How high can you jump on other planets?

Background Information

Weight and mass are very different even though the words are used interchangeably in the English language. **Mass** is a measure of the total amount of material or matter that makes up a body and is measured in kg. **Weight** is a measure of how much **force** pulls on a body and is measured in Newtons (N).

Weight is dependent on mass and acceleration or gravity 'g'.

The mathematical relationship can be described with the following equation:
W = m x g (N)

'g' varies according to which planet you are standing on. In general, planets with more mass have stronger surface gravity.

On the Earth's surface g = 9.8kg/m/s2 (where m = metres and s = seconds).
If your mass is 70kg, then your
Weight = 70 x 9.8 = 686 N

So your **weight can vary according to which planet you are standing on**, however **your mass stays the same.**

Students are provided with relative scaling factors for the surface gravity of the Sun, the other planets in our Solar System, Pluto (a dwarf planet) and the Moon. With this information they can calculate and compare the heights of their jumps and the reading that bathroom scales (calibrated on Earth) would have if they were to stand on the different bodies in the Solar System.

The stronger the surface gravity, the more they are pulled by the planet, moon or star so it would make it more difficult for them to jump.

Object	Surface Gravity (ms-2)	Surface Gravity relative to Earth
Earth	9.8	1
Sun	273.42	27.9
Mercury	3.72	0.38
Venus	8.92	0.91
Mars	3.72	0.38
Jupiter	23.13	2.36
Saturn	9.02	0.92
Uranus	8.72	0.89
Neptune	10.98	1.12
Pluto (dwarf planet)	0.59	0.06
The Moon	1.63	0.16

How high can you jump on other planets? Worksheet

Introduction

The larger the mass of the planet, moon or star, the more it would pull on you and the harder it would be to jump.

What you need

• metre ruler
• pencil
• paper
• adhesive tape
• scales

What to do

Work in pairs.

1. Tape the metre ruler against a table leg or bench so that it is vertical.
2. One student should kneel down so that their eyes are level with the ruler.
3. The other student should stand between the first student and the ruler. (Refer to drawing below).
4. The student who is standing jumps as high as they can while the other student records the height they achieved.
5. Repeat the jumps two more times so that an average value can be calculated.
6. Change positions so that each person gets a turn at jumping.
7. Calculate an average value for 'h' by following the instructions in the table below (Table 1).

Table 1

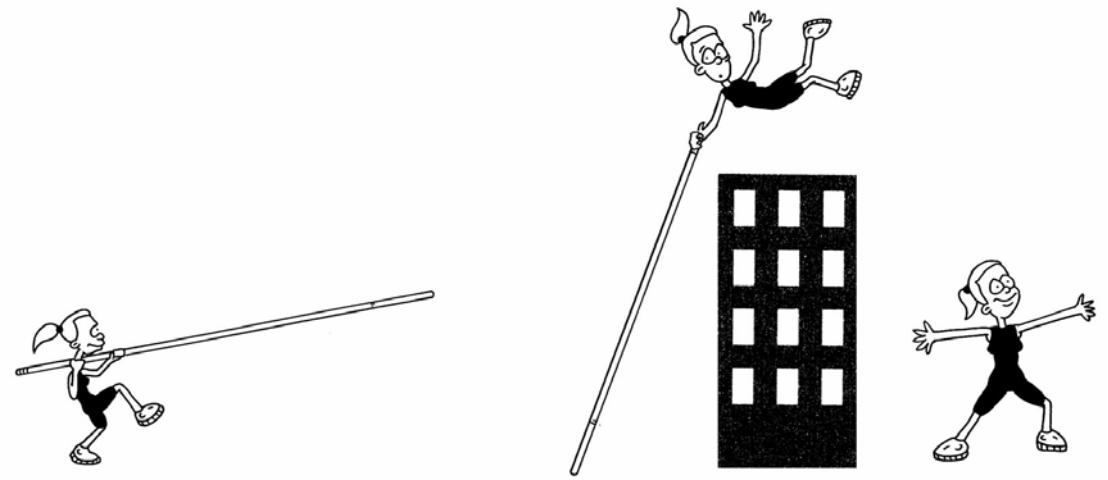
Student Name	Jump height no. 1 (m)	Jump height no. 2 (m)	Jump height no. 3 (m)	Average (h) (1+2+3)/3 (m)

Write the average value for 'h' in table 2 in the first row for Earth. Using this value, you can now calculate how high you can jump on other planets as well as the Moon and the Sun by following the instructions in the table.

You can also calculate what a bathroom scale would read if you were standing on each object. Refer to Table 2.

Table 2

Member of the Solar System	Surface gravity compared to Earth	I can jump this high in metres (divide height 'h' on Earth by surface gravity)	This is what the scale would read in kg if I was standing on the given members of the Solar System. (Multiply scale reading on earth by the surface gravity).
Earth	1	h =	S =
Sun	27.9	h/27.9 =	S x 27.9 =
Mercury	0.38	h/0.38 =	S x 0.38 =
Venus	0.91	h/0.91 =	S x 0.91 =
Mars	0.38	h/0.38 =	S x 0.38 =
Jupiter	2.36	h/2.36 =	S x 2.36 =
Saturn	0.92	h/0.92 =	S x 0.92 =
Uranus	0.89	h/0.89 =	S x 0.89 =
Neptune	1.12	h/1.12 =	S x 1.12 =
Pluto (dwarf planet)	0.06	h/0.06 =	S x 0.06 =
The Moon	0.16	h/0.16 =	S x 0.16 =



Questions

1. On which member of the Solar System would you be able to jump:
   (i) highest?
   (ii) lowest?
2. Why do you think you would be able to jump higher on Mercury than on Neptune?
3. If you wanted to break the world record in high jump, on which planet would you choose to perform your jump? Why?
4. What other sporting records might you be able to break on this planet?