

The Fastest Cyclist

A toughnut puzzle

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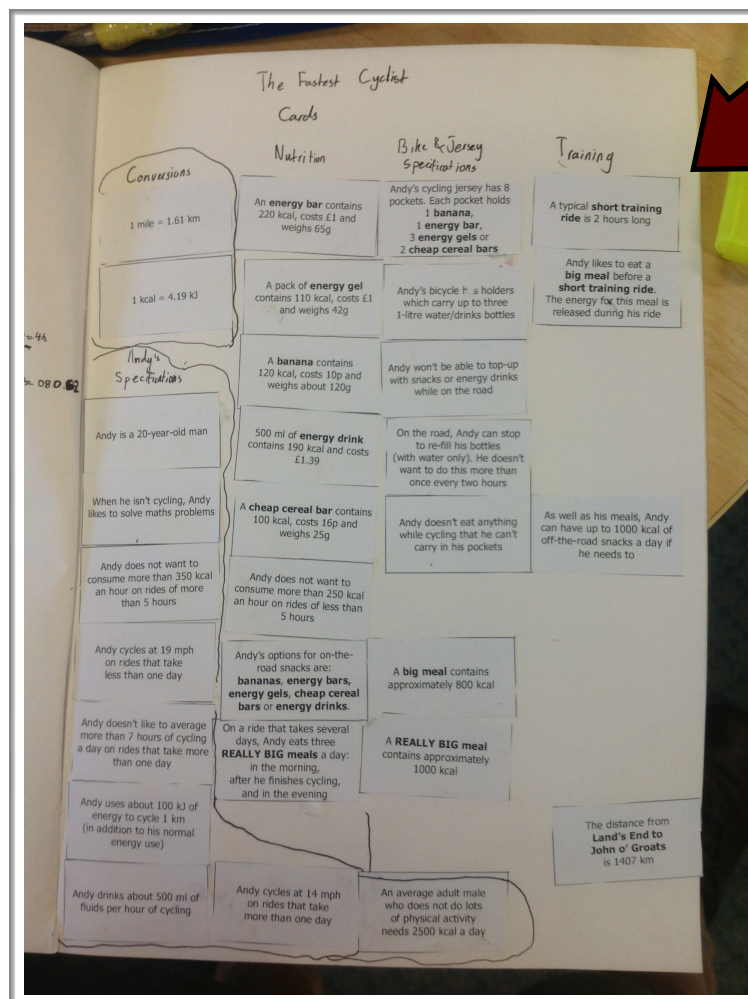
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Maths report

The fastest cyclist

What was the question?

The question was to find out the fastest possible time for a cyclist to ride from Land's End to John o' Groats, a distance of 1407 kilometres using these cards.



It stated that we were Andy the cyclist's coach, and that we had to make him win, so we had to calculate the minimum time it would take him to complete the race.

What were the materials?

The materials available to us were just the above cards. These provided us with many useful bits of information, but which seemed to be disconnected. They did, however, prove helpful.

What did I do?

Firstly, I sorted out the cards which were provided as in the above photograph, then, converting the different measurements to metric, I filled each of the eight pockets in my jersey with three energy gels, as that would fit the most energy into the jersey. See fig a

Fig A	Energy Gels	Energy Bar	Banana	Cereal bar
Number per pocket	3	1	1	2
Energy per unit	110 kcal	220 kcal	120 kcal	100 kcal
Energy per pocket	330 kcal	220 kcal	120 kcal	200 kcal
Weight per Unit	42 grams	65 grams	120 grams	25 grams
Weight per pocket	126 grams	65 grams	120 grams	50 grams
Cost per unit	£1	£1	10p	15p
Cost per pocket	£3	£1	10p	30p

This clearly demonstrates that, if weight and cost are ignored, then energy gels are the way to go. This would give him 330 x 8 kcal (2640 kcal) to be ingested during the ride. He has 3 really big meals of 1000 kcal (3000 kcal). His bike also holds 3 litres of water or energy drink, at 190 kcal per 500 ml, so that is 1140 more kcal. Finally, he can have 1000 kcal of off-the-road snacks. This comes to 7780. Unfortunately, he uses 2500 kcal a day normally, so the amount of energy he can use to cycle is only 5280 kcal.

The actual cycling

However, the energy rates for cycling are in kJ, so we have 22123.2 kJ. This allows him to travel 221.230 km. At 14 m/ph (22.5 km/h) this would take him 9 hrs, 49 mins, and 56.8 seconds. At this rate, he would take 7 days to complete the race, but he only needs to cycle 80.62 km on the last day. This would take him three hours after

77.5 km, and the last 3.12 km would take 8 minutes 9.2 seconds. So 3 hours, 8 minutes and 9.2 seconds. This brings the total time to $(32400+2940+56.8)$ seconds x six $+(10800+480+9.2)$

So $35396.8 \times 6 + 11289.2 = 223, 670$, or 62.13 hours.

What did I find out?

I found out that it would take him a minimum of seven days, if we ignore all his preferences. In hours it is 62 hours 5.8 seconds. This assumes that his mid-race stops take no time at all. I also found out that it would cost him £24 a day for his in-pocket snacks and £8.36 a day for his drinks.

Were there any other questions?

The only other questions that occurred were 'what would happen if he was not allowed to carry anything?' and 'what if Andy slowed down when he had more weight?'

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