2. A part of an experimental setup that is used to determine the thermal conductivity of a metal using Searle's method is shown in the figure.
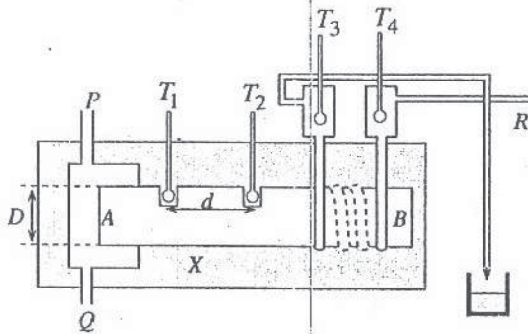
(a) Draw a figure of the apparatus that you need to connect to tube R, in the **appropriate place** of the space in front of R. Clearly show how you would connect the apparatus to R.

(b) What additional instruments are essential in order to perform this experiment?

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(c) End A of the metal bar is heated using steam. Give **two** reasons as to why it is better to send steam through tube P rather than sending through tube Q.

(i) ....

(ii) ....

(d) How do you observe whether the system has reached the steady state?

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(e) How do you achieve a good thermal contact between thermometers T_1, T_2 and the metal bar?

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(f) You are provided with the following set of data related to this experiment.

Reading of the thermometer T_1 (θ_1)	= 75.0 °C
Reading of the thermometer T_2 (θ_2)	= 61.0 °C
Reading of the thermometer T_3 (θ_3)	= 37.0 °C
Reading of the thermometer T_4 (θ_4)	= 28.0 °C
Mass of water collected in 3.0 minutes (M)	= 0.4 kg
Cross sectional area of the metal rod (A)	= 1.2×10^{-3} m^2
Distance between the thermometers T_1 and T_2 (d)	= 0.08 m
Specific heat capacity of water (s)	= 4200 J kg^{-1} K^{-1}

Calculate the thermal conductivity of metal.

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(g) Space X is filled with a good thermal insulator such as polystyrene to reduce the heat loss from the metal bar. Thermal conductivity of air is 0.025 $W\ m^{-1}K^{-1}$ and that of polystyrene is 0.08 $W\ m^{-1}K^{-1}$ which implies that air is a good thermal insulator than polystyrene. Explain why it is still better to fill the space X with polystyrene rather than having air.

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