Tutor

Introduction to small engines - tutor notes

What students will learn

When they have finished this introduction module, students should know:

- ❑ how small engines work
- ❑ the main differences between 2-stroke and 4-stroke engines
- ❑ the main parts of small engines
- ❑ why engines need air, fuel and a spark to run
- ❑ why engines need maintenance
- ❑ technical information about their engine

Things you need before you start

Information

You will need ideas and information on:

What type of engines available locally

Where engines can be repaired locally – mechanics, workshops, dealers

Manuals or books for the engines students will use – or the technical information they need

Materials

Examples to show students:

2- and 4-stroke fuel engines – outboard motors, mowers etc

Dismantled engine(s) for students to see the inside moving parts

Tools or equipment

Students do not work on engines in this module – they look at your examples. So, no tools or other equipment is needed

Activity

The activities in this module require the students to collect information about their engines.

You may need to help them find their information.

Students should work together in small groups to find answers

The module

The workbook sections for this module are:

What is a small engine?

How do engines work?

- 4-stroke engines
- 2 stroke engines
- engines with more cylinders

Size and power of an engine

What an engine needs to work and why maintenance helps.

Service and repair workshops

Information and manuals

Work through each section with the students.

- Talk about the engine parts and show them to students.
- Help them understand the basics.
- This module has a lot of theory and knowledge. Keep things as simple as you can.
- They do not need to **remember** most of the theory, but it should help them understand why all the bits of the course are important.

Remember

The workbooks are **not** designed to be used by the students learning on their own.

What is a small engine?

Talk about

- Engines can be in all sorts of shapes and sizes.
- The worksheets show pictures of outboards, mowers, bikes etc. Talk about each one.
- Explain that each has a small engine that works in the same way – but they are different in:

  shape and size

  where the bits are

  the equipment they drive (chains, propellers, blades etc)

The names for the engine parts marked on the pictures. Give students any other names for the parts you use locally.

Show the examples of any engines you have. Help students find the named parts on each engine.

Note

For all these sections.

We have not mentioned any parts or unnecessary complications in our explanations and diagrams. For example: bearings, big ends, con-rods, piston pins, piston rings, cam shafts, valve seats/springs, top-dead-centre (tdc) Students **do not need to know** about these at this level of this course.

If students ask about them – then explain as simply as you can, but do not get too deep!

How do engines work?

Talk about

Fuel and air in the right mix burn VERY quickly – they explode!

Ask if students have ever seen an explosion? – what was it like?

Engines get their power by making the explosion inside a sealed tube – or cylinder.

The explosion pushes a **piston** down inside the cylinder

The piston is attached to a **crankshaft** that turns.

Show

- the parts on the diagram on the worksheet
- your examples of the piston, cylinder and crankshaft if you have a dismantled engine.

Explain about the movement of a man on a bicycle and his leg being like the piston and the pedal/chainwheel being the crankshaft

Show

The movement of piston and crank if you have a dismantled engine.

The engine cycle

Talk about

- the steps in the engine cycle:

Intake – compression – **ignition/power** – **exhaust**.

Or – some people call them:

Suck – Squash – Bang – Blow

Use the diagrams on the worksheet to help explain. Keep it simple.

4-Stroke engines

This is the true Otto cycle

Talk about

- there are 4 strokes to each cycle
- the engine revolves two turns with each cycle.
- The spark ignites the fuel on every **two turns** of the crankshaft
- The fly wheel helps to keep the engine turning between power strokes

Explain each of the 4 strokes and what is happening to:

- fuel-air
- piston
- valves
- spark and exhaust gasses.

Use the worksheet diagrams

Talk about – good and bad things of 4 strokes

- They have oil in the bottom of the engine to lubricate the moving parts

  Need to be careful if you lay them down on their sides.

  Not good engines if the equipment has to work at funny angles – for example, a chainsaw

- They need more engine parts – to open and close the valves at the right time.

  They are usually heavier than 2-strokes

- They used ordinary petrol
- They are smoother running – but a bit less powerful (for same size engine)
- If looked after, they usually last longer than 2 strokes.

2-stroke engines

Talk about

- These engines use the same basic engine cycle – but they do it in just two up and down movements of the piston – or 2 stokes per cycle.
- They work slightly differently:

  no valves. They have ports (holes) in the cylinder wall instead.

  fuel-air mix is sucked in through crankcase at the bottom of the engine.

Explain the strokes in the cycle using the worksheet diagrams. For each stoke talk about what is happening to:

fuel-air in the crankcase

fuel-air in the cylinder

the piston

exhaust gasses.

Talk about – good and bad things of 2 stroke engines

- They can be made lighter then 4-strokes because they:

  have less parts – no valves or valve – operating parts.

  use oil mixed with the fuel (petroil) to lubricate the engine parts, so they have no oil, filter or oil pumps.

- They are more powerful than 4-strokes (same size engine)
- They use more fuel than 4 strokes – and make more smoke and pollution
- They make more noise and usually run faster
- They can be used in almost any position – because of the fuel and oil mix (see later)

Engines with more cylinders

Talk about

- Most mower, chainsaw, brush-cutter and many other small engines have just one cylinder.
- More cylinders give more power, make engines run smoother.

- Keeping engines balanced – 2 cylinders and 4, 6 and 8
- Usually the pistons are fitted in pairs that balance each other
- V and horizontal opposed shapes (if students are interested)

Show

your examples of multi-cylinder engines if you have them.

The size and power of an engine

Talk about

- **The capacity or volume**:

  Cubic centimetres/litres

  USA – Cubic inches.

  Depends on width of the cylinder (the bore diameter) – and how far the piston goes up and down inside the cylinder (the stroke). (Technical name – the 'swept volume'.)

- **Power.** Horse power is an old term. Still used by engine and car makers (especially USA)

Note

There are about 6 different standards for a "horse-power" and you have no way of knowing what measure the maker is giving ! Use it as a rough guide only!

The work sheet gives some typical examples of engine capacity and HP.

Talk about

the size and power rating of your examples – and the students engines.

What an engine needs to work

Explain the diagram and talk about

- The need for:

  Air

  Fuel

  Spark

  In the right amounts in the engine – and at exactly the right time.

  Also, talk about engines needing **COMPRESSION** to help the fuel/air explode. Leaking valves or worn cylinders reduce power and make engines difficult to start. These are major engine faults and we do not cover them in this course.

- The need for:

  oil to lubricate

  some way to cool the engine

- Regular operator maintenance will keep things just right in the engine, it will:

  start and run better

  give more power

  use least fuel

  keep going!

  last longer

- We call this **'Operator Maintenance".**

- Expalin that the course will work through modules and worksheets on: Air, Fuel, Electrics (sparks), Lubrication and Cooling.

Service and repair workshops

Talk about

- More difficult work – or work needing special tools or equipment – must be done by experienced mechanics in a workshop.
- Local service and repair workshops. What is available – and where.
- Where students can buy parts – and things like oil or filters from.

Information and manuals

Talk about

Technical manuals

Handbooks

Parts lists/books

What do students have?

Where can they get manuals (or the information they need)

Show – your examples of manuals and technical information.

Student activity

Help students with the activity. They find out information about their engines.