



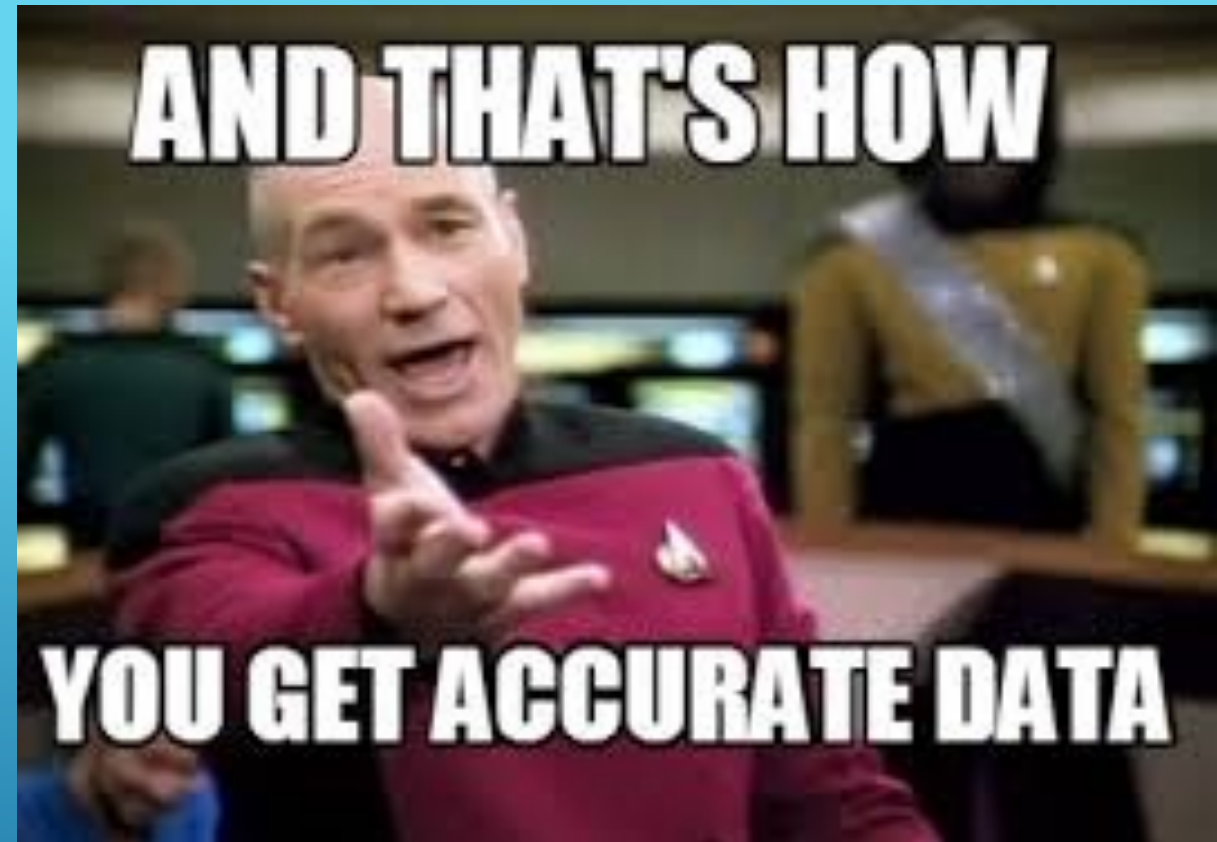
USING THE RIGHT TOOL  
FOR THE JOB





# ACCURACY

- ▶ What standards are you testing to?
- ▶ Specifications of the device being tested.
- ▶ Specifications of the test device
- ▶ Combination of tolerances



# WEIGHTS

- ▶ What class needed?
- ▶ How many decimals?
- ▶ Handling of precision Weights and effects
- ▶ Quadrants
- ▶ Re-Zeroing



# WEIGHT CLASSIFICATION

- ▶ Higher class number means less accuracy.

Weight	Class 0	Class 4	Class 7
15kg	19.5mg	150mg	3.3g
10g	0.025mg	0.5mg	21mg
1g	0.017mg	0.1mg	4.5mg



# DETECTO 6745 – BABY SCALE FOR NICU

- ▶ **Capacity:** 6745: 30 lb x 0.1 oz / 15 kg x 0.005 kg - 6745KG: 15 kg x 0.005 kg
- Overall Dimensions:** 26 in W x 14.2 in D x 7.5 in H / 66 cm W x 36 cm D x 19 cm H
- Tray Dimensions:** 26 in W x 12.2 in D / 66 cm W x 31 cm D
- Display:** 6-digit, 7-segment 1.0 in / 25 mm high transfective LCD
- Power:** 6 C size Alkaline, Ni-Cad or NiMH batteries (not included) or 100-240VAC, 12VDC/1.2A medical UL-approved AC adapter (included)
- Weight Units:** Pounds and Ounces / Kilograms
- Integrated Measuring Tape:** 0 - 22 in / 0 - 56 cm
- Connectivity Port:** RS232 serial output for connectivity with a PC or printer for patient records
- Net Weight:** 18 lb / 8 kg
- Shipping Weight:** 22 lb / 10 kg
- Country of Origin:** USA
- UPC Codes:** 6745: 809161140705 - 6745KG: 809161302806
- Keys:** ON, ZERO, UNITS, PRINT, OFF
- Weighing Units Settings:** Pounds and Ounces only, Kilograms only, Pounds and Ounces / Kilograms, Kilograms / Pounds and Ounces
- Battery Life:** The 6745 can operate for 200 hours of continuous use when using alkaline batteries, or 50 hours of continuous use with fully charged Ni-Cad or NiMH batteries

# WEIGHT HANDLING

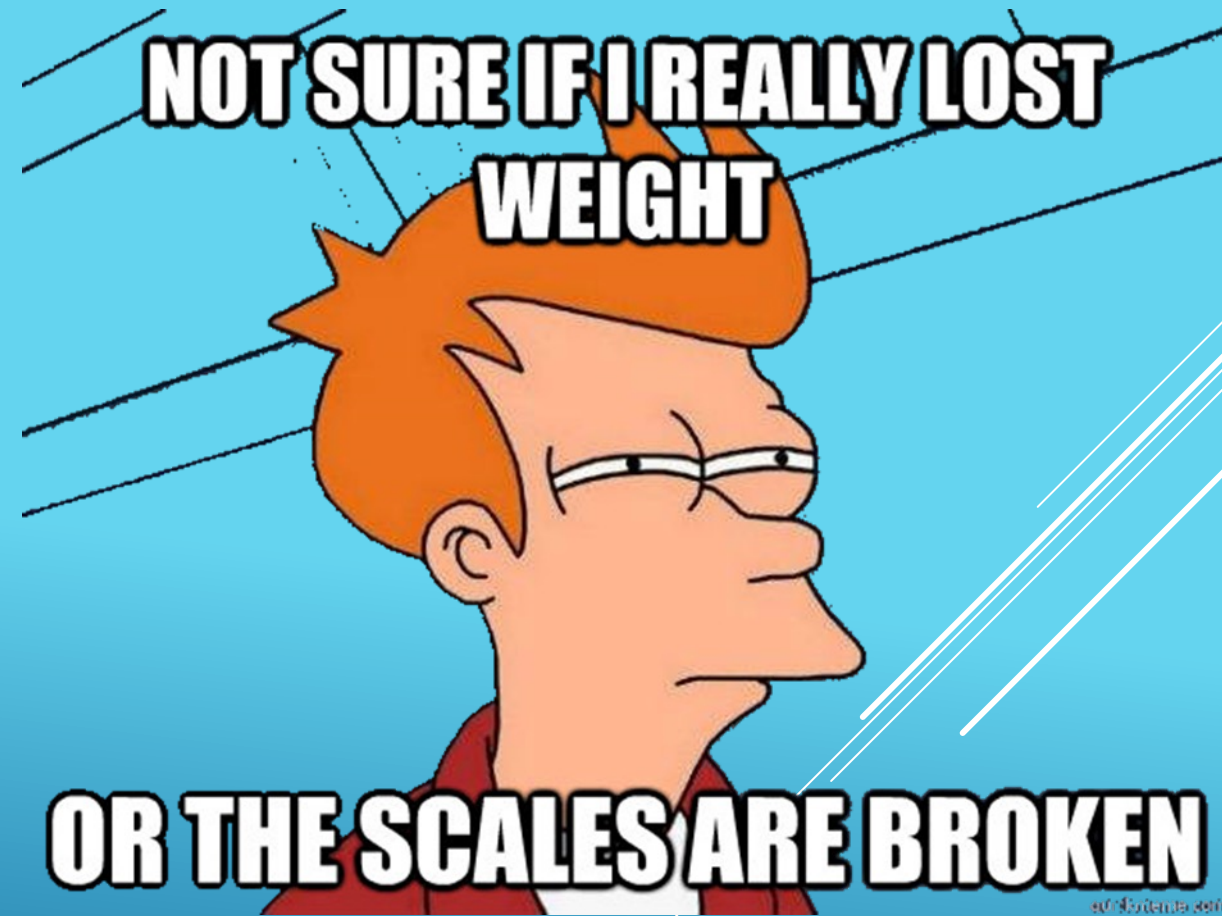
- ▶ Always use lint free gloves/cloth or plastic/teflon tweezers
- ▶ Never slide weight on scale
- ▶ Always place weights in approved weight box for storage and between measurements
- ▶ Do not place near magnetic sources
- ▶ Do not clean with cleaners
- ▶ If dropped weight must be recalibrated.





# SCALE CALIBRATION

- ▶ Warm up device for 30 minutes prior to testing
- ▶ Always zero balance before calibration
- ▶ Use the quadrant method for verification
- ▶ Perform multiple tests for repeatability
- ▶ Test the full range if possible



# TEMPERATURE

- ▶ Thermocouple

- ▶ J Range -40c to 760c
- ▶ K Range -200c to 1200c

- ▶ Advantages – Low Cost, Fast response time

- ▶ Disadvantages 1%-3% accuracy. Dependent on measuring device.

- ▶ Consider accuracy of the probe and the multimeter

Fluke 87V vs Fluke 52

Voltage (.05% +1)

80BK probe 2.2C or 2% .05% +.3C



# TEMPERATURE

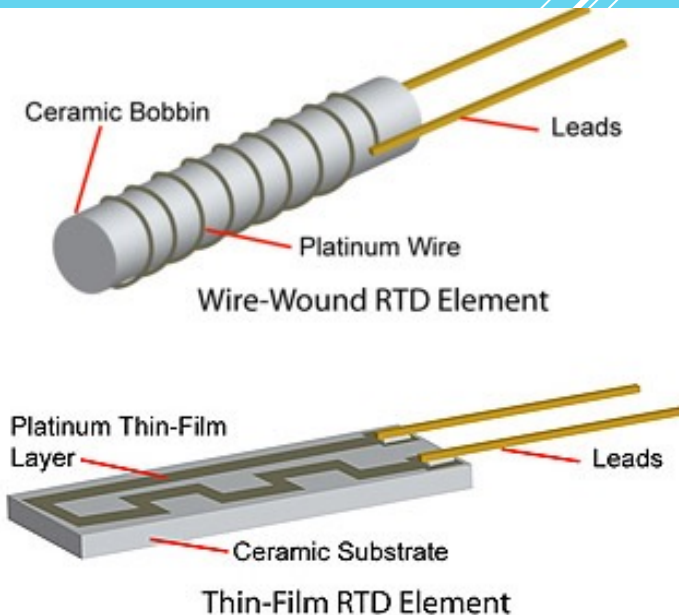
- ▶ RTD – Resistance Temperature Sensors
  - ▶ -270C to 850C

Send a current to the probe and measure the resulting voltage

2wire vs 4 wire. 4 wire method used to compensate for lead resistance.

Advantage – Very Stable, Higher temperature ranges

Disadvantage -Most expensive.



# TEMPERATURE

- ▶ Thermistor
  - ▶ Like an RTD resistance changes with temperature changes
    - ▶ Range -55C to 150C
    - ▶ Typically best option for measurements below 150C
    - ▶ Advantage – Best performance in range
    - ▶ Disadvantage – limited range

Sensor type	Thermistor	RTD	Thermocouple
Temperature Range (typical)	-100 to 325°C	-200 to 650°C	200 to 1750°C
Accuracy (typical)	0.05 to 1.5°C	0.1 to 1°C	0.5 to 5°C
Long-term stability @ 100°C	0.2°C/year	0.05°C/year	Variable
Linearity	Exponential	Fairly linear	Non-linear
Power required	Constant voltage or current	Constant voltage or current	Self-powered
Response time	Fast 0.12 to 10s	Generally slow 1 to 50s	Fast 0.10 to 10s
Susceptibility to electrical noise	Rarely susceptible High resistance only	Rarely susceptible	Susceptible / Cold junction compensation
Cost	Low to moderate	High	Low

# INCUBATOR TESTING



- ▶ Common Parameters to be tested

- ▶ Temp (accuracy, overshoot, rise time, uniformity) Air Velocity, Sound Level, Humidity, O<sub>2</sub>, and Scale.

Temp Spec from Drager 8000 Isolette <0.8C

Temp ex. Fluke 87V

Fluke Biomedical INCU II

2.2C accuracy or 2%

INCU 0.05C

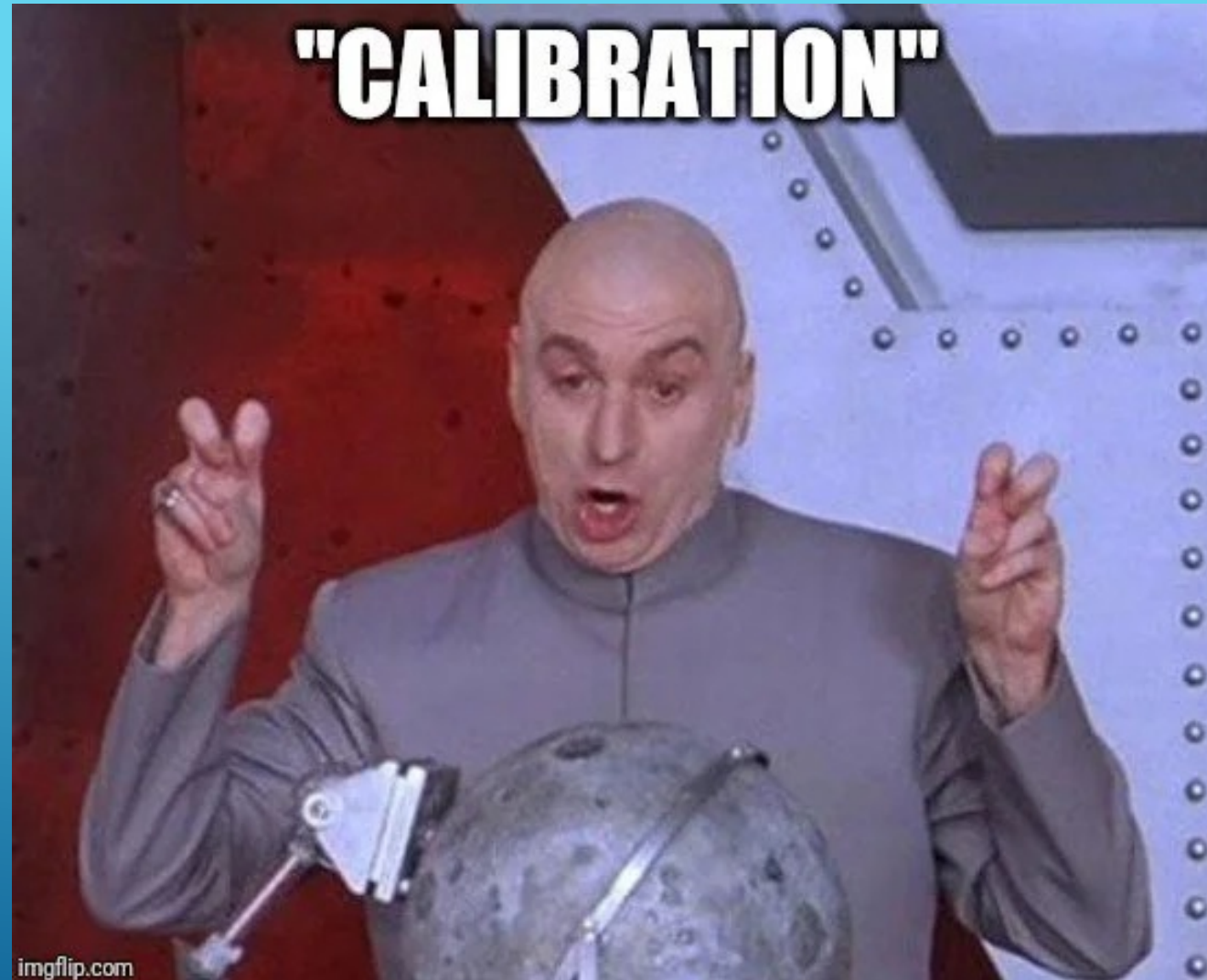
Environmental Changes – Opening hood changes the environment

# LIGHT METERS

- ▶ Bilimeters – What is the Spectral range needed?
  - ▶ Flourescent approx. 460nm      Newer LEDs  
approx. 480nm
  - ▶ Radiology Reading stations - Luminance
    - ▶ Mammography – 350 cd/m<sup>2</sup>
    - ▶ Other modalities – 250 cd/m<sup>2</sup>
  - ▶ Medical Light sources – Illuminance
    - ▶ Usually measured in Lux

# CALIBRATION STANDARDS

- ▶ Standard
- ▶ With Data
- ▶ ISO 17025





# OPERATING ENVIRONMENT

- ▶ Temperature
- ▶ Humidity
- ▶ Elevation
- ▶ Stabilization

