Energy

3. Work

CONCEPT 2

LESSON GUIDE

SIMPLE MACHINES

PRECISE LEARNING POINTS

KNOW

I know that a simple machine reduces the work required to move an object and I can give examples.

APPLY

I can apply my knowledge of simple machines to describe how levers work.

EXTEND

I can extend my knowledge of simple machines to explain how levers are incorporated into everyday objects.

NOTES

If we want to move or lift an object then we must apply a force to move or lift it over some distance. In other words, work has to be done to move or lift the object.

If we could, somehow, make the force we apply smaller, then it will be easier for us to move or lift the object. However, to move or lift the object by the intended distance then applying a smaller force has a price – we will have to apply the smaller force over a longer distance.

A simple machine can come in a variety of forms, but they have one thing in common – they make work easier. They reduce the force needed. There is a limit to the size of force we can apply, so machines are useful. People have been using machines for thousands of years and we still make use of them every day. We may not even realised when we're using them.

LEVERS

One of the most common types of machine is a **lever**. Here are three simple examples of levers:

For these, if there was NO handle there, there would simply be a rod to try and twist. Even if we could grip this rod, applying enough force would be really difficult. Each rod needs a certain amount of work to make it turn. **By gripping the rod itself, a large force is required because we are only moving it around by a**

small distance. **Attaching a handle is to attach a lever to the rod**. **We can move the lever around by a larger distance but with a smaller, easier force**. **The same work is done to turn the rod but it is easier for us to do so**.

A lever is an example of a machine that reduces the force needed by increasing the distance. We need to mention a critical feature of using a lever as a machine. There must be a pivot that the lever turns around. In the examples above the rod itself is the pivot.

If the lid is stuck on a tin of paint it can take a lot of force to move. Using our fingers to pull the lid required a large force that may be too much for us.

The pivot is the rim of the paint tin. The screwdriver rests on the pivot. There is a small length of screwdriver from the pivot to the paint tin lid. There is a large length of screwdriver from the pivot to your hand.

Pushing down on the screwdriver with a small force at a longer distance from the pivot will result in a large force pushing up at a short distance from the pivot. This force will be enough to open the paint tin lid.

The same work is done on both sides of the screwdriver (lever) but your **input force** is much less than the **output force**.

WHEELS

Another example of a simple machine is to use wheels. This doesn't increase the size of the force applied, but rather, it reduces the friction and so makes the opposing force less.

Pushing the boxes in photo along the floor would require a large force due to the large frictional forces between the box and the floor.

You think a bicycle is a machine too. In fact, its several machines combined together into one. One kind of machine is the lever and there are several on a bike; gears are also a kind of machine and even the wheels themselves are a machine as they reduce friction.