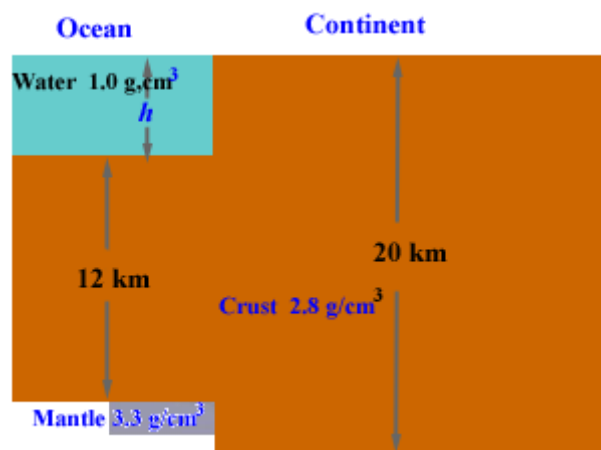


65.

Problem 15.22P (HRW)

We are given a situation in which the ocean is about to overrun the continent. From the data given in the figure and the method of compensation we have to estimate the depth of the ocean.



Solution:

In analysing certain geological features, it is often appropriate to assume that the pressure at some *horizontal level of compensation*, deep inside the Earth, is the same over a large region and is equal to the pressure exerted by the weight of the overlying material. That is, the pressure on the level of compensation is given by the fluid pressure formula.

We will estimate the depth h of the ocean from the data given in the diagram by using the concept of *level of compensation*. That is we will require that the pressure at a depth of the continent and at the same depth below the ocean be the same.

Pressure at a depth of 20 km below the continent will be

$$P_{\text{continent}} = 20 \times 10^3 \times 2.8 \times 10^3 g.$$

Pressure below the ocean will have three contributions.

$$P_{\text{ocean}} = 1.0 \times 10^3 \times g \times h,$$

$$P_{\text{crust}} = 12 \times 10^3 \times 2.8 \times 10^3 \times g,$$

and

$$P_{\text{mantle}} = (20 - 12 - h) \times 10^3 \times 3.3 \times 10^3 \times g.$$

Level of compensation implies

$$P_{\text{continent}} = P_{\text{ocean}} + P_{\text{crust}} + P_{\text{mantle}}$$

Solving the algebraic equation, we find

$$h = 1.74 \text{ km.}$$