In an experiment to find the density of coconut oil you are provided with the following:

(1) U-tube mounted on to a vertical frame with appropriate scales
(2) Water and sufficient amount of coconut oil
(3) Funnels.

(a) (i) Draw a labelled diagram of the experimental setup, clearly showing the levels of wat and coconut oil columns and their common interface.

(ii) On the diagram drawn above mark, as h_1 and h_2, the two measurements that you hav to take.

(b) If the densities of coconut oil and water are given by d_1 and d_2 respectively, write down an expression for d_1 in terms of d_2, h_1 and h_2.

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(c) (i) Select the correct procedure out of the following in order to draw a graph in determining d_1

(1) Adding more water to the respective arm.
(2) Adding more coconut oil to the respective arm.

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(ii) Give the correct reason for not selecting the other procedure.

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(iii) In such a graph the gradient is found to be 0·87. Determine the density of coconut oil (density of water = 10^3 kg m^{-3}).

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(*d*) In this experiment which liquid should be poured into the U-tube **first**. Give reasons for your answer.

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(*e*) If you want to determine the density of coconut oil with a fractional error of 0·1, what should be the minimum height possessed by a liquid column? Assume that the height of a liquid column can be measured with an accuracy of 1 mm.

[**Hint:** Fractional error of density $\left(\frac{\Delta d}{d}\right)$ = 2 × fractional error of height of a liquid column $\left(\frac{\Delta h}{h}\right)$]

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(*f*) What is the experimental **disadvantage** of using mercury instead of water in this experiment?

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