Activity 2: Calibrating equipment

This activity requires you to complete a check on the calibration of a micropipette, as an example of checking high resolution laboratory equipment for accuracy.

The practical requires you to work accurately and with precision over a number of readings, using equipment with which you may not previously be familiar.

**Equipment**

* P1000 micropipette
* Pipette tips
* Distilled water (50cm3)
* A beaker
* Digital thermometer or temperature probe
* Digital balance, resolution ±0.0001g
* Balance draught shield
* Weighing boats

**Safety**

Risk of breakages and spillages

**Procedure**

1. Collect approximately 50cm3 distilled water in a beaker. Stir, and leave for a few minutes to ensure it reaches a consistent temperature.
2. Use the digital thermometer/temperature probe to measure the temperature of the distilled water in several positions; confirm that the temperature throughout the liquid is consistent to within ±0.1°C.
3. Ensure the draught shield is in place on the balance. Place an empty weighing boat onto the balance and tare to 0.0000g.
4. Collect a P1000 micropipette. Select a volume of 500𝜇l.
5. Attach a new tip to the micropipette.
6. Fill the micropipette up to the required volume with distilled water; ensure that air bubbles have not formed in the micropipette. If bubbles are seen, fully expel the liquid and repeat this step.
7. Expel the liquid from the micropipette into the weighing boat. Take care to ensure all liquid is expelled from the micropipette.
8. Measure the mass of water added to the weighing boat.
9. Repeat the whole process until you have five results. Discard any anomalies, then calculate the mean mass of water collected in the weighing boat.
10. Using the table below, identify the correct Z-factor for your water temperature. This is a correction factor to allow for the change in water density at different temperatures.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Temp/°C | Z-factor | Temp/°C | Z-factor | Temp/°C | Z-factor |
| 15 | 1.0019 | 19 | 1.0027 | 23 | 1.0035 |
| 16 | 1.0020 | 20 | 1.0029 | 24 | 1.0037 |
| 17 | 1.0023 | 21 | 1.0031 | 25 | 1.0039 |
| 18 | 1.0025 | 22 | 1.0033 |  |  |

1. Calculate the measured volume of water from the micropipette using the formula:

measured volume (𝜇l) = mean mass of water 🞨 Z-factor 🞨 1000

1. Calculate the measurement error in your result using the formula:

measurement error = measured volume (𝜇l) – 500

1. Calculate the % measurement error, using the formula:

% measurement error = (measurement error / 500) 🞨 100

To be correctly calibrated, the % measurement error should lie in the range ±1%.

1. Review these steps. Consider where errors may have occurred, and the possible implications of these errors. Agree your calibration findings with your teacher/facilitator.