Cart

Roller Coaster Diagram

135

meters

115

95

75

55

Cart b at rest

35

15

V2 15m

P2 95m

V1 35m

P1 135m

Initial height

Mass of the roller coaster cart = 550kg

Cart at P1

**kinetic energy KE = (sitting at highest peek has no kinetic energy) = 0J**

**potential energy PE = mgh = (550kg)(9.8)(135m) = 727650J**

**momentum = mv = 0** **kg\*m/s (at P1 the cart is at the highest making KE 0, since KE is 0 so is the velocity. With the velocity 0 that makes the momentum equal 0)**

Cart at V1

**kinetic energy KE =**

**= 727650 + 0 = 188650jjj**

**= 539000J**

**potential energy PE= mgh = (550kg)(9.8)(35m) = 188650J**

**momentum = mv =**

**= 539000**

**= 539000**

**=**

**V = 44.27**

**mv = (550)(44.27) = 24348.5** **kg\*m/s**

Cart at P2

**kinetic energy KE =**

**= 727650 + 0 = 512050**

**= 215600J**

**potential energy PE= mgh = (550kg)(9.8)(95m) = 512050J**

**momentum = mv =**

**= 215600**

**= 215600**

**=**

**V = 28**

**mv = (550)(28) = 15400** **kg\*m/s**

Cart at V2

**kinetic energy KE =**

**= 727650 + 0 = 80850**

**= 646800J**

**potential energy PE= mgh = (550kg)(9.8)(15m) = 80850J**

**momentum = mv =**

**= 646800**

**= 646800**

**=**

**V = 48.50**

**mv = (550)(48.50) = 26675 kg\*m/s**

When the cart is at the highest peak 135m(P1) the PE is **727650J and KE is equal to 0J. When the cart follows the track to the first valley of 35m(V1) 539000J is transferred to KE, making PE equal 188650J. As the cart then continues to the next peak at 95m(P2) where 323400J from the KE will transfer to PE making PE equal to 512050J and KE equal to 215600J. Now the cart will continue to the second valley(V2) at only 15m. During the ride for P2 to V2 431200J of potential energy transferred to kinetic energy. This then makes KE equal to 646800J PE equal to 80850J. During the transfer energy to the total energy in the system remains the same. So then at any given point on the track at and after P1 the sum of both kinetic energy and potential energy equals 727650J(The same potential energy at P1).**

* **Since the principle of conservation of energy stats that energy is neither created nor destroyed, the energy from the cart can only be transferred form KE to PE or PE to KE, but the sum of these to energies will always be the same.**

Before the collision cart A:

**momentum = = mv =**

**= 646800**

**= 646800**

**=**

**v = 48.50**

**= (550)(48.50) = 26675 kg\*m/s**

**kinetic energy KE =**

**= 727650 + 0 = 80850**

**= 646800J**

**Before collision cart B:**

**momentum = = mv =**

**= 0**

**=0**

**=**

**v = 0**

**= (550)(0) = 0 kg\*m/s**

**kinetic energy KE =**

**= (550)(9.8)(15) + 0**

**= 80850J**

Cart A after collision: (velocity is cut in half with a collision with an object of equal mass)

**momentum = = mv**

**550(24.25) = 13337.50 kg\*m/s**

**kinetic energy KE = =**

**= = .5**

**= .5**

**= 323400 J**

Cart B after collision: **(object is hit with a moving object of equal mass so half of momentum is transferred.)**

**momentum = = mv**

**550(24.25) = 13337.50 kg\*m/s**

**kinetic energy KE = =**

**= = .5**

**= .5**

**= 161700 J**

Before the collision cart A had **a kinetic energy of 646800J and cart B had a kinetic energy of 80850J. Both carts had an equal mass of 550kg. After the collision the kinetic energy was cut in half of cart A and transferred to cart B making cart A’s new KE equal to 323400 J and cart B’s new KE equal to 161700 J. Since energy is neither created nor removed and has just transferred the sum of the total energy remains the same as stated in the *Principle of the Conversion of Energy*.**

**Work =**

**((.5)(500)(24.25)) – (.5)(500)( 48.50)**

**= -6062.5 J**

**Due to the friction(collision) the cart was slowed down (as shown by the negative work) but never actually stops.**