www.cdsoft.com.au info@cdsoft.com.au
Freecall 1800 634 050

Design Task: Make and race Vbots
Design Brief: Students will build a simple robot and learn how friction can be used to manoeuvre robots autonomously.

Australian Curriculum Links:

Design and Technologies, in which students use design thinking and technologies to generate and produce designed solutions for authentic needs and opportunities.

	Knowledge and Understanding	**Processes and Production Skills**
Year 3 & 4	Investigate how forces and the properties of materials affect the behaviour of a product or system (ACTDEK011)	Generate, develop, and communicate design ideas and decisions using appropriate technical terms and graphical representation techniques (ACTDEP015) Select and use materials, components, tools, equipment and techniques and use safe work practices to make designed solutions (ACTDEP016) Evaluate design ideas, processes and solutions based on criteria for success developed with guidance and including care for the environment (ACTDEP017)
Year 5 & 6	Investigate how electrical energy can control movement, sound or light in a designed product or system (ACTDEK020)	Develop project plans that include consideration of resources when making designed solutions individually and collaboratively (ACTDEP028) Select appropriate materials, components, tools, equipment and techniques and apply safe procedures to make designed solutions (ACTDEP026)

Physical Sciences

Year 4 Forces can be exerted by one object on another through direct contact or from a distance (ACSSU076) Elaboration: comparing and contrasting the effect of friction on different surfaces.

Year 6 Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources (ACSSU097)

Critical and Creative Thinking

In the Australian Curriculum: Technologies, students develop capability in critical and creative thinking as they imagine, generate, develop and critically evaluate ideas. They develop reasoning and the capacity for abstraction through challenging problems that do not have straightforward solutions. Students analyse problems, refine concepts and reflect on the decision-making process by engaging in systems, design and computational thinking. They identify, explore and clarify technologies information and use that knowledge in a range of situations.

Tips for Teachers:

Lessons are based on Gary Stager's iterative design cycle of TMI = Think, Make, Improve. (Invent to Learn, Stager & Martinez)

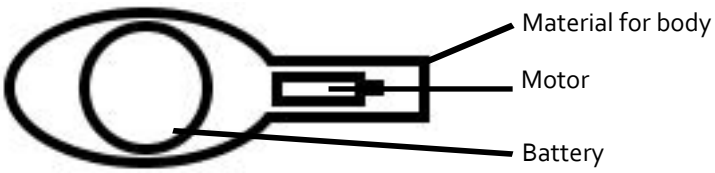
Buzzbots are great for teaching kids about making, working with basic electronics and applying design thinking principles.

Think

Think about how the components provided can be used to design and make a simple robot that uses friction to move. See Teacher's Notes for science concepts for discussion.

Make

Components: motor, battery, toothbrush head, double sided tape.
Step 1: Use a toothbrush head to create the body of your buzzbot.
Step 2: Connect one wire from the motor to the bottom of the battery with double sided tape.
Step 3: Using double sided tape, attach the motor to the end of the toothbrush head.
Step 4: Using double sided tape, attach the battery to the top of the body. This makes it easy to reposition components to make adjustments to the movement of your buzzbot.
Step 5: Tape the second wire from the motor to the top of the battery to bring your buzzbot to life.



Customise your buzzbot to make it easy to identify! You could add LEDs (remember the longer pin is positive so it should touch the top of the battery), pipe cleaners or stickers.

Improve

It's time to test and modify your design to prepare for racing. Does your buzzbot spin in circles? Can you make it go in a straight line? Both movements will be required for separate races. Encourage students to explore positioning the battery and motor to change the motion of their buzzbot. Does flipping the battery over make a difference? Does trimming the base of the scouring pad or bristles change the movement?

Race time!

Race 1: The buzzbots are on the track
This race requires the buzzbots to travel in a straight trajectory to cross the finish line. To ensure a fair race, line up the buzzbots on a slight incline held by a ruler or something to act as the starting barrier. Remember they will already be switched on and raring to go! When all buzzbots are in place, remove the barrier and let the race begin.
Reflection: Which designs enabled the best forward movement? How many modifications did students make to their designs?

Race 2: Last buzzbot standing
This race requires the buzzbots to remain within the race area for as long as possible. Students will need to modify their design to spin around in circles. Mark a race area with tape, a marker or use a round table. Begin by placing all buzzbots under a round countainer then lift it to let the race begin. The winner is the last buzzbot remaining in the racing ring.
Extension: Time each race and compare results. Older students could estimate how long their buzzbot will survive, time it and find the difference. Who guessed the closest?
Reflection: Which designs enabled the best spinning motion? How many modifications were made?

Buzzbot Hack

See if you can hack the buzzbot to create the ultimate bot using different material for the base and more than one motor! Think about counter-torque with helicopter rotors (Newton's 3rd Law)
http://www.explainthatstuff.com/helicopter.html

Teacher's Notes:

Science Concepts

Friction is defined as a force that resists the relative motion between two objects in contact. It appears when two things rub against each other. Without friction, buzzbots wouldn't be able to move. The unbalanced weight causes the entire motor to vibrate which makes the buzzbot shake very quickly in one direction and then the other. This friction allows it to move across smooth, flat surfaces.

The **centre of gravity** is the exact spot on an object where there is the same amount of weight on one side of the spot as there is on the opposite side. The ease of which an object can be balanced depends greatly on the location of its centre of gravity.

Newton's Laws of Motion

Newton's 1st Law: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force. This law is often called the "law of inertia." The vibrating motor provides an unbalanced force that causes the buzzbot to move erratically.

Newton's 2nd Law: Acceleration is produced when a force acts on a mass. The greater the mass of the object being accelerated, the greater the amount of force needed to accelerate the object. If you built a larger, heavier buzzbot, you may need to use a larger, more powerful motor to move it because of the increase in mass.

Newton's 3rd Law: For every action, there is an equal and opposite reaction. This law describes how the friction we create works.