Isostasy and Gravity

The pull of gravity at any point varies with the mass of the rock below. If there are more rocks or rocks of greater density then the value of gravity will be higher than normal (= positive anomaly). If there is less mass below then the value will be lower. Normal can be taken as the pull of gravity over the oceanic crust where there are no volcanoes.

Instructions

1 A volcano builds up rapidly. Place the volcano including the top part so that the base rests on the oceanic crust, level with A.
If the pull of gravity is measured above the volcano at point x will the pull be greater or less than elsewhere over the oceanic crust?

2 The volcano ceases to erupt and begins to sink into the mantle until the weight of the volcano is the same as the volume of mantle which has been displaced. It is now in isostatic equilibrium.
Move the volcano including the top part so that its base is level with B.
Will the pull of gravity as measured at point x be the same, more or less than normal?

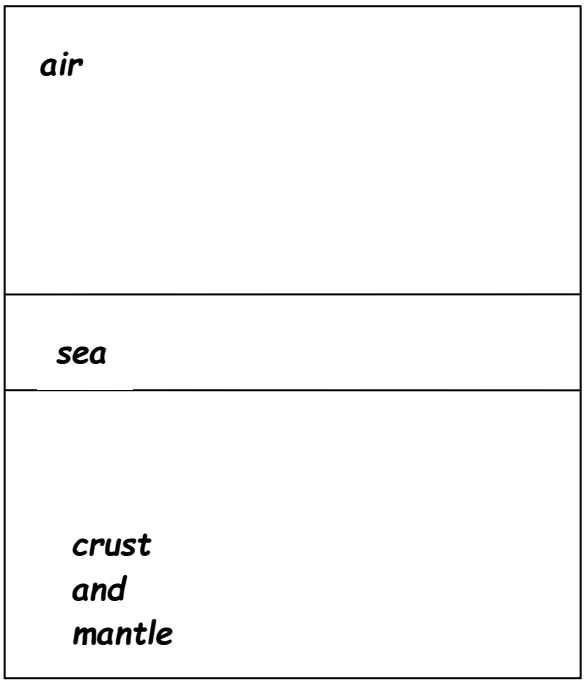
3 The waves and rain now erode away that part of the volcano above sea level.
Remove the top part of the volcano.
Will the pull of gravity at point x now be the same, more or less than normal?

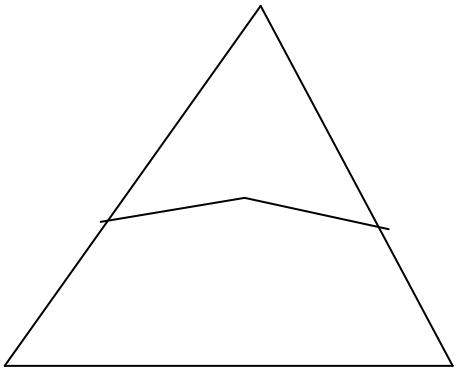
Teacher's Section

The extra mass of the volcano means that the pull of gravity will be greater than normal, so there will be a positive gravity anomaly.
After the volcano has sunk and reached isostatic equilibrium there will be no extra mass because the extra weight of the volcano is compensated for by the mantle which has been displaced. So there is no gravity anomaly.
However, either side of the volcano, over the trough there will be a negative anomaly.
After the volcano has been eroded the mass of the remaining part of the volcano is insufficient to compensate for the mantle that has been displaced so there will be a negative anomaly.

Making the magnetic model

This is a magnetic model and needs to be placed on steel surface, e.g. white board or sheet of galvanised steel. They are made from an A4 sheet of thin card with coloured paper stuck on it as in the photos below. Magnetic strips are stuck onto the back. The volcano is made from stiff card and both parts have magnetic strips on the back.






AIR
VOLCANO
SEA
MANTLE