Vector®

EPro8 Challenge

Practice Challenges

These challenge cards are provided so that teams can practice and prepare for the Vector Vector EPro8 Challenge.

During the Vector EPro8 Challenge teams will be based at a workstation containing gears, motors, pulleys, aluminium extrusion, weights, wheels, electronics blocks, cable, wing nuts, bolts and much more.

The scope of these practice challenges is limited to equipment readily available to schools.

You can complete all parts of a challenge, or select which parts you wish to complete. They can be done in any order.

Each challenge has a “Criteria” and a “Hint”.
Criteria is what you will be judged on.
Hints are some ideas. You won’t be judged on the hints and don’t need to follow them.

Engineer Problem Solve Innovate

Format

Each team should consist of four students. Each team should be supplied with the equipment shown below.

Teams have 2 ½ hours to finish as many challenges as they can. There is no "correct" answer for each challenge. Provided they achieve the criteria any solution is fine. It's great to think outside the square.

Start by explaining the rules and demonstrating the equipment.

Equipment

During the actual EPro8 Challenge teams will be based at a workstation containing gears, motors, pulleys, aluminium extrusion, weights, wheels, electronics blocks, cable, wing nuts, bolts and much more.

It is not practical to supply all schools with this equipment. Instead these practice challenges are designed around equipment that can be purchased locally. Purchase enough equipment so that each team has access to one set.

Item	Price	Supplier
48 bamboo garden stakes, 24 x 900mm long, 24 x 600mm long	$18	Mitre 10 Mega
1 rolls insulation tape	$3	Mitre 10 Mega
15m rope (3mm diameter)	$5	Mitre 10 Mega
1 tape measure	$6	Mitre 10 Mega
20mm Pulleys	$7	Mitre 10 Mega
2 small clamps	$4	$2 Shop
Packet balloons	$2.50	The Warehouse
1 banana box	-	Pak n Save
2 scooters	-	Your Students
1 Nurf Gun, with bullets	-	Your Students
4 2l milk bottle, full of water	-	
Rubber bands	-	
Drawing pins	-	
Scissors	-	
Sellotape	-	
Green card	-	
Pens	-	

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Alien Racing

Catch an alien, train it, and then take it to an arena to race other aliens.

What could be more fun than that?

The best alien arenas have tracks with an obstacle course. Some of the obstacles are challenging for the aliens and some are downright impossible.

Alien Capture		
Criteria	Decorate a banana box to look like an alien. Only stick things onto the box, with nothing poking out. It must have at least five distinctive “alien” features. Measure the alien’s height, length and width (in mm).	40 Points

520 x 240 x 410

Caution: Aliens are very dangerous. Now that you have captured and measured the alien you must not come within two metres of the alien.

The only person who can touch the alien is the judge and they can only touch it when judging a challenge.

Crawling		
Criteria	An obstacle has a barrier arm less than 300mm above the ground, but high enough that the alien can crawl under it.	40 Points
Hint	Draw a picture first Think carefully about the dimensions first. Use the insulation tape to join the bamboo stakes.	

Jump		
Criteria	A wall is approximately 900mm tall and 1.6m wide. The only way past the wall is to go over it (or cheat and go around it. Aliens…)	50 Points
Hint	Draw a picture first. Dimensions, dimensions, dimensions…	

Trap		
Criteria	Two 1m long fences run roughly parallel creating a corridor. At the entrance the gap is big enough for the alien to fit. The gap gradually gets narrower so that the alien will get stuck somewhere in the second half of the corridor.	50 Points
Hint	Dimensions, dimensions, dimensions…	

Start Cage		
Criteria	A cage is big enough to hold the alien inside yet small enough that the alien has less that 100mm movement. There are no gaps big enough for the alien to fit through (including the roof of the cage).	60 Points
Hint	Diagonal bracing on each side of the box will make it much stronger.	

Start Gate		
Criteria	The cage has a gate on it. The alien cannot open the gate by pushing on it. You can open the gate from 2m away.	40 Points

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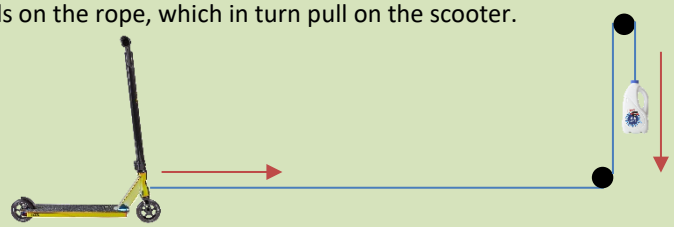
Driverless Scooter

It is just not fair. Your mum won't let you ride your scooter on any dangerous roads or near any cliffs.

Wouldn't it be safer if a scooter didn't require a rider? Then the scooter could go to all sorts of dangerous places and do all sorts of dangerous tricks.

Four Wheeled Scooter		
Criteria	Two scooters are joined together. The scooters can be pulled by a rope. They travel in a straight line	50 Points
Hint	Two wheeled vehicles are unstable. They require something to control their balance (eg the rider). Four wheeled vehicles are stable. Try lashing the scooters together with bamboo and rope.	

Remote Steering		
Criteria	All your team members must be at least 2m from the scooter. The scooter can be pulled using a rope. The scooter can turn to the left then to the right	40 Points

Driverless		
Criteria	The scooter is connected to a rope. The rope feeds through pulleys up and over a door (or other similar classroom structure). A bottle is connected to the end. When the bottle is let go, the scooter moves forward.	50 Points
Hint	The weight pulls on the rope, which in turn pull on the scooter. 	

Speed		
Criteria	Time how long it takes the scooter to travel 1.5m. Calculate how far the scooter can travel 1m. Calculate how far the scooter can travel in 1 hour.	40 Points
Hint	Varying the weight will changes the force on the rope. This is the force applied to the scooter. The force on the scooter is what controls its speed.	

Delivery Vehicle		
Criteria	The scooters carry a load of two x 2L milk bottles. Adjust the weight on the door until the time for the loaded scooter to travel 1.5m is the same as it was for the unloaded scooter.	50 Points
Hint	The force on the string doesn't change, as this is the weight hanging from the door. A loaded scooter will not speed up as much	

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Lunch Box Booby Trap

Celery sticks are the best. You pack celery sticks with your lunch every day.

But it seems word is getting out. Your celery sticks are going missing from your lunch box.

You suspect it is “Jeff”, the classroom rabbit – but have no way of proving it.

Build a booby trap alarm that will automatically activate the moment your lunch box is lifted. It needs to scare the villain or even trap the culprit inside.

Drop Alarm		
Criteria	When the lunch box is lifted an object drops onto the ground making a sound.	40 Points
Hint	A trap or alarm works by using a small amount of energy to release a much larger amount of stored energy. For example a trip wire might trigger a switch that releases the energy stored in a battery, allowing an ear piercing siren to sound. Energy can be stored in a number of ways: • Electrically (charging a battery) • Gravitationally (lifting an object - a rock before you drop it on your foot) • Mechanically (stretching a spring or a rubber band) You will need to make a trigger – like a lever or hook – that will be released when the lunch box is lifted.	

Long Distance Alarm		
Criteria	A balloon is at least five metres away from the lunchbox. When the lunch box is lifted the balloon pops.	40 Points

Fox		
Criteria	When the lunch box is lifted, and image of a fox appears next to the lunch box	50 Points

Trap		
Criteria	Lifting the lunchbox activates a trap, capturing any object that is close to the lunch box.	60 Points

Nerf Gun		
Criteria	When the lunchbox is picked up, a nurf gun fires one nurf dart towards the lunchbox (and hopefully the rabbit)	60 Points

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