

Team Name: _____

Team Members:

1.	Captain:
2.	
3.	
4.	

* Teams may consist of three or four members only.

SCORE CARD

For detailed rules of scoring refer to corresponding sections labeled A-E overleaf.

A) TIME OF CONSTRUCTION

Table A

Total construction time available (min)	50
Time completed (min) [A]	
Time not used (min) [B = 50-A]	
Points Awarded [C = 2 x B]	

* Every construction minute used has a utilization cost of 2 points.

* There is no minimum construction time but a maximum of 50 minutes is allowed.

B) MATERIAL OF CONSTRUCTION [MOC]

Table B

	[D] Units Supplied	[E] Cost per unit supplied	[F] Materials Returned (Not used)	[G=E x F] Point scored for returned materials
Rubber bands (127mm x 3mm)	2	2		
Big paper clips (51mm long)	2	6		
Small paper clips (33mm long)	2	4		
Marble (glass, 16mm diameter)	1	10	0	0
A4 paper (210 x 297 mm, 80 g/m ² , white)	20	1.5		
Pencil (hexagonal-shaped with eraser)	2	4		
Ruler (300mm)	2	6		
Tape (Scotch type 508, 19mm x 33m)	1	16		
	Points supplied [H = Σ (D x E)]	100	Total Points Scored [J = Σ G]	

* The packaging materials may not be used as part of the construction material.

* Partial usage of the tape will be charge for in full. The centre ring of the tape may form part of the construction.

C) COASTER HEIGHT (cm)

Table C

Height (cm) = Points Scored [K]	
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* One point per cm up to a maximum of one hundred points.

* The height is measured to the release point of the marble (underside).

D) COASTER TRAVEL TIME (s)

Table D

Time (s) [L]	
Fell off track or stopped (yes or no) [M]	
Points awarded [N = If (M = 'no', then 2 x L, else L/2)]	

* There is no limit on the point that may be scored in this category.

* For every second the marble rolls two points are awarded. If the marble falls off or stops on the 'track' and the position this occurs at is judged to be higher than 5 cm from the base of the structure, then for every second the marble rolled before it fell only half a point will be awarded.

* Teams have a maximum of two minutes to relocate the construction to the test area and perform a dry run. The dry run will not be timed. During this period any adjustments can only be made with your teams left over tape or materials already on the roller coaster only.

* The marbles frictional properties may not be altered. Only the frictional properties of the track may be altered.

E) POINTS TALLY

Table E

	Score
Construction time [=C]	
MOC [=J]	
Height [=K]	
Coaster travel time [=N]	
Total score [C+J+K+N]	

Judges Signature: _____ Captains Signature: _____

This year's Friendly Engineers Week Challenge is building a marble roller coaster. The competition has been organized by Fluor South Africa who is celebrating their 50th anniversary.

OBJECTIVE

The objective of this challenge is to create a marble roller coaster that will score your team the most points in the following categories: Time of Construction (A), Material of Construction (B), Coaster Height (C) and Coaster Travel Time (D). The team that achieves the highest internal office score will win the internal office competition and the office with the highest score globally will be the Engineers Week Office Champions. This office will then have the prestige of running next year's Friendly Engineers Competition.

RULES AND REGULATIONS

Before construction begins teams get 5 minutes to read the rules and regulations and check the Materials of Construction (MOC) against the inventory list. In this time, teams may conceptually plan how to complete the task but strictly no construction may occur. The construction time will then be started from 0 minutes with a maximum construction time of 50 minutes.

A) TIME OF CONSTRUCTION

Points will be awarded on completing the construction as quickly as possible. Every construction minute used has a utilization cost of 2 points and a maximum construction time of 50 minutes is allowed. Construction time will be rounded up to the next minute (E.g. 31:20 = 32:00 min). The point allocation is shown in Table A.

B) MATERIAL OF CONSTRUCTION (MOC)

Each item of material used has a cost associated with it (as per Table B) and points are awarded for any unused items.

C) COASTER HEIGHT

Points will be awarded on the height of the construction. For every 1 cm (vertical height), one point is awarded. The maximum possible points scored for height is 100. This corresponds to 100 cm (1 m). The height is measured between the working surface (table, floor etc) and the release point of the marble underside (top portion of used track) in the shortest straight line distance (i.e. 90° to the working surface). Coaster points on height will be rounded down (E.G. 81.3 cm is worth 81 points). The marble must be released directly onto the track (no freefall is allowed). The point allocation is shown in Table C.

D) COASTER TRAVEL TIME

Points will be awarded on the time it takes for the marble to roll from the top of the roller coaster to the bottom (Refer to Table D). Two points will be awarded for every second of travel with no limit on the point that may be scored. Travelling time will be rounded down to the nearest second (E.G. 21.6 s = 21 s = 42 points). The moment that the marble touches the test area 'surface' or exits the test area the time stops.

If the marble falls off or stops on the 'track' and the position this occurs at is judged to be higher than 5 cm from the base of the structure, this constitutes a safety hazard and the stopwatch will be stopped. Only half a point per second will be awarded in this case for every second of travel.

Teams have a maximum of two minutes to relocate the construction to the test area and perform a dry run. The dry run will not be timed. During this period any adjustments can only be made with your teams left over tape or materials already on the roller coaster only. The team can request judging any time during this period. After two minutes the marble must be released regardless of whether the team is ready or not. Once the decision to judge has been made or is enforced at two minutes, the coaster will only be timed once.

It is very important that the marble must roll on a new track the whole time. Stated differently, the marble may roll over each section of track only once. The moment this design condition is broken the stopwatch must also be stopped. If at the time the

stopwatch was stopped and the marble was judged to be higher than 5 cm from the base on the structure, this constitutes a fall and as such your coaster travel time points will be divided by two.

Clarifications:

- The marble may not be broken, scratched, diameter decreased OR its' frictional properties altered. If a marble is deemed to be damaged a replacement marble will be used for the test with a MOC penalty of 10 points. The friction properties of the track may be altered. The marble must roll and may not be put on a sleigh or sled. If a marble does not roll the team is disqualified.
- The moment a marble stops the stopwatch will be stopped, regardless of whether it will resume rolling.
- As long as the marble is on any MOC it is judged to be on a track. However, if there are multiple tracks in parallel or concentric circles they must be separated with walls, otherwise the marble is judged to be on the same track and the time will be stopped. E.G. Conventional skateboard half-pipes or funnels are not allowed. However if a separating wall is built so that there is a clearly defined track that is acceptable.
- The marble need not be visible at all time. If the marble stops when not visible it will be up to the local judge to determine at what time this occurred.

E) FINAL POINTS TALLY

The final score will be tallied in Table E. There are four categories to score points so multiple strategies are possible. Good luck to all the teams.

GENERAL RULES

1. The construction must fit in a base area of 100 cm x 100 cm. This construction area extends vertically to the ceiling, i.e. devices must not overhang the 100cm x 100cm area at any elevation else the team will be automatic disqualified.
2. Judging will occur at a designated test site(s) which will be a flat surface. The structure must be portable and free standing (no walls or ceiling for support). The construction and track support should be strong enough to withstand the relocation for judging. Board or stiff material may be used to make the relocation easier, but may not form part of the final design. The construction must stand / rest on the test surface and may be taped to the test surface.
3. Scissors and a tape dispenser may be brought in to aid in construction but may not form part of the construction. No safety equipment is required but care must be taken with sharp objects.
4. During the construction period the marble may be released on the roller coaster as many times as desired.
5. Teams must check the MOC against the inventory list (Table B). If there is a delivery problem or quality problem (e.g. deformed marbles), the local office must make a 'reasonable' replacement. Equipment not swapped before the start of construction will be considered damaged by construction and billable.
6. The marble may be hand released on the highest portion of your track. No rolling, pushing or dropping the marble from a height onto the track is allowed. If this infringement occurs on the judging roll no travel time points will be scored. Once the marble is released, it may not be touched again or structure pulled or distorted by any outside influences else no points for coaster travel time will be scored.
7. As soon as the team is satisfied with the construction, the team captain must announce that the construction time has ended. The construction time will then be logged and MOC costs counted. Excess materials (excluding the tape) will be taken by the judge including the marble to prevent any further construction or trial runs. Judging (measuring height and roller coaster travel time) will occur once all teams have completed construction.
8. The local engineering week's judge's decision is final.