Transport, Tools, Machines: Outcomes and activities
God is a Servant Year 6

Spiritual Awareness: Using the power in God's creation for reaching the world
God has placed within the creation, forces that serve man. Machines give us the power to perform tasks with comparatively less effort. The development of machines, transport and technology has facilitated the spread of the gospel.

God has also given us His power for sharing the Gospel. His power enables us to achieve greatly beyond what our human resources can achieve. As God's servants, we must rely on His power when sharing our faith.

Values: Our response to 'God is a Servant'
- **Service**: follow the example of Jesus, the greatest servant
- **Appreciation** of God's gifts to us through His creation
- **Enthusiasm** for sharing our faith
- **Creativity** in using the tools God has given us to use in serving Him

Bible Passages and stories about serving God by sharing the Gospel:
Luke 4:18; 7:22 Jesus came to bring the Good News
Mark 16:14-20 "Go into all the world…"
Matthew 28:18-20 - Jesus said, "All power in heaven and on earth is given to me. So go and make disciples of all nations…"
Romans 10:14-17: How can they believe if they have not heard the message? And how can they hear if the message is not proclaimed? And how can the message be proclaimed if the messengers are not sent out? How wonderful is the coming of messengers who bring the Good news.
Ephesians 6:15 Stand ready with truth as a belt right around your waist, with righteousness as a breastplate, and your shoes to announce the Good News of Peace.
The book of Acts: Paul traveled by boat to share the Good News.

Outcomes: Students will
Knowledge
- demonstrate application of the following simple machines: lever, wheel and axle, inclined plane, screw, wedge
- explain how a pulley works
- explain how the wheel allows things to move
- understand that the use of the machines involves less effort to perform work than would be required in their absence
- illustrate the significance of machines in everyday life
- appreciate the value of tools and objects that allow us to do work more effectively and efficiently and with greater ease
- identify the function and purpose of tools and machines
- experiment with some tools and machines and record observations
- explain how machines have served us in facilitating the spread of the Gospel
- identify ways in which technology can be used to spread the Gospel today, e.g. internet

Skills

- make predictions and test them
- devise experiments and record results
- compare
- draw conclusions
- Be willing to serve God and others

Activities

- Free play with levers, wheel and axles, inclined planes and pulleys.
- Use levers to lift substantial weights in the playground. Use the same pivot point but alter the length of the lever.
- Draw levers in action: spades, scissors, bottle openers, pliers, fishing rod.
- Vary the length of an arm and position of load on a lever and measure the effort required to move the load.
- Use tools and machines to move a load of books across the floor and on to a table.
- Try lifting a load with, and without a pulley. Compare the amount of force required for both tasks.
- Lift the same load with a double pulley system. Two single pulleys can be used in one system and then a double pulley system. Compare the amount of effort required for each system. Compare the amount of distance the rope travels through the various systems.
- Tie a solid toy to a spring balance and measure the force necessary to lift the toy vertically over a distance of 50 cm. The same toy, connected to the spring balance, can be pulled up a 50-cm. high ramp, 70 cm. long, and the force compared. Children can predict result for different gradations of ramps.
- Discuss application to transport modes.
- Research the development of the car.
- Design a 'crazy machine' or a machine of the future as an art activity.
- Make a machine.
- Discuss how machines have facilitated the spread of the Gospel. Consider the printing press, transport modes, computers.
- Research the lives of famous inventors and their inventions:
  James Watt, (steam engine); Elias Howe, (sewing machine); John Gutenberg, (printing press); Samuel Morse, (telegraph); Alexander Bell, (telephone); Thomas Edison, (electric light); Orville and Wilbur Wright, (aeroplane); Guglielmo Marconi, (wireless); John Baird, (television); John Holland, (submarine); Von Braun, (space rocket)
- Identify levers in the human body (e.g. arm) and discuss God's design for our bodies.

Assessment

1. Design and make a machine. Demonstrate and explain to the class how it works.
2. What have I learned from the study of tools and machines about serving God?

Values education Year 6
God is a Servant
Enthusiasm

Enthusiasm is …

- having a positive attitude about the things you do
- not looking on the bad side of things
- putting all your energy into the job you are doing

To be good at something we need to put all our energy into it.
We need to get on with the job with a cheerful attitude. This can inspire the people around us to do the same.

1. Who do you know that is enthusiastic about the job they do?
2. How can enthusiasm make a sports team play better?
3. How can enthusiasm help people get a job done better?
4. Make a list of some of the things you are enthusiastic about.

What does the Bible say about enthusiasm?
Ecclesiastes 9:10 Whatever your hand finds to do, do it with all your might.
Philippians 2:14 Do all things without grumbling or complaining

Art Year 6

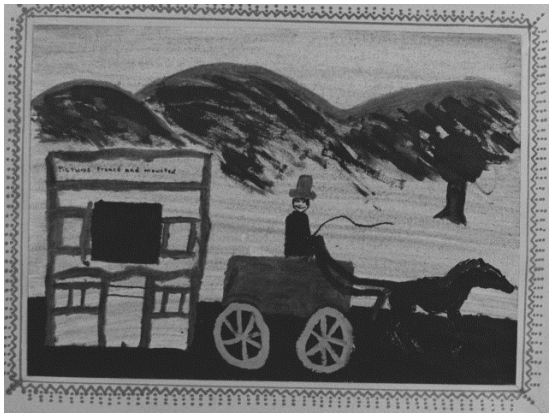
God is a Servant

Tools, transport and machines

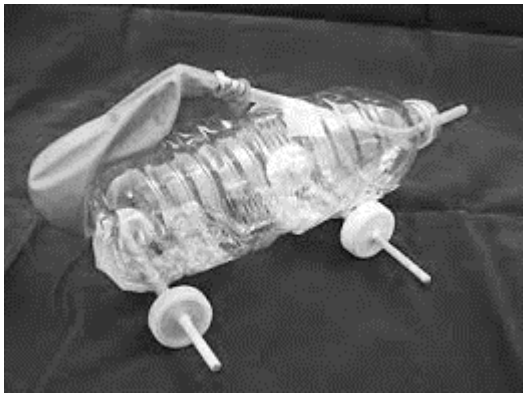
Biblical wall art and text: How can the message be proclaimed if the messengers are not sent out? How wonderful is the coming of messengers who bring good news! Romans 10:15

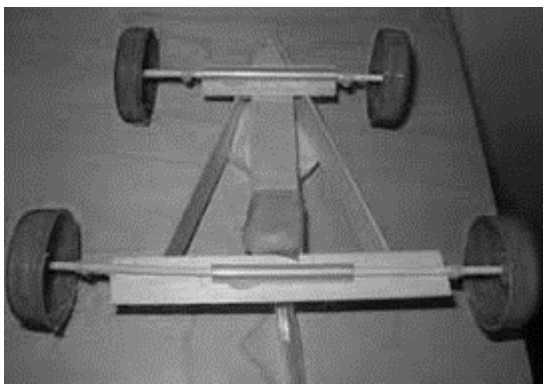
Transport and technology are means of spreading the Good News!

Painting and drawing
Make a display showing transport from early times, today and projections of transport in the future. Students can choose their subject: past, present or future.



Construction
Collect bottle caps. Students can construct a vehicle that moves, using skewers for axles, and other construction materials such as cardboard boxes and straws. For boats, they can experiment with balloon power to make the boat move in water.





Practical Science Year 6
God is a Servant

Topic: Tools, machines, technology
Elastic spring

What you will need:
A collection of rubber bands
Pencils

What to do:
Wind and turn an elastic band between two pencils.
Let it unwind.

This is how a spring works.

Practical Science: Transport, tools, machines
Design a catapult

http://www.primaryscience.ie/media/pdfs/col/Design_a_catapult_activity.pdf

Information:

- When a force acts on an object that cannot move, it may change its size or shape.
- Some things (e.g. plasticine/ modelling clay) stay in the new shape when the force is removed. But some substances, like rubber, return to their original form when the force is removed. The latter are called ELASTIC substances.
- Elastic materials store energy when they are stretched, and release the energy when the force is removed. So energy is stored in stretched rubber bands (this is the energy which you have put into it to stretch it). This energy is released when the rubber band is let go and it goes back to its original size.
- Elastic things will not stretch forever! They will snap if you stretch them too far.
- This activity also shows the strength of the triangle. The triangle is a shape often used in architecture because of its strength.

Questions:
What do you use rubber bands for?
What is the advantage of rubber bands over a piece of string? (They stretch).
When you stretch a rubber band what does it do? (It gets longer).
When you let it go again what does it do? (It goes back to its original size).
Do you think a trampoline is elastic? (Yes!)
What happens to a trampoline when you jump on it? (It stretches downwards).
Then what happens? (It goes back to its original shape, releasing the stored energy and pushes you up in the air)

Activity:
The children should be given some rubber bands to play with and explore their properties carefully. (Thickness, stretchiness, etc.)

To make a catapult
What you will need:
1 bulldog clip
short ruler (15 cms.),
1 thick rubber band,
small piece of paper (approximately one quarter of an A4 sheet)

What to do:
Attach the bulldog clip to the end of the ruler and then attach the rubber band to the clip.
Pull back the rubber band. This puts energy into it
Put a tightly-rolled ball of paper into the end of the rubber band, and then letting it go. This releases this energy very quickly, and the paper may go shooting off.

This should be tried a few times, investigating at which angle the ruler was held, how far the band was pulled, what length rubber band gave the longest distance etc.
The distance the paper travelled should be measured and recorded. This should be done a number of times and the average taken.

Safety:
Although paper is soft the bullets should not be aimed at anyone.

Follow-up activity:
There are a large number of ways in which the principle of stored energy is used to make catapults.
The children should be encouraged to design and make their own catapults.
They could try using a piece of eggbox as a holder for the paper ball.
They could try using rolled-up kitchen foil instead of the paper ball.

Practical Science: Tools, machines, technology
Pulleys

http://www.primaryscience.ie/media/flash/act31/index.html#

Question 1: Do you know what a pulley is?
A pulley is a simple machine with a wheel that has two raised edges. The edges allow a rope or string to run around the wheel without falling off.

A pulley can also be called a block and tackle.

Question 2: Can you think of where pulleys are used?
Pulleys can be used in lots of different ways. They can be used to lift heavy things, so you might find them on building sites. Have you been in a lift recently? How do you think the lift was able to move up and down between floors?

Question 3: Where else might you find pulleys being used?
Pulleys can be used to move things, like pulling clothes along a clothes line in the garden, or moving a cable car from one side of a valley to another.

Make a pulley
You will need:

- A bucket
- A weight
- Rope
- A rolling pin

Attach one end of your rope strongly to the bucket handle.
Put a weight in the bucket, e.g. stones
Place the rolling pin on a desk or table, with one end hanging over the desk.
Get two people to hold the rolling pin down firmly so that it doesn't move.
Now put the other end of the rope over the end of the rolling pin hanging over the desk, and lift the bucket by pulling DOWN on the rope.
Test to see whether the bucket is easier to lift by the pulley method: (pulling down), or by just lifting it up from the floor without the pulley.

Practical Science: Tools, machines and technology
Levers

http://nationalgeographic.org/activity/simple-machine-challenge/

Definition of work:

The definition of work used in science may differ from what most people think of as work. Work can be defined as applying a force over a certain distance.

Exercise:

Move a book from one desk to another.

Is this work by the scientific definition? (Yes, this is work.) You are applying force for a certain distance.

Is doing homework work by this definition? (No, homework is not work.) Pushing a book across a desk is work because you are applying a force (a push) on a book for a certain distance (the length of the desk). You are not pushing homework anywhere.

A lever makes work easier

An example of a machine making work easier: The claw of a hammer to remove a nail.

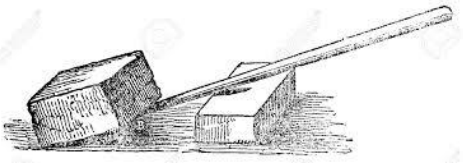
A small force applied to the handle of the hammer produces a greater force at the claw end of the hammer, allowing for the removal of nails.

Other examples of levers: A see saw; scissors; a door handle

Make a lever from a ruler

You will need:

- a firm ruler (or other long, firm, flat object)
- a pen or pencil
- a stack of books



Make a lever

Use a ruler and pencil to make a lever to lift the books.

Does it feel easier or harder to lift the stack of books when using the ruler as a lever instead of lifting them straight up?

Practical Science: Tools, machines and technology
The wheel and axle

The wheel and axle uses rotational movement to make work easier. When effort is applied to the wheel, it produces movement in the axle, and when it is applied to the axle, it produces movement in the wheel.

Observation

Distribute small toy cars that have wheels joined by axles to groups of students.

Discussion

How do these toy cars move?
How are the wheels on each side of the car joined to each other? (the axle)
Which common machines use only one wheel? E.g. a wheelbarrow.
How did the invention of the wheel make life easier?

The challenge

In groups, design and build a machine that incorporates wheels and axles.
Wheels can be made from plastic bottle top lids. Use hammer and nail to put a hole in the centre of the lid. (These can be prepared ahead of time by an adult.) Wooden skewers can be used for axles.

How to make wheels and axles on toy cars

There are two ways to make wheels turn. One way is the make the wheels spin and the other way is to make the axle spin.
To make a car / vehicle with a spinning axle: Slip the axle (such as a toothpick) through a larger tube / cylinder (such as a straw). Now make wheels out of something (such as bottle caps, buttons, cork, etc.). and stick these to the end of the axle (toothpick, chopstick, pencil, etc). These wheels must be tightly secured to the axle...so the axle turns inside the tube, but the wheels don't.
To make a car / vehicle with spinning wheels: If you want the wheels to spin, then you will need to place the axle (toothpick, etc.) inside a bigger hole in the middle of each wheel (or a tube / cylinder (straw) that is placed in the middle of each wheel). An example of this would be to cut a hole in a bottle cap...one large enough to stick a small straw inside of it. Then place the toothpick in between both wheels...now the wheels will turn on the toothpick (axle) instead of the axle turning with the wheels as one piece.

Practical Science: Tools, machines and technology
Bucket Spinning (Newton's first law of motion)

You might think that an upside-down bucket of water above your head would end up with you getting very wet but what if the bucket is spinning quickly in a circular motion? Give this fun science experiment for kids a try and see what happens while learning a thing or two about centripetal force.

What you'll need:

- A reliable bucket with a strong handle
- Water
- An open area outside where spilling some water is ok.

Instructions:

1. Fill the bucket until it is around half full with water.
2. Stand well clear of other people or anything else that could get in the way.
3. Hold the bucket by its handle with your arm extended and start spinning it by your side towards the sky and back to the ground in a circular motion, make sure to spin it fast enough to keep the water inside the bucket. Be prepared to get a little wet as your technique improves.
4. Stop spinning before your arm gets tired, watching out for splashes as you carefully bring the bucket back to rest on the ground.

What's happening?

There's half a bucket of water spinning upside down above your head and yet it's not falling out and getting you wet, what's going on?

This experiment makes use of something called 'centripetal force', which is a force acting on an object moving in a circular path, directed towards the center around which it is moving. This type of force can also be seen on roller coasters or by satellites in orbit around a planet.

As you spin the bucket you might feel that it wants to fly off in a straight line away from you (you might even accidentally let go of it), this is a demonstration of Newton's first law of motion, that an object will continue in a straight line unless an outside force (in this case your arm) acts upon it.

Thinking Skills Servant Yr 6

Tools, machines and technology 1 Invent a "super tool" that can fix all household problems.	**Tools, machines and technology 2** List 10 ways that technology and machines can **serve** by helping to spread the Gospel.
Tools, machines and technology 3 What will a computer look like 100 years from now? Draw it.	**Tools, machines and technology 4** Place the letters A-Z down the side of a page. For each letter name a tool or machine that assists us.
Tools, machines and technology 5 Draw a screw driver. Now redesign it using the following steps: **B** – igger **I** – nstead of **N** – onsense **G** – et rid of **O** – ther uses	**Tools, machines and technology 6** What if all tools were banned. Write down 10 possible consequences.

Thinking Skills Servant Yr 6

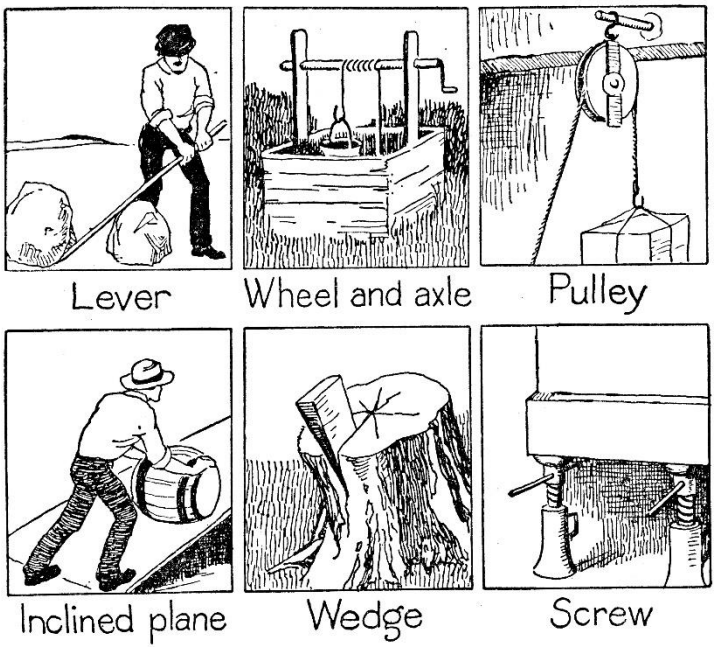
Tools, machines and technology 7 Brainstorm 10 ways we can use machines to help people.	**Tools, machines and technology 8** Write down 4 disadvantages of computers. Now work out an improvement for each of these.
Tools, machines and technology 9 Create a new machine using: **pliers** and **a lawn mower**	**Tools, machines and technology 10** All machines in the world have suddenly broken down. Give 3 interesting explanations.
Tools, machines and technology 11 Design a power tool that can work in an alternative way in the case of power failure.	**Tools, machines and technology 12** Design a clean, efficient and economical means of transport for the future.

Simple machines 1
The six simple machines

Student activities

Simple machines can be used to make work easier. They can change the direction of movement and can lessen the amount of work needed for moving things.

Although people had been using simple machines in earlier times, scientists like Galileo and Da Vinci identified the six simple machines we have today: pulley, screw, wheel & axle, lever, wedge, and inclined plane. Most modern machines use one or more of these six simple machines.



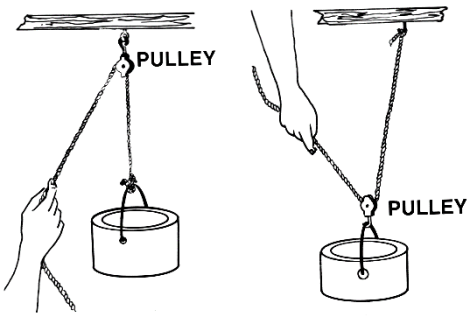
Draw the six simple machines and explain how they are being used in each picture.

Simple machines 2
Pulleys

A pulley is a simple machine that uses a rope over a wheel, or a tree branch or similar. When one side of the rope is pulled down, the other side goes up. The direction of movement is changed, and the load is easier to lift.

Here are some examples:

- a flag pole
- an old fashioned well where a bucket was pulled up by a rope
- pulleys in construction work
- window blinds and sails on a ship that get hoisted up.



Draw and name two pulleys in action.

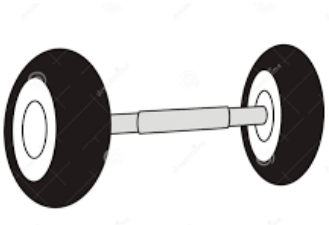
Simple machines 3
Wheel and axle

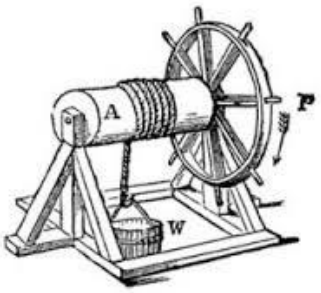
The wheel and axle is a machine used to help move heavy things. It is a large wheel with an axle connected at the center of it. When the wheel is spun the axle spins with it.

Examples of wheel and axle:

- a wheel barrow
- a car
- roller skates

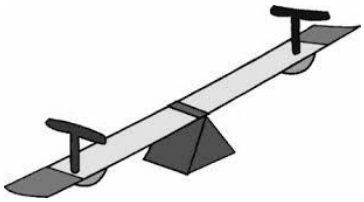
Write a list of machines that use the wheel and axle. Add two things that are not on the list above.
Draw two things that use the wheel and axle.



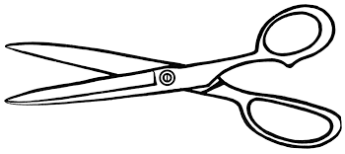


Simple machines 4
Lever

A lever is a machine with a board or bar that is fixed on a support called a fulcrum. The fulcrum is a pivot point. Find the pivot point on this see saw.



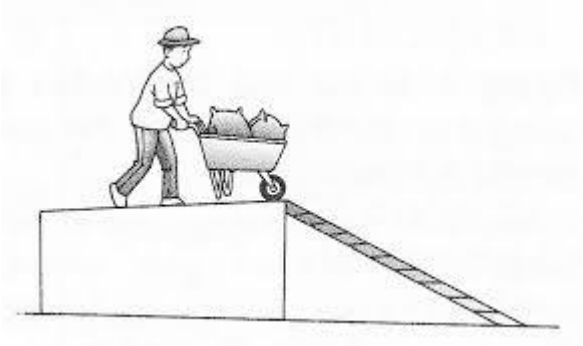
By changing how much of the board (or bar) is on each the side of the fulcrum it can be made more difficult or easier to lift a weight. If you push down on the long side it will be easier to lift something on the short side.

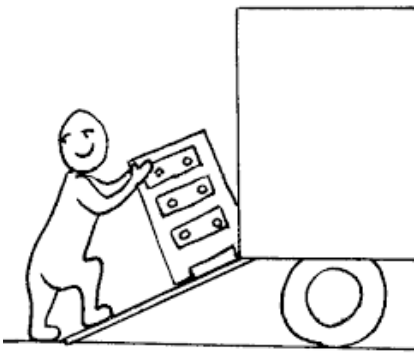


Draw three different types of levers and explain where the fulcrum is.

Simple machines 5
Inclined plane

An inclined plane, also known as a ramp, is a flat supporting surface tilted at an angle, with one end higher than the other. It is used to help raise or lower objects more easily by allowing them to move diagonally instead of up and down.



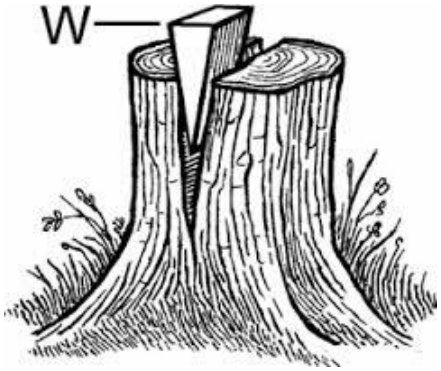


1. How would the man in the first picture get his sacks down if he didn't have the ramp?
2. How would the man in the second picture get his chest of drawers into the van if he didn't have the ramp?

Simple machines 6
The wedge

A wedge is triangle shaped. It can be used to stop or hold things in place. When a wedge is pushed under a door, the diagonal edge pushes up against the bottom of the door and holds it still.

An axe is an example of a double-wedge. It is also triangle shaped. It is used to split wood or separate things. When the triangle is pushed down, its two sides push out diagonally.

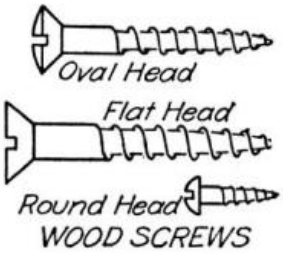


1. Give examples of two types of wedges and draw them doing work.
2. How do they make the work easier?

Simple machines 7
A screw

A screw is a nail-shaped rod with threads spiraling down it. A screw twists as it goes into wood, but it goes in straight. It stops turning because of the head.

Examples of screws:
A corkscrew
A bolt



1. Draw different kinds of screws.
2. Why is a screw sometimes stronger than a nail?

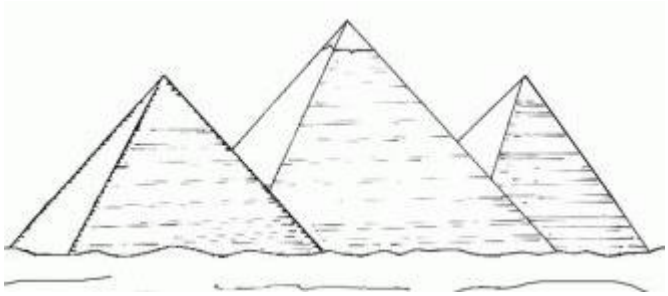
Simple machines 8
Machines in the Bible

1. Here are some machines used in Bible times:

A sling shot
An axe
A bow and arrow
A chariot

Explain where in the Bible these machines were mentioned. Explain what type of machine they are and how they were used.

2. In the time of Moses, the Israelite slaves worked on building the Great Pyramids of Egypt. The slaves had to transport huge block of stone to the top of the pyramids. What kind of machines do you think they may have used? Draw a picture to explain, and label your drawing.



3. Machines can help us serve the Lord

God created us with intelligence. Over history, scientists have discovered the energy principles built into God's creation, and used these principles to develop machines.
Explain how machines can help us serve the Lord and spread the Gospel.