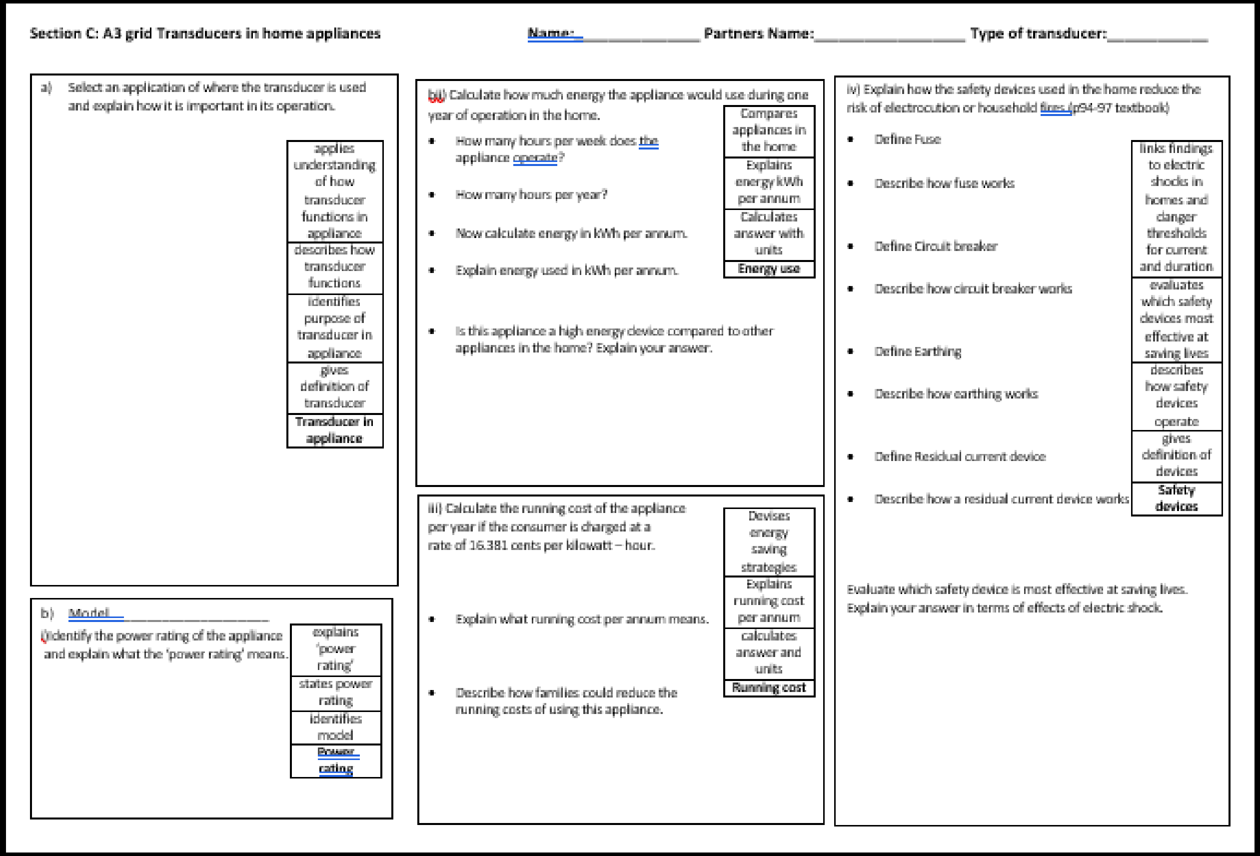
Select a transducer to investigate and complete the relevant experiment.

- Thermistor Experiment
- Light Dependent Resistor
- Potentiometer



U1AOS2 Transducer Investigation

SECTION C: Investigate how the transducer that you have selected is used in a home appliance. Insert your answers into the A3 grid.


Section C: A3 grid Transducers in home appliances **Name:**______________ **Partners Name:**________________ **Type of transducer:**___________

a) Select an application of where the transducer is used and explain how it is important in its operation.

applies understanding of how transducer functions in appliance
describes how transducer functions
identifies purpose of transducer in appliance
gives definition of transducer
Transducer in appliance

b) Model________________

i)dentify the power rating of the appliance and explain what the 'power rating' means.

explains 'power rating'
states power rating
identifies model
Power rating

bii) Calculate how much energy the appliance would use during one year of operation in the home.

- How many hours per week does the appliance operate?
- How many hours per year?
- Now calculate energy in kWh per annum.
- Explain energy used in kWh per annum.
- Is this appliance a high energy device compared to other appliances in the home? Explain your answer.

Compares appliances in the home
Explains energy kWh per annum
Calculates answer with units
Energy use

iii) Calculate the running cost of the appliance per year if the consumer is charged at a rate of 16.381 cents per kilowatt – hour.

- Explain what running cost per annum means.
- Describe how families could reduce the running costs of using this appliance.

Devises energy saving strategies
Explains running cost per annum
calculates answer and units
Running cost

iv) Explain how the safety devices used in the home reduce the risk of electrocution or household fires (p94-97 textbook)

- Define Fuse
- Describe how fuse works
- Define Circuit breaker
- Describe how circuit breaker works
- Define Earthing
- Describe how earthing works
- Define Residual current device
- Describe how a residual current device works

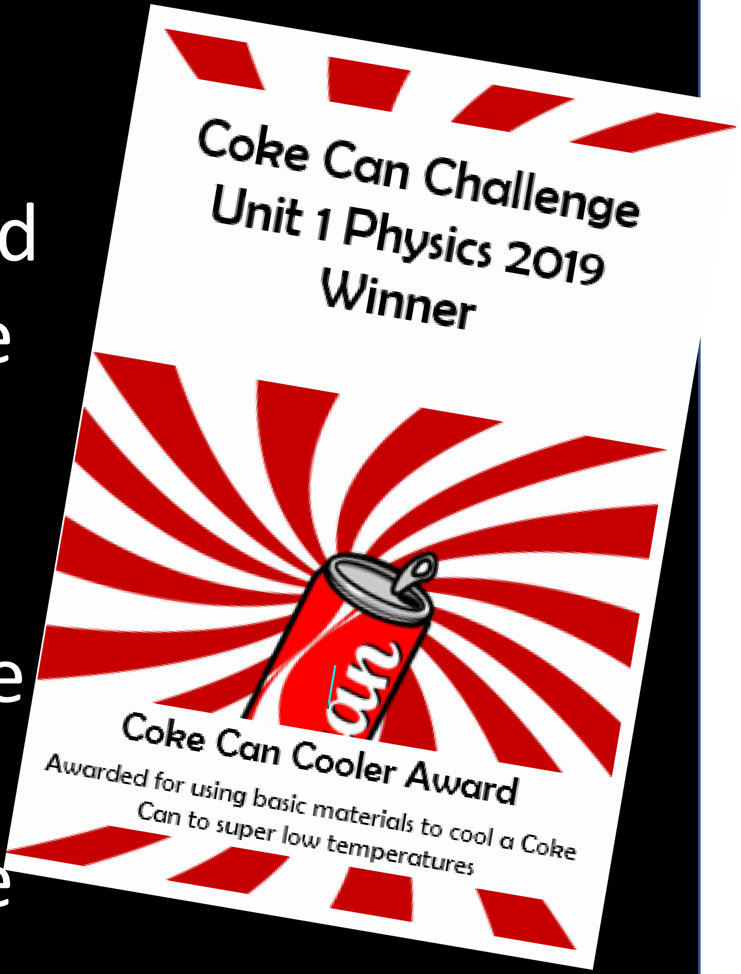
links findings to electric shocks in homes and danger thresholds for current and duration
evaluates which safety devices most effective at saving lives
describes how safety devices operate
gives definition of devices
Safety devices

Evaluate which safety device is most effective at saving lives. Explain your answer in terms of effects of electric shock.

U1AOS1 Coke Can Challenge

Scenario: Today is the hottest day of the year and its 44°C. You would love a can of coke, BUT there is no electricity for your fridge.

But you have been learning about Thermodynamics so you can use your knowledge of conduction, convection and radiation to cool the coke can. The challenge is that you only have limited materials.



U1AOS1 Coke Can Challenge

There are two awards

Coke Can Cooler Award – Cool car to lowest temperature.

Thermodynamics Genius Award Embeds most thermochemical principals into design

U1AOS1 Coke Can Challenge

Materials

Choose 6 items

- 200 g Ice (150 g)
- 10 g Salt (5 g)
- 2 L water
- 30 cm plastic wrap
- small plastic container
- 20 cm aluminium foil
- 1 x zip lock bag
- packing peanuts
- 20 cm foam insulation
- 20 cm bubble wrap

Procedure

There are three phases; design, build and test.

Design

You have **20 minutes** to design your fridge. During this time you select your materials and draw a design. You need to explain where you have used thermodynamic principles in your design.

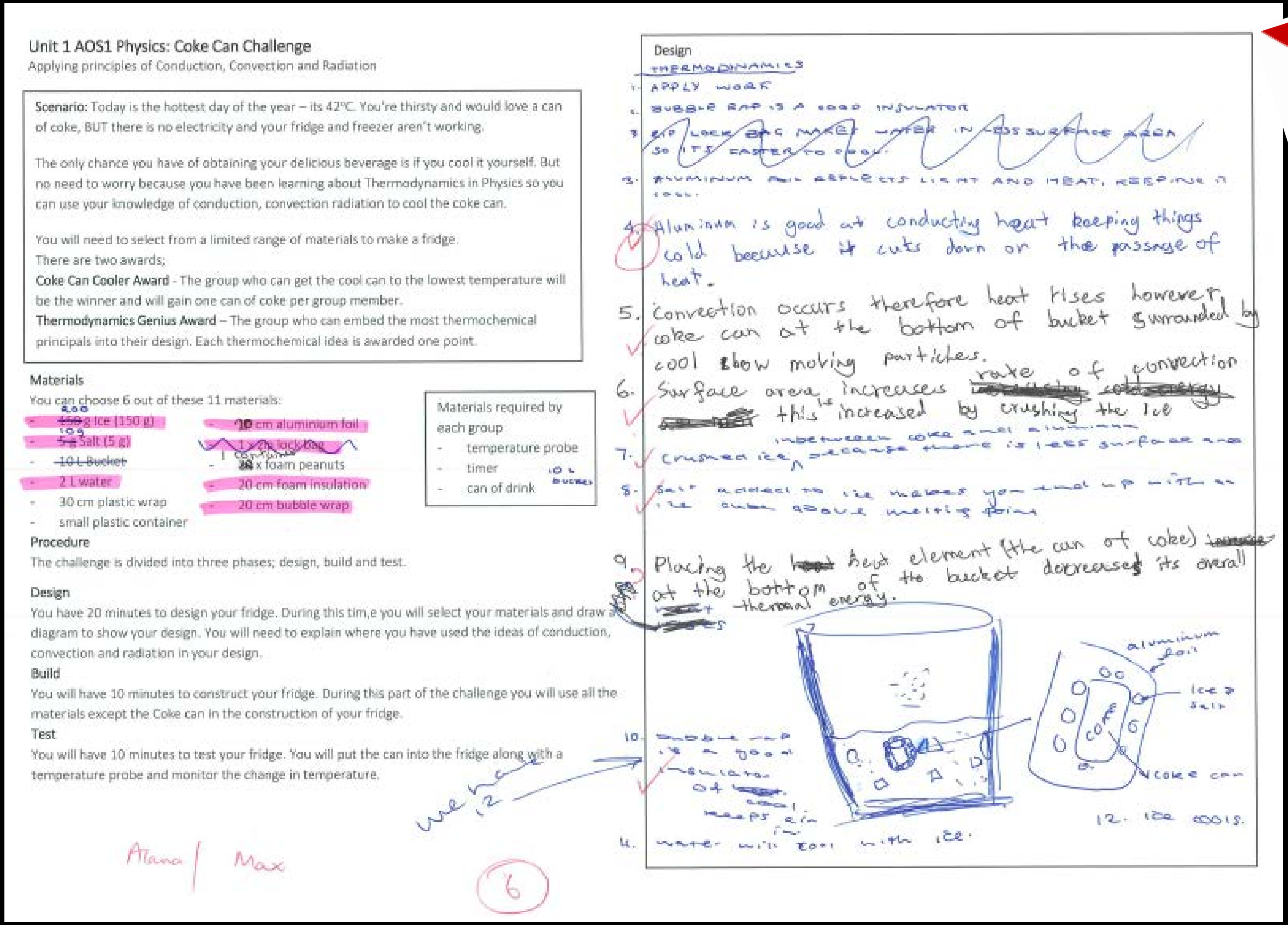
Build

You have **10 minutes** to construct your fridge. Do not put your Coke can in your fridge yet.

Test

You have **10 minutes** to test your fridge. Place the Coke can into the fridge along with a temperature probe and monitor the change in temperature.

U1AOS1 Coke Can Challenge


Unit 1 AOS1 Physics: Coke Can Challenge

Applying principles of Conduction, Convection and Radiation

Scenario: Today is the hottest day of the year – its 42°C. You're thirsty and would love a can of coke, BUT there is no electricity and your fridge and freezer aren't working.

The only chance you have of obtaining your delicious beverage is if you cool it yourself. But no need to worry because you have been learning about Thermodynamics in Physics so you can use your knowledge of conduction, convection radiation to cool the coke can.

You will need to select from a limited range of materials to make a fridge.

There are two awards;

Coke Can Cooler Award - The group who can get the cool can to the lowest temperature will be the winner and will gain one can of coke per group member.

Thermodynamics Genius Award – The group who can embed the most thermochemical principals into their design. Each thermochemical idea is awarded one point.

Materials

You can choose 6 out of these 11 materials:

- 150 g ice (150 g)
- 5 g Salt (5 g)
- 10 L Bucket
- 2 L water
- 30 cm plastic wrap
- small plastic container
- 10 cm aluminium foil
- 1 x zip lock bag
- 20 x foam peanuts
- 20 cm foam insulation
- 20 cm bubble wrap

Materials required by each group

- temperature probe
- timer
- can of drink

Procedure

The challenge is divided into three phases; design, build and test.

Design

You have 20 minutes to design your fridge. During this tim,e you will select your materials and draw a diagram to show your design. You will need to explain where you have used the ideas of conduction, convection and radiation in your design.

Build

You will have 10 minutes to construct your fridge. During this part of the challenge you will use all the materials except the Coke can in the construction of your fridge.

Test

You will have 10 minutes to test your fridge. You will put the can into the fridge along with a temperature probe and monitor the change in temperature.

Alana | Max

6

Design

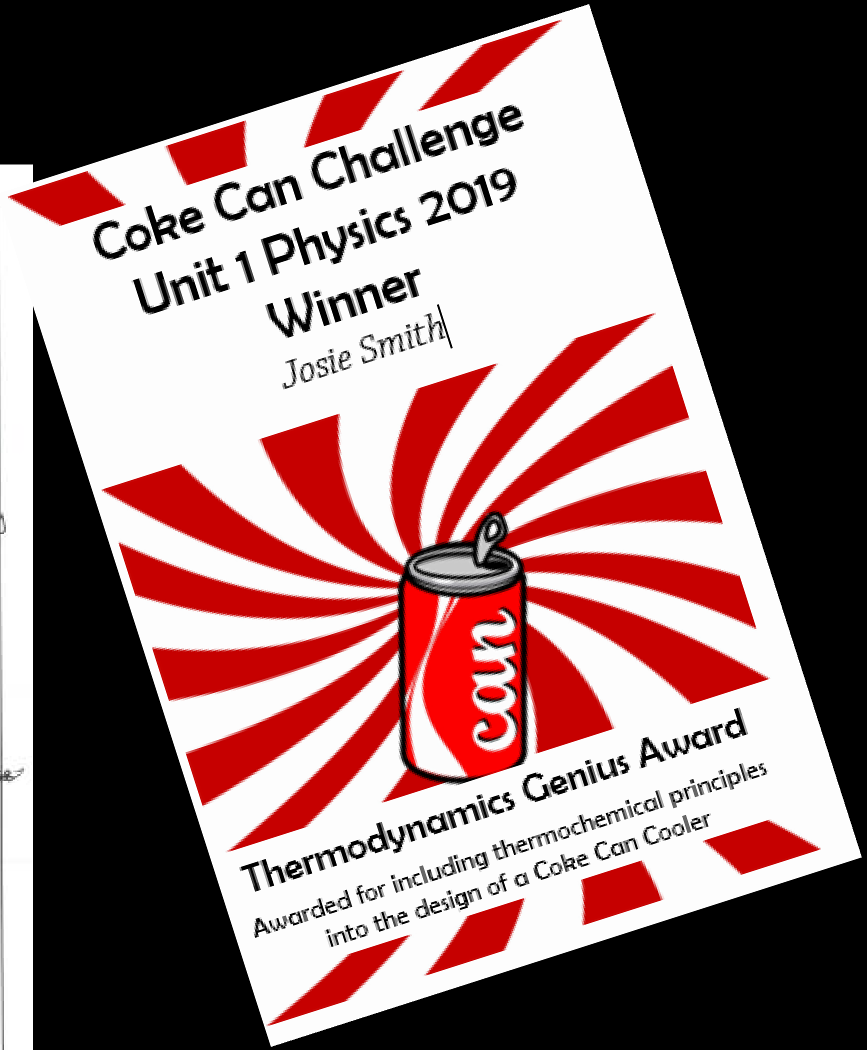
THERMODYNAMICS

4. Aluminium is good at conducting heat keeping things cold because it cuts down on the passage of heat.

5. Convection occurs therefore heat rises however bucket surrounded by coke can at the bottom of cool slow moving particles.

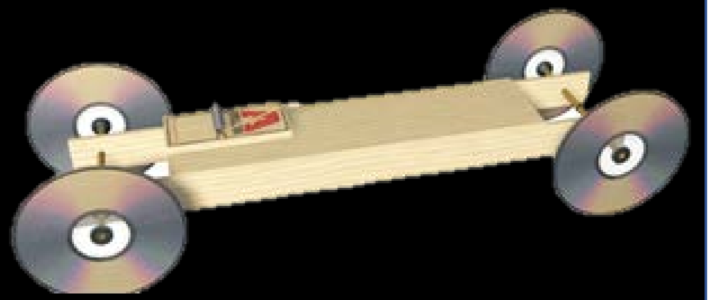
6. Surface area increases rate of convection this increased by crushing the ice

9. Placing the heat element (the can of coke) at the bottom of the bucket decreased its overall thermal energy.



U2AOS1 Mousetrap car investigation

Task Outline



Your aim is to improve the design of a mouse trap car.

Awards will be presented for the car that covers the greatest distance and the car with most improved base line data.

Each team of three will be allocated a basic mousetrap car and will determine the baseline data.

You team will then improve the design and you will write an individual report on your investigation under test conditions.

U2AOS1 Mousetrap car investigation

Instructions

1. Collect baseline data for the mousetrap car during experiments 1 – 3.
2. Design three improvements for the car. Predict and justify the effect of these improvements on data.
3. Collect data for modified car. Explain the changes that were observed. Justify with theory.
4. Complete the discussion grid. Submit the summary table and discussion grid for assessment.

U2AOS1 Mousetrap car investigation

Task Timeline

Lesson 1: Collect data on pulling distance and mechanical advantage

Lesson 2: Calculate the static and kinetic friction force

Lesson 3: Determine the torque and PE of the spring

Lesson 4: Design three improvements and justify with theory

Lesson 5: Modification Day – make improvements to car.

Competition day - Both classes will be competing together at lunch time for the awards. Measurements will be taken for assessment task.

Lesson 6: Collect data on modified car.

Lesson 7: Complete summary table and discussion grid.

U2AOS1 Mousetrap car investigation

Calculate Maximum Pulling Distance of Mousetrap Car

Reference: Balmer, A.J (2012) Calculate maximum pulling distance, www.docfizzix.com, date accessed 23rd July 2018.

Purpose

To determine the pulling distance, mechanical advantage and distance travelled by mousetrap car.

Equipment

- Ruler or digital callipers
- Measuring tape or meter ruler

BACKGROUND THEORY

The pulling distance of a mousetrap car is a measurement of how far the car will be under the pulling force of the mouse trap. In this activity, you will calculate how far your mousetrap car should be pulled (theoretical pulling distance) and then compare this to the actual pulling distance.

The pulling distance is not the total distance that a mousetrap car will travel, but rather how far the vehicle will be under the force of the mouse trap's spring.

IMPORTANT FACTS

- The distance that a mousetrap car is being pulled under the force of the mouse trap's spring is directly proportional to the size of the drive wheels, the drive axle, and the length of the lever arm.
- The travel distance is inversely proportional to the size of the drive axle.

Mathematical Equations for calculating the pulling distance

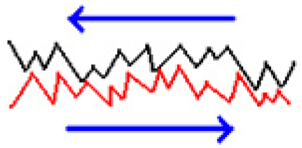
The pulling distance is calculated from the number of turns that the drive wheel(s) make times the circumference of the drive wheel. The number of turns that a drive wheel makes depends on the length of string that can be pulled from the drive axle divided by the circumference of the drive axle. By putting the first two formulas together you can predict the pulling distance.

U2AOS1 Mousetrap car investigation

Measuring static friction and kinetic friction

Background

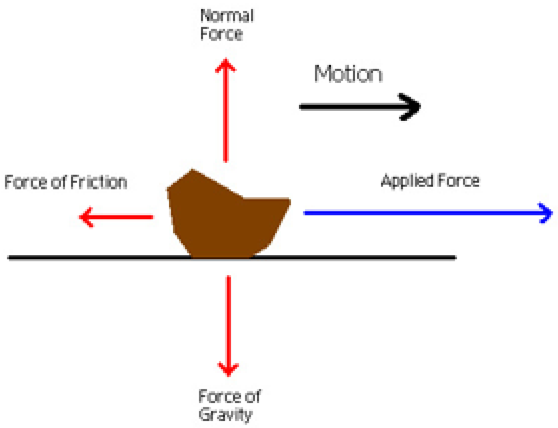
Reference: http://ffden-2.phys.uaf.edu/211_fall2002.web.dir/ben_townsend/staticandkineticfriction.htm

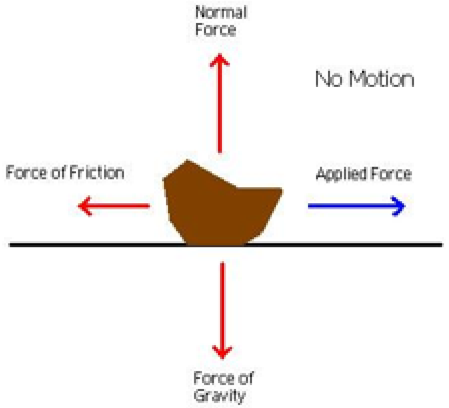


The force of friction is a force that resists motion when two objects are in contact. If you look at the surfaces of all objects, there are tiny bumps and ridges. Those microscopic peaks and valleys catch on one another when two objects are moving past each other.

This explanation is a little simplified. There are other processes at work, including chemical bonding and electrical interactions.

The level of friction that different materials exhibit is measured by the coefficient of friction. The formula is $\mu = f / N$, where μ is the coefficient of friction, f is the amount of force that resists motion, and N is the normal force. Normal force is the force at which one surface is being pushed into another. If a rock that weighs 50 Newtons is lying on the ground, then the normal force is that 50 Newtons of force. The higher μ is, the more force resists motion if two objects are sliding past each other.





U2AOS1 Mousetrap car investigation

Lesson 3: Measuring the Torque and the Spring constant of the Mousetrap Spring

A mousetrap car is a vehicle that is powered by the energy stored in the spring of a mousetrap. One of the basic ways in which most mousetrap vehicles are set into motion is by connecting the lever of the mousetrap bar through a string to the axle of the car. As the mousetrap lever is released, the tension that was built up in the spring is released, and the car sets into motion.

To get the car to go the farthest, you need to store the maximum amount of potential energy in the mousetrap spring. A car which has a higher spring constant will be able to store more potential energy.

You will use the torque formula to calculate the torque from the measured force at different angels.

Torque formula

$\tau = r_{\perp}F_{\perp}$ (To use this simple formula you need to ensure that the angle between the lever and the force sensor is at 90°)

The spring constant (k_1) can be determined from the equation that connects torque (τ) and the angle of rotation (θ).

$$\tau = k_o + k_1\theta$$

As it is a linear equation, the spring constant can be determined from the slope of the line.

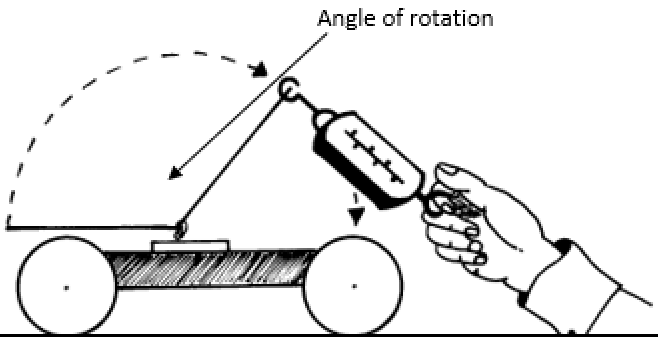


Table 1

Angle of rotation	Torque (Nm)
0	
45	
90	
135	
180	

U2AOS1 Mousetrap car investigation

	Base Car	Reports results	Predicted effect of modifications on car Justify with theory (in text citations)	Modified car	Observations Summarise the effect of changes
Mechanical Advantage		*Identify links between mechanical advantage, pulling distance and total distance*			
Pulling Distance					
Total distance travelled by car					
Static friction		*Summarise static and kinetic friction and spring constant data*			
Kinetic friction					
Spring Constant					
Makes conclusions: Summarise key findings, identifies limitations, makes recommendations and discussions implications					

U2AOS1 Mousetrap car investigation

		explains how modifications improve quality of results	discusses implications of key findings
uses observations that summarises investigation	summarises results and identifies trends	justifies effect of modifications using theory with in text citations	makes recommendations
identifies observations that influence results	summarises results	explains how modifications improve design	identifies limitations of key findings
records observations	lists results	identifies modifications	summarises key findings
makes observations	**reports results**	**modifies method**	**makes conclusions**
Links to VCAA VCE Physics Key Science Skills			
systematically generate, collect, record and summarise quantitative data		analysis and evaluation of primary data	draw conclusions consistent with evidence and relevant to the aim
process quantitative data using appropriate mathematical relationships, units and number of significant figures		linking of results to relevant physics concepts	identify, describe and explain the limitations of conclusions, including identification of further evidence required
		Identification of limitations in data and methods, and suggested improvements	determine to what extent evidence from an investigation supports the purpose of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation
		take a qualitative approach when identifying and analysing experimental data with reference to accuracy, precision, reliability, validity, uncertainty and errors (random and systematic)	discuss the implications of research findings and proposals

U2AOS3 Practical investigation

Task Outline

You will complete an individual research task within a research group. In your research group you will be able to support each other by collaborating on the background theory and even measurement techniques. However, you will need individual research questions.

There are four research groups to choose from:

- Ski Jump Safety
- Design a safety harness
- Safety Barriers

U2AOS3 Practical investigation

Task Timeline

Lesson 1&2: Plan the investigation - design research question, establish variables, write hypothesis & aim.

Lesson 3: Write materials lists, method, table of results. Submit materials order.

Lesson 4: Submit logbook requirements and introduction for assessment rubric 1.

Lesson 5: Conduct experimental work.

Lesson 6: Conduct experimental work

Lesson 7: Draw graphs. Complete discussion template.

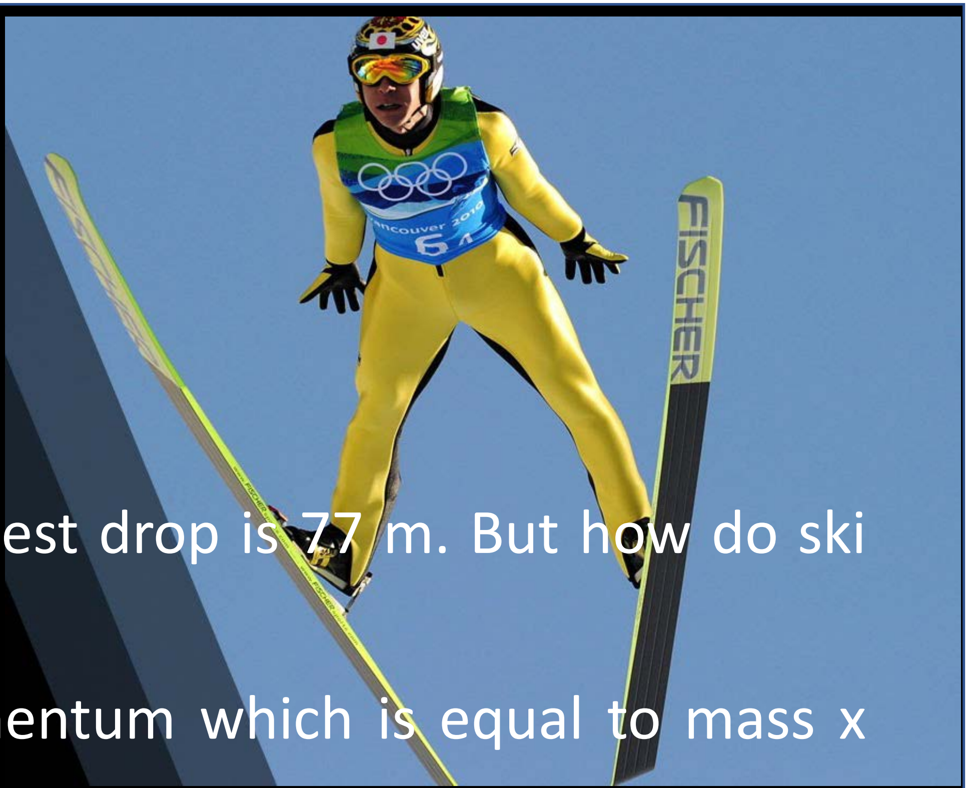
Lesson 8: Complete analysis on template

Lesson 9: Write up discussion under test conditions

Lesson 10: Complete poster and submit.

U2AOS3 Practical investigation

Research groups; ski jump safety



The longest ski jump in world is 246 m while the longest drop is 77 m. But how do ski jumpers land in the snow without breaking their legs?'

When the skier lands it causes a change in the momentum which is equal to mass x Δvelocity.

The momentum is also equal to; Impulse = Force x Δ time where F = impact force multiplied by the collision time.

You will investigate strategies that can be used to reduce the force of impact on the ski jumper when they land, by extending the time of the collision.

U2AOS3 Practical investigation

Research groups; safety barriers

Safety barriers reduce the severe injuries when cars run off the road.

When a moving car comes in contact with a stationary object, it causes a change in the car’s momentum which is equal to mass x Δvelocity.

Momentum is also equal to; Impulse = Force x Δ time

The purpose of safety barriers is to extend the collision time in order to reduce the force of the impact on the car.

You will investigate different strategies that can be used to extend the time of the collision in order to reduce the force of impact on the car.

U2AOS3 Practical investigation

Research groups; safety harness

Falls are a significant danger to workers in a range of industries. From 2003 to 2011, 232 workers were killed following a fall from a height.

People first used ropes to stop falls, but this caused severe injuries to internal organs. This was because when a person falls, they experience a change in momentum. This change in momentum is equal to; Impulse = Force x Δ time which is the impact force multiplied by the collision time. So when a person comes to a sudden stop, this results in a huge impact force on the body.

Today, harness systems spread the impact force across the whole body. Shock absorbers are also used, which reduce the impact force on the body.

In this project, you will investigate the types of materials that can be used as shock absorbers to extend the time that it takes for the body to become stationary after a fall.

U2AOS3 Practical investigation

see onenote

Investigation Guide

Use this to guide your investigation. Include all information into your log book. The checklists and assessment rubric is a useful tool to ensure that your investigation is of the required standard.

Planning the Experiment

Research Question

In your logbook, you need to include a research question that will be used to guide all parts of the investigation. It is important that your research question is not too broad or too generalised. The research question should also state what will be done in the investigation and should be able to be answered in a laboratory investigation.

Research Question Checklist

	states what will be done
	can be answered experimentally

Variables

In your logbook, you need to include the independent and dependent variables and summarise what factors you will control. A variable can exist in differing amounts or types and can be measured. Use the table below as a guide. Remember that you need to investigate two independent variables, one of which is a continuous variable.

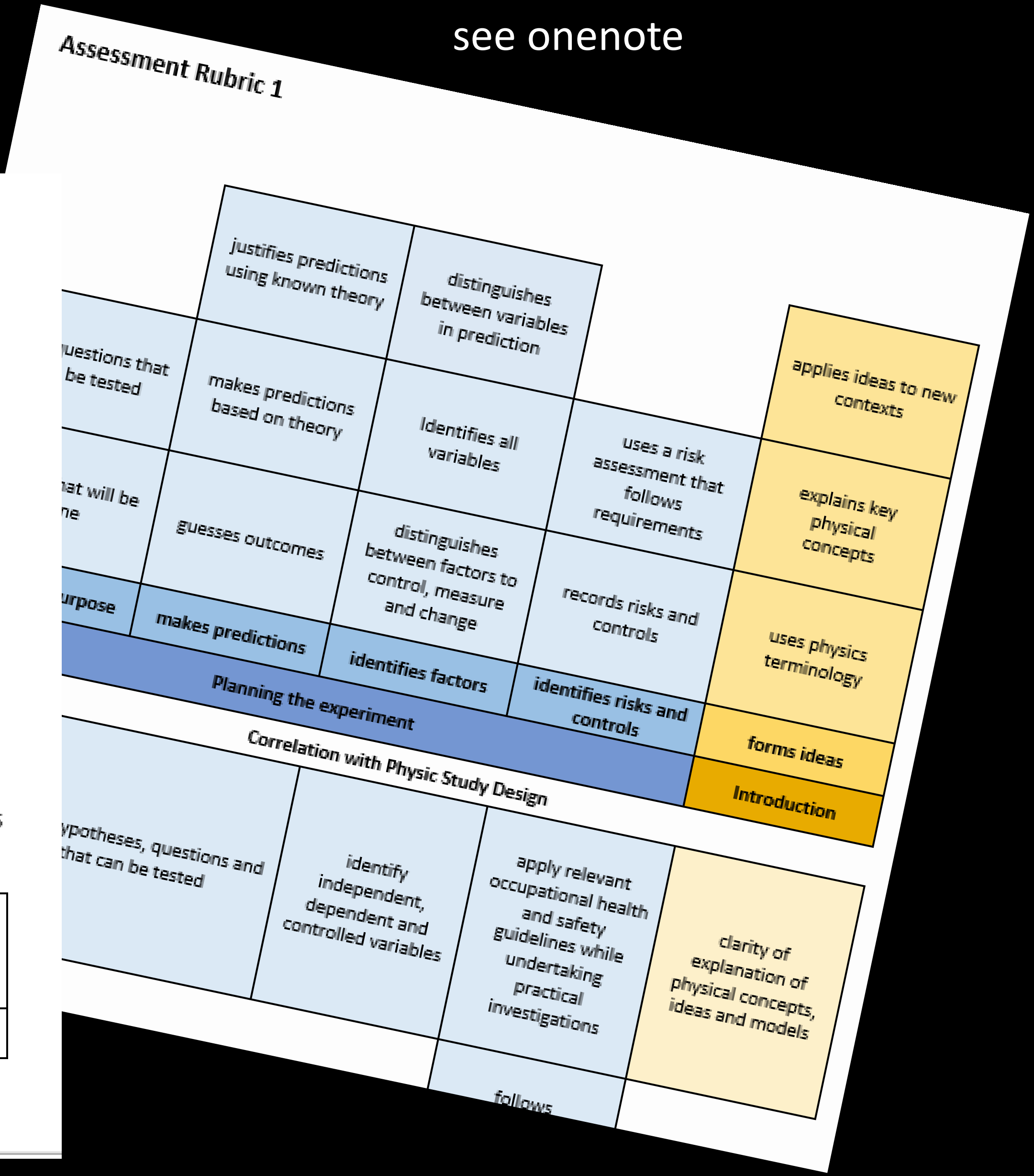
Independent Variable (what will you be changing?)	**Dependent variable** (what change will you be measuring?)	**Controlled variables** (what will you keep constant in each trial?)

Hypothesis

You need to include a hypothesis in your logbook. The hypothesis is

Hypothesis Checklist

	States the predicted effect and



U2AOS3 Practical investigation

Safety barrier student investigation

Introduction:

Safety Barriers are a means to reduce the impact of crashing high moving vehicles. The SAFER barrier is a newer design and has become the safest option primarily achieved through the Steel And Foam Energy Reducing (SAFER) barrier model. The foam can absorb large amounts of force and return back into its original shape which is essential for safety barriers on race courses that might need to be used frequently. In motion physics impulse-momentum is calculated by; P (momentum)=Force x Δtime and therefore safety barriers reduce momentum by either absorbing the force or by increasing the duration of the collision to give the object a slower deceleration rate.

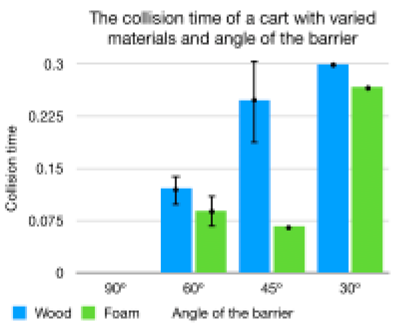
This experiment aims to determine what angle and material of a safety barrier will reduce the overall momentum of the vehicle by increasing the collision time by increasing the total distance travelled. If the angle of the barrier is decreased and material with lower friction is used, the duration of the collision will be longer and therefore reduce the risk of a driver dying in a crash. This is because by increasing the friction the vehicle will come to a halt faster due to the fact that whilst the force remains constant the increase of friction increases resistance force therefore increasing the deceleration rate (Andrew Rader Studios, n.d.). Furthermore the decrease of the angle will increase the surface area of the safety barrier therefore increasing the distance and subsequently the duration of the collision as the driver has to go up and back down the barrier on a angle of 30° compared to a straight collision at 90°

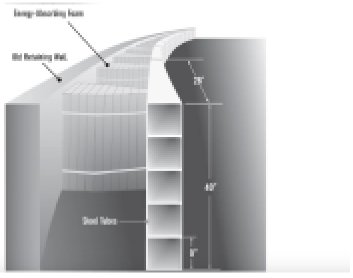
Methodology:

Initially, the time it took for a car to go up the barrier, (duration of the collision) was collected. The car was attached to a waited pulley system. The car was pulled back and let go and moved due to the weight in the pulley system. Videos of each trail was recording and through video physics the collusion duration time was recorded.

To ensure safety, equipment was securely fastened and heavy objects was attached to other comments and placed in the middle of the table avoiding any falling objects from damaging feet.

Results:





The SAFER barrier design displayed in "Know your NASCAR: SAFER barrier.

Discussion:

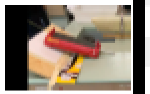
It was found that when the barrier was at 90° the collision duration time was 0 seconds for both wood and foam. When the barrier was at 60° the average collision duration time was 0.122 seconds for the wood board and 0.089 seconds for the foam board. When the barrier's angle decreased to 45° the average collision duration time was 0.248 seconds for the wood board and 0.067 seconds for the foam board. For the final result when the wood and foam boards were at 30° the collision duration time was 0.3 seconds on the wood board and 0.267 seconds for the foam board. The narrow 95% confidence intervals indicate that the data obtained is precise as 95% of trails will not differ more than 0.075 seconds from the mean. On 3 seperate occasions the 3 trails had the same consistent result either suggesting the results were acutely recorded or the recording device was not specific enough and a trend is broken when the foam board at 45° has a shorter collision time despite the wooden counterpart increasing proving results to be inaccurate for the 45° data set.

This data suggests that lower angles for barriers increase the duration of the collision. This is potentially due to the increase in surface area lengthening the time it takes to go up the barrier. Additionally the friction of the barrier is inversely proportional to the duration of the collision. This is due to friction theory suggesting that the increase of friction 'slows objects down' faster as it takes a greater amount of force to travel the surface distance and if force is constant the object will travel to a halt faster (Andrew Rader Studios, n.d.).

The angle was not controlled since a protractor was manually used to measure the angle of barrier and the barrier shifted in-between trails. Consequently, collision times would have been impacted as a lower angle would have increased the collision time. Furthermore at 30° the car was going over the barrier which in a real life scenario would not be effective as the high speeding vehicle could endanger civilians behind the barrier. The precision of the data may have been compromised as each trail would have different barrier angles which would lead to more variation in collision duration time. This could be rectified by inserting a block of wood carved to a specific angle which was fixed to the barrier to ensure consistency of angle readings and collect data on angles that could have practical use preventing the car to go over the edge. However the wood carved block could dislodge and alter the angle therefore there are limitations within the proposed solution to controlling this variable. The precision and reproducibility of results is increased by ensuring that that further trails experience nearly identical conditions as one another.

The car traveling of the edge of the barrier.

When the foam board was trailed the original foam material was incapable of collecting results as the friction was so high causing the car to stop on impact of the foam. The thickness of the foam was reduced which decreased friction and increased



The car colliding with the foam barrier.

Conclusion:

The decrease of the barrier's angle and the surface area with the least amount of friction tended to increase the duration of the collision, evident by the average collision time of wood and foam being significantly higher (Wood-0.3, Foam-0.267) at 30° compared to data at 90° (Wood-0 seconds, Foam- 0 seconds.) Lower angled barriers are potentially a viable option in race-car courses. However some of the angles tested caused the car to go over the barrier becoming a safety issue and thus it is unknown what specific angle is the most effective at increasing the collision duration without the car traveling over the barrier. Further testing should be conducted to determine which angle is most suitable to increase the collision time whilst reducing the risk of race cars travelling over the edge. Additionally other materials that vary in friction level should be tested to determine what material will increase the duration of a collision by the highest factor.

References:

-Las Vegas Motor Speedway 2017, Know Your NASCAR: SAFER Barrier, 1 February, viewed 5 November 2019, <https://www.youtube.com/watch?v=z_LqZHwoELc>.

-Friction Basics n.d., PHYSICS4KIDS, viewed 5 November 2019, <http://www.physics4kids.com/files/motion_friction.html>.

-Professor Dave Explains 2017, Impulse and Momentum, 14 March, viewed 5 November 2019, <https://www.youtube.com/watch?v=E13h1E_Pc00>

Year 10 Biomechanics Investigation

Task Outline

During this term, you will design a prototype assistive aid for a client. You will need to identify your client's needs, develop an understanding of the biomechanics of how people walk, identify suitable materials to use for your prototype and then design an assistive aid suitable or your client.

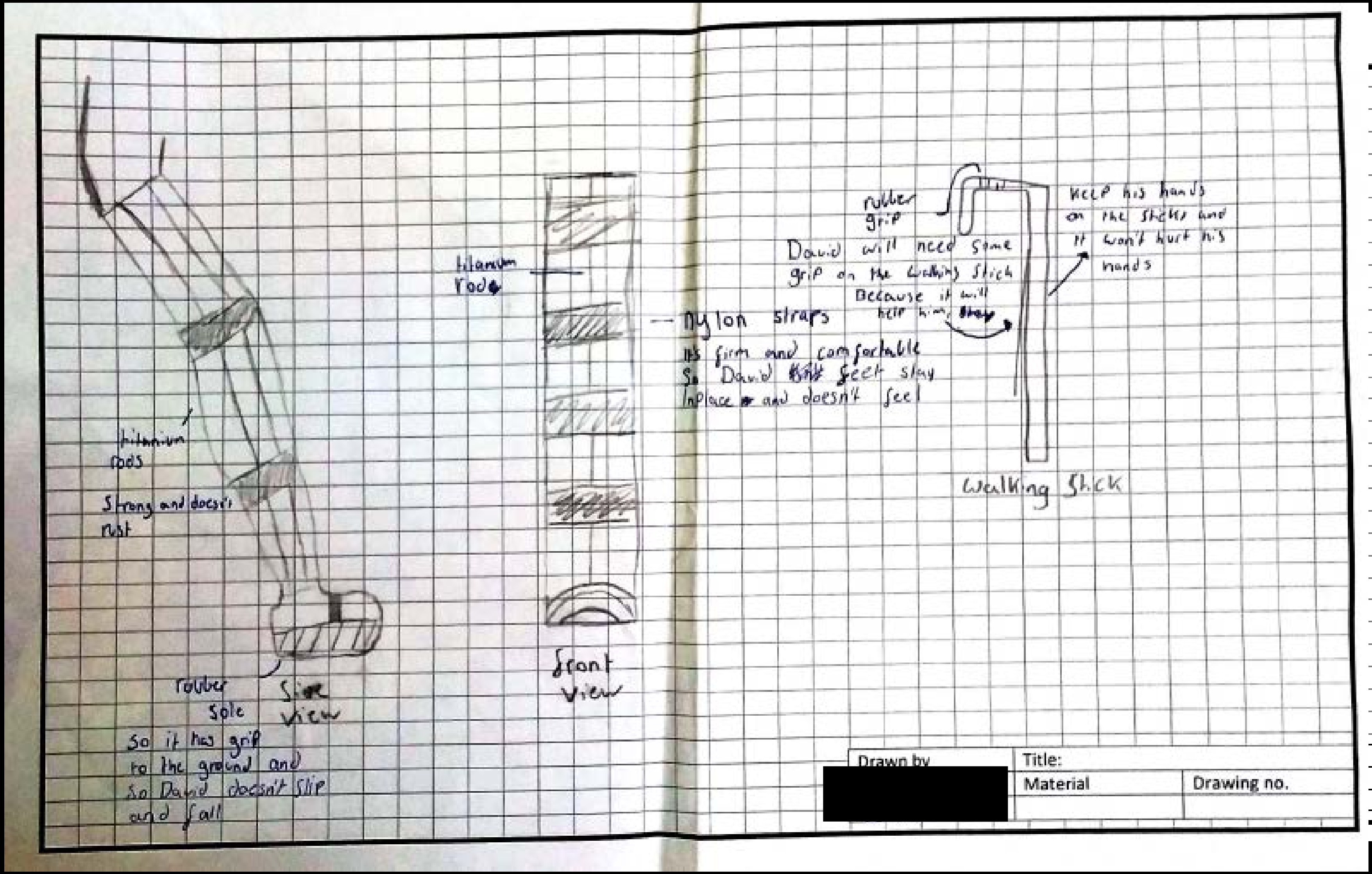
The final assessment task will be in Week 5 where you answer questions about your meeting with your client. In this meeting you will need to describe to them the main features of the assistive that you will have designed for them.

Year 10 Biomechanics Investigation

Timeline

Investigation Lesson 1: Identifying your clients' needs
Investigation Lesson 2: Forces and Balance – Centre of Gravity
Investigation Lesson 3: Newton's First Law of Motion
Investigation Lesson 4: Newton's 2nd Law
Investigation Lesson 5: Newton's 3rd Law
Investigation Lesson 6: Investigating properties
Investigation Lesson 7: Designing the prototype
Investigation Lesson 8: Designing the prototype
Investigation Lesson 9: Complete client interview under test conditions

Year 10 Biomechanics Investigation



explains how assistive aid functions
design considers constraints
design considers client needs
lists reasoning behind the choice of materials
includes a drawing with labels
designs assistive aid

Drawn by	Title:	
	Material	Drawing no.

Year 10 Biomechanics Investigation

Assessment

	design considers all client needs	tailor's explanations to suit audience		
evaluates effect of science ideas on assistive aid design	design considers most of client needs	explains subject specific words		identifies limitations of key ideas
applies science ideas to assistive aid design	lists reasoning behind the choice of materials	defines subject specific words	explains links between science ideas and design	evaluates importance of key ideas
explains clients' needs	uses labels	uses subject specific words in correct context	identifies links between science ideas and design	explains key ideas
includes facts about client	includes a drawing	uses general words	discusses ideas	lists key ideas
forms ideas	**designs model**	**uses terms**	**evaluates ideas**	**makes conclusions**
client profile	**design assistive aid**	**client interview**		

Year 10 Student design investigation

Task Outline

In this task, you will design an investigation based on a research area. You will need to plan the experiment, collect data and communicate your findings as a poster.

The planning and design of your investigation will be submitted for assessment prior to conducting the experiment.

You will be writing the discussion under test conditions and then complete a digital poster of your research.

You will collect your own individual data and submit your own poster. Although you will be working individually on your own research question, you will be working in a research team.

Year 10 student design investigation

Timeline

Week 1: Plan the investigation - research question, introduction, aim, identify variables, set up poster template

Week 2: Plan the investigation - materials list, method, design the table of results, sign off experimental design

Week 3: Conduct experimental work

Week 4: Conduct experimental work

Week 5: Graph data and complete statistical analysis, work on poster

Week 6: Complete discussion planning document, write discussion under test conditions, complete poster

Year 10 student design investigation

Investigation guide

Planning the Experiment

Research Question

A research question is used to guide all parts of the investigation. It is important that your research question is not too broad or too generalised. For example, "What type of starch can be used to make the best bioplastic?" is too broad are there are many different types of starch and how is it possible to measure 'best'?

A more specific research could be;

"What type of starch (potato, tapioca or cornflour) produces bioplastics with the greatest tensile strength?"

Research Question Checklist

	Includes the variable(s) that will be changed.
	states what will be effected

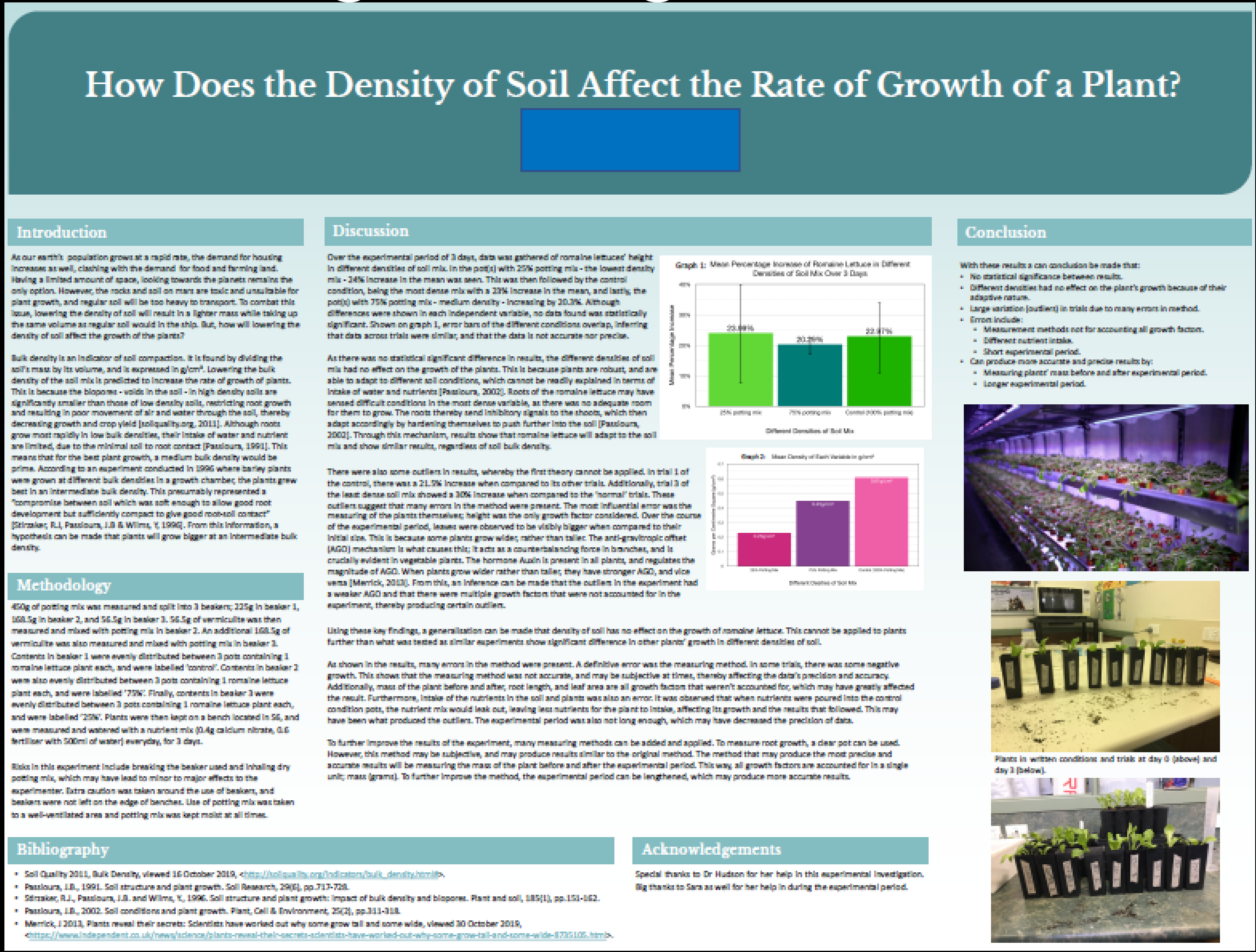
Variables

Identify the independent, dependent and controlled variables. Use the table below as a guide.

Independent Variable (what will you be changing?)	**Dependent variable** (what change will you be measuring? Include units)	**Controlled variables** (What will you keep constant? – You will need at least 5 controlled variables)

Year 10 student design investigation

See MyAitken and OneNote



Year 10 student design investigation

Assessment

		distinguishes between variables in prediction	
applies ideas to new contexts	makes predictions based on further research	identifies all variables	identifies risk impact and likelihood
explains key science ideas	makes predictions based on theory	distinguishes between factors to control, measure and change	describes precautions
uses scientific terminology	makes predictions based on own ideas	identifies factors to change	Identifies risks
forms ideas	**makes predictions**	**identifies factors**	**identifies risks and controls**
Introduction		**Planning**	

uses graphs that include statistical analysis	evaluates quality of summarised data	uses theory to link or reconcile key findings including outliers	assesses effect of errors on quality of data	makes recommendations to overcome limitations	communicates ideas in concise and easy to read way
uses graphs that follows the set conventions	identifies trends and or patterns in data	explains key findings using theories	explains errors	identifies limitations of key findings	follows required poster conventions
uses graphs that follows some of the set conventions	summarises data	matches key findings with theory	identifies errors	summarises key findings	follows some of the poster conventions
includes graphs	includes data	includes findings	includes errors	includes findings	represents information on poster
represents data	**evaluates data**	**analyses results**	**evaluates method**	**makes conclusions**	**designs poster**
Reporting results		**Discussion**			**Poster**