

Project car cover



Year 10 STEM Project

Project car cover : PROJECT OVERVIEW

AGE GROUP - Year 10

TIMEFRAME - 6 months

DRIVING QUESTION - How can we design a car cover to protect our dream car from a catastrophic hailstorm?

PROJECT DESCRIPTION - Students are tasked with saving their dream car from being crushed by hail.

Students will need to learn about how hail forms and how destructive it is to then design an effective protective cover. They will need to consider the trade-off between bulkiness and effectiveness and design and test different solutions.

Students will then consider how local businesses might use the product to protect their fleet or customer cars to avoid huge insurance excess payouts. During this phase of the project, students explore the viability of their design from a product marketability standpoint which culminates with a Shark Tank like pitch of their product before an audience of business-people, scientists and engineers.

FINAL PRODUCT – A 1m square prototype car cover designed to prevent hail damage to student’s imaginary future dream car.

Students will then consider the viability of their cover as a marketable good and produce a presentation to local businesses marketing their prototype as a design to prevent damage to fleet or customer vehicles in the event of unexpected storms

Areas of study and key standards assessed

Designing phase

Maths - ACPM10M05 modelling and scaling - students will create small models of the car covers using model vehicles and will employ an understanding of scaling to calculate the measurements of the full-size cover
Science - AC9S10E04 students will learn about energy flows and climate. Students will explore how hailstorms form and if hailstorms are becoming more frequent
Maths - AC9M0ST01-05 - statistical analysis will be used to explore if hailstorms are becoming more frequent and if so why through proposing a hypothesis then studying potential correlation.
Science - AC9S10U05 - students will learn about force, mass and acceleration - they will gain an understanding of the forces involved in a hailstorm to better understand what they need to do to protect their vehicle.
Design and Technology - AC9DTE10K06 students will explore attributes of different materials they will use for the car cover gaining an understanding of the role of materials in product design. They will use trial and error using samples.
Design and Technology - AC9TDE10K01 - students will consider sustainability in the design of the car cover. Students will also learn what happens when vehicles are written off. They will explore vehicle scrapping and recycling. They will identify likely non reuseable components resulting from a hail damage insurance write off vehicle.

Testing phase

Design and technology - AC9TDE10K03 - students will test different prototypes of a 1m square section of car cover. Students will explore how product testing takes place in the real world
Science - AC9S10U05 - students will learn about force, mass and acceleration - Students will use this knowledge to support effective product testing

Business plan and cost analysis phase

Maths - AC9M10A02 - students will explore solving simultaneous linear equations through break even analysis using different ranges to explore sweet spots and likely cost effectiveness
Business and Economics - AC9HE10S04 - cost benefit analysis will be used to support students in determining the marketability of the cost of the product
Business and Economics – AC9HE9K05 – consideration will be made of risks - students will explore consumer rights regarding injury related to product and product being fit for purpose (doing what you said it would do).

Shark tank presentation - phase

Business and Economics - AC9HE10S05 - communicating will be used in the presentation students give to local businesses engineers and scientists in which they present their prototype and discuss how they would market their product. Students will have choice in presenting in person or using pre-recorded video with one or two spokespersons for the group answering questions

Cross Curricular Priorities

Sustainability

General Capabilities

- | | |
|---------------------------------|-------------------|
| *Critical and creative thinking | *Digital literacy |
| *Personal and social capability | *Numeracy |
| *Ethical understanding | *Literacy |

THE PROJECT MILESTONES & STEPPING STONES.

MILESTONE #1: Student explore the project and develop need to know questions (NTKs).			MILESTONE #2: Students construct knowledge for design	
ENTRY EVENT	PREVIEW THE PROJECT	DRIVING QUESTION	Construct knowledge	Idea formation
Students consider their dream car. Students then hear about the extent of the recent storms from RACQ insurance. Students consider how to protect a car from hail.	Students are provided with an outline of the project including the project overview including the driving question, the marking rubric, planning workbook. Students are placed in groups determined by the teacher.	Students hear the driving question "How do we design a car cover to protect our dream car from a catastrophic hailstorm". Students begin brainstorming ideas in their groups and generate their NTK list.	Students develop understanding of how hail forms and the forces involved, they explore different design materials, they carry out preliminary testing and consider suitability.	Student groups begin to meet each lesson to discuss the project. Students can select their own mode of organising their project provided there is clear structure and assigned tasks. Teacher checks in regularly.
MILESTONE #3: Student teams explore alternative design options and present between 2 and 4 initial design plans and scale models		MILESTONE #4: Students complete the prototype		
Material testing phase	Evaluate options	Students solicit feedback and make design changes	The design is re-worked if required	A final prototype is developed
Student groups present between 2 to 4 initial design plans to the teacher	Students create a report outlining the design option they prefer and why, a plan for the creation of their 1m ² prototype and budget report. FA1	Students have completed the first prototype. They present the prototype to the teacher along with a rework list on any design changes they wish to make. FA2	The teacher provides feedback and if required the cycle phases back to testing and re-creation until a satisfactory prototype is completed	Students present their final prototype including a video outlining details of why their product is needed, how it works and what materials were used. FA3
MILESTONE #5: Students construct knowledge related to creating a business pitch for the product		MILESTONE #6: Student teams present prototypes and product pitch to an audience of business people, scientists and engineers.		
Develop product pitch	Revise and refine pitch	Practice and prepare	Present	Reflect 
Students construct knowledge on pricing and break even. They watch shark tank presentations for inspiration.	Students prepare and refine their draft pitch.	Students prepare and rehearse their live or video-taped pitch. They deliver their draft pitch to the class for peer and teacher feedback and refine. FA4	Students complete the pitch at the shark tank presentation and receive formal and informal feedback from attendees. Teacher assesses against the rubric provided to students. SA1	Students reflect on the project using a reflection sheet in which they capture how much they have learned, what they enjoyed, what was challenging and what they would have done differently

RECOMMENDED RESOURCES

TEXTS AND DATA

RACQ Insurance
Suncorp insurance
SES Queensland

INITIAL AUDIO AND VISUALS

<https://www.youtube.com/watch?v=2JxC0fQhd-k>
<https://www.dailymail.co.uk/video/news/video-2050642/Video-Footage-car-getting-damaged-hail-Queensland-hailstorm.html>
<https://www.insurancebusinessmag.com.au/news/catastrophe/suncorp-and-bom-unveil-advanced-hail-forecasting-model-512124.aspx>
<https://youtu.be/GPSAKhDx-Ig>
<https://youtu.be/6JbU0dIq70E>
<https://youtu.be/oiZW37YZBbY>

TOOLS & FORMS

Jamboard of NTK questions
Planning workbook

MILESTONE #1: LAUNCHING INQUIRY

As young adults, a right of passage for most of you will be getting a driver's license and getting your own wheels. For many of you this will be the most important asset you will own for some time. Today we shared our dream car with the class. Over the next six months we will be applying knowledge and skills from a range of subjects to solve the problem "How do we design a car cover to protect our dream car from a catastrophic hailstorm".

We will then consider the commercial viability of marketing this product. Today we will hear from RACQ insurance on the catastrophic damage caused by hail storms. We will then begin to consider the scope of this project by developing a jam board of need to know questions.

SO HOW ARE WE GOING TO DO THIS? WHERE DO WE START?

- Start by exploring the audio and visual resources
- Begin considering what others have done (including storm chasers)
- Consider what design obstacles exist
- Consider why a car cover that reduces the impact of hail is important.

NOW IN YOUR GROUP WRITE YOUR THOUGHTS AS NEED TO KNOW QUESTIONS IN THE JAMBOARD. WRITE EVERY THOUGHT, EVEN IF IT SEEMS IRRELEVANT.

STEPPING STONES

ENTRY EVENT

Students discuss their dream car then hear from RACQ Insurance about the damage caused by storms.

EXPLORE THE DRIVING QUESTION

Students explore the driving question and create the class wide electronic jamboard of NTK questions

PREVIEW THE PROJECT

Students receive and the class discusses the project outline, driving question, project rubric and project planning workbook.



Get ready for the launch!

Milestones for the project introduction lesson

DESIRED OUTCOMES

1. ENTRY EVENT

Students consider their dream car and how to protect it from hail

2. PREVIEW THE PROJECT

Students are introduced to the driving question "How do we design a car cover to protect our dream car from a catastrophic hailstorm". and as a class the group reviews the project requirements, duration, areas of study, rubric.

3. EXPLORE THE DRIVING QUESTION

Students engage with the driving question, explore the initial resources and begin to generate need to know questions (NTKs)

MIGHT LOOK LIKE...

Ask students the question of the day during roll call – "What is your Dream Car". Allow positive banter. Students are then asked what will happen if a hail-storm comes. They then hear about the extent of recent storms from RACQ insurance.

Students are provided with an outline of the project including a rubric of the final product. Students are placed in groups determined by the teacher.

Students consider the driving question and begin to draft questions they need to explore. They brainstorming in their groups and regroup as a class to generate an electronic jam board NTK list.



LET'S BEGIN WITH NEED TO KNOWS – EXAMPLES BELOW

QUESTIONS ABOUT HAIL

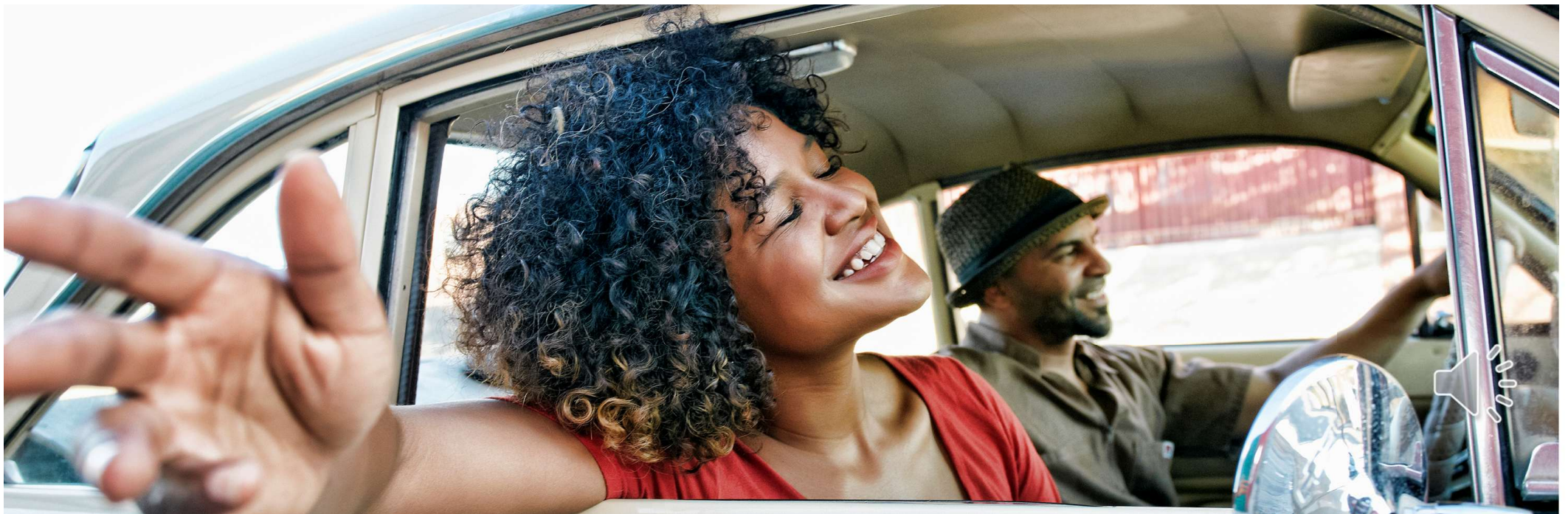
- How do hail stones form?
- What are the forces involved when hail makes contact with the earth?

QUESTIONS ABOUT DESIGN

- How do we figure out which material to use
- Have others tried to design a cover and what have they made?

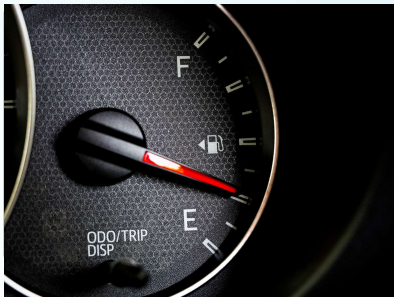
QUESTIONS ABOUT PRODUCT

- What makes the shark tank presenters want to go ahead?
- How do we come up with a cost and price for our product?



MILESTONE #1: LAUNCHING INQUIRY

LESSON LAUNCH



THE ENTRY EVENT

Students discuss their dream car then begin to consider how to protect their car from hail. They then hear about the damage hailstorms cause to south-east Queensland. Students are put into their project groups and students begin by exploring the resources and developing a list of need-to-know questions with one representative from the group adding the ideas to a collaborative online jamboard. The class reconvenes and the teacher facilitates a discussion of the ideas within the jamboard. Duplicates are consolidated and the list of NTKs are thus refined and synthesised for students to have a clear starting point.

INVESTIGATE



PREVIEW PROJECT EXPECTATIONS

Students need to create a prototype 1m² car cover to protect a vehicle from hail. Students will consider if their project could be commercially viable by creating a shark tank style presentation of how they would market their idea and why it is important. This will require students to draw on knowledge and skills across a range of subjects. Students will consider the need-to-know questions and begin to brainstorm design ideas in their project workbooks as a team.



To focus students' thinking during the entry event:

Students use their project planning workbook to work as a group to begin to plan for the project including

- Brainstorm design ideas
- Brainstorm design challenges
- Explore NTKs and begin to create an ideas list of where to get the information to answer NTKs.

Guest Speaker Options

RACQ insurance
GCHub – business community
Reach out to family members of students who have experienced hailstorms who can share their experience.
Design engineers
Storm chasers



INVESTIGATE (CONT'D)



EXPLORING THE DRIVING QUESTION

Students will explore the driving question, “How do we design a car cover to protect our dream car from a catastrophic hailstorm”. This will begin with a class wide “popcorning” of ideas (Buck Institute for Education, 2017).

INITIATE THE NEED TO KNOW PROCESS

Students work in groups to explore initial resources and brainstorm NTK questions and add these into an electronic jamboard. Groups can also add to other ideas as they present. The class then resumes and the teacher discusses, collates and synthesis the questions in the jamboard.

SYNTHESIZE AND REFLECT

CLOSING THE LAUNCH

Students reflect on the launch and consider the next steps. The teacher introduces students to the project planning workbook which contains suggested pathways and templates students can use to begin to think about where to start with the project. Students meet for 15 minutes to create an initial plan which will include what must be done by who by when for the upcoming week. Students must report weekly in this way to the teacher but will be given some autonomy in what systems they will use to manage the project.



Investigate

Students begin to develop NTKs in their project groups with one team member putting their brainstormed ideas on a class wide collaborative jamboard. The class will then discuss all NTKs and the jamboard ideas will be synthesised. The jamboard will continue to be a go to resource for students throughout the project. Encourage “popcorning” of ideas (Buck Institute for Education, 2017)



Project Car Cover: **PROJECT OVERVIEW**

FINAL PRODUCT
A 1m² prototype product and shark tank pitch of their idea.

AREA OF STUDY
Mathematics
Science
Design and Technology
Business and Economics

TIMEFRAME
6 months

AGE GROUP
Year 10

KEY STANDARDS
ACPM10M05
AC9S10E04
AC9M0ST01-05
AC9S10U05
AC9DTE10K06
AC9TDE10K01
AC9TDE10K03
AC9S10U05
AC9M10A02
AC9HE10S04
AC9HE9K05
AC9HE10S05

PLANNING TOOLS AND TEMPLATES
Planning workbook
NTK jam board

DRIVING QUESTION

How do we design a car cover to protect our dream car from a catastrophic hailstorm?

PROJECT DESCRIPTION

The project initiates from a personal desire to protect student's own future dream car but soon progresses into a more far-reaching project which explores if student designs might be a cost-effective solution for local businesses and ultimately if their ideas might reduce damage and write-off of vehicles, reducing waste and contributing to sustainability. The project culminates at a meeting of local business owners, engineers and scientists in which each group pitch their design and cost as a solution to prevent hail damage and reduce insurance write offs. Attendees will have the option to leave anonymous or in person feedback on the student's designs

WHAT MAKES THIS PROJECT GOLD-STANDARD PBL?

CHALLENGING PROBLEM OR QUESTION

The problem may seem straightforward but very few viable commercial products to solve this problem exist for a reason. There is an inherent design problem in which a trade-off exists between bulkiness and effectiveness. It will require deep consideration and problem solving to come up with an effective workaround.

PUBLIC PRODUCT

A 1m² prototype car cover will be presented by the group in a shark tank type pitch to local business-people, scientists and engineers

KEY KNOWLEDGE, UNDERSTANDING, AND SUCCESS SKILLS

This project will require students to draw on knowledge from science, maths, business and economics and design and technology to solve the design problem.

AUTHENTICITY

This problem is relevant to students because they are about to come of age and own their first car. This will soon become their most important asset. The project then extends to how the product would benefit the broader community.

SUSTAINED INQUIRY

To succeed in this project, students will need information from a range of subjects. Their designs are likely to evolve as they begin to acquire relevant skills and information. Their initial prototypes will likely require refinement. For this reason, the project is designed to run for 6 months

STUDENT VOICE AND CHOICE

Students are afforded creative freedom in their choice of design, the tools they use to manage the project and the format of their shark tank pitch which can be live or a combination of pre-recorded video and live Q&As.

CRITIQUE & REVISION – 4 formative assessments at key points in the project encourage students to revise their design ideas, prototypes and pitches following teacher and peer feedback.

REFLECTION

Reflection will occur throughout the project, but in particular, after each formative assessment and at the conclusion of the project. In the final reflection, students will consider the content they have learned and how they have used it (transformed it) into something tangible





REFERENCES

Buck Institute for Education. (2017).
Need to knows. https://s3-us-west-2.amazonaws.com/bie-ootg/documents/NKTs_final.pdf

