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| **YEAR 8** | **Mechanical/Kinetic Energy** |

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| **Learning Intentions** | **Success Criteria** |
| Understand kinetic energy in terms of speed, distance and time. | * Define kinetic energy. * Define mechanical energy. * Relate kinetic energy to speed. * Identify the standard units for speed, distance and time. * Use the equation *speed = distance / time* * Apply the equation above in real life situations, such as speed limits and paper planes. |

**READ:** *Mechanical Energy*

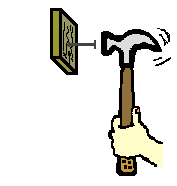
An object that is moving is said to have kinetic   
energy, but it also has potential energy. Therefore   
it is best to describe an object in motion as having   
**mechanical energy**.   


Image: <https://www.physicsclassroom.com/class/energy/Lesson-1/Mechanical-Energy>

**Mechanical energy** is the sum of an objects potential energy and kinetic energy. Examples of mechanical energy include a roller coaster, skateboarder, an arrow flying through the air, a weight lifter and aanything in motion.

**READ:** *Potential to Kinetic Energy*

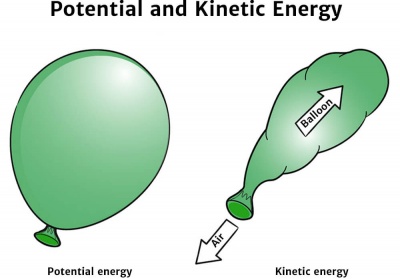


Image: <https://www.solarschools.net/knowledge-bank/energy/forms/potential>

Potential energy is influenced by mass and position. Kinetic energy is influenced by mass and speed.  **ACTIVITY 1:** *Mechanical Energy*

**YOUR TASK:** Refer to the images below and answer the following questions:

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| **1)** | Which location on the rollercoaster is potential energy at its maximum? |  |
| **2)** | Which location on the rollercoaster is kinetic energy at its maximum? |  |
| **3)** | Which location on the rollercoaster is there an equal amount of kinetic and potential energy? |  |

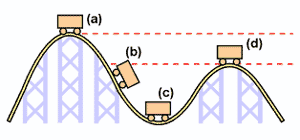


Image: <http://www.hk-phy.org/articles/roller_coaster/roller_coaster_e.html>



Image: <https://www.solarschools.net/knowledge-bank/energy/types/elastic>

**Fill the blanks:***When the bow is drawn, the string has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy. When the arrow leaves the bow, the arrow has \_\_\_\_\_\_\_\_\_\_\_\_ energy. The arrow hits the target. The target material puts a force on the arrow. The force changes the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy of the arrow into \_\_\_\_\_\_\_\_ , \_\_\_\_\_\_\_ and stored energy.*

**READ and WATCH:** *Calculating Speed*

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| File:Logo of YouTube (2015-2017).svg - Wikipedia | Watch this YouTube video:  <https://youtu.be/JZD3WlqtRyo> |

## What is speed?

Speed tells us how **fast** something or someone is travelling. You can find the average speed of an object if you know the **distance** travelled and the **time** it took.

The formula for speed is **speed = distance ÷ time**. To work out what the units are for speed, you need to know the units for distance and time. In this example, distance is in metres (m) and time is in seconds (s), so the units will be in metres per second **(m/s)**.

## Rearranging the formula

The formula **speed = distance ÷ time** can be rearranged, just like any other equation.

The formula can be rearranged in three ways:

* **speed** = distance ÷ time
* **distance** = speed × time
* **time** = distance ÷ speed

To calculate one of the **variables** (speed, distance or time) we need the other two.

For example, to find the time taken to make a journey, we need the length of the journey and the speed of travel

**ACTIVITY 2:** *Speed, Distance, Time*

**YOUR TASK:** Complete the "speed, distance, time" quiz below.

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| **Q1.** What two measurements are necessary for calculating speed?   * Mass & Time * Mass & Distance * Temperature & Mass * Distance & Time | **Q6.** Calculate the average speed if a cheetah runs 180 meters in 10 seconds.   * 1800 km * 1800 m/s * 18 m/s * 18 km |
| **Q2.** If you travel 10 metres in 5 seconds, what is your average speed.     * 2 m/s * 5 m/s * 10 m/s * 50 m/s | **Q7.** Calculate the distance travelled if Arthur cart-wheeled for 40 sec at an average speed of 3 m/s.     * 120 km * 120 m * 3 km * 3 km |
| **Q3.** What key words tell me I'm measuring time?     * How fast * How far * How long * How hot | **Q8.** How much time would it take for the sound of thunder to travel 8000 metres if sound travels at 330 m/s?     * 24.24 sec * 3 secs * 24 000 secs * 2.4 secs |
| **Q4.** What key words tell me I'm measuring distance?     * How fast * How far * How long * How hot | **Q9.** What is speed?     * How far you go. * How fast you accelerate. * How much distance is covered over a period of time. * The change in location of an object. |
| **Q5.** Which is the correct formula to find time, when speed and distance are known?     * S = D / T * T = D / S * T = S / D * D = S x T | **Q10.** What form of energy is speed?     * Mechanical (potential) * Mechanical (kinetic) * Chemical * Electrical |

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| **YOUR SCORE:** | /10 |

**ACTIVITY 3:** *Investigating Speed of Paper Planes*

**AIM:** To investigate how different paper plane designs influence flying speed.

**STEP 1: Plane Designs**Create three (3) different paper plane designs. Label the first design **(A)**, label the second design **(B)** and label the third design **(C)**.

**SKETCH YOUR FINAL THREE DESIGNS BELOW**

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| **DESIGN (A)** | **DESIGN (B)** | **DESIGN (C)** |

**STEP 2: Variables & Hypothesis**

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| **a)** | **Independent variable:**  *What are you changing in this experiment?* |  |
| **b)** | **Dependent variable:**  *What are you measuring in this experiment?* |  |
| **c)** | **Two controlled variables:**  *What are you keeping the same in this experiment?* | 1. |
| 2. |

**Write a hypothesis for this experiment.**

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**STEP 3: Equipment**

You will need:

* 3 pieces of paper
* A stop watch
* Tape measure
* Calculator

**STEP 4: Method**

1. Throw plane (A) from the start line.
2. Start the timer when the plane leaves the throwers hand. Stop the timer when it hits the ground.
3. Measure the distance the plane travelled.
4. Repeat for planes (B) and (C).

**STEP 5: Draw a diagram of your method**

**STEP 6: Collecting Data**

1. Conduct multiple trials for each plane design.
2. Find the average distance & time.
3. Use these averages to calculate the average speed.

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| **Design (A)** | **Time (s)** | **Distance (m)** |
| **Trial 1** |  |  |
| **Trial 2** |  |  |
| **Trial 3** |  |  |
| **Average** |  |  |

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| **Design (A):** Average Speed (m/s) |  |

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| **Design (B)** | **Time (s)** | **Distance (m)** |
| **Trial 1** |  |  |
| **Trial 2** |  |  |
| **Trial 3** |  |  |
| **Average** |  |  |

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| **Design (B):** Average Speed (m/s) |  |

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| **Design (C)** | **Time (s)** | **Distance (m)** |
| **Trial 1** |  |  |
| **Trial 2** |  |  |
| **Trial 3** |  |  |
| **Average** |  |  |

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| **Design (C):** Average Speed (m/s) |  |

**STEP 7: Summary**

1. Which of your plane designs had the fastest average speed? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Was your hypothesis correct? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Compare the designs of your paper planes. Describe the design features that allowed a plane to fly faster.   
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4. Describe a problem you had conducting this experiment. Suggest a way to improve this.

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**END OF WEEK TEST:** *Mechanical / Kinetic**Energy*  
 **Question 1**List five examples of kinetic / mechanical energy.

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| **1** |  |
| **2** |  |
| **3** |  |
| **4** |  |
| **5** |  |

**Question 2**Identify two factors that influence how much kinetic energy something has.

**1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Question 3**Ms Dobrich rides her bike to school which is **900 meters** away. It takes her **180 seconds** to get to school. Calculate her **average speed**.

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**Question 4**While Miss Dobrich is riding a toddler runs onto the road ahead. If Ms Dobrich took **0.5 seconds** to react, how far does she travel before hitting the breaks?

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**Question 5**Using examples, explain why is it important to follow speed limits when driving a car.

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Rate your understanding of kinetic/mechanical energy:  
 