BIIG Problem Solving Method

Buddies Identification Isolation Gourmet

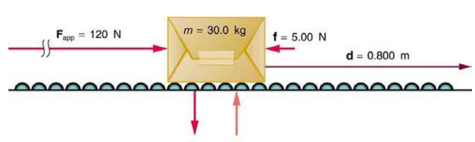
Format	Checkpoint	Entails	BIIG Elements			
Decode	1	Assigning of known information to the corresponding variables, and performing unit conversions	B	I	I	
	2	Assigning of the unknown information to the variable(s)		I	I	
Solve	3	Providing the description of the formula and writing of the formula(e), and including diagram(s) if needed				G
	4	Showing the math clearly with consistent use of variables and units	B	I	I	G
Analyze	5	Reporting the final answer with correct significant figures for the solved (unknown) variable(s)	B	I	I	
	6	Specifying the correct units, and performing the proper analysis of the solution if needed	B			G

Dr. Hiremath

College Physics - Example 7.4 - Page 231

- Problem (E7.4):
  Suppose that you push on the 30.0-kg package on the roller belt conveyor system moving at 0.500 m/s with a constant force of 120 N through a distance of 0.800 m, and that the opposing friction force averages 5.00 N. Find the speed of the package at the end of the push.

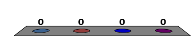
A. 76 m/s
B. 2.6 m/s
C. 2.53 m/s
D. 2.5 m/s



- Solution:

m = 30.0 kg v_0 = 0.500 m/s F = 120 N

d = 0.800 m f = - 5.00 N θ = 0°



v = ?

The **net work** is

$$W_{net} = W_{app} + W_{friction}$$
$$= F\,d + f\,d = [\,F + f\,]\,d$$
$$= [\,(120\text{ N}) + (-5.00\text{ N})\,]\;(0.800\text{ m}) = 92\text{ J}$$

Using the **work-energy theorem**, the **net work** is

$$W_{net} = \tfrac{1}{2}\,m\,v^2 - \tfrac{1}{2}\,m\,v_0^2$$

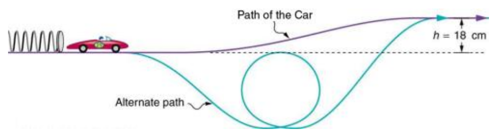
Solving the **speed** of the package at the end of the push

$$v = \sqrt{[\,(2/m)\,(W_{net} + \tfrac{1}{2}\,m\,v_0^2)\,]}$$
$$= \sqrt{[\,(2/30.0\text{ kg})\;(92\text{ J} + \tfrac{1}{2}\,(30.0\text{ kg})\,(0.500\text{ m/s})^2)\,]} = 2.52653\text{ m/s}$$
$$= \mathbf{2.5\ m/s}$$

College Physics - Example 7.8 - Page 239

- Problem (E7.8):
  A 0.100-kg toy car is propelled by a compressed spring. The car follows a track that rises 0.180 m above the starting point. The spring is compressed 4.00 cm and has a force constant of 250.0 N/m. Assuming work done by friction to be negligible, find how fast it is going at the top of the slope.

  A. 0.45 m/s
  B. 200 m/s
  C. 0.687 m/s
  D. 0.69 m/s



- Solution:

  $m = 0.\underline{100}$ kg $h_i = 0$ m $h_f = 0.180$ m $v_i = 0$ m/s $\boldsymbol{v_f} = ?$
  $x_i = -0.040$ m $x_f = 0$ m $k = 250.0$ N/m $g = 9.80$ m/s²

  Since the friction is negligible, the **conservation of mechanical energy** is

  $KE_i + PE_i = KE_f + PE_f$

  $\frac{1}{2} m v_i^2 + m g h_i + \frac{1}{2} k x_i^2 = \frac{1}{2} m \boldsymbol{v_f}^2 + m g h_f + \frac{1}{2} k x_f^2$

  Solving for the **final velocity** at the top of the slope

  $\boldsymbol{v_f} = \sqrt{[(k x_i^2 / m) - 2 g h_f]}$

  $= \sqrt{[((250.0 \text{ N/m}) (-0.040 \text{ m})^2 / (0.\underline{100} \text{ kg})) - 2 (9.80 \text{ m/s}^2) (0.180 \text{ m})]}$

  $= 0.\underline{687}023$ m/s

  $=$ **0.687 m/s**

References

1. College Physics
   OpenStax College
   Rice University, 201.

2. Hiremath, C. N..
   "Let Your Success be BIIG: A New Paradigm for Problem-Solving in Science."
   International Journal of Physics 3.3 (2015): 113-119.

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