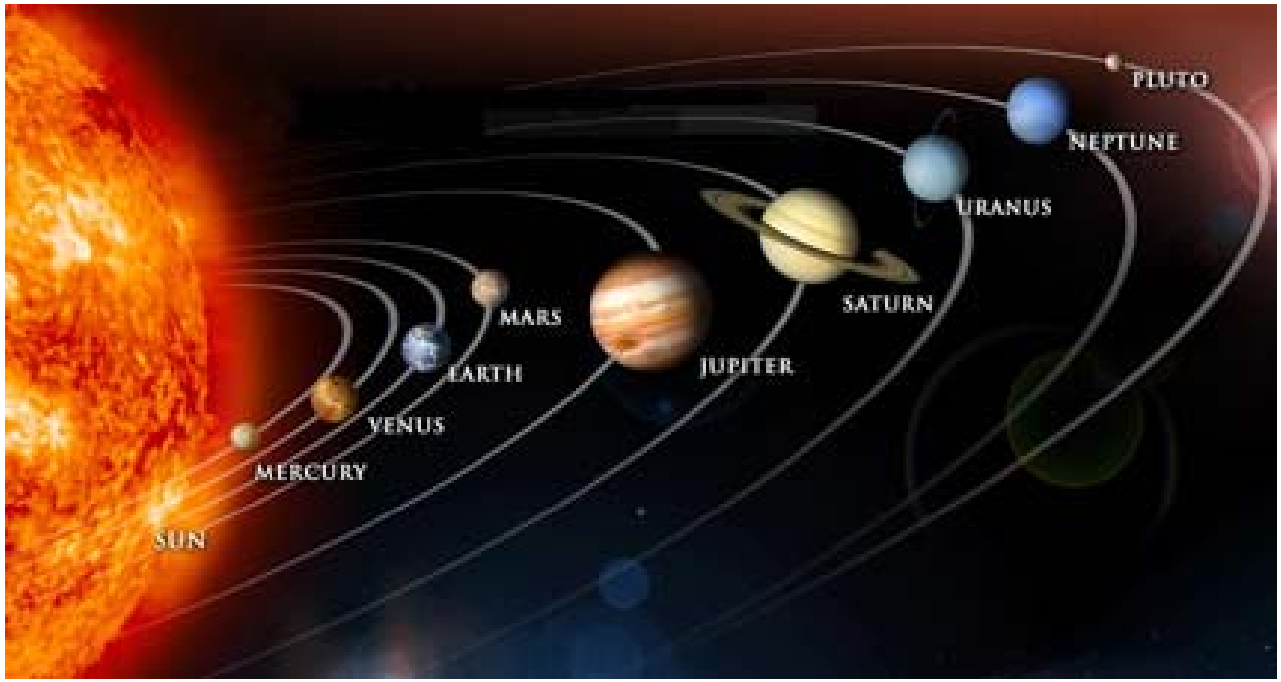
# What do these all have in common?



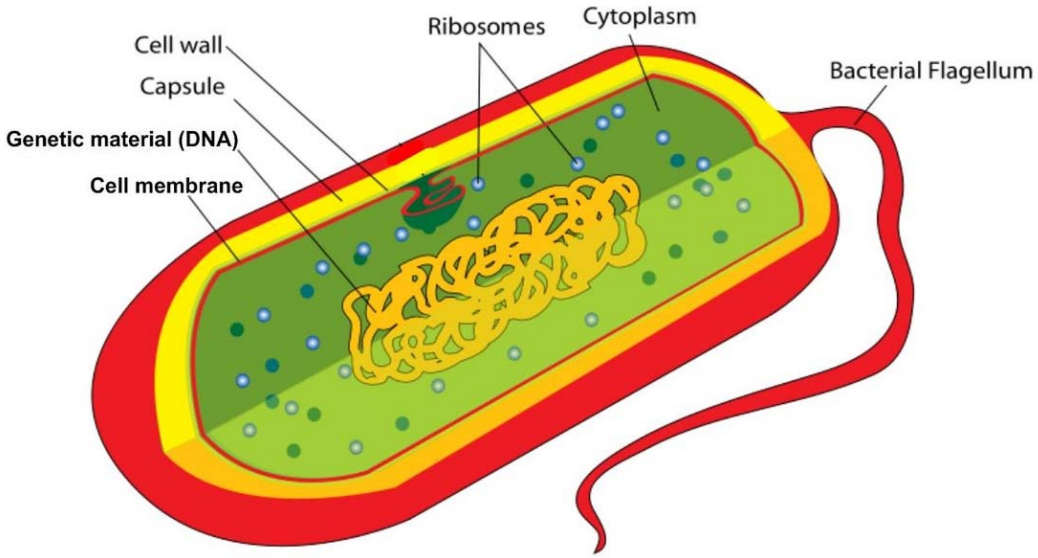

# Scale models

- L Objective : use a ‘scale factor’ to create a scale model for the solar system




**BIG STUFF**

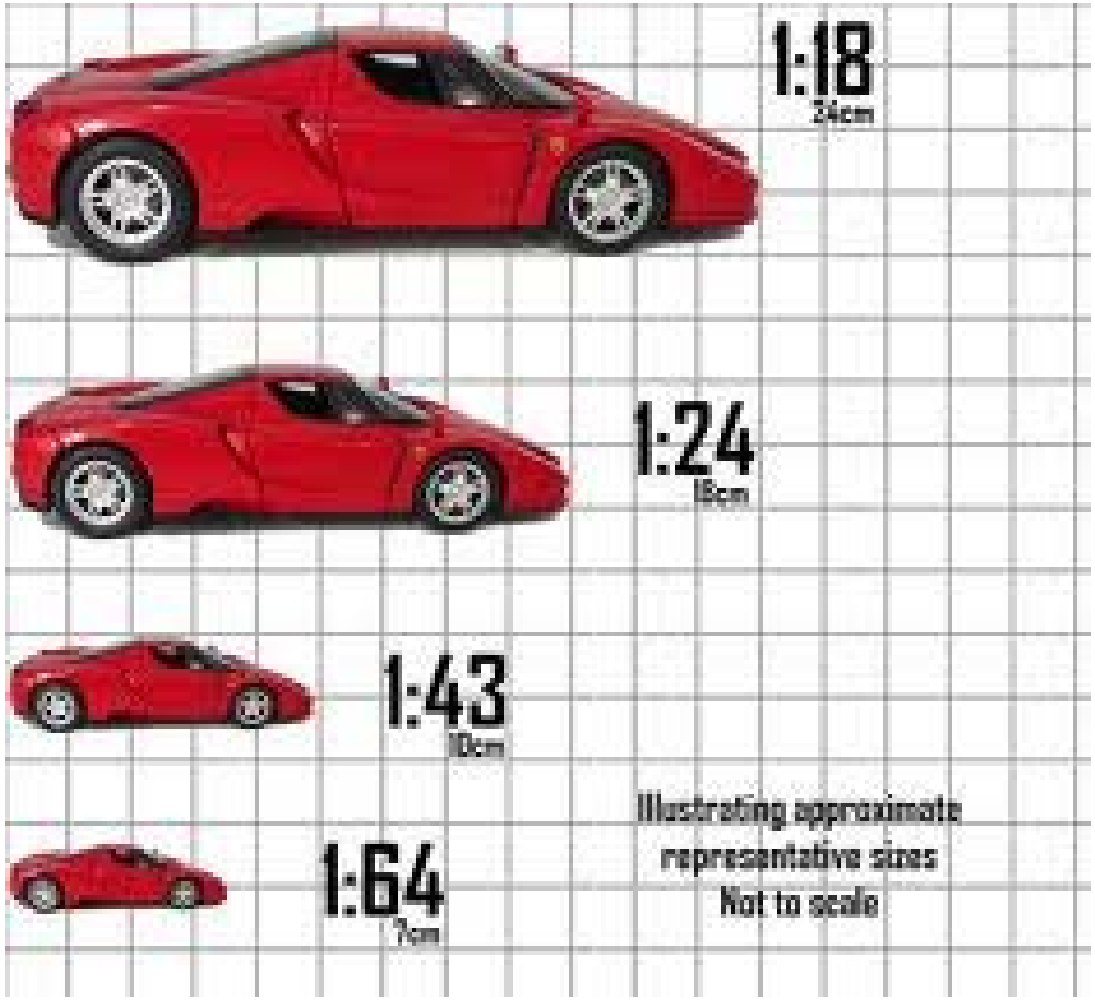
## Bacterial cell




**LITTLE STUFF**

# Scale factors

- In order for something to be ‘to scale’ we need all the parts to be bigger or smaller by **the same amount**
- A 1:1 scale would be the same size



# Modelling the solar system at home

- Think about an image of the solar system (not including Pluto)
- Imagine you could reduce everything down so it could fit in your back garden-say (20m)
- Write the names of the people in your family/friends on each Post-It note.
- Then write the name of one planet onto each Post-It (Mercury, Venus, Earth, Mars, Jupiter, Saturn Uranus, Neptune)

# Order of the planets

- Mercury
- Venus
- Earth
- Mars
- Jupiter
- Saturn
- Uranus
- Neptune

# Scale model

- Start at the back of your house.
- This is the edge of the Sun
- Move down the garden, placing the Post-Its on the floor or wall where you ***think*** the planet would be on that scale.

# Modelling the Solar System

| Planet | Actual distance from Sun (km) | Scaled distance (m) |
|---|---|---|
| Mercury | 60,000,000 | |
| Venus | 110,000,000 | |
| Earth | 150,000,000 | |
| Mars | 230,000,000 | 1.0 |
| Jupiter | 780,000,000 | |
| Saturn | 1,430,000,000 | |
| Uranus | 2,880,000,000 | |
| Neptune | 4,590,000,000 | |

# Producing an accurate scale model

- The furthest real distance we need to deal with is from the Sun to Neptune (4,590,000,000km)
- The furthest distance we have on our scale is 20m
- So we need to fit 4,590,000,000 into 20m
- 4,590,000,000 / 20 = 229,500,000
- We can round this up to 230,000,000
- So our model will be a 1 : 230,000,000 scale

# Modelling the Solar System

| Planet | Actual distance from Sun (km) | Scaled distance (m) |
|---|---|---|
| Mercury | 60,000,000 | |
| Venus | 110,000,000 | |
| Earth | 150,000,000 | |
| Mars | 230,000,000 | 1.0 |
| Jupiter | 780,000,000 | |
| Saturn | 1,430,000,000 | |
| Uranus | 2,880,000,000 | |
| Neptune | 4,590,000,000 | |

# What does that mean?

- A 1 : 230,000,000 scale means that each metre of the garden represents 230,000,000km for the real distance.
- So once we know the real distances, all we need to do is divide that by 230,000,000 and we will have the scale distance **in metres.**
- For example, the real distance from the Sun to Mars is 230,000,000km
- So 230,000,000 / 230,000,000 = 1m
- **On our model, Mars is 1m away from the Sun**

# Modelling the Solar System

| Planet | Actual distance from Sun (km) | Scaled distance (m) |
|---|---|---|
| Mercury | 60,000,000 | 0.26 |
| Venus | 110,000,000 | 0.47 |
| Earth | 150,000,000 | 0.65 |
| Mars | 230,000,000 | 1.00 |
| Jupiter | 780,000,000 | 3.39 |
| Saturn | 1,430,000,000 | 6.22 |
| Uranus | 2,880,000,000 | 12.52 |
| Neptune | 4,590,000,000 | 20.0 |

Did you put your Post-its in
the right place?
Check your post its against the correct
scale in the table.

# Purple pen reflections

- Did you put your first Post-Its close to any of the scale distances?
- What do you notice about the rocky planets (Mercury, Venus, Earth and Mars)?
- Why do you think scientists show the planets ‘incorrectly’ – like the image earlier on?
- Two things which surprised me are…
- Two questions I would like to ask are…

# Extension question

- The next closest star to Earth is called Proxima Centauri. It is 40,000,000,000,000,000m away.

- An e-coli bacteria is 0.0000004m in length.

- How many bacteria could you fit (end to end) in the gap space between the Earth and Proxima Centauri?

# How near is the nearest star (our next door neighbour in the Milky Way galaxy) on the scale we have used for the solar system?

Distance to nearest start (proxima centauri) = 4.2 light years.

Converting this into km = 4.2 ly x speed of light in km/s x number of seconds in a year

Distance in km = 4.2 x 300,000 x 31,536,000 = **$3.97 \times 10^{13}$**

Using our scale of 1:230,000,000

Scaled distance in metres = $3.97 \times 10^{13} \div 230{,}000{,}000$

Scaled distance in metres to the nearest star = **172,762 metres (or nearly 173km)**

This is more than the distance from Wigan to Birmingham!