Permeability

Effect of Grain size ***D***

Take two large funnels with gauze in the bottom one filled with sand and the other gravel or pebbles. A litre of water is poured into each to see how long it takes to flow through.

Effect of grain size ***D F***

Draw and shade in 20 or so circles which are nearly touching to represent grains. Make enlarged and reduced copies of this. Mark around each circle a rim 5mm wide which represents the water held by capillary attraction. The gaps through which the water can flow get smaller as the grain size decreases and with small grains there is no gap at all.

Flow through rock ***D***

A tube is glued to the flat surface of a piece oolitic limestone and filled with water. A paper cap is put on the top to stop evaporation. The water level drops slowly as it sinks in to limestone.

Flow of oil and water ***E P F 30 min for each experiment***

The purpose of these experiments is to demonstrate the effects of grain size, sorting, length, cross sectional area, temperature and pressure on permeability.

A number of short tubes (100ml measuring cylinders with the base sawn off) are filled with sediment and the time water takes to flow through them is measured.

Coefficient of permeability *E P F 30 min per tube*

This experiment measures the coefficient of permeability for various grain sizes. Tubes, 1.5m long, are filled with well sorted sediment of known grain size. The tube is filled with water. The time the water takes to fall each 10cm is recorded.

Darcy's laws of permeability *E P F 45 min per tube*

The purpose of this activity is to determine how the quantity of water passing though an aquifer is affected by the hydraulic gradient, the diameter and the length of the aquifer. Transparent vertical tubes filled with water are connected to horizontal tubes of varying lengths and diameters filled with sediment. The volume of water flowing through each in five minutes is measured.

Speed of flow *Pa I 3 min*

Students calculate the speed of flow of water that arrives at an oasis in Libya having fallen as rain in the Atlas mountains 1000km away. Radiometric dating indicates that the water entered the aquifer 10,000 years ago.

Infiltration *A P F 30 min*

The speed at which water infiltrates the soil is measured using a piece of 10cm diameter plastic pipe. This can be done at several places around the school or college.

Hydraulic gradient *D*

A vertical tube filled with water is attached to a horizontal tube filled with sediment. The pressure at various places along the horizontal tube is measured using thin vertical tubes. Students can see or plot the relationship between the height of water in the vertical tubes and the distance to the outflow.

Hydrostatic pressure *D*

A tall cylinder has three equally spaced holes drilled into it. If filled with sediment one can demonstrate that the water rises to the same level and thus that the water pressure is not effected by the presence of sediment.

When the cylinder is full the water squirts out of the holes. The distance it comes out increases with the height of water above that hole in the

cylinder showing how the pressure increases with depth below the water table. This cylinder used to be available from Griffin Education and was called a spouting cylinder.