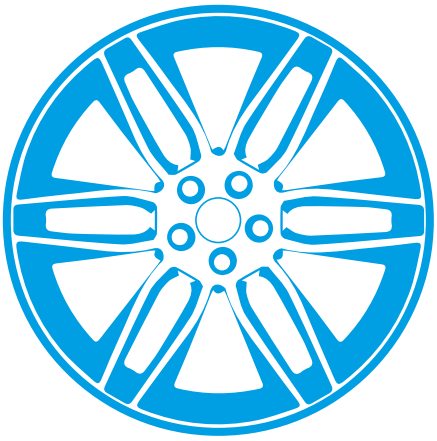
alu D&T Challenge 2017/18

A curriculum-linked design and technology challenge using aluminium. For students aged 11 – 14.

Challenge your students to design...



– an accessible vehicle for the future

– a garden building for a creative home worker

– a new way to use aluminium in packaging

Main sponsors: ALFED Aluminium Federation, alupro, Novelis, Technology Supplies Ltd

Endorsed by: D&T the design and technology association

Supporters: ARCONIC, BEFESA

Developed by: EdComs

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FOR STUDENTS

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About the Alu D&T Challenge

The **Alu D&T Challenge** has been created to inform and enthuse young people about aluminium, its use in our everyday lives, and the valuable contribution it can make towards a more sustainable way of life. These resources have been developed following extensive research to identify the 'best fit' with the secondary school curricula across the UK, and at every stage of their development they have been tested with, and by, teachers.

THE DESIGN CHALLENGES

The **Alu D&T Challenge** is centered around three design challenges, each of which focuses on different uses for aluminium. Students can choose to design:

- an accessible vehicle for the future
- a garden building for a creative home worker
- or a new way to use aluminium in packaging.

STUDENT LEARNING

The Challenge and its resources are designed for students aged 11–14, but can also provide useful skills-building exercises for older students to support their further study. The resources help students' design and technical knowledge, allowing students to get creative and put their design skills to work.

The challenges will build students' understanding of:

- the importance of sustainable, recyclable design
- the role product designers play in shaping the world around us
- the role aluminium can play in the context of sustainable and recyclable design.

DELIVER THE CHALLENGE

The resources are designed to be flexible. You can choose how long to take over the design challenges, and they can be delivered in a range of settings, whether:

- in D&T lessons
- as an extracurricular project
- to support a D&T or STEM club
- or to enter our competition, with a chance for students to win great prizes for themselves and their school.

Make use of our PowerPoint and the information presented in this booklet to help you deliver the Challenge.

ENTER THE COMPETITION

To be eligible for the competition, students must be in years 7–9 (England and Wales), 8–10 (Northern Ireland) or P7–S2 (Scotland) on 22 December 2017, the closing date of the competition. Students can enter individually or in teams of up to four and can respond to more than one design challenge.

Further information on how to enter can be found on page 9 in this booklet.

PRIZES

Category winners (awarded to the best design by either an individual or team in each category):

- a Standard Magnetic MODI Classpack and a Mini Mambo Drone for their school
- £100 of vouchers for the winning students (shared between team members).

Runners up (one per category):

- an Expert Magnetic kit and a Mini Mambo Drone for their school
- £75 of vouchers for the winning students (shared between team members).

Shortlisted finalists:

- a 3Doodler 3D pen for their school.

The judges may decide to make additional awards at their discretion in any, or all, of the categories.

Plus:

- all schools entering the competition will receive a certificate
- shortlisted finalists, winners and runners up will receive a named certificate.

Winners and their teachers will also be invited to a prize-giving ceremony Celebration Event on 7 March 2018 at the Thinktank Science Museum in Birmingham. For more information on these amazing prizes, see the Terms and conditions on page 12, and check out our website: https://learningaluminium.co.uk/aludtchallenge/

Getting started

THE PROCESS

Read the three **Design challenge guides** and choose which one(s) you'll use.

Print copies of the **Design challenge guides** and information sheets for your students, or view the content online at learningaluminium.co.uk/aludtchallenge

DELIVER DURING LESSONS

Use **Deliver during lessons**, the hints and tips on page 5, and show the classroom presentation.

OR

DELIVER THROUGH A PROJECT OR CLUB

Use **Deliver through a project or club**, the hints and tips on page 5, and show the classroom

ENTER THE CHALLENGE

Eligible students (aged 11 – 14 in permitted year groups) can enter individually or in teams of two to four. Entries may be presented as handwritten work, PDF, Microsoft Office, or video files, but should not exceed four A4 pages/ five minutes in length. Entries can include up to 10 additional images and we encourage entrants to use a mix of freehand illustrations and computer-generated design. For full terms and conditions see page 12.

ENTER ONLINE

Collect student entries and submit them online at https://learningaluminium.co.uk/aludtchallenge/enter-the-challenge/

See **How to enter** on page 9 to find out more.

OR

ENTER BY POST

Complete an entry form per entry (page 13).

See **How to enter** on page 9 to find out more.

Getting started

ABOUT THE THREE DESIGN CHALLENGES

Each of the three design challenges will help build key skills throughout the design and technology curriculum. However, the focus of each challenge can make them particularly suitable for exploring and developing certain interests or design techniques.

AN ACCESSIBLE VEHICLE FOR THE FUTURE

An exciting and forward-looking design challenge based on an important and current industry issue.

Great for:

- considering how designers in industry approach their responsibility to the environment
- understanding how specific consumer needs can be addressed through design
- engaging vocational learners interested in mechanical engineering or the automotive industry.

Find the **Design challenge guide** on page 14.

A GARDEN BUILDING FOR A CREATIVE HOMEWORKER

An accessible and creative brief to help budding designers bring out their own flair and imagination.

Great for:

- exploring architectural ideas and graphics techniques
- creating creative and inspiring designs, balancing personalising detail with environmental considerations
- allowing students to practise hands-on modelling techniques.

Find the **Design challenge guide** on page 15.

A NEW WAY TO USE ALUMINIUM PACKAGING

A graphics-based challenge that extends creative and technical thinking.

Great for:

- 'rethinking' a current product or problem to create individualised design briefs and specifications
- challenging students considering further study in product design
- exploring graphics and computer-aided design.

Find the **Design challenge guide** on page 16.

HINTS AND TIPS

- Encourage students to answer the brief with an original design.
- Help students be creative, but make sure they keep checking the brief; don't let them lose sight of their users' needs.
- Give your students opportunities to carry out independent research – the best entries are the ones where students have really read up on their chosen challenge and understand their potential customers and the materials they are using.
- Refer to **What the judges are looking for** (page 17), which includes a handy checklist for creating a great entry – the more boxes they can tick, the stronger their entry.
- Encourage students to look at the past successful entries (pages 18-20), so that they can see what a good entry looks like.
- Help students think of their own original ideas and explanations – we don't want them to copy the examples!
- Watch the **Aluminium Life Cycle** film, get advice from previous winners and lots more at https://learningaluminium.co.uk/about/film-hub/ or by checking out our YouTube channel.
- Encourage students to see what our sponsors are up to. See more details on page 26.

Finally – and most importantly – please encourage every student to enter, and do send their work in to us! We love seeing how students have tackled the Alu D&T Challenge and we're delighted to receive entries from students of all abilities within the age range. We send every participating school and all shortlisted students a certificate to reward them for their efforts.

Getting started

SUSTAINABILITY

All designs should address the 6Rs of sustainability.

In each category, entries should state and explain how every one of the 6Rs is used in the design. It's not enough to say that a product will be easy to repair, for example. We want to know how!

Rethink	What real need can this product satisfy? What benefits do we need to deliver? How could this product be made more effectively, efficiently and sustainably?	Repair	What parts of your design might break or wear out? How could these parts be repaired or replaced? Who might do this, and where?
Refuse	What materials are usually used in products like this? Do these materials harm the environment? What materials can we use that are less harmful?	Reuse	Which parts could be reused at the end of the product's life? How will the product be taken apart? How might someone reuse each part?
Reduce	How can the design be simpler than existing products? How can it use fewer materials, while still being safe and fit for purpose? What features don't people need?	Recycle	Which parts or materials can be recycled at the end of the product's life? How would these products be recovered? How might they be reprocessed into new things?

KEY QUESTIONS

Use these questions to help your students to get the most from the design challenges.

Before they start sketching ideas, help students find out more and put people first.

- *What is the need we are addressing?*
- *What improvements, changes or benefits do we want to deliver?*
- *What else do we need to find out?*
- *How can we find out more?*

Make sure students use plenty of illustrations and labels.

- *What are the key features of your design?*
- *How is your design original?*
- *What research has helped you come up with your ideas?*
- *How will your design work?*
- *How does your design deliver real benefits for its users?*
- *How did you arrive at your final design? (I.e. include and explain initial sketches in addition to computer-generated designs.)*

Students should show how they are using aluminium (and other sustainable and recyclable materials).

Help students put aluminium at the heart of their design.

- *Which parts of your design are aluminium, and why?*
- *How will each part be formed, joined and finished?*
- *Why is aluminium a good choice for this part?*
- *What other materials will your design use? (I.e. plastics, textiles, composites or biocomposites, natural materials.) Why will you use them?*

Deliver during lessons

The resources and competition are a great way to get students thinking like product designers and engage with some contemporary design issues.

There's no set time requirement but these lesson ideas give you a handy starting point you can simplify or extend to suit your needs, and you can use the classroom presentation to help you.

LESSON 1

STARTER

Using the **About design** stimulus sheet or web page to help you discuss the role of a product designer. Ask students to list some key questions any product designer should ask about the design briefs they respond to. Ask students which products they find interesting, and discuss their designs.

DESIGN BRIEF

Discuss as a class:

- What existing products does the design brief relate to? How can these products shape students' thinking about the design brief?
- Think of a related product that is a great design, and one that is a poor design, ask students to explain their choices.
- What problems does the design brief challenge students to solve?

GENERATE IDEAS

Split students into groups to generate their initial ideas. Ask students to gather their ideas in a concept map that includes words and sketches. Use the ideas on the student information sheets to help each group.

PLENARY

Discuss students' ideas so far. Remember that some groups may not want to share their design ideas, so focus on general themes that every entry should address. Brief students to begin developing their ideas as homework.

LESSON 2

STARTER

Review the Design challenge guides and explain that students' entries must show how they have met the requirements of the design brief. Explore the sample entry together.

DEVELOP IDEAS

Guide students as they finish their designs, adding labels and explanations to bring their ideas to life. Encourage students to use annotated drawings as part of the process – it really helps the judges understand their thinking. Make sure students are focused on the design brief and are meeting the requirements listed in the Design challenge guide to explain how they're responding to the brief. Students should articulate why they have selected the material they have, therefore demonstrating an understanding of its properties.

PLENARY

Make sure each group has met the basic requirements for entry. Get each student or group to complete an entry form, which you must sign.

FILM HUB

You may find the following films useful in your delivery:

Thinking about design – a closer look at design in the packaging industry
https://learningaluminium.co.uk/about/film-hub/top-tips-creating-winning-design-alu-dt-challenge/

Discussing the design briefs – meet the 2016 winners
https://learningaluminium.co.uk/about/film-hub/alu-dt-challenge-2016-meet-winners/

Developing ideas – the use of aluminium at Jaguar Landrover
https://learningaluminium.co.uk/about/film-hub/working-aluminium-technical-specialist-jaguar-land-rover/

Deliver through a project or club

The resources and competition are a great activity for a club or independent learning project, and challenge students to think about some real, contemporary design issues.

There's no set time requirement and you can make the project anything from a quick activity to an extended challenge. These ideas give you a handy starting point you can easily adapt to suit your needs, and you can use the classroom presentation to help you.

GET DESIGNING

- Introduce the competition.
- Explain that students can work alone or in groups of up to four.
- Hand out copies of the three **Design challenge guides** and let students decide which one(s) they would like to enter.
- Review the **Design challenge guides** and draw students' attention to the Design brief and 'Get creative!' section – if entering the competition they need to meet these criteria in their entries.
- Hand out copies of the four student information sheets, **About aluminium**, **About aluminium manufacture**, **About design** and **About sustainability.** Explain that students need to use these ideas and their own research to help them come up with a strong entry. (There are more ideas on the previous page.)
- To help them, share a **Previous successful entry sheet**, or students can download a sample entry from learningaluminium.co.uk/aludtchallenge or read it online. Explain that students don't need to match this sample entry, but instead provide their own best work. Ask students to identify ways in which this entry might stand out for the judges, for example through elements of the design and annotations, and how the 6Rs have been considered. Students should recognise that this entry has demonstrated an understanding of the properties of aluminium and other materials by justifying the selection of the materials.
- Brief students on when you need them to bring in their completed entries and encourage them to continue their research to develop their design ideas at home.
- When gathering in entries, ensure each student or group completes an entry form,which you also must sign.

FILM HUB

The **Learning Aluminium Film Hub** contains many further resources to help inspire your students. You may find the following especially useful.

Introducing the competition:

- Meet the 2016 winners https://learningaluminium.co.uk/about/film-hub/alu-dt-challenge-2016-meet-winners/
- Meet the 2015 winners https://learningaluminium.co.uk/about/film-hub/alu-dt-challenge-2015-celebration-event/

On design:

- A closer look at design in the packaging industry https://learningaluminium.co.uk/about/film-hub/top-tips-creating-winning-design-alu-dt-challenge/
- Design for the future with Jaguar Landrover https://learningaluminium.co.uk/about/film-hub/alu-dt-challenge-advice-creating-winning-entry/

On aluminium:

- The aluminium life cycle https://learningaluminium.co.uk/teacher-resources/aluminium-life-cycle-11-14/
- The use of aluminium at Jaguar Landrover https://learningaluminium.co.uk/about/film-hub/working-aluminium-technical-specialist-jaguar-land-rover/

How to enter/ key dates/ contact us

ELIGIBLE STUDENTS

Students in years 7–9 (England and Wales), 8–10 (Northern Ireland) or P7–S2 (Scotland) on 22 December 2017 (the closing date of the competition) can enter. Students can enter as individuals or in groups of between two and four students (in which case any prize will be shared between the group).

HOW TO ENTER

- Entries can be handwritten, or a PDF or Microsoft Office file. Videos/web entries may be submitted, but the URL must be placed within a PDF or Microsoft Office file. Videos/web entries should also be publicly accessible. Entries should take no more than five minutes to skim at the initial judging stage. We advise this would equate to no more than four pages of A4. In addition, up to ten photographs per entry can also be submitted.

  Please include the entrant/ team/ school name on each page.

- Students and schools can enter more than one design challenge.
- Entries must cover the three areas shown on each **Design challenge guide** how students are responding to the brief, how they are using aluminium, and how they are making their design sustainable.
- Entries should balance drawings and written descriptions Students can build and photograph 2D or 3D models of their designs if they wish, but please do not send models as part of entries.
- Entries can be made either online or via post. For entries made via post, a completed entry form (provided on page 13), signed by a teacher, must accompany each entry. Please ensure each entry form is clearly attached to its corresponding entry. For more information, please visit: https://learningaluminium.co.uk/aludtchallenge/enter-the-challenge/

Send postal entries to:

Alu D&T Challenge
c/o EdComs
Studio 1.19
Canterbury Court
1–3 Brixton Road
London
SW9 6DE

Key dates

22 December 2017 at midday

Deadline for submission of entries.

31 January – 5 February

Finalists will be notified. As part of the final judging process some schools may be contacted to enable a discussion about an entry with the students and/or teacher involved.

6–9 February 2018

Results announced and category winners invited to the Celebration Event.

7 March 2018

Celebration Event at the **Thinktank Science Museum** in Birmingham.

Good luck!

CONTACT US

Should you have any queries about the Alu D&T Challenge, please visit our website: learningaluminium.co.uk/aludtchallenge**, call us at 0121 601 6386, or email us at learningaluminium@edcoms.co.uk**

Curriculum links – 11 – 14

THESE RESOURCES SUPPORT DESIGN AND TECHNOLOGY/ TECHNOLOGY IN ALL UK SCHOOLS

England

Design and technology KS3

Design:

- Develop specifications and designs that respond to needs in a variety of situations.
- Generate creative ideas through a variety of methods to avoid stereotypical responses.
- Develop and communicate design ideas using a wide range of techniques.
- Identify and solve design problems and understand how to reformulate problems given to them.

Evaluate:

- Understand the responsibilities of designers and the impact of design developments on individuals, society and the environment.

Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions.

Wales

Design and technology KS3

Skills: Designing 1, 2, 3, 4, 5, 6, 8

Range: investigate, analyse and evaluate products in order to acquire technological and health and safety knowledge and understanding that can be applied in their designing and making; learn about the responsible use of materials considering issues of sustainability; reflect on the work of designers; be creative, be innovative and enterprising and work independently and in groups.

Key processes: 2a, b, c, d
Range and content: 3a, d, e, k, l
Curriculum opportunities: 4a, b, c, d

Scotland

Technologies third/fourth level

TCH 3-02a; TCH4-02a; TCH3-14a; TCH4-14a; TCH4-14b; TCH4-14c; TCH4-14d; TCH3-15a; TCH3-15b

Northern Ireland

Technology and design KS3

Knowledge, Understanding and Skills: Design, Communication

Objective 2: Design cost effective and appropriate solutions to meet the specific needs of diverse local and global groups.

Objective 3: Pursue design solutions using environmental friendly materials and energy sources. Identify product needs and pursue sustainable harmonious design solutions in a local outdoor/ indoor context.

Learning Outcomes: Show deeper understanding by thinking critically and flexibly, solving problems and making informed decisions, using Mathematics and ICT where appropriate; demonstrate creativity and initiative when developing ideas and following them through; work effectively with others; demonstrate self-management by working systematically, persisting with tasks, evaluating and improving own performance; communicate effectively in oral, visual (including graphic), written, mathematical and ICT formats showing clear awareness of audience and purpose.

SUPPORT FOR OTHER SUBJECTS

The activities are also a great way to:

- enhance the profile of STEM subjects and careers and deliver STEM activities with students in lessons or after-school clubs
- embed Education for Sustainability (ESD) into design and technology and STEM
- support Eco-Schools by helping students think about the links between consumption and environmental impact and include environmental thinking in your curriculum
- and build students' enterprise and employability skills, critical thinking skills, understanding of sustainable development, or Thinking Skills and Personal Capabilities (Northern Ireland).

Curriculum links – qualifications

THE DESIGN CHALLENGES SUPPORT THE DELIVERY OF TECHNOLOGY QUALIFICATIONS

Students embarking on formal qualifications in the permitted year groups (see page 12) may still enter the competition.

Students in higher year groups are not able to enter the **Alu D&T Challenge**, but the resources can still be used to explore real industry questions and sustainable design.

England

Design and technology GSCE (DfE, 2015; Edexcel, 2017; OCR, 2017)

- Generating and developing design ideas to solve real and relevant problems, considering their own needs and those of others (particularly the disabled or elderly).
- Develop an understanding of the impact of design and technology on daily life and the wider world.
- Understanding the impact of resource consumption, for instance carrying out a life cycle assessment of a material or product, exploring the 6Rs.
- Build an understanding of key metals, their alloys and their properties, including forming, joining and finishing techniques.
- Communicate design ideas and decisions using different media and techniques, as appropriate.

Wales

Design and technology GCSE (WJEC, 2017)

- The importance of sustainability issues and environmental issues when designing and making products, including the ecological and social footprint of materials and components (Core Knowledge and Understanding 2.1.1: a, b, e).
- The aesthetic and functional properties of non-ferrous metals including aluminium; selection processes for design materials and knowledge of forming, joining and surface treatments for materials (In-depth Knowledge and Understanding 2.1.2, product design: c, f, g, j, k).
- Understand and investigate the effects of different contexts and challenges on design and identify consumer needs; use different design strategies to develop and apply s uitable techniques to communicate ideas (Core skills 2.2.1: a, b, d, f, g).

Scotland

Design and manufacture, national five (SQA, 2015)

- Understanding of the impact of a range of design and manufacturing technologies on our environment and society.
- Applying knowledge of research techniques and analysing information.
- Generating ideas through a variety of techniques.
- Applying knowledge and understanding of design factors and graphic techniques.

Higher design and manufacture (SQA, 2014)

- Researching and evaluating existing product types.
- Selecting and applying a range of idea generation techniques.
- Applying a range of creative design skills when refining and resolving product design tasks which encompass a range of key design factors.
- Selecting and using graphic techniques to visually represent design solutions, justifying the chosen selection of techniques.

Northern Ireland

Technology and design GCSE (CCEA, 2017)

- Design communication; materials and their general physical, aesthetic and structural characteristics; demonstrate understanding of the main features and applications of the following semi-permanent joining methods, production methods, and finishing techniques, demonstrate understanding of the benefits and disadvantages of CAD (Technology and Design core content 1.1,1.2, 1.4, 1.5, 1.7, 1.10).
- Product design and the roles of the client, user, designer and maker; product analysis, ideas generation and development, communication techniques, ergonomics and anthropometrics, discuss and consider form and function selection of materials, joining materials, energy efficiency and recycling (Option C, product design: 2.36, 2.37, 2.38, 2.39, 2.40, 2.41, 2.47, 2.48, 2.49, 2.55).

Terms and conditions

1. The competition is open only to students in the UK who are in years 7–9 (England and Wales), 8–10 (Northern Ireland) or P7–S2 (Scotland) on 22 December 2017.
2. The closing date for receipt of entries is 12 noon on 22 December 2017.
3. Students can enter either as individuals or in groups of two to four. For winning entries, cash in the form of vouchers, will be awarded solely to individual winners or shared equally among team members.
4. Entries can be made online or via post. All entries must be submitted by a teacher and, for entries made via post, must include an entry form signed by the supervising teacher. Models should not be submitted.
5. Entries can be handwritten, or submitted as a PDF or Microsoft Office file. Videos/web entries may be submitted, but the URL must be placed within a PDF or Microsoft Office file. Videos/web entries should also be publicly accessible.
6. Entries should be correctly labelled with the student or team name and the school name on each page of the entry, and with the corresponding entry form attached.
7. Entries must cover the three areas shown on each Design challenge guide: how students are responding to the brief, how they are using aluminium, and how they are making their design sustainable by addressing all six of the 6Rs of sustainability.
8. Entries must be a maximum of four pages of A4 and may also include up to ten photographs.
9. Entries may be completed at school or in students' own time.
10. Entries cannot be returned. Please keep a copy before entering.
11. No responsibility will be accepted for any entries lost, delayed or damaged in the post, and proof of sending is not proof of receipt.
12. Entries will not be acknowledged. If you would like your entry/entries to be acknowledged, please include a stamped addressed postcard in your entry which we will return to you.
13. Winners will be notified in writing by Friday 9 February 2018.
14. The judges' decision is final, there is no appeal system and no correspondence will be entered into.
15. The winner(s) will be selected from all eligible entries received on the basis of the Judging Criteria set out on the website. All schools taking part in the Challenge will receive a certificate marking their participation before 23 February 2018.
16. All prizes are awarded conditionally upon acceptance. If a winner is unable to be contacted after a reasonable period, or if any prize is unclaimed or declined within a reasonable period, the prize shall be deemed as unclaimed or unaccepted and the next best entry may be awarded at the discretion of the competition organiser.
17. The **Alu D&T Challenge** organisers will not be responsible for any inability of a prize winner to take up the specified prize.
18. The **Alu D&T Challenge** organisers reserve the right to provide substitute prize(s) of similar value should the specified prize(s) become unavailable for reasons beyond its control. For shortlisted finalists, only one 3D Doodler Pen will be awarded per school, per category, even if more than one entry from a school is shortlisted. Cash or credit alternatives will not be offered. None of the prizes are transferable.
19. The **Alu D&T Challenge** organisers will not be liable for any change of date or venue or cancellation of the prize-giving ceremony.
20. Travel costs to the ceremony will not be covered. However the **Alu D&T Challenge** organisers may agree to cover some of the travel expenses for schools who are required to travel a long distance, however – these expenses will be awarded at Alupro's discretion.
21. The winner(s) may be required to participate in publicity connected with the competition.
22. By entering the Challenge, students and teachers give agreement for the details of winners and shortlisted entries to be shared via the www.learningaluminum.co.uk website and associated media channels.
23. Entry will be deemed to signify acceptance of these terms and conditions.
24. This competition is governed by English Law and is subject to the exclusive jurisdiction of the English courts.

The promoter and organiser of this competition is:

Aluminium Packaging Recycling Organisation (Alupro)

1 Brockhill Court
Brockhill Lane
Redditch B97 6RB

Entry form for postal entries

A completed entry form must be signed by a teacher and attached to each separate entry sent via post.

SCHOOL DETAILS

(All entrants must complete this section in block capitals)

School name:

School address:

Postcode:

Contact teacher's name:

Daytime telephone number:

Mobile:

Contact teacher's email address:

Contact teacher's signature:

By signing this form, I confirm that this is a valid entry and complies with the Terms and Conditions of the Challenge, which I accept.

STUDENT(S)

(No more than four students per team entry. Please use a separate form for each entry.)

First name	Surname	Date of birth	Year group	Gender (M / F / Other)
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4

CHALLENGE COMPLETED (TICK ONE PER ENTRY)

☐ Accessible vehicle ☐ Garden building ☐ Aluminium packaging

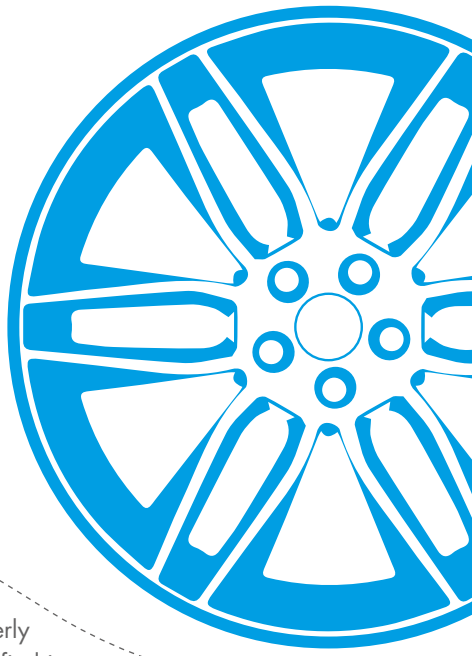
Please attach this form to all sheets which are to be sent, writing student(s) or team names on the reverse of each sheet.

Please send your completed entry to:

Alu D&T Challenge, c/o EdComs, 1Studio 1.19, Canterbury Court, 1–3 Brixton Road, London SW9 6DE

DESIGN CHALLENGE GUIDE

An accessible vehicle for the future



WHAT'S THE PROBLEM?

As people get older, using a car can become difficult. This includes getting in and out of a vehicle, as well as controlling and driving it. Populations in many countries around the world are getting older, so this will become an increasing challenge.

Design brief

Design a new vehicle for the future, suitable for one person, or one person and a passenger. Your design should make travel easier for elderly or disabled drivers.

Think about how an elderly or disabled person may find it difficult to use a car or other vehicle. How could you make it easier and quicker to get in and out, or to control the car's speed and direction? Think about how you'll use aluminium in your design and what other sustainable and recyclable materials you'll use. How can aluminium make your vehicle strong, stiff and stable? How might it form part of any assistive features you include? Make sure your vehicle has minimum impact on the environment throughout its life, and its component parts can be recycled when they are no longer functional.

GET CREATIVE!

Think about the problem and the design brief → Carry out research then generate ideas → Develop them into a winning design → ...then present your ideas in a winning way!

MAKE SURE YOU:

1. Show how you're responding to the brief
2. Show how you're using aluminium (and other sustainable and recyclable materials)
3. Show how you've addressed the 6Rs of sustainability

GET INSPIRED!

- Read the brief carefully and look at previous successful entries.
- Carry out your own research on design, aluminium and the 6Rs.
- Think of your own original ideas – don't copy ours!
- Do some market research – can you talk to someone who knows about caring for older or disabled people?

JUDGES' TIPS

- Answer the brief with a really original design.
- Show us how you form, join and finish aluminium.
- Explain how you address all 6Rs of sustainability.

DESIGN CHALLENGE GUIDE

A garden building for a creative home worker

WHAT'S THE PROBLEM?

Many people with creative careers work at home and need a dedicated space that inspires them and reflects their personality.

Design brief

Design a garden building that's a working space for someone who is creative. Your building might be for a painter, musician, potter, cartoon artist, fashion designer, or any other creative career. It should use aluminium and be a strong statement about their personality.

Think about the person who might use your garden building. What do they create? What sort of space do they need? How will it look and feel? Will it blend into its natural surroundings, or stand out to impress? Think about how you could use aluminium in your design and what other sustainable and recyclable materials you could use to make sure your building is sustainable throughout its life.

GET CREATIVE!

Think about the problem and the design brief → Carry out research then generate ideas → Develop them into a winning design → ...then present your ideas in a winning way!

MAKE SURE YOU:

1. Show how you're responding to the brief
2. Show how you're using aluminium (and other sustainable and recyclable materials)
3. Show how you've addressed the 6Rs of sustainability

GET INSPIRED!

- Read the brief carefully and look at previous successful entries.
- Carry out your own research on design, aluminium and the 6Rs.
- Think of your own original ideas.
- Do some market research – can you talk to someone who works from home?

JUDGES' TIPS

- Answer the brief with a really original design.
- Show us how you form, join and finish aluminium.
- Explain how you address all 6Rs of sustainability.

DESIGN CHALLENGE GUIDE

A new way to use aluminium in packaging

WHAT'S THE PROBLEM?

People buy all kinds of products which use packaging to transport, protect and promote them. Many of these products don't come in packaging which is easy to recycle. Buying them can add to waste and landfill.

Design brief

Redesign packaging for an existing product that people might buy but which doesn't currently use aluminium. Your packaging should keep the product safe and in great condition, and be easier to recycle.

Think about the products you use most often. How could you use aluminium to package one of these products safely and conveniently?

How will using aluminium make the packaging perform better, or even perform another function so that it can be used in different ways?

What size and shape would your packaging be?

How would it open?

How will you use aluminium to create a design that is eye-catching and appealing to young people?

GET CREATIVE!

Think about the problem and the design brief → Carry out research then generate ideas → Develop them into a winning design → ...then present your ideas in a winning way!

MAKE SURE YOU:

1. Show how you're responding to the brief
2. Show how you're using aluminium (and other sustainable and recyclable materials)
3. Show how you've addressed the 6Rs of sustainability

GET INSPIRED!

- Read the brief carefully and look at previous successful entries.
- Carry out your own research on design, aluminium and the 6Rs.
- Think of your own original ideas – don't copy ours!
- Do some market research – talk to your friends and family about the products they buy and the packaging in which it comes.

JUDGES' TIPS

- Answer the brief with a really original design.
- Show us how you form, join and finish aluminium.
- Explain how you address all 6Rs of sustainability.

What the judges are looking for

Your entry must cover the three areas shown on each **Design challenge guide** how you are responding to the brief, how you are using aluminium, and how you are making your design sustainable by addressing all 6Rs of sustainability.

USE THESE HANDY CHECKLISTS TO HELP YOU!

How am I responding to the Design brief?

- ☐ I have thought about and can show my research into who will use my product and what they need it to do.
- ☐ I have explained how my design solves the problem in the brief.
- ☐ I have used existing ideas to inspire me, but I'm not copying them.
- ☐ I have generated my own original ideas.
- ☐ I have shown that I have done independent research.
- ☐ I have included lots of detailed drawings or sketches using a mix of freehand sketching and computer-aided design.
- ☐ I have included plenty of labels to explain my design ideas, materials and construction.
- ☐ I have presented my designs either as a handwritten, Microsoft office, PDF or video file without exceeding four A4 pages, or five minutes of film, in length.

How am I using aluminium (and other sustainable and recyclable materials)?

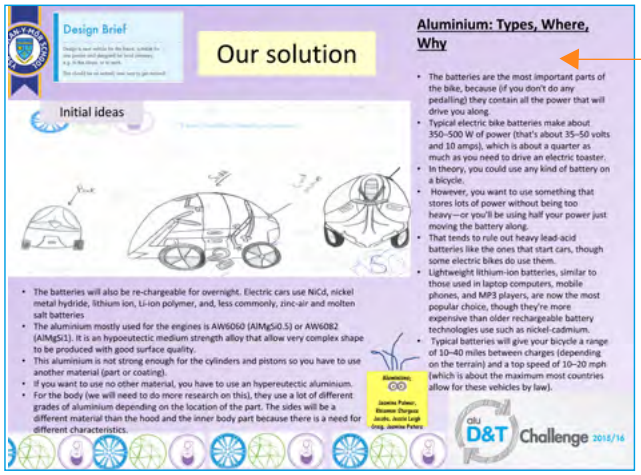
- ☐ I have used aluminium throughout my design.
- ☐ I have used aluminium in lots of different ways.
- ☐ I have explained how using aluminium helps to solve the design problem.
- ☐ I have justified (give good reasons for) how I will form each aluminium part.
- ☐ I have justified how I will join parts together.
- ☐ I have justified how I will finish each aluminium part.
- ☐ I have explained why I chose other materials in my design and how I use them sustainably.

How am I thinking about the 6Rs of sustainability?

- ☐ I have written my own explanations of how I deal with all the 6Rs – not just what they are.
- ☐ I have explained where each material will come from.
- ☐ I have used recycled raw materials where possible.
- ☐ I have explained how my design will be sustainable at every stage of its life:
  - ○ making
  - ○ using
  - ○ repairing
  - ○ what happens at the end of its useful life.
- ☐ I have looked over each of the **Previous successful entries** to help develop and present my ideas.

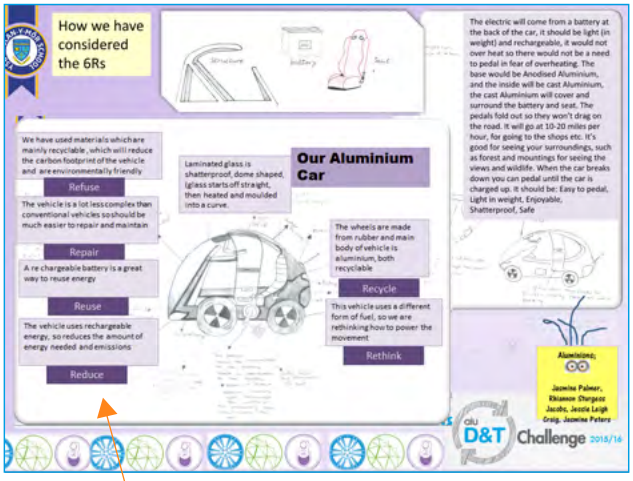
Previous successful entries (1/3)

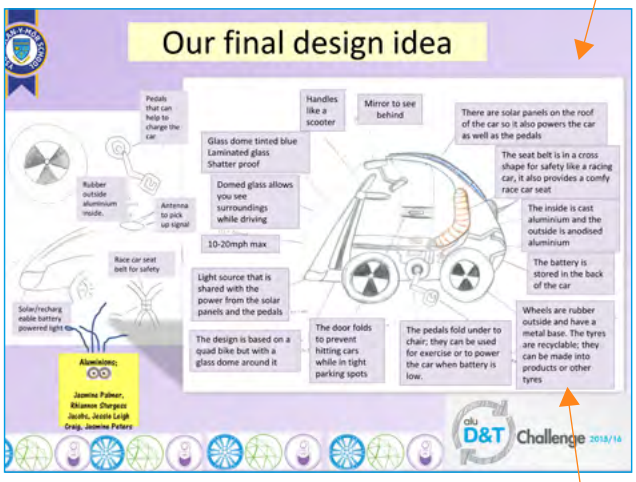
AN ACCESIBLE VEHICLE FOR THE FUTURE *



Shows multiple uses of aluminium

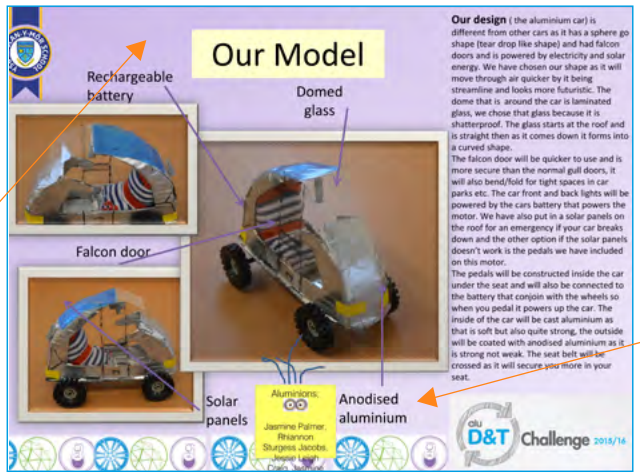
Shows all aspects of the design





Demonstrates original thinking about all 6Rs of sustainability

Considers how other materials will be used sustainably and justifies their selection and use



Puts aluminium at the heart of the design

Justifies the choices of finish used

This example entry was taken from the 2015 competition in which students were challenge to design a one-person vehicle.. Please note the brief has since shifted slightly in focus to take account of the identified industry trends surrounding the aging population and smarter technology.

Previous successful entries (2/3)

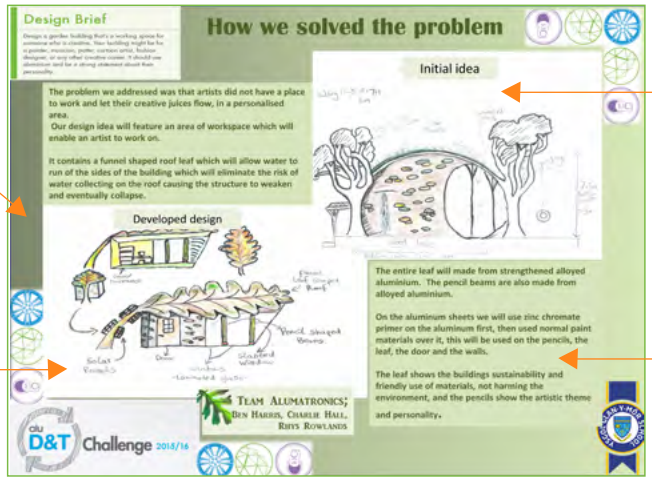
GARDEN BUILDING FOR A CREATIVE HOME WORKER

Responds fully to the brief and explains how the key ideas developed

Demonstrates original thinking behind the design and shows how the key ideas developed

Labels explain materials, construction and key ideas

Jusifies the choices of finish used



Design Brief

How we solved the problem

The problem we addressed was that artists did not have a place to work and let their creative juices flow, in a personalised area.
Our design idea will feature an area of workspace which will enable an artist to work on.

It contains a funnel shaped roof leaf which will allow water to run of the sides of the building which will eliminate the risk of water collecting on the roof causing the structure to weaken and eventually collapse.

Initial idea

Developed design

The entire leaf will made from strengthened alloyed aluminium. The pencil beams are also made from alloyed aluminium.

On the aluminum sheets we will use zinc chromate primer on the aluminum first, then used normal paint materials over it, this will be used on the pencils, the leaf, the door and the walls.

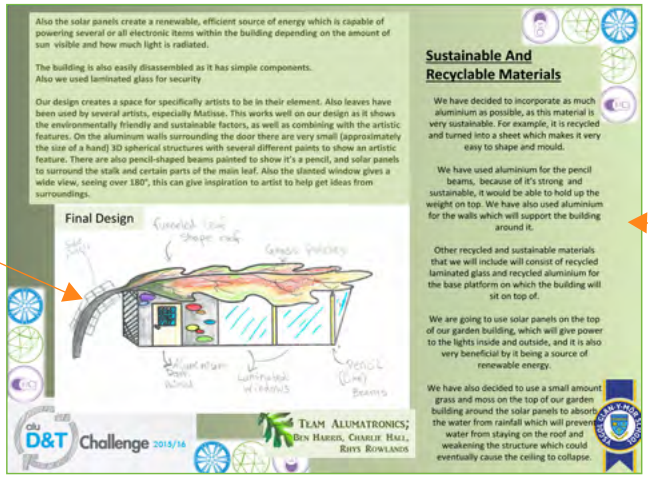
The leaf shows the buildings sustainability and friendly use of materials, not harming the environment, and the pencils show the artistic theme and personality.

Team Alumatronics; Ben Harris, Charlie Hall, Rhys Rowlands

alu D&T Challenge 2015/16

Shows all aspects of the design

Puts aluminium at the heart of the design



Also the solar panels create a renewable, efficient source of energy which is capable of powering several or all electronic items within the building depending on the amount of sun visible and how much light is radiated.

The building is also easily disassembled as it has simple components.
Also we used laminated glass for security

Our design creates a space for specifically artists to be in their element. Also leaves have been used by several artists, especially Matisse. This works well on our design as it shows the environmentally friendly and sustainable factors, as well as combining with the artistic features. On the aluminum walls surrounding the door there are very small (approximately the size of a hand) 3D spherical structures with several different paints to show an artistic feature. There are also pencil-shaped beams painted to show it's a pencil, and solar panels to surround the stalk and certain parts of the main leaf. Also the slanted window gives a wide view, seeing over 180°, this can give inspiration to artist to help get ideas from surroundings.

Final Design

Sustainable And Recyclable Materials

We have decided to incorporate as much aluminium as possible, as this material is very sustainable. For example, it is recycled and turned into a sheet which makes it very easy to shape and mould.

We have used aluminium for the pencil beams, because of it's strong and sustainable, it would be able to hold up the weight on top. We have also used aluminium for the walls which will support the building around it.

Other recycled and sustainable materials that we will include will consist of recycled laminated glass and recycled aluminium for the base platform on which the building will sit on top of.

We are going to use solar panels on the top of our garden building, which will give power to the lights inside and outside, and it is also very beneficial by it being a source of renewable energy.

We have also decided to use a small amount grass and moss on the top of our garden building around the solar panels to absorb the water from rainfall which will prevent water from staying on the roof and weakening the structure which could eventually cause the ceiling to collapse.

Team Alumatronics; Ben Harris, Charlie Hall, Rhys Rowlands

alu D&T Challenge 2015/16

Demonstrates research, creativity and innovation

Our Model showing what our product would look like

Team Alumatronics; Ben Harris, Charlie Hall, Rhys Rowlands

alu D&T Challenge 2015/16

Previous successful entries (3/3)

A NEW WAY TO USE ALUMINIUM IN PACKAGING

Demonstrates research, creativity and innovation

Justifies how each part will be formed

Justifies how each part will be joined

Target Market

My packaging is for a ukulele, it will be called the Zookulele. My packaging will be aimed at children aged 9-14. The packaging design will have a child friendly design and a quirky shape to appeal to my target audience. They enjoy music and playing with friends.. They are creative and plan to do music, D&T and Art GCSE. Live in a three bedroom house with one brother who is younger. Going to the local school and having a large group of friends.
They can read music and plan to take ukulele exams. They play in a band with 8 other students, practising two a week.

The Problem

Ukulele cases are usually made from a plastic material that is hard to recycle. It is made to look like leather, or some come in cardboard packaging which will deteriorate and not good for different weather conditions when used after school and having to walk home.

My new packaging will be made from aluminium, which will not deteriorate in different weathers, and will not rust or corrode because aluminium is a non-corrosive metal. My packaging will use recyclable materials so it is eco-friendly.

These cases can be awkward to carry because they don't have back carry straps, also it would be heavy because looking at the two examples they are made from heavy materials and will be hard to carry without a back carry strap.

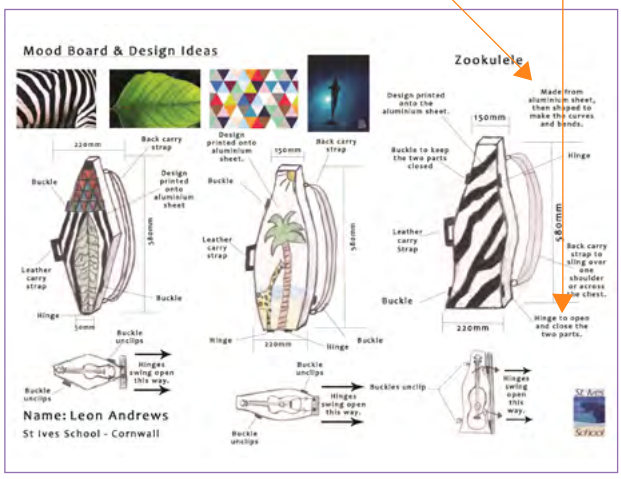
Design Brief

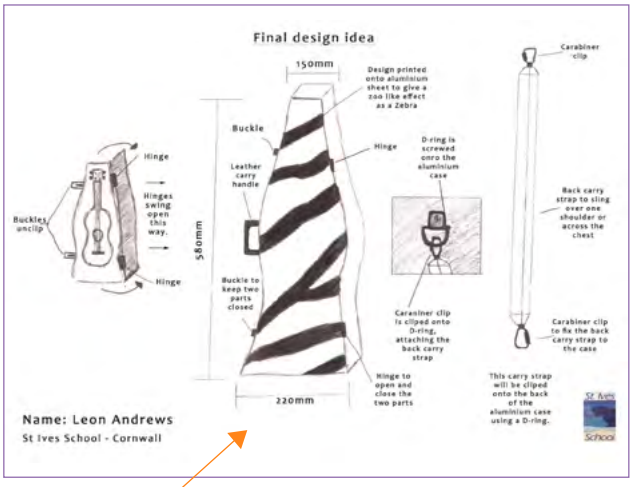
My packaging will be designed to hold one ukulele, protecting it from being damaged during travel. It will open with two buckles and two hinges and can be used over and over. The case will be made of hard aluminium alloy. It will be designed for a child aged between 9-14 years old. It must be safe and easy to use.
All the materials will be recycleable

Design Specification

My packaging will be light weight and and easy to carry because of the aluminium outer layer and the corrugated cardboard padding for protection.
Also it will have a handle made from leather and a single leather shoulder carry strap.
It will hold and protect one ukulele.
It will be affordable so that more young people can take up playing and protecting their instrument.
The materials used can be recycled and reused.
The aluminium will have a design on the surface to attract the target market as they want a funky design.
It will be easy to carry by having a shoulder strap and a handle.
The corrugated card can be shaped to suit the size of the ukulele as there are different sizes.

Name: Leon Andrews
St Ives School - Cornwall



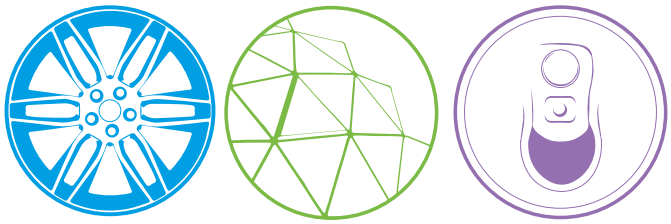


Detailed drawings or sketches

Detailed explanations of how each of the 6Rs has been addressed

Demonstrates original thinking about all 6Rs of sustainability

About design



Great designs start with people, not things. Great designers work out what the problems are and how design can solve them. People don't need to notice a great design, but they should notice that their problems have been solved.

Use these questions to come up with a great design:

WHO...

... is this product for and what benefits do they want from it?

WHY...

...will people use this product?

...would they prefer it to other products?

WHEN...

...will people use this product?

WHERE...

...would it be used and how does this affect the design?

HOW...

...will people use this product?

...can we make this simpler, easier, safer, better?

WHAT...

...will we make it out of?

...will happen at the end of its lifetime?

"THE ONLY IMPORTANT THING ABOUT DESIGN IS HOW IT RELATES TO PEOPLE."

VICTOR PAPANEK (1923 – 1998)
DESIGNER, EDUCATOR AND ADVOCATE FOR SOCIALLY AND ECOLOGICALLY RESPONSIBLE DESIGN

"DESIGN IS NOT JUST WHAT IT LOOKS LIKE AND FEELS LIKE. DESIGN IS HOW IT WORKS."

STEVE JOBS (1955 – 2011)
CO-FOUNDER AND CEO OF APPLE

About aluminium

The raw source of aluminium is bauxite, a clay found in wet tropical or sub-tropical climates such as Latin America, South America, Africa and Australia.

EXTRACTING ALUMINIUM

Bauxite mining, (4 kg bauxite)

About 240 million tonnes of bauxite is mined every year! The clay is usually found in the top five metres of top soil, so great care is taken to restore and replant land after the mineral is extracted. 97% of all bauxite mines have formal rehabitation procedures for reforestation once mining is complete.

Alumina production (2 kg alumina)

To extract alumina (aluminium oxide) bauxite must be chemically treated. Bauxite is mixed in a hot sodium hydroxide solution to remove impurities. The solution is then precipitated and heated to 1,000 °C to form pure alumina.

Primary aluminium production (1 kg aluminium)

The alumina then goes through a process of electrolysis in a bath of molten cryolite (a mineral containing sodium aluminium fluoride) to produce aluminium metal.

It is estimated that bauxite reserves are sufficient to last another 300 years! However, the process of converting bauxite to aluminium requires a lot of energy. For example, converting 4 kg of bauxite into 1 kg of aluminium consumes **13-15 kWh of electricity** – compare this to the energy needed to produce aluminium from recycled material and there is a huge 95% energy saving!

Bauxite

Bauxite Mining

Bauxite, alumina, aluminium

Hydroelectricity turbines

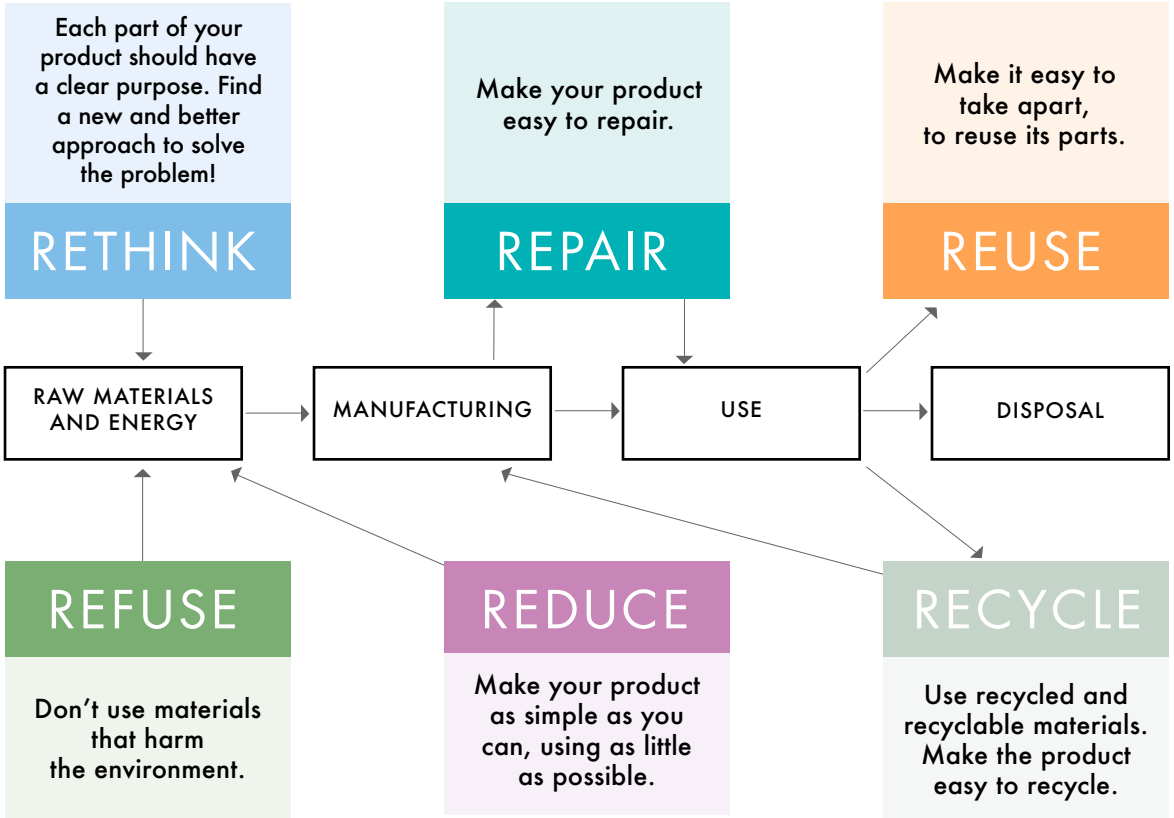
Aluminium

THE ALUMINIUM LIFE CYCLE

Although energy for primary aluminium production is increasingly produced through renewable sources, such as hydroelectricity, more important to the sustainability of aluminium production is the metal's suitability for recycling. Producing secondary aluminium provides an amazing 95% energy saving compared to the same weight of primary metal.

About sustainability

Use the 6Rs of sustainability as you generate ideas and develop your design.
Try to use each of these six ideas in the lifecycle of your design solution.

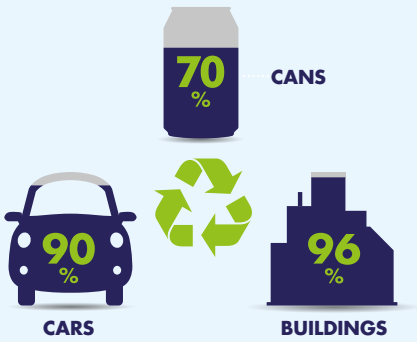


ALUMINIUM AND SUSTAINABILITY

When the best technology is used, recycled aluminium is equal in quality to the primary (or newly formed) metal.

Recycling aluminium uses just 5% of the energy needed to produce new aluminium

of aluminium ever made is still in use today



Aluminium is widely recycled in the UK

What other properties of aluminium could help make your design sustainable throughout its lifecyle?

FIND OUT MORE:

learningaluminium.co.uk/about-aluminium

About aluminium manufacture

ALUMINIUM IS...

- the second most-used metal, after steel
- lightweight: just 1/3 the weight of steel
- a good conductor of heat and electricity
- as strong as steel when alloyed with other metals
- resistant to corrosion and non-magnetic
- infinitely recyclable: you can use it again and again.

The combination of these properties makes it a valuable, versatile material to designers.

ALUMINIUM CAN BE...

FORMED

CAST

Molten aluminium is poured into moulds. Casting can create complex parts or decorative shapes. Ingots – or blocks – cast from molten aluminium are also supplied to aluminium producers for further manufacturing. Decorative hard-wearing garden furniture is often made from cast aluminium.

ROLLED

Aluminium can be rolled into foils, sheets and thick plates. These can be cut, formed and joined. Thin foils can be laminated with plastics and paper. Applications for rolled aluminium include body panels, packaging and lithographic plates, which are used in the printing industry.

EXTRUDED

Extrusion is used to force heated, softened aluminium through a shaped die to form a long product. These can be used as long lengths or cut into smaller pieces. Extrusion is used to create long, thin products like aluminium handrails, greenhouse frames and curtain tracks, for example.

FORGED

Forging uses presses and other tools to apply pressure to shape the aluminium. Forging is ideal for applications where strength and safety are key, but efficiency is crucial too. So wheels of race cars, for example, are often made from forged aluminium.

LASER CUT

Laser cutting uses a high-power computer-controlled laser to cut accurate shapes from aluminium sheets or plates.

JOINED

MECHANICAL FASTENERS

Fasteners, like screws, bolts or rivets can hold sheet or formed aluminium together at single points or along longer seams. In aircraft construction for example, the sheets of aluminium which, are used for the body are joined together with aluminium rivets.

ADHESIVES

Special adhesives can bond aluminium together. Aluminium window frames are smaller pieces of aluminium joined with strong adhesive.

SPOT WELDING

Spot welding uses resistance to heat the metal so it forms a joint. This can help form complex structures from pressed or rolled sheets. In the automotive industry, spot welding is a very popular method for joining the aluminium sheets which form the body of a vehicle.

CONTINUOUS WELDING

Continuous welding creates a seam to join sheets of aluminium together. This takes place at a temperature high enough to melt the aluminium. This technique is popular in the automotive industry.

BRAZING OR SOLDERING

Brazing or soldering creates spot joins or seams, but at a lower temperature so the aluminium does not melt. A filler metal with a lower melting point fills the joint. This is used in plumbing, where leaks are not at all desirable!

CLIP TOGETHER

Due to its elasticity, aluminium can form snap-fit (clipped) joints. Aluminium extrusions are shaped to hook together, allowing for quick assembly. If the joints will be repeatedly opened, plastic clips or steel springs are used for the joint's bending portion to prevent any loss of shape.

FINISHED

ANODISED

Anodising uses an electrical process to coat the surface of the aluminium with its oxide. This helps the treated part resist corrosion. The anodised surface can be dyed to add colour to the part.

POWDER COATED

Aluminium parts are dipped in or sprayed with dry paint powder. The part is then placed in an oven and the powder particles melt to form a continuous coating.

UNCOATED

Aluminium doesn't always need protecting from the elements, because it doesn't corrode. Using aluminium uncoated reveals its natural 'shine', which is seen as an asset by designers. This appearance is said to be 'mill finish', meaning that it looks like it has come straight from the mill. Ladders, for example, are often sold this way. Uncoated aluminium is an economical choice when appearance is not of primary importance.

ETCHED

Etching – or engraving — on to aluminium can create a very decorative product, as you can apply as intricate a design as you require. Etching is also useful because the design will not wear easily – you will see it for a long time!

PAINTED

Special aluminium paint is long-lasting and durable. Painted products still retain a realistic aluminium finish. With an infinite choice of colours available, very unique aluminium products can be created using aluminium paint.

What other ways to form, join and finish aluminium can you discover?

FIND OUT MORE:

learningaluminium.co.uk/about-aluminium

Useful links

You and your students can use these web links to find out more about design, aluminium and the context for each Challenge.

ALUMINIUM

Explore the Learning Aluminium resources Life Cycle resources
Our materials for 11–14 year olds include a film and lesson plan focusing on the aluminium life cycle, which can be used to support the **Alu D&T Challenge**: https://learningaluminium.co.uk/teacher-resources/aluminium-life-cycle-11-14/

Watch our film
Visit our **Film Hub** https://learningaluminium.co.uk/about/film-hub/ which is full of films from previous competitions, as well as useful information and advice from our industry partners.

Follow us on social media:
Twitter **@aludtchallenge** https://twitter.com/aludtchallenge – for latest news and information

Pinterest: **DT Challenge** https://www.pinterest.com/learningalu/ – for ideas and inspiration.

Check out our industry partners p26:

Visit their websites for information, news and insight into all things aluminium.

ALUMINIUM IN PACKAGING:

Aluminium Packaging Recycling Organisation: www.alupro.org.uk/consumers

European Aluminium Foil Association (EAFA): www.alufoil.org/did-you-know.html

European Aluminium: https://www.european-aluminium.eu/about-aluminium/aluminium-in-use/packaging

Novelis – Think Cans in the Classroom: http://www.thinkcans.net/

Industry Council for Packaging & the Environment (Incpen): http://www.incpen.org/pages/pv.asp?p=incpen49

ALUMINIUM IN AUTOMOTIVES

European Aluminium: https://www.european-aluminium.eu/about-aluminium/aluminium-in-use/automotive-and-transport/

Jaguar Land Rover's REALCar: (YouTube videos) https://www.youtube.com/playlist?list=PLrMOhOrmeR6mJQrtEfZi1O6pFgfaTuZFG

ALUMINIUM IN BUILDING

Council for Aluminium in Building (CAB): http://www.c-a-b.org.uk/why-aluminium/

European Aluminium: https://www.european-aluminium.eu/about-aluminium/aluminium-in-use/building-and-construction/

RECYCLING AND SUSTAINABILITY

European Aluminium Foil Association: www.alufoil.org/recyclingandrecovery

Recycle Now: https://www.recyclenow.com/recycling-knowledge

Think Cans from Novelis: http://www.thinkcans.net/aluminium/aluminium-recycling

Other useful search terms:

Circular Economy

Other sources of information:

Aluminium Federation: www.alfed.org

European Aluminium: https://www.european-aluminium.eu/about-aluminium/

International Aluminium Institute: http://www.thealuminiumstory.com/

Novelis: www.thinkcans.net/aluminium

DESIGN

Innovate UK is the government agency for Innovation: https://www.youtube.com/user/Innovateuk

Supporters and sponsors

The development of the Learning Aluminium resources and the **Alu D&T Challenge** competition is funded by organisations that represent the breadth of the UK aluminium industry; from primary production through to finished product and ultimately recycling.

ALUPRO

The Aluminium Packaging Recycling Organisation (Alupro) represents the leading aluminium packaging producers and reprocessors in the UK. Our membership comprises the full spectrum of the aluminium packaging 'loop' – from primary metal producer to packaging converter, from packer filler to reprocessor.

Alupro aims to meet, and exceed, recycling targets for the aluminium packaging industry. We work in partnership with local authorities, the waste management industry and the community recycling sector to develop and stimulate the UK's collection infrastructure. We also run consumer information and education campaigns to encourage participation in recycling schemes.

ALFED

The Aluminium Federation (ALFED) is the trade body that represents the UK aluminium industry. With members spanning the whole lifecycle of aluminium, it plays a key role in supporting its members' needs. This includes providing technical and commercial services, as well as engagement in political lobbying with the UK Government and at EU level.

ALFED also plays a key role in promoting aluminium as a metal for the future to a wide range of audiences, from schools and colleges to designers, engineers and manufacturers.

NOVELIS

Novelis Inc. is the global leader in aluminium rolled products and the world's largest recycler of aluminium. The company operates in 11 countries and has approximately 12,000 employees. Novelis supplies premium aluminium sheet and foil products to transportation, packaging, construction, industrial and consumer electronics markets throughout North America, Europe, Asia and South America.

In the UK, Novelis operates Europe's largest dedicated aluminium drinks can recycling plant, in Warrington, Cheshire, which has the capacity to recycle every drinks can sold in the UK every year.

Novelis is a subsidiary of Hindalco Industries Limited, part of the Aditya Birla Group, a multinational conglomerate based in Mumbai, India.

TECHNOLOGY SUPPLIES

Technology Supplies is the leading Design, Technology and Engineering specialist for education worldwide. Our globally trusted services include installations, from design and consultation to commissioning and training; maintenance services for all types of educational workshops; supply of over 8,000 curricula-aligned products; and excellent aftercare support across all products and equipment.

ARCONIC

Arconic (NYSE: ARNC) creates breakthrough products that shape industries. Working in close partnership with our customers, we solve complex engineering challenges to transform the way we fly, drive, build and power. Through the ingenuity of our people and cutting-edge advanced manufacturing techniques, we deliver these products at a quality and efficiency that ensure customer success and shareholder value. www.arconic.com.

BEFESA

Befesa is a leading international company that provides innovative sustainable solutions for the management and recycling of industrial residues – including aluminium residues – to produce high value aluminium alloys.

Befesa manages more than 2.2 Mt of residues, returning nearly 1.3 Mt to the production of new materials through recycling.