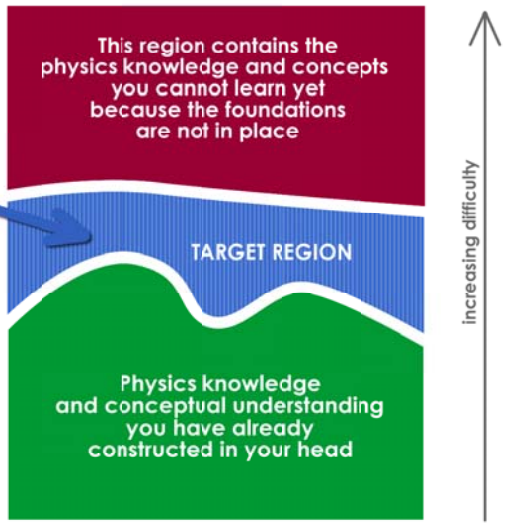
EXAMPLE

How to... Master Physics by Writing MCQs

Submit and answer questions on topics in the target region, just above the physics you have already mastered.



PHYSICS TOPICS IN YOUR TARGET REGION

Relativity

Newton's Third Law

Applying Newton's Laws in situations that involve tension

YOUR CHOSEN TOPIC

CONCEPT

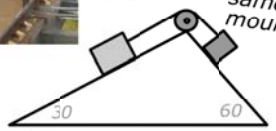
Tension *... in cords connecting accelerating masses.*

RELEVANT EXAMPLES

Funicular railways

Cairngorm railway

Like: *(except both cars are on same side of mountain)*



[HRW Ch.5 qu 67]

Try to find photographs or diagrams to provide context

COMMON MISCONCEPTIONS AND ERRORS

(See http://phys.udallas.edu/C3P/Preconceptions.pdf for a list of common misconceptions)

Wrong physics:

- ✗ *Tension is greater in the cable on the side of the pulley that has the greatest mass.*
- ✗ *If the bodies are accelerating, the tension will be greater than if they're at rest.*
- ✗ *If both cars are accelerating at the same rate, the magnitude of the forces on them must be equal.*

Wrong math: Confuse sines and cosines. ✗

DATA

From wikipedia: max speed = 10m/s, max gradient = 23 degs
120 people max per car. *Guess cars accelerate from rest in 10s*
I estimate masses of car + people to be about 8 to 10 tonnes $g=9.81$

Neglect friction and mass of cable.

Question stem *Railway car 1, m=10 tonnes, accelerates down 23 deg slope. This pulls car 2, m=8.4 tonnes, up 10 deg slope. Calc Tension.*

The Key (the correct answer)

25.3×10^3 N

Check that your answer is reasonable and possible.

Distracters

zero (i.e. believe T's balance)

50.6×10^3 N (T's add)

52.6×10^3 N (acceleration = 0)

85.3×10^3 N (uses cos instead of sin)

Explanation *Cable pulls on each of the cars with the same force magnitude, even though cars are accelerating. Car1 has same acceleration as car 2. F=ma but masses are different therefore accelerating forces must be of different magnitude. Key idea, use coordinate system parallel to slope in each case.*

Draw free body diagram for each car *Find components. Obtain a, then substitute back to get T.*