

TEMPERATURE

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Background

Temperature is perhaps the easiest of all analyses but one that may be very inaccurate without the operator knowing it. Many thermometers as they come from the factory are not accurately calibrated. It is safe to assume that the least expensive thermometers will be more often out of calibration than the more expensive. All thermometers should be checked against a certified thermometer at yearly intervals. It is especially important to calibrate thermometers which are used in incubators. The Environmental Conservation Laboratory has access to a certified thermometer and arrangements can be made with you to calibrate your thermometer. Other commercial laboratories also offer this service for a fee.

Equipment

It is necessary to match the thermometer to the application. For general laboratory measurements, the standard, mercury-filled thermometer capable of reading from -20° to 110°C , graduated in degrees, is sufficient. For outside work, this same thermometer can be encased in a metal shield. Thermometers for the coliform water bath incubator must be graduated in 0.1°C divisions as the maximum variation in temperature is only $\pm 0.2^{\circ}\text{C}$.

Procedure

When taking temperatures, make sure that the thermometer has ample time to stabilize at the sample temperature. Also be sure that if the thermometer is a **76 mm immersion** type, it is immersed to the indicated line on the thermometer; if a **total immersion** type, it is totally immersed. Temperature is reported to the nearest 1°C or 0.1°C , depending on the thermometer. It is imperative that temperatures be taken immediately after sampling. It is best to take the temperature in the waste stream rather than to collect a sample and take it back to the lab for a temperature reading.

There is a general method for checking the accuracy of the thermometers which can be done easily right in your lab. First, fill a beaker that is deep enough to cover the submersion line on thermometer in question with a mixture of ice and water. Stir the mixture so that the temperature becomes uniform. Put the thermometer in the mixture until it reads 0°C , or 32°F . Remove the thermometer. Next heat the beaker until the water starts to boil. Insert the thermometer, it should read 100°C or 212°F . If it doesn't this may be due to differences in elevation/barometric pressure. Check the current barometric pressure, using the correlating boiling point from this chart:

BOILING POINT OF WATER
(Centigrade Scale)

Pressure mm	.0	Pressure mm	.0
700	97.714	740	99.255
701	.753	741	.293
702	.792	742	.331
703	.832	743	.368
704	.871	744	.406
705	97.910	745	99.443
706	.949	746	.481
707	.989	747	.518
708	98.028	748	.555
709	.067	749	.592
710	98.106	750	99.630
711	.145	751	.667
712	.184	752	.704
713	.223	753	.741
714	.261	754	.778
715	98.300	755	99.815
716	.339	756	.852
717	.378	757	.889
718	.416	758	.926
719	.455	759	.963
720	98.493	760	100.000
721	.532	761	.037
722	.570	762	.074
723	.609	763	.110
724	.647	764	.147
725	98.686	765	100.184
726	.724	766	.220
727	.762	767	.257
728	.800	768	.293
729	.838	769	.330
730	98.877	770	100.366
731	.915	771	.403
732	.953	772	.439
733	.991	773	.475
734	99.029	774	.511
735	99.067	775	100.548
736	.104	776	.584
737	.142	777	.620
738	.180	778	.656
739	.218	779	.692

Pressure mm		Pressure mm	
	.0		.0
780		790	
781	100.728	791	101.087
782	.764	792	.122
783	.800	793	.158
784	.836	794	.193
	.872		.229
785		795	
786	100.908	796	101.264
787	.944	797	.300
788	.979	798	.335
789	101.015	799	.370
	.051	800	.406
			.441

You should also carefully inspect the column of mercury. It can separate and cause inaccuracies. This space may be eliminated by holding the thermometer in one hand and carefully hitting the palm of that hand against the open palm of the other hand to force the column together.

References

There is a short section on temperature in Standard Methods for the Examination of Water and Wastewater, 18th Edition, on page 2-59, 17th Edition, on page 2-80 and the 16th Edition, on page 126.