- The sodium-potassium pump moves sodium ions out of the neurone, but the membrane isn't permeable to sodium ions, so they can't diffuse back in. this creates a sodium ion electrochemical gradient because there are more positive sodium ions outside the cell than inside.
- The sodium-potassium pump also moves potassium ions in to the neurone, but the membrane is permeable to potassium ions so they move back out through potassium ion channels.
- This makes the outside of the cell positively charged compared to the inside

Action potentials

Neurone cell membranes become depolarised when they are stimulated.

- **stimulus –** this excites the neurone cell membrane, causing sodium ion channels to open. The membrane becomes more permeable to sodium, so sodium ions diffuse into the neurone down the sodium ion electrochemical gradient. This makes the inside less negative.
- **Depolarisation –** if the potential difference reaches threshold level (around -55mV) voltage gated sodium ion channels open. More sodium ions diffuse into the neurone. This is positive feedback.
- **Repolarisation –** at a potential difference of around +30 mV the sodium ion channels close and voltage gated potassium ion channels open. The membrane is more permeable to potassium so potassium ions diffuse out the neurone down the potassium ion concentration gradient. This starts to get the membrane back to its resting potential. This is negative feedback.
- **Hyperpolarisation –** potassium ion channels are slow to close so there's a slight 'overshoot' where too many potassium ions diffuse out of the neuron. The potential difference becomes more negative than the resting potential (less than -70mV)
- **Resting potential -** the ion channels are reset. The sodium-potassium pump returns the membrane to its resting potential and maintains it until the neurone is excited by another stimulus.

The action potential creates a wave of depolarisation

- When an action potential happens, some of the sodium ions that enter the neurone diffuse sideways
- This causes sodium ion channels in the next region of the neurone to open up and sodium ions diffuse into that part.
- This causes a wave of depolarisation to travel along the neurone.