0 Question: A train is following a circular path around a pole, held by a string. It is then switched to a smaller string and continues its circular path. How does its speed change? Assume no friction or gravity.

A1: It stays at the same speed

A2: It slows down

Arguments for A1

4 Question: Is there a force acting on the train?

A1: Yes, because the train is not moving linearly.

A2: Yes.

9 Question: Should a long train be modeled as a single rigid body, or as a chain of rigid bodies which are moving together because they have the same momentum and the same forces apply to them?

A1: Chain of rigid bodies

A2: Neither, it's atoms that are somehow bound together in a 3D shape. Neither a chain or a single rigid body.

Arguments for A2

5 Question: Is the energy of the train conserved?

A1: No

A2: Yes

6 Question: Are the two types of energy the train has the sum of the energy from the train moving around the track (its translational kinetic energy at each moment) and its energy from rotating around its center of mass when not considering the rotation around the track (rotational kinetic energy) such that

Energy = (1/2)mv^2 + (1/2)Iw^2

where I is the 'moment of inertia' of the train and w is the radians/s of the train

A1: Yes

A2: Yes

14 Question: Then as w = vr,
v = w/r so that

Energy = (1/2)mv^2 + (1/2)I(v/r)^2

As I, m are constant and r decreases, if v is constant Energy will increase. So v has to decrease for Energy to stay constant.

As Energy is conserved, v decreases.

Correct or no?

A1: Incorrect; the energy of the train is not conserved.

A2: Correct