

**Friday 9<sup>th</sup> February 2024**

**Period 4:** 8A4 Physics

**Title:** Work, energy and machines.

Complete on paper or in your books – you will need to hand in this work after half term.

1. Using the text book page 94 & 95 (copy on next page) Write out what work in physics means.
2. Write out the formula for work done.
3. Make notes on simple machines and gears.
4. Answer summary questions 1-4.

## 2.8 Work, energy, and machines

### Learning objectives

- After this topic you will be able to:
  - calculate work done
  - apply the conservation of energy to simple machines.



▲ Riding downhill is much easier than riding uphill.

Have you ever tried to ride your bike uphill in the same gear that you use to ride downhill? Choosing a lower gear makes it easier to go up hills.

### Working out work

Not all energy transfers are to do with heating and cooling. You can transfer energy by doing **work**.

In physics the word 'work' has a special meaning.

- When you lift a book you do work against gravity.
- When you slide the book you do work against friction.

$$\text{work done} = \text{force} \times \text{distance}$$

(J)                      (N)                      (m)



▲ Lifting a book:  
work done = force  $\times$  distance  
= 2 N  $\times$  1 m  
= 2 J



▲ Sliding a book:  
work done = force  $\times$  distance  
= 1 N  $\times$  0.2 m  
= 0.2 J

### State the equation for calculating work.

### Making life easier

A **simple machine** makes it easier to lift things, move things, or turn things. It reduces the force that you need to do a job, or increases the distance that something moves when you apply a force.

### Levers

Most people use a **lever** to open a tin of paint. If you put a screwdriver between the lid and the rim of the tin, you can open the tin with a much smaller force.

The force applied to the lid by the lever is bigger than the force that you apply with just your hand. A lever is a force multiplier.



### Climb a mountain!

When you walk upstairs you are using a force to overcome your weight.

### Name two types of simple machine.

### Getting something for nothing?

A small force acting over a big distance produces a big force. The big force can only move a small distance. You cannot get something for nothing.

The reason is the law of conservation of energy. If you increased the distance as well as the force then you would get more energy out than you put in. You cannot get out more than you put in.

### Key Words

work, simple machine, lever, gear

### Summary Questions

- Copy and complete the sentences below.  
You need to know the \_\_\_\_\_ and the \_\_\_\_\_ to calculate work done.  
A simple \_\_\_\_\_ like a \_\_\_\_\_ can be used to open a paint tin because it is a \_\_\_\_\_ multiplier.  
A \_\_\_\_\_ on a bicycle can make it easier to cycle uphill. All simple machines obey the law of \_\_\_\_\_ of energy. You cannot get more \_\_\_\_\_ out than you put in. (8 marks)

- You can use a stone under a plank of wood to lift a heavy rock.  
a. State the type of machine that you can make with this equipment. (1 mark)  
b. Calculate the work done by lifting a rock of weight 200 N a distance of 0.25 m. (2 marks)
- A person with a weight of 600 N climbs Mount Everest, a vertical height of 10 km. Compare the work done climbing Mount Everest and climbing 2.5 m upstairs to bed. (4 marks)

- Look at the diagram of the bicycle chain and cogs above. Explain in detail why you exert a force on the pedals, but you still obey the law of conservation of energy. (6 marks) (MC)