

Scrap Heap Challenge

Target Audience: Under 18s

Number of volunteers required: 2-5 (more helpers may be needed depending on the number of teams)

Budget: £100 includes costs of trophies and prizes for winning team.

Time required: 5-16 hrs

Resources required: See IMechE scrap heap challenge parts list. Minimum of 1 judge and 1 assistant will be needed, ensure that all helpers are briefed before the event and roles assigned – i.e. judge, technical advisor, parts store co-ordinator, event judge. Set out piles of scrap around the room with one pile for each team. Ensure that each team has materials for chassis, wheels, propulsion though they don't need to be identical. Possible prize categories – overall winner, best design, best team captain, team work.

Learning outcomes: Students will be exposed to the engineering key skills of design, team work, problem solving and project management whilst competing and having fun.

Overview Sample Event (Based on an event run by Coventry Automobile Division Young Member's Panel 2009)

Each team must register on the forms provided, with a team name and a team captain listed. Team Captains must be clearly identified.

You have been provided with a number of items of scrap. Using these materials each team must design and build a vehicle which will compete against the other teams' vehicles. A maximum of 600 points can be scored in this competition. The competition winner is the team with the most points.

Teams should note that care must be taken when handling the scrap there may be some sharp edges.

When using tools the guidance and instructions of the judges, teachers and helpers must be obeyed at all times. Tools may only be used in the allocated areas, and teams must negotiate to use them with the other teams – remember that there will be a rush to use resources as time runs out!

Have fun and enjoy the challenge!

Stage 1 Instructions: DESIGN

Teams can earn up to 100 points at this stage of the competition. You have 20 minutes to design a vehicle, which in stage 3 of this competition you will use to pull increasingly heavy weights a distance of 1m.

The objective is to design a vehicle that will be able to pull the most weight. If two or more teams are tied on points, there will be a tie breaker event and the team managing to pull the heaviest (of the previously achieved) weight(s) the furthest distance will win.

Teams may inspect and measure the weights at this stage and must design their vehicle to accommodate these weights.

At this stage teams **must not** start building their vehicles. Whilst teams may handle the materials, this part of the competition is purely to design your vehicles in. Teams will have time allocated to build their vehicles later.

After 20 minutes you must provide the competition judges with:

1. A concept sketch of your design with relevant annotations.
2. A Bill of Materials (BOM) / Parts list

The concept sketch can be in any form, but must allow the judges to compare the design intent with the finished product after the build phase.

A blank BOM / Parts list sheet will be provided at the start of this exercise, but the basic format is shown below.

Part Description	Part Function (optional)	Quantity
Blu Tack	Adhesive	1 piece
String	-	2 pieces

Scoring Notes

Judges will impose an **unlimited points penalty** to any team that starts to modify or assemble the parts given to them at this stage of the competition.

Points will be awarded for completeness of the BOM and quality of concept sketch. Teams needing technical input to their design can consult one of the nominated experts. Each consultation is limited to 1 piece of advice at a **cost of 25 points**.

Design's Impact on the scoring of the build phase

If the judges deem your design concept sketch to be different to the vehicle built, the judges will **deduct up to 50 points** from your team. Points deductions will be at the judge's discretion and will be confirmed prior to the beginning of the stage 3 - compete.

Any items your team forgets to list on the BOM / Parts list submitted to the judges will have to be purchased from the 'parts store'. You may visit the parts store to see what items are available during stage 1, but the store will not be open for business until stage 2. Items can be purchased at the cost of a 25 point deduction per item. **Late submissions cost teams 50 points.**

No submissions accepted more than 1 minute late.

SCRAP HEAP CHALLENGE – BUILD PHASE

Overview

No points can be won in this phase of the competition, but they can be spent or deducted.

Each team will be left with only the items of scrap listed on their BOM during the design phase. Using these materials each team must build a vehicle which will compete against the other team's vehicles.

Teams may purchase any additional items required from the 'parts store', but these items will cost your team 50 points per item.

Stage 2 instructions: Build

You have 45 minutes to build and test the vehicle you designed in the previous stage of the competition. If you deviate from your original design intent, you may be penalised for doing so (see scoring notes).

A tool table has been set up with a number of tools you may use to build your vehicle. These tools must not be removed from this area, but you are free to use / or direct the helper to use any tools you need to at the tool table. You must share tools with the other teams and plan your time accordingly

After 45 minutes you must report to the competition judges with you team's vehicle. No modifications will be allowed after this time.

Scoring Notes

Teams needing technical input to their design can request a technical consultation from one of the nominated experts. Each consultation is limited to 1 piece of advice at a **cost of 50 points**. If the experts have no suitable advice no charge is made.

If the judges deem your design concept sketch to be different to the vehicle built, the judges will **deduct up to 50 points** from any team. However no points will be deducted for changes deemed to be 'decorative' only (i.e. no effect on functionality). Points deductions will be at the judge's discretion and will be confirmed prior to the beginning of the stage 3 -compete.

Any items your team forgets to list on the BOM / Parts list submitted to the judges will have to be purchased from the 'parts store'. **Items are purchased at the cost of point deductions, the details of which will be published at the store.**

Parts listed in your BOM / Parts list which you do not use will be penalised at 50 points per item. Parts judged to be 'not needed' are at the judges' discretion and the decision will be made on the basis of function not form.

Late submissions cost teams 50 points per minute.

SCRAP HEAP CHALLENGE - COMPETE

Overview

Each team will try to tow progressively heavier weights over a distance of 1 metre. Points are awarded for each weight class passed.

Stage 3 instructions: Compete

Teams attempt to tow the weights one after another.

Each team has a total of 2 attempts at each weight, provided they achieved the previous weight.

Scoring Notes

- Each team's best result will be the only score taken.
- Vehicles start fully behind the start line and to complete a weight must tow or carry the weight clear of the finish line.
- No assistance to the vehicle may be provided, it must travel under its own power.
- Each weight completed scores 100 points.
- A bonus of 100 points will be awarded to the team which completes all the weights

Judges discretion will be applied to the rules above and any judge's decision is final.

Good luck!

Parts Suggestions

Tools	Materials (All optional adapt according to brief)	Task items
scissors	kebab sticks	BOM blank sheet
glue	cocktail sticks	Build process blank sheet
Sellotape	pipe cleaners	Drawing Sheets - Blank paper for designs
blue tack	straws	Written rules for each stage -posted in central place too
pen	bottle tops I.e. soft drinks	written deliverables for each stage
pencil	jam jar /coffee jar lids	tape measure
ruler	cardboard cereal boxes	prizes!!!!!!
paper/note pad	cans	
pu tape	material	
Staples	balloons	
Stapler	plastic bags I.e. sandwich bags	
Hand Drill	string	
Drill bits to suit axle materials	elastic bands of various sizes and shapes	
Safety glasses	plastic bottles	
Wooden block	plastic containers I.e. takeaway cartons	
	things which could be dismantled for parts?	
	old music cassettes	
	small motors?	
	maybe some old toys? - miniture cars, motorised things	
	table tennis balls?	
	hand held fans?	