Coordinator Notes:

Module 5.1: Engineering – What's it all about?

In this Module, students explore what engineering involves and what an engineering job it like. In longer sessions, students explore different types or engineering through the interactive 'My Big Tomorrow' website or through a card matching activity.

This session's challenge requires students to put themselves in the shoes of an engineer. They will use team work and problem solving skills to find a solution to the problem at hand. Students will design and build a device to transport an 'aid package' accurately over a long distance. Using their knowledge of levers students may choose to build a catapult, although they are not restricted in the creativity of their design.

This session would be a fantastic opportunity to invite along a **guest speaker** from an engineering field – this could act as a substitute to or complement the career exploration activity. Some places to enquire about guest speakers are: Engineers Australia, City Councils, Engineering firms and Universities. The engineer may be able to stay and engage in the Challenge activities and assist with testing and scoring. Ensure "Working With Children Checks" are in cleared for any session guests (systems vary in each state of Australia).

Session Length:

This Module can be presented in different session durations per your needs. Lesson plans are provided for:

- A 120 minute session, or, 2 x 60 minute sessions
- 45 minute, 75 minute, and 90 minute sessions

Technology:

PowerPoint: If you do not have access to a data projector and cannot display the PowerPoint presentation, we recommend that you print the most important slides before the session, and either enlarge them onto cardboard to use in place of slides, or create a booklet that students can share in small groups.

The most important slides have been included as a 'Reduced Slides' PowerPoint file, and an easily printable pdf version of these slides is also provided. If you choose this option, we recommend that you still read and use the slide notes included in the full PowerPoint for the session. The session can be conducted without slides all together, but they offer visual aid in explanation of scientific concepts. We recommend at the very least that instructions for each experiment are printed for the students.

Videos links: The suggested links to online videos within the session can be helpful with explanation. Notes have been included in the slides if there is an essential component to a video which the facilitator should discuss or demonstrate, if the video cannot be played.

Please read the Module 5 Risk Assessment before proceeding with the session

Contents	Page

Module 5.1: Engineering – What's it all about?

Overview

In this Module, students explore what engineering involves and types of engineers.

Students will put themselves in the shoes of an engineer in this session's challenge, to creatively solve an engineering aid problem.

Content overview:

Concept / Activity	Session Duration (minutes)			
	120	90	75	45
Engineering, what's it all about? Introduces engineering as a career, and different types of engineers.	*	*	*	*
Career planning, explores interests and skills, and possible engineering pathways.	*	*	*	-
Simple machines: Levers	*	*	*	*
Catapults	*	*	*	*
Simple machines: Pulleys	*	-	-	-
Engineering Aid Challenge, engineering planning, design, team work, and resource and budget management.	*	*	*	*

Slides:

PowerPoint Slides are available to support the delivery of this module. Slides explain concepts visually, and include short, engaging videos relevant to the topic. A full list of slides and recommended inclusions for each session duration are provided in the table below. Appropriate slides are also noted in lesson plans for each duration.

PowerPoint Presentation: 'M 5.1 - Master Slides 120 minute Session Duration'		**Session Duration (minutes)**			
Slide	**Content**	**120**	**90**	**75**	**45**
1	Introductory Title Slide for the Session	*	*	*	*
2	Prompt slide and video link: What is engineering?	*	*	*	*
3	Prompt slide for discussion, engineer's tool kit / skill sets	*	*	*	-
4	Prompt slide for discussion, types of engineers	*	*	*	-
5	Introductory slide: My Big Tomorrow careers activity **Activity 5.1.1**	*	*	*	-
6	Prompt slide for discussion about careers post activity	*	*	*	-
7	Intro slide: Simple machines, levers	*	*	*	*
8	**Activity 5.1.2** Levers	*	*	-	-
9	Overview slide, 3 different types of levers	*	*	*	*
10	Overview slide, catapults as levers	*	*	*	*
11	Intro slide: Simple machines, pulleys	*	-	-	-
12	**Activity 5.1.3** Pulleys	*	-	-	-
13	Intro slide: **Challenge 5.1** Engineering Aid Challenge	*	*	*	*
14	Challenge overview	*	*	*	*
15	Challenge rules	*	*	*	*
16	Designs	*	*	*	*
17	Session references	*	*	*	*

Module 5.1 Engineering – What's it all about?

Lesson Plan

120 minute session or 2 x 60 minute sessions

High Tech: Use PowerPoint Presentation 'M5.1 - Master Slides'
Low Tech: Print PowerPoint 'M5.1 - Reduced Slides for Printing'. Use slide notes from the ENTIRE 120 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area	**Topic**
Engineering, Physics, Careers	Engineering

Timing	Running Time (hh:mm)	Procedure	Materials
		Lesson Introduction	
5 min	00:05	Welcome! Session intro. Show University of Newcastle's "What is Engineering" video. If video unable to be played during session, the coordinator should watch prior to session and explain content to students.	PowerPoint M5.1 (Slides 1-2)
		Body of Lesson (Lesson 1, 2 x 60 minute sessions)	
3 min	00:08	Discuss engineering skill sets, "tool kits" and types of engineers.	PowerPoint M5.1 (Slides 3-4)
10 min	00:18	Introduce and undertake Activity 5.1.1 "My Big Tomorrow". Use internet if available, or print (and cut out) sets of the tech free card matching activity before the session. Note: Post activity discussion is encouraged! This is also a good opportunity for an invited guest engineer to talk about their career, instead of or as well as the activity.	PowerPoint M5.1 (slides 5-6) Computers for participants & internet access (or printed cards, paper, pens). Coordinator planning sheet available. www.mybigtomorrow.com.au
12 min	00:30	Introduce the concept of simple machines (2 min). Undertake Activity 5.1.2 'Levers'.	PowerPoint M5.1 (slides 7-8) Rulers, 20 cent coins (or similar), hard cover books

3 min	00:33	Discuss different types of levers and introduce catapults as a form of lever.	PowerPoint M5.1 (slides 9-10)
12 min	00:45	Introduce concept of pulleys as another simple machine. (2 min). Undertake Activity 5.1.3 'Pulleys'.	PowerPoint M5.1 (slides 11-12) String, scissors, empty cotton reels, masking tape, weights (toys, water bottles), chairs
5 min	00:50	**Introduce the Challenge**	PowerPoint M5.1 (slides 13-16)
5 min	00:55	Form into groups of 2 – 4 Hand out planning sheets and show groups available materials. **(Break for 2 x 60 minute sessions)**	
		(Lesson 2, 2 x 60 minute sessions) *Note: Reintroduce the challenge and briefly cover catapults again at if starting lesson 2 on a different day to concluding lesson 1).*	
30 min	00:30 01:30	Hand out materials to groups, and additional planning sheets if needed. Plan, design and build devices. Allow students to test and re-design as they go.	PowerPoint M5.1 (slides 13-16) Planning and scoring sheets. Foam balls, paper, paddle pop sticks, dagwood dog sticks, straws, rubber bands, masking tape, paperclips, bottle caps, plastic spoons, plastic bags Measuring tape, hula-hoops
20 min	00:50/ 01:50	Official Testing	
5 min	00:55/ 01:55	Clean up	
5 min	01:00/ 02:00	**Lesson Conclusion** Pack up and discussion. Announce scores and winning team. Discuss the strengths of each team's designs.	

Activity 5.1.1: My Big Tomorrow

HIGH TECH (Computers and Internet available)

This activity requires a number of computers to be available to students. At least 1 between 3 is recommended.

'My Big Tomorrow' is a very useful online tool for students to explore possible career pathways, as well as for them to clarify what skills and interests those careers require.

http://www.mybigtomorrow.com.au/

The project was developed by the Centre of Excellence for equity in Higher Education at the University of Newcastle and funded by the Commonwealth's Higher Education Participation and Partnership Program (HEPPP). The Centre of Excellence for Equity in Higher Education is a multi-disciplinary and practice-oriented research hub.

For this activity, you may allow students free range to explore the website as they wish (although students may get side tracked). Or, you can step them through it with tasks i.e. 'everyone search mechanical engineer, what does a mechanical engineer do?' etc.

A planning worksheet has been included to help you coordinate the activity. It is recommended that you do not get students to complete this as a worksheet themselves, but rather use it for yourself to aid in creating discussion points and structure.

LOW TECH (Computers and Internet not available)

There are a vast array of different engineering careers that are suitable for students with a wide range of interests. This activity introduces students to just a few of these activities through a matching activity – participants match the engineering description to the type of engineering.

Materials:

- 1 Piece of paper for each student or group to write answers on
- 1 pen or pencil for each student or group
- 1 set of cards (below) printed. Note: for a larger group you could print a few sets of these cards and have each set set-up in a different area of the room – separating the large group of participants into smaller groups

Instructions / Activity Notes:

- Print out the set of 10 cards provided (from page 10 -13 of this document), and spread them around the room. Depending on student group numbers, you may require up to 5 sets for an effective session.

- At the top of each card there is a description of a type of engineering and at the bottom of each card there is a name of a type of engineering. The description and name on each card does not match – instead participants must read the description on a card and then find the card that has the name which matches the description.
- Once they have found this card they then read the description on this card – they then find the card which matches this description and so on. This creates a type of loop where participants visit every card once.
- Once participants are back to their starting card they have completed the activity. It is a good idea to get participants to write down the order of cards they visited and to have participants show this order to the facilitator or an adult to check the order after completion. If their order is incorrect, you can explain where it is incorrect, and challenge them to try and find the correct order, or, you can simply tell them the correct order, and support them to walk through again correctly.
- Participants do not have to start at the same card.
- It is a good idea to encourage participants to work in groups of two or 3 and a good idea to encourage the groups to start at different places.
- This activity will take longer if you spread the cards out at longer distances around a room, compared to shorter distances.

Planning worksheet for Activity 5.1.1 "My Big Tomorrow" (HIGH TECH)

Engineering – What's it all about?

Use the 'My Big Tomorrow' website to explore some of the different engineering fields.

Website: http://www.mybigtomorrow.com.au/

Structured exploration of the website:

Guide students to navigate to and open the My Big Tomorrow website.

1. At the top right of the webpage there is a search bar. Guide students to click on the search bar, and enter a search for 'mechanical engineering'.
2. Suggest students have a look through the page, and watch the video profile to learn more about mechanical engineering.

Discussion prompts for students after searching and investigating is completed:

a. What does a mechanical engineer do?

b. Can you think of something in your everyday life that a mechanical engineer would have helped design and construct?

c. What skills does a mechanical engineer need?

d. What subjects should you study in high school if you want to become a mechanical engineer?

Encourage students to look up another type of engineer. After they have had a look at the page and watched the video, prompt them to answer the questions below.

i. What sort of engineer did you research? What exactly do they do?

ii. Can you think of something in your everyday life that they would have helped design and construct?

iii. What skills do they need and what subjects should you study in high school if you want to work in this area?

Activity Cards for Activity 5.1.1 "My Big Tomorrow" (LOW TECH)

ANSWERS:

Card 1 to Card 4 to Card 10 to Card 2 to Card 3 to Card 7 to Card 5 to Card 9 to Card 6 to Card 8 to Card 1

Card 1 This type of engineering uses science and engineering principles to solve different problems in the environment, such as recycling material or disposing of hazardous waste. **Broadcast Engineer**
Card 2 This type of engineering studies the way electricity is used to control equipment. You will then use this knowledge to develop and test devices or electrical components. **Mechatronics Engineer**
Card 3 This type of engineering looks after anything that has motorised components that move. They might be involved with designing, developing and testing a concept or maintaining machines. **Electronic Engineer**

Card 4

This type of engineering solves problems in the medical and health field. A big part the job is designing or improving technology to help people going through rehabilitation or those with a disability.

Environmental Engineer

Card 5

This type of engineering handles advanced aerospace hardware and software systems. Aerospace includes atmospheric and space flight and equipment such as rockets, satellites and planes

Automotive Engineer

Card 6

This type of engineering works on lots of different infrastructure projects. They plan, design, build and maintain various structures including roads, buildings, transportation systems (like airports and subways) and water supplies.

Façade Engineer

Card 7

This type of engineering creates and tests new technologies that make vehicles more efficient. The role is very hands on and involves designing new products, finding solutions to problems or coming up with new ways to do things.

Mechanical Engineer

Card 8

This type of engineering makes sure the broadcast signal used for radio and television is working properly, including the equipment sending the signal. This is a hands-on technical role that will likely find you in a master control room working on a range of tasks.

Civil Engineer

Card 9

This type of engineering designs the facades of new buildings and works with existing buildings to pick up on problems that may affect durability. This could include cracked glass panes, movement within structural elements or worn seals.

Aerospace Systems Engineer

Card 10

This type of engineering involves mechanical, electrical and electronic systems combined with information technology. As a mechatronics engineer you have a broad knowledge across all these areas so that you can understand a complete system, not just certain parts of it.

Biomedical Engineer

Activity 5.1.2: Levers

Aim: To observe how levers help to lift heavy weights

Materials (per group):

- Fulcrum (small hard cover book)
- 30cm ruler
- 10 x 20 cent coins
  (or other small objects of equal weight)

Procedure:

1. Form into groups and collect materials.
2. Balance the ruler on the book, with the book in the centre of the ruler, and one 20 cent coin on each end. It looks just like a see saw.
3. What happens if you move one coin closer to the book?
4. Next, keep the book in the centre, and place 2 coins on one end, and a single coin on the other. What happens?
5. Slide the ruler so the book is no longer in the centre, to see if you can make the ruler balance with the uneven number of coins.
6. Experiment with more coins!

Expected result:

When the ruler is centred over the book, the ruler will become unbalanced / un-level when the single coins are not at the same distance from the book.

Moving the book when uneven numbers of coins are placed on each end of the ruler will enable the ruler to become level again.

To balance, heavier loads need to be closer to the fulcrum (book) than lighter loads on the same ruler.

For additional information on levers, visit:
http://www.engquest.org.au/students/about-engineering/

Activity 5.1.3: Pulleys

Aim: To observe how pulleys help to lift heavy weights

Materials (per group):

- 2 x 1m lengths of strong string
- Scissors (shared between groups)
- Empty cotton reel (or similar)
- Masking tape
- A weight to lift e.g. toy car, or drink bottle filled with water

Procedure:

1. Form into groups and collect materials.
2. Thread one of the lengths of string through the middle of the cotton reel.
3. Tape or tie the ends of the string with the cotton reel at the same height between two chairs or two tables (or have two group members hold either end). Move the chairs, tables, or group members apart until the string is quite taut (straight and tight).
4. Tie the second piece of string to the weight. Place the weight on the floor and lift it up using just the string.
5. Next, return the weight to the floor, loop the string attached to the weight over the cotton reel, and pull down on the string.
6. Is it harder or easier, to lift the weight with the pulley? Document your results!

Expected Result:

It will be easier to lift the weight using the pulley plus the string, than to just lift the weight using the string.

Explanation:

It's easier to pull down on the string using a pulley, than to lift the load up without the pulley, because pulling down is working with the force of gravity, not against it. Gravity is the force that pulls things downwards.

Extension: Create a system of pulleys. How many pulleys are needed to lift two or more weights as easily as one weight?

For additional information on pulleys, visit:
http://www.engquest.org.au/students/about-engineering/

Challenge M5.1 – Engineering Aid

Scoring:

A scoring mechanism is included so that the element of 'competition' may challenge all students to participate to their fullest. You may remove the scoring system all together if it does not work with your group of students.

When scoring it is important to only announce who the winning team is- so there will be no 'losers' or last place. Highlight the good strategies of each team. Consider asking how the students might approach the task differently if asked to do it again, or how they might teach the same things they learned during the club to a younger student.

The Problem:

"A contagious virus has struck an area of Australia. There are doctors and nursing staff onsite, helping the local people but… the vaccine is running out!

All transportation has ceased to the infected town, and an exclusion zone has been set up, so no one can pass!

How will we get more vaccine packages to the doctors?

*Your team of engineers must construct a **device** that will deliver the vaccine package to the infected town.*

The closer you get to the town the more risk there is of becoming infected. So you need to build a device that can launch the packages from the greatest distance.

Your device also needs to be on target, so the doctors receive the vaccines on time and can treat their patients."

Activity Notes:

- This challenge requires students to build a launching device which is accurate and can transport an object over a distance.
- Students should form groups of 3-4 and decide how they will approach the problem.
- A catapult is one suggested device, there are many other possibilities which students can explore.
- For testing, place a hula-hoop at one end of the room and have the students use their devices to get the 'aid packages' (foam balls) into the infected town (hula-hoop). You may choose to set up 1 – 3 testing stations / towns.
- If hula-hoops are unable to be sourced, use masking tape to mark out a shape for the town. (For example, a 50 cm x 50 cm square).
- Use a measuring tape to mark out distances intervals at 0.5 metre spacing's form 0.5 metres from the "town", to up to 6 metres away from the "town".

- Support students to choose a starting distance to launch their device from. Students can launch their device from different distances for each of the final test. Keep the measuring tape handy!
- If time permits, allow each team to have 3 official attempts at completing the challenge during final testing, using the device they have built. Teams will select a distance for their first attempt and can only increase the distance if they are successful in getting the foam ball into the hula-hoop (town).
- Devices should not be modified or repaired during the final testing phase, only during the design and pre-test phase.
- Supply the teams with the materials listed in the table on the next page. Excess material can be used, but each piece used incurs a penalty as listed in the table. This is to encourage student to think about minimising resources, and meeting budgets!
- If time permits and student skill level allows, encourage teams to consider the way their foam ball (vaccine package) will land. Support students to trial adding landing aids to their foam balls (perhaps weight, parachutes, legs…) to reduce the "package" from bouncing or rolling out of the "town".

Rules

- Build a device which can accurately propel the vaccine package to the infected town. The further away you can launch the package from, the more points you will receive.
- You will be given a supply of materials. Extra materials you collect will cost you penalty score points.
- You will have 3 scored attempts to launch the package. You can also have unlimited trial attempts as pre-testing, before the official scoring begins.
- During official testing your team will select a distance for your first attempt. You can only increase the distance for your other attempts if you are successful in getting the foam ball into the hula hoop. Points for each distance are only achieved if the aid package (ball) lands in the town (hula hoop).
- Bonus points may be available for packages that stay within the town boundaries, and don't have to be tracked / fetched by the doctors!

Challenge 5.1: Materials List & Score Sheet

Engineering Team Name:				
Material	**Initial amount supplied per group**	**Penalty per extra item collected (each)**	**Tally of extra items**	**Total Penalty Points**
Paddle pop sticks	10	- 20 points		
Dagwood dog sticks	10	- 40 points		
Straws	5	- 10 points		
A4 Paper / newspaper	2 sheets	- 10 points		
Plastic spoons	2	- 40 points		
Rubber bands	15	- 5 points		
Masking tape	2 m	- 5 points per 20 cm		
Paperclips	5	- 5 points		
Bottle caps	4	- 5 points		
Plastic bag	1	- 40 points		
Foam ball	1	- 100 points		
			Total Score Penalty (A)	-

Distance from which launch was made (and package arrived at town!)	**Total points awarded**
≤ 0.5 metres	50
≤ 1	100
≤ 1.5	150
≤ 2	200
≤2.5	250
≤ 3	300
≤ 3.5	350
≤ 4	400
≤ 4.5	450
≤ 5	500
≤ 5.5	550
≤6	600
> 6 metres	800

Official Testing

Launch Distance (metres)	**Success?**	**Points awarded**
Test 1:	Yes / No	
Test 2:	Yes / No	
Test 3:	Yes / No	
Total Points Awarded (B)		

Note: Only move on to the next test if the previous test successfully lands in the town!

Final Score (C)	
B – A = C (Points awarded minus penalty points)	

Challenge M5.1 – Planning Sheet: Engineering Aid Challenge

To design your device, consider:

DISTANCE – How far away from the town (hula-hoop) will you launch your vaccine?

MATERIALS – How many materials will you need to build your device, can you minimise the amount of resources used?

LANDING – Will your vaccine package stop where it lands, or, have to be tracked down by the doctors? How could you reduce bounce and tracking time…

Take a look at the materials available, and design your device!

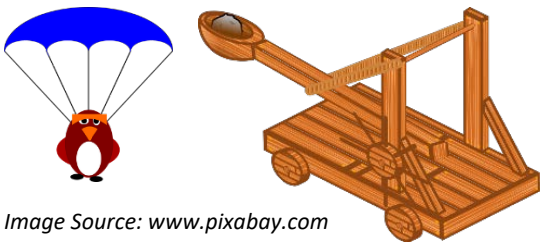

Image Source: www.pixabay.com

Module 5.1 Engineering – What's it all about?

Lesson Plan

90 minute session

High Tech: Use PowerPoint Presentation 'M5.1 - Master Slides'. Hide slides: 11 and 12
Low Tech: Print PowerPoint 'M5.1 - Reduced Slides for Printing'. Use slide notes from the ENTIRE 90 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area	**Topic**
Engineering, Physics, Careers	Engineering

Timing	Running Time (hh:mm)	Procedure	Materials
		Lesson Introduction	
5 min	00:05	Welcome! Session intro. Show University of Newcastle's "What is Engineering" video. If video unable to be played during session, the coordinator should watch prior to session and explain content to students.	PowerPoint M5.1 (Slides 1-2)
		Body of Lesson	
3 min	00:08	Discuss engineering skill sets, "tool kits" and types of engineers.	PowerPoint M5.1 (Slides 3-4)
12 min	00:20	Introduce and undertake Activity 5.1.1 "My Big Tomorrow". Use internet if available, or print (and cut out) sets of the tech free card matching activity before the session. Note: Post activity discussion is encouraged! This is also a good opportunity for an invited guest engineer to talk about their career, instead of or as well as the activity.	PowerPoint M5.1 (slides 5-6) Computers for participants & internet access (or printed cards, paper, pens). Coordinator planning sheet available. www.mybigtomorrow.com.au
12 min	00:32	Introduce the concept of simple machines (2 min). Undertake Activity 5.1.2 'Levers'.	PowerPoint M5.1 (slides 7-8) Rulers, 20 cent coins (or similar), hard cover books

3 min	00:35	Discuss different types of levers and introduce catapults as a form of lever.	PowerPoint M5.1 (slides 9-10)
3 min	00:38	**Introduce the Challenge**	PowerPoint M5.1 (slides 13-16)
2 min	00:40	Form into groups of 2 – 4 Hand out planning sheets and materials to each group.	Planning and scoring sheets. Foam balls, paper, paddle pop sticks, dagwood dog sticks, straws, rubber bands, masking tape, paperclips, bottle caps, plastic spoons, plastic bags
20 min	01:00	Plan, design and build devices. Allow students to test and re-design as they go.	
20 min	01:20	Official Testing	Measuring tape, hula-hoops
5 min	01:25	Clean up	
5 min	01:30	**Lesson Conclusion** Pack up and discussion. Announce scores and winning team. Discuss the strengths of each team's designs.	

Module 5.1 Engineering – What's it all about?

Lesson Plan

75 minute session

High Tech: Use PowerPoint Presentation 'M5.1 - Master Slides'. Hide slides: 8, 11 and 12
Low Tech: Print PowerPoint 'M5.1 - Reduced Slides for Printing'. Use slide notes from the ENTIRE 75 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area			**Topic**
Engineering, Physics, Careers			Engineering
Timing	**Running Time (hh:mm)**	**Procedure**	**Materials**
5 min	00:05	**Lesson Introduction** Welcome! Session intro. Show University of Newcastle's "What is Engineering" video. If video unable to be played during session, the coordinator should watch prior to session and explain content to students.	PowerPoint M5.1 (Slides 1-2)
		Body of Lesson	
3 min	00:08	Discuss engineering skill sets, "tool kits" and types of engineers.	PowerPoint M5.1 (Slides 3-4)
12 min	00:20	Introduce and undertake Activity 5.1.1 "My Big Tomorrow". Use internet if available, or print (and cut out) sets of the tech free card matching activity before the session. Note: Post activity discussion is encouraged! This is also a good opportunity for an invited guest engineer to talk about their career, instead of or as well as the activity.	PowerPoint M5.1 (slides 5-6) Computers for participants & internet access (or printed cards, paper, pens). Coordinator planning sheet available. www.mybigtomorrow.com.au
2 min	00:22	Introduce the concept of simple machines and levers.	PowerPoint M5.1 (slide 7)

3 min	00:25	Discuss different types of levers and introduce catapults as a form of lever.	PowerPoint M5.1 (slides 9-10)
3 min	00:28	**Introduce the Challenge**	PowerPoint M5.1 (slides 13-16)
2 min	00:30	Form into groups of 2 – 4 Hand out planning sheets and materials to each group.	Planning and scoring sheets. Foam balls, paper, paddle pop sticks, dagwood dog sticks, straws, rubber bands, masking tape, paperclips, bottle caps, plastic spoons, plastic bags
20 min	00:50	Plan, design and build devices. Allow students to test and re-design as they go.	
20 min	01:10	Official Testing and clean up	Measuring tape, hula-hoops
5 min	01:15	**Lesson Conclusion** Pack up and discussion. Announce scores and winning team. Discuss the strengths of each team's designs.	

Module 5.1 Engineering – What's it all about?

Lesson Plan

45 minute session

High Tech: Use PowerPoint Presentation 'M5.1 - Master Slides'. Hide slides: 3, 4, 5, 6, 8, 11 and 12
Low Tech: Print PowerPoint 'M5.1 - Reduced Slides for Printing'. Use slide notes from the ENTIRE 45 minute presentation, adapting discussion to cover omitted slides.

Key Learning Area	**Topic**
Engineering, Physics, Careers	Engineering

Timing	Running Time (hh:mm)	Procedure	Materials
		Lesson Introduction	
5 min	00:05	Welcome! Session intro. Show University of Newcastle's "What is Engineering" video. If video unable to be played during session, the coordinator should watch prior to session and explain content to students.	PowerPoint M5.1 (Slides 1-2)
		Body of Lesson	
2 min	00:07	Introduce the concept of simple machines and levers.	PowerPoint M5.1 (slide 7)
2 min	00:09	Discuss different types of levers and introduce catapults as a form of lever.	PowerPoint M5.1 (slides 9-10)
2 min	00:11	**Introduce the Challenge**	PowerPoint M5.1 (slides 13-16)
2 min	00:13	Form into groups of 2 – 4 Hand out planning sheets and materials to each group.	Planning and scoring sheets. Foam balls, paper, paddle pop sticks, dagwood dog sticks, straws, rubber bands, masking tape, paperclips, bottle caps, plastic spoons, plastic bags
20 min	00:33	Plan, design and build devices. Allow students to test and re-design as they go.	
10 min	00:43	Official Testing and clean up	Measuring tape, hula-hoops

2 min	00:45	**Lesson Conclusion** Pack up and discussion. Announce scores and winning team. Discuss the strengths of each team's designs.	

Module 5.1 - References

http://www.mybigtomorrow.com.au/

https://www.engineersaustralia.org.au/career-development-centre/what-engineering

https://www.youtube.com/watch?v=bipTWWHya8A

http://www.engquest.org.au/students/about-engineering/

https://www.newcastle.edu.au/__data/assets/pdf_file/0005/175478/Catapult-1.pdf

http://www.stormthecastle.com/catapult/the-history-of-the-catapult.htm

http://www.real-world-physics-problems.com/catapult-physics.html

https://jemiii.wordpress.com/2013/02/28/catapults-levers/

Module 5.1- Required Materials

- Pens, pencils and writing paper are generally required every session.
- Students may like to bring a note pad to record their observations and ideas.
- A group usually refers to 2 - 4 students.

Activity	Material	Amount	Where can I find it?
All sessions	PowerPoint Slides* (digital, or printed)	1 per coordinator	Coordinator Package
All sessions	Printed PowerPoint* Slide Notes	1 per coordinator	Coordinator Package
All sessions	Printed Lesson Plan	1 per coordinator	Coordinator Package
All sessions	Printed Module 1 Risk Assessment	1	Coordinator Package
All sessions	Computer, Data Projector, Screen	1	Venue
Activity 5.1.1 "My Big Tomorrow" 120 minute, 2 x 60 minute, 90 minute and 75 minute sessions	**HIGH TECH:** Computer, tablets, laptops, internet connection.	1 per 2 students	Venue, BYO Device
	LOW TECH: Printed career cards	1 set per 5 participants	Coordinator package (print & cut out pre-session)
Activity 5.1.2 "Levers" 120 minute, 2 x 60 minute, 90 minute and 75 minute sessions	30 cm rulers	1 per group	Supermarket, stationary store, recycled
	Fulcrum, small hard cover book or similar	1 per group	recycled
	10 x 20 cent coins (or similar equally weighted objects)	1 set of 10 per group	recycled
Activity 5.1.3 "Pulleys"120 minute, 2 x 60 minute, 90 minute and 75 minute sessions	2 chairs (or tables)	1 set per group	venue
	Strong string	2 x 1m lengths per group	Supermarket, hardware store
	Empty cotton reels	1 – 2 per group	Sewing, craft or toy store; "Officeworks"
	Weight: toy car, drink bottle etc	1 per group	recycled

Required Materials List Continues on Next Page

* PowerPoint Slides have been provided as a Master Set for a 120 minute (or 2 x 60 minute) session duration. Hide/ omit slides as noted in lesson plans for delivery of shorter sessions.

Cotton reels online at Officeworks:

80 reels, from $32 (40 cents each)
https://www.officeworks.com.au/shop/officeworks/p/learning-can-be-fun-cotton-reels-jar-of-80-edlcbfcr

Activity	Material	Amount	Where can I find it?
Challenge 5.1 "Engineering Aid" All sessions	Hula-Hoop (or form a 'town' shape with masking tape)	1 per testing station (1 – 3 hoops)	Variety store, department store, recycled.
	Measuring tape	1 per testing station (1-3)	hardware shop, supermarket, recycled
	Dagwood dog sticks	Min 10 per team	Catering supply shop (see example links)
Adjust material types and quantities as needed to suit.	Rubber bands	Min 15 per team	Supermarket, stationary shop
	Plastic spoons	Min 2 per team	Catering supply shop (see example links)
	Straws	Min 5 per team	supermarket
You may add or remove items to suit your location.	Paddle pop sticks	Min 10 per team	Craft shop, variety store
	Foam balls (size of ping pong balls)	Min 1 per team	Craft shop, sport shop or online (see example links)
	A4 paper or newspaper	Min 2 sheets per team	recycled
Adjust scoring as needed to match materials used.	Paper clips	Min 5 per team	Supermarket, stationary shop
	Masking tape	3 rolls per session	Supermarket, stationary shop
Allow extras (refer to notes)	Bottle caps	Min 4 per team	recycled
	Plastic bag	Min 1 per team	recycled

Online shopping links:

Catering stores (Dagwood dog sticks, plastic spoons):
From $28 for 1000 sticks (~3 cents each)
http://www.sydneypartyshop.com.au/dagwood-dog-stick-22-5cm-1000/

From $11 for 100 spoons (11 cents each)
http://www.geminicateringequipment.com.au/disposables/disposable-plastic-serving-dishes/chinese-spoon-plastic-120mm-10ml-clear-100pk

Foam balls
From $7 for 6 (< $1 each)
http://www.rebelsport.com.au/Product/Optima-True-Flight-Foam-Practice-Golf-Balls-6-Pack-/384886

From $4 for 10 (< 50 cents each)
https://www.spotlightstores.com/craft-hobbies/basic-craft-supplies/craft-materials/polystyrene-shapes/shamrock-craft-deco-foam-balls-10-pieces/p/BP80224943