

## Energy calculations

$$E_k = \frac{1}{2}mv^2$$

$E_k$  = kinetic energy (J)  
 $m$  = mass (kg)  
 $v$  = velocity (m/s)

$$E_e = \frac{1}{2}ke^2$$

$E_e$  = elastic potential energy (J)  
 $k$  = spring constant (N/m)  
 $e$  = extension (m)

$$E_p = mgh$$

$E_p$  = gravitational potential energy (J)  
 $m$  = mass (kg)  
 $g$  = gravitational field strength (N/kg)  
 $h$  = height (m)

$$P = \frac{E}{t}$$

$P$  = power (W)  
 $E$  = Energy transferred (J)  
 $t$  = time (s)

Find the kinetic store of energy of a 1500 kg car travelling at 25 m/s.	Find the energy stored in an elastic band with a spring constant of 27 N/m and an extension of 1.2m.	Calculate the energy in the gravitational store gained by a 5 kg mass when lifted 0.7m in the air by a bodybuilder ( $g = 10$ N/kg).	Calculate the power output of a bodybuilder when 10J of energy is transferred from their muscles in 3 seconds.
Find the kinetic store of energy of a ball with a mass of 100 g as it flies through the air at 3 m/s.	Find the energy stored in a spring which is stretched to an extension of 0.58m. The spring constant of the spring is 30 N/m.	Find the height gained by a 4.2 kg exercise ball that is lifted to gain 340 J of energy in the gravitational store ( $g = 10$ N/kg).	A 3W mechanical device transfers energy over 30 s. How much energy is transferred?
Find the mass of a rocket travelling at 30m/s that has a kinetic store of energy of 150J.	A spring stores 180 J of energy when extended by 1.8 m. Calculate the spring constant.	A box of unknown mass gains 300J of energy by being raised 0.5m. What is the mass of the box? ( $g = 10$ N/kg).	How long would a 2 kw heater take to transfer 500 J to the thermal store of the air around it?
A 200 g ball is dropped from a height where it has 1.20 J of energy in its gravitational store. Calculate the speed of the ball just before it lands (ignore the effects of air resistance).	How long would a bungee rope be extended by if it stored 450 J of energy in its elastic store and it had a spring constant of 62 N/m?	A 100g ball is thrown upwards with an initial speed of 3m/s. Calculate the maximum height reached. Ignore the effects of air resistance. ( $g = 10$ N/kg)	A bodybuilder lifts a 5kg mass repeatedly from the ground to a height of 1.2m. If it is lifted up 10 times in 1 minute, calculate the power output of the weightlifter.

## Answers to energy calculations

$$E_k = \frac{1}{2}mv^2$$

$E_k$  = kinetic energy (J)  
 $m$  = mass (kg)  
 $v$  = velocity (m/s)

$$E_e = \frac{1}{2}ke^2$$

$E_e$  = elastic potential energy (J)  
 $k$  = spring constant (N/m)  
 $e$  = extension (m)

$$E_p = mgh$$

$E_p$  = gravitational potential energy (J)  
 $m$  = mass (kg)  
 $g$  = gravitational field strength (N/kg)  
 $h$  = height (m)

$$P = \frac{E}{t}$$

$P$  = power (W)  
 $E$  = Energy transferred (J)  
 $t$  = time (s)

Find the kinetic store of energy of a 1500 kg car travelling at 25 m/s. <b>468,750 J</b>	Find the energy stored in an elastic band with a spring constant of 27 N/m and an extension of 1.2m. <b>19.44 J</b>	Calculate the energy in the gravitational store gained by a 5 kg mass when lifted 0.7m in the air by a bodybuilder ( $g = 10$ N/kg). <b>34.4 J</b>	Calculate the power output of a bodybuilder when 10J of energy is transferred from their muscles in 3 seconds. <b>3.33 W</b>
Find the kinetic store of energy of a ball with a mass of 100 g as it flies through the air at 3 m/s. <b>0.45 J</b>	Find the energy stored in a spring which is stretched to an extension of 0.58m. The spring constant of the spring is 30 N/m. <b>5J</b>	Find the height gained by a 4.2 kg exercise ball that is lifted to gain 340 J of energy in the gravitational store ( $g = 10$ N/kg). <b>8.25 m</b>	A 3W mechanical device transfers energy over 30 s. How much energy is transferred? <b>90 J</b>
Find the mass of a rocket travelling at 30m/s that has a kinetic store of energy of 150J. <b>0.33 kg</b>	A spring stores 180 J of energy when extended by 1.8 m. Calculate the spring constant. <b>111.1 N/m</b>	A box of unknown mass gains 300J of energy by being raised 0.5m. What is the mass of the box? ( $g = 10$ N/kg). <b>61.2 kg</b>	How long would a 2 kw heater take to transfer 500 J to the thermal store of the air around it? <b>0.25 s</b>
A 200 g ball is dropped from a height where it has 1.20 J of energy in its gravitational store. Calculate the speed of the ball just before it lands (ignore the effects of air resistance). <b>3.46 m/s</b>	How long would a bungee rope be extended by if it stored 450 J of energy in its elastic store and it had a spring constant of 62 N/m? <b>3.81 m</b>	A 100g ball is thrown upwards with an initial speed of 3m/s. Calculate the maximum height reached. Ignore the effects of air resistance. ( $g = 10$ N/kg) <b>0.45 m</b>	A bodybuilder lifts a 5kg mass repeatedly from the ground to a height of 1.2m. If it is lifted up 10 times in 1 minute, calculate the power output of the weightlifter. <b>10 W</b>

