

Transformation of Mechanical Energy

Extra credit is worth 1 point this week.

Remember to always keep your wheel in balance.

Keep in mind the Potential Energy into a system should equal the Kinetic Energy out of a system (P.E. = K.E.). As such, the final column in your data table should be zero. However, I am giving you a 15% error margin of 0.735 J in which your data may be off but your answers considered to be "error-free". Any errors off by more than +/- 0.735 J should be explained in your write-up.

Examples of equations worked out in a hypothetical trial where the wheel has 6 cylinders attached and a rim mass of 1.885 kg. If the time for five revolutions is $t = 6.5$ s, then

$$\text{Period} = p = t / 5 = 6.5 \text{ s} / 5 = 1.3 \text{ s}$$

$$\text{Speed} = s = 2.1 \text{ m} / \text{period} = 2.1 \text{ m} / 1.3 \text{ s} = 1.6 \text{ m/s}$$

$$\text{Speed squared} = s^2 = \text{speed} * \text{speed} = (1.6 \text{ m/s}) * (1.6 \text{ m/s}) = 2.6 \text{ m}^2/\text{s}^2$$

$$\begin{aligned} \text{Wheel's mass} = m_w &= (\text{mass of wheel's rim}) + (\text{mass of attached cylinders}) \\ &= (1.885 \text{ kg}) + [(6) * (0.305 \text{ kg})] \\ &= 1.885 \text{ kg} + 1.830 \text{ kg} = 3.715 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Potential Energy} = \text{P.E.} &= \text{mass dropped} * \text{gravity} * \text{height} = m_d * g * h \\ &= 0.5 \text{ kg} * 9.8 \text{ m/s}^2 * 1.0 \text{ m} \\ &= 4.9 \text{ kg} * \text{m}^2/\text{s}^2 = 4.9 \text{ J} \end{aligned}$$

Note: energy units are called Joules and can be shortened to "J".

$$\begin{aligned} \text{Kinetic Energy} = \text{K.E.} &= 0.5 * \text{wheel's mass} * \text{speed squared} = 0.5 * m_w * s^2 \\ &= 0.5 * 3.715 \text{ kg} * 2.6 \text{ m}^2/\text{s}^2 \\ &= 4.830 \text{ kg} * \text{m}^2/\text{s}^2 = 4.830 \text{ J} \end{aligned}$$

Note: energy units are called Joules and can be shortened to "J". Also note how the units for Potential Energy and Kinetic Energy are the same.

Textbook References

- Note: These are meant as a rough guide only.
- Conceptual Physics - Ch. 7: 112-4, 117-8
- Physics, A World View - Ch. 7: 113-21

Last Modified: 21Aug07