

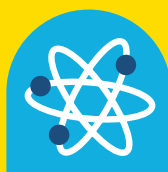
Suitable for  
3-7 years

- ✓ Solo
- Pairs
- Groups

Sara's activity

# Space Rover Worksheet

Resource Pack



## Components of a Rover

The below tables describe the different components, and instruments, that can be included on the Mars Rover. The table gives details of the mass and cost of the various items. For the components advantages and disadvantages of the relative choices are given. For the instruments a description of their function is provided with a link to find out more.

Structure			
	Mass	Cost	Comments
<b>Large</b>	100KG	\$45M	The bigger a rover is the more science instruments we can have on board, but this makes the rover a lot heavier! (7 Instrument slots).
<b>Small</b>	50KG	\$25M	A small rover body means we will have to have less instruments on board, but we have lots of mass budget left to pick our instruments! (4 Instruments Slots).

Structure II			
	Mass	Cost	Comments
<b>Mast</b>	15KG	\$10M	A tall mast of a rover gives the rover similar height to a person on the surface. This helps people on Earth understand the surroundings better. But they are heavier!
<b>Short Mast</b>	10KG	\$5M	The short mast means we can't quite see from the same height a person would, but it is much lighter!

Locomotion			
	Mass	Cost	Comments
<b>4 Wheels</b>	20KG	\$25M	Four wheels, like a car, are much lighter than the rocker-bogey 6 wheel system. But, they are much less stable when driving around Mars!
<b>6 Wheels</b>	30KG	\$35M	6 wheels, or a rocker-bogey system, give the rover better ability to move around on the uneven surface of Mars. They are a heavier choice though!
<b>Tracks</b>	35KG	\$30M	Tracks can be slower than wheel, but they are helpful if we have to travel up steep hills!
<b>Legs</b>	35KG	\$30M	Rovers with legs can be a bit slower than wheels and uneven surfaces can be a challenge. The rover is more manoeuvrable though and can climb out of craters if it gets stuck!

## Power

	Mass	Cost	Comments
<b>Solar + battery</b>	20KG	\$15M	Solar panels and batteries are quite light, but the panels need to charge in the sun. We have to make sure our rover has enough time to charge. Dust storms can also cause issues when they cover the solar panels in dust!
<b>Battery</b>	10KG	\$10M	Battery only powered rovers are very light and reliable but only has a small, fixed amount of power, so our mission can't go on for as long.
<b>RTG + Battery</b>	150KG	\$150M	A RTG or Radio thermonuclear Generator is a very reliable power system. It can sustain more instruments for a longer time but takes up a large chunk of our mass and cost budgets!

## Sensors

	Mass	Cost	Comments
<b>Stereo Camera system</b>	4KG	\$15M	A stereo camera system has two camera on either side of the rover head, like our eyes. This allows the rover to see in 3D and build a map of the terrain around it.  <a href="#">Link to similar instrument: PanCam</a>
<b>Single Camera System</b>	2KG	\$5M	We can still create 3D images with a single camera system but we need several images to reconstruct 3D information- this takes time and data up on mission!

## Instruments – Add ons

	Mass	Cost	Comments
<b>Multispectral camera</b>	7KG	\$5M	Multispectral Cameras let us look at how light and matter are interacting on Mars. It helps us see the fingerprints of materials. We can compare these fingerprints to observations on earth and figure out what we can see on Mars.  <a href="#">Link to similar instrument: PanCam</a>
<b>HR Colour Camera</b>	5KG	\$2M	A High-resolution colour camera lets us see really high detail images of targets on Mars. This helps us understand small features and textures.  <a href="#">Link to similar instrument: CLUPI</a>

<b>Microphone</b>	2KG	\$2M	A Microphone on the rover mean we can listen to Mars, the winds, maybe even seismic activity! <b>Link to similar instrument:</b> <a href="#">Microphone</a>
<b>Laser Camera</b>	10KG	\$10M	Laser cameras use laser light to evaporate targets on Mars and then take data of the sample. This gives us chemical information about what the target is made of. <b>Link to similar instrument:</b> <a href="#">ChemCam</a>
<b>Environmental Sensor</b>	2KG	\$2M	Environmental Sensors help us to understand the conditions at the landing site. They measure temperature, pressure, wind, radiation and humidity. <b>Link to similar instrument:</b> <a href="#">REMS</a>
<b>2m Drill</b>	30KG	\$50M	A large drill like this can help us take samples from deeper in the Martian surface, below the high radiation where life might exist! <b>Link to similar instrument:</b> <a href="#">Drill</a>
<b>Sample Collection</b>	40KG	\$100M	Our drill samples have to be kept and analysed on board the rover inside the sample collection unit. This lets us investigate our samples for signs of life. <b>Link to similar instrument:</b> <a href="#">ALD</a>
<b>Radiation sensor</b>	3KG	\$2M	Radiation sensors help us understand the environment the rover is working in. This means we can improve our understanding for protecting future rovers on the surface <b>Link to similar instrument:</b> <a href="#">RAD</a>
<b>Ground penetrating radar</b>	10KG	\$15M	Ultra-high frequency radar pulses are aimed at the ground around the rover. The reflection of these pulses helps us map the ground beneath the rover to work out what it's made of. This can help us select safe drill sites! <b>Link to similar instrument:</b> <a href="#">Wisdom</a>
<b>X-ray Camera</b>	10KG	\$10M	X-ray cameras can help us find information about which elements are in a sample down to tiny, tiny scales. This helps us look for life on Mars. <b>Link to similar instrument:</b> <a href="#">PIXL</a>
<b>Rover Arm</b>	40KG	\$50M	Adding a rover arm is heavy but it is much more manoeuvrable and gives us more space for scientific instruments! (2 Extra instrument spaces) <b>Link to similar instrument:</b> <a href="#">Rover Arm</a>