How does a Gel Electrophoresis work?

Equipement:
Signs for: Big DNA Fragment, small DNA fragment, plus pole, minus pole, gel

12 Students in different roles:

- 8 are playing the agarose gel (in 4 rows, two students each row; between the students are the pores of the gel
- 2 are playing the plus and minus pol, left and right of the gel
- A tall student plays the big DNA fragment
- A small student plays a small DNA fragment

The big and the small DNA fragment are waiting close together (in the wells of the gel) next to the negative pole. DNA is negatively charged by the phosphate groups.
If electricity is switched on both DNA fragments start at the same time to enter the gel, driven by the currency and to migrate as fast as possible in the direction to the plus pole.

Migration speed of both fragments inside the gel is different, because a smaller fragment migrates faster through the pores of the gel in comparison to a larger fragment.

If both fragments are inside the gel, mentor team switches off the electricity. Consequence is that migration of both fragments stops immediately.
At this moment the following situation of both fragments inside the gel must be visible for the audit:
Because the smaller fragment has a higher migration speed inside the gel in comparison to the bigger one the smaller one migrates inside the gel closer to the positive pole.

Mentor team explains the different migration speeds of DNA fragments depending on different length (number of nucleotides) inside the gel by using the model to make rules about gel electrophoresis visible.

Details about the consistence of the gel:
Gel is made out of a specific percentage of agarose dissolved in gel electrophoresis buffer. Agarose is a linear polysaccharide out of monosaccharide glucose building a net of molecules containing pores inside. As higher the percentage of agarose is in the gel as smaller are the pores in the gel. If you have to separate a mixture out of small DNA fragments in a gel electrophoresis it`s necessary to use a higher concentrated agarose gel witgh small pores. The solid net of agarose molecules keeps together by hydrogen bonds (H brigdes). H bridges are weak forces between agarose molecules not real chemical bindings. If the gel is heated up it gets liquid and can`t be used in gel electrophoresis. This is the reason why voltage is limited in a gel electrophoresis. Above 200 Volt resistance of the gel is very high, gel heats up and gets liquid.