

CASE STUDY: Global Warming - the forest from the trees

3. Measuring the daily maximum and minimum air temperature.

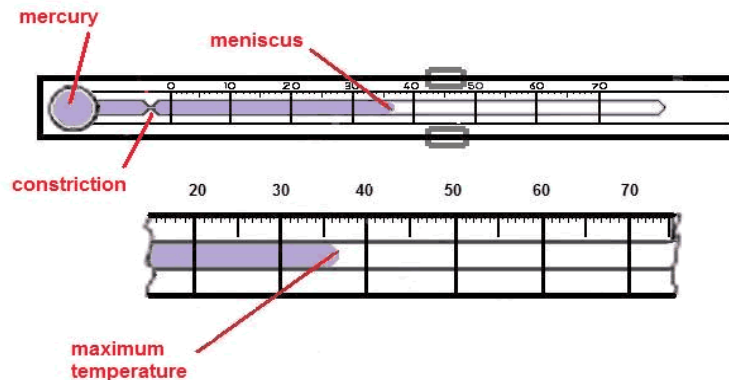
Air temperatures over land are usually measured at a height of between 1.2 and 2.0 m above ground in a Stevenson Screen. Liquid-in-glass thermometers are the traditional instruments used. For measuring maximum temperatures, the liquid is usually mercury. Minimum thermometers, on the other hand, usually contain alcohol because it freezes at a lower temperature (-130°C) than does mercury (-38.3°C). When the bulb of a thermometer is heated, the liquid expands and is forced up the fine bore of the tube, and when the bulb is cooled the liquid tends to contract down the bore.

A maximum thermometer has a constriction just above the bore. If the temperature rises the mercury expands past the constriction, but when the temperature falls the mercury is prevented from receding to the bulb due to the constriction. Thus the mercury in the stem remains at its maximum point of expansion, fixing the position of the highest temperature reached.

A minimum thermometer contains a small dumbbell shaped glass index. When the temperature falls the index is drawn along with the alcohol as it retreats down the bore. After the lowest temperature is reached and the temperature starts to rise again, the alcohol rises in the bore but flows past the index leaving its position fixed. The minimum temperature is read at the upper edge of the stranded index.

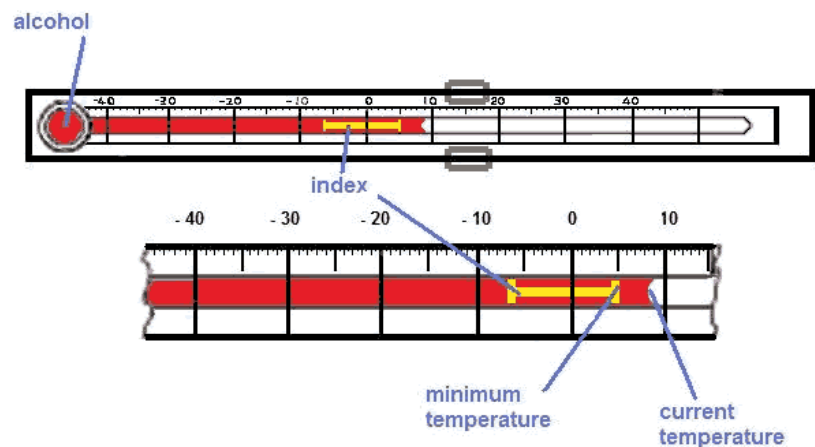
Maximum thermometer

In a maximum thermometer, the mercury thread breaks at the constriction as the temperature falls. To re-set the thermometer, it should be held bulb downwards and shaken until the mercury has been returned to the bulb-side of the constriction.



Minimum Thermometer

In a minimum thermometer, the index is drawn by surface tension back to the minimum position as the temperature falls. The thermometer can be reset by tilting it bulb end upwards, so as to allow the upper edge of the index to rejoin the surface of the alcohol. It must be ensured that bubbles do not form in the alcohol.



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QUESTIONS:

1. Assuming it is 9 am and that the two thermometers shown above have not been reset since 9 am yesterday, determine:

- (a) the highest temperature reached during the last 24 hours;
- (b) the lowest temperature reached during the last 24 hours;
- (c) the current 9 am temperature.

2. Do these temperatures seem reasonable? Why? – Perhaps one or other of the thermometers is in error; perhaps they need to be checked (see **Appendix 2** in the separate **Appendices**).



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