Basic Instrumentation

Temperature Sensors Review Questions

Some Good Reference Links:
https://www.omega.co.uk/temperature/z/thermocouple-rtd.html#faq

1. Which of the following temperature sensors have been discussed in class?

a. NTCs, Thyristors, Picocouplers

b. RTDs, Thermistors, Thermocouples

c. PTCs, Thyrometers, Synchros

d. Thermomistors, STDs, Pyrometers

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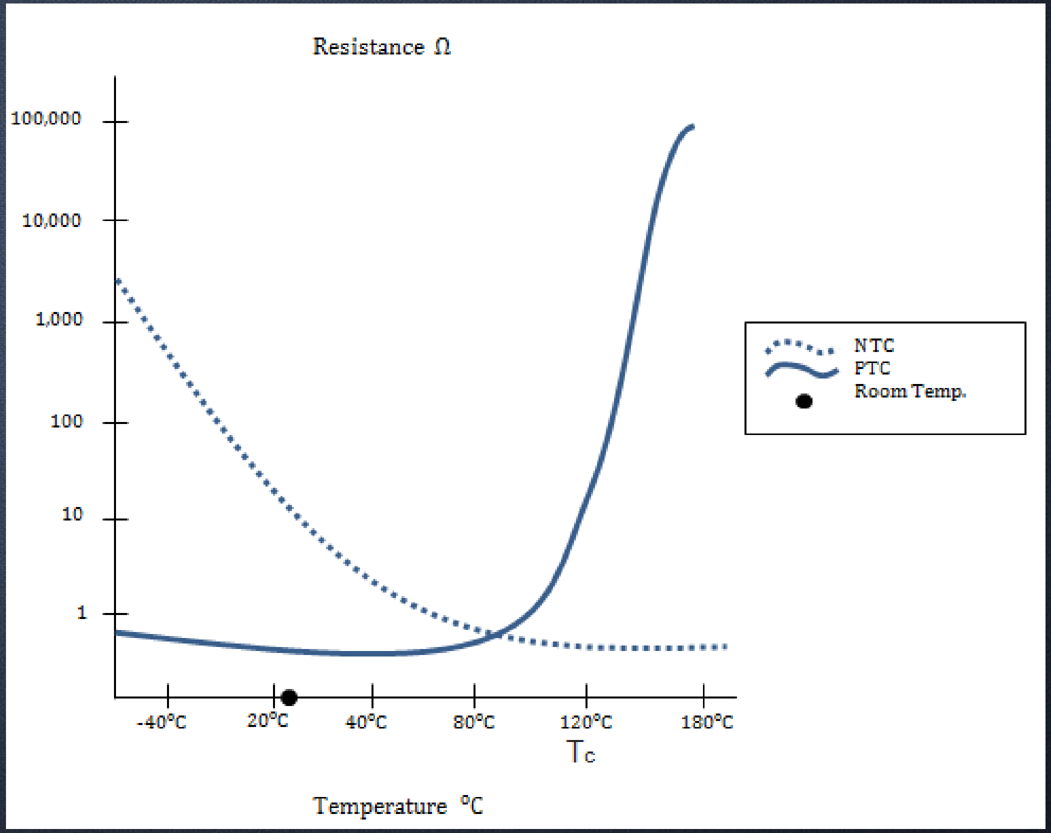
2. A Positive Temperature Coefficient (PTC) means that as the ambient temperature increases, the resulting resistance of the temperature sensor _______________.

a. Increases

b. Decreases

c. Stays the same



https://www.ametherm.com/ptc-thermistors-vs-ntc-thermistors-for-inrush-current

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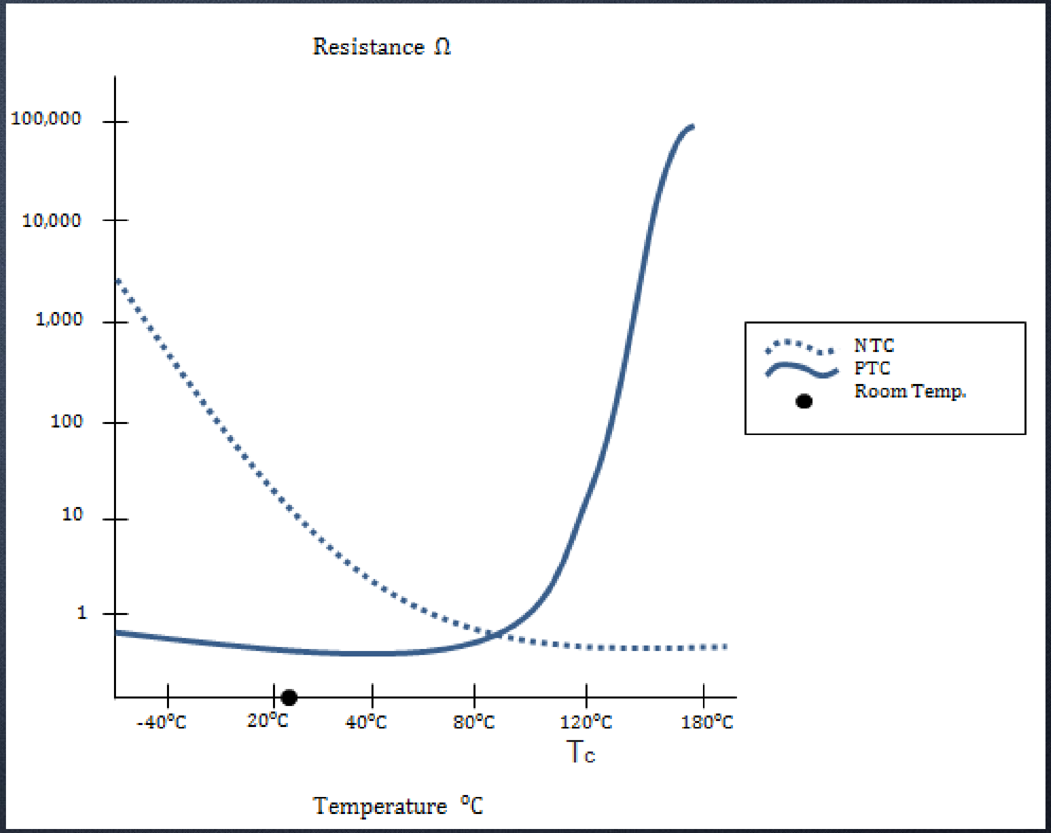
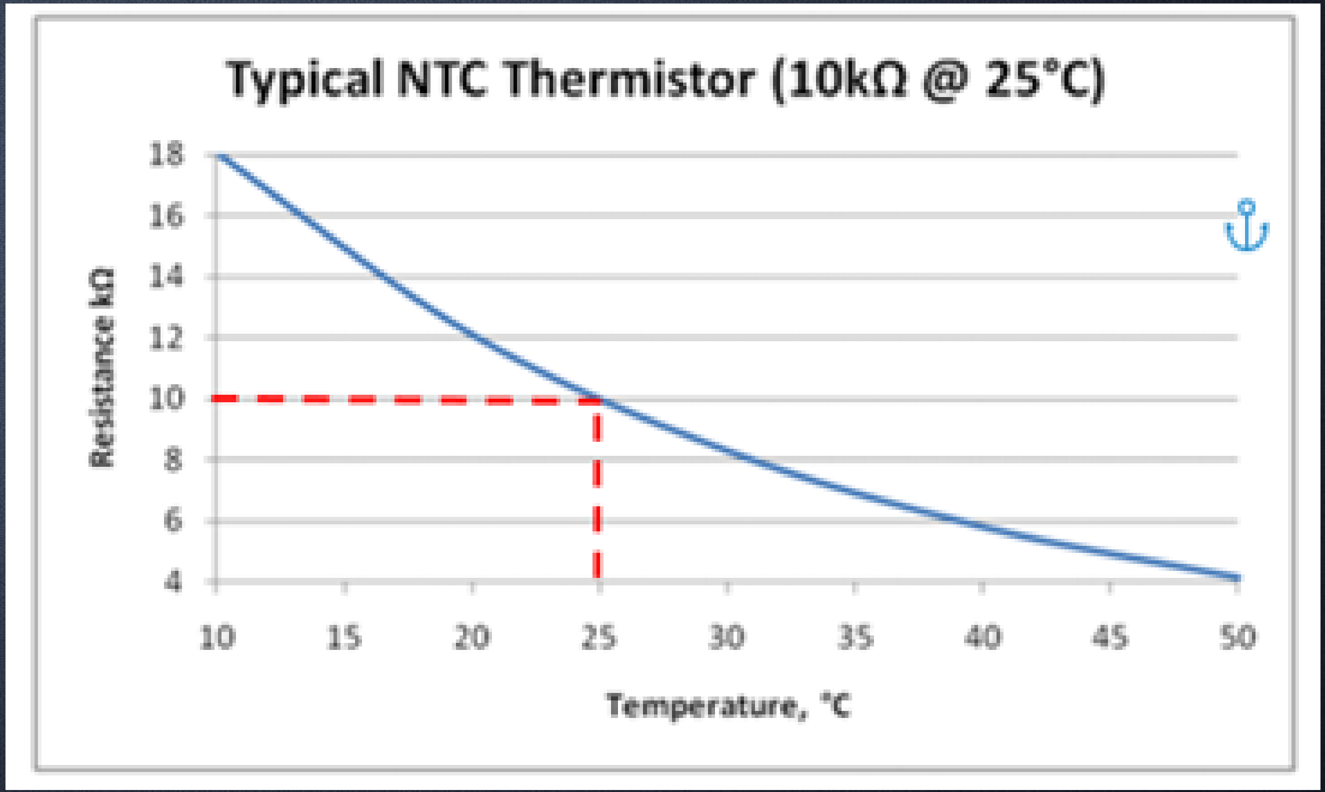


https://www.ametherm.com/ptc-thermistors-vs-ntc-thermistors-for-inrush-current

3. A Negative Temperature Coefficient (NTC) means that as the ambient temperature increases, the resulting resistance of the temperature sensor ______________.

a. Increases
b. Decreases
c. Stays the same



http://esp8266tutorials.blogspot.com/2016/09/esp8266-ntc-temperature-thermistor.html

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a. Increases

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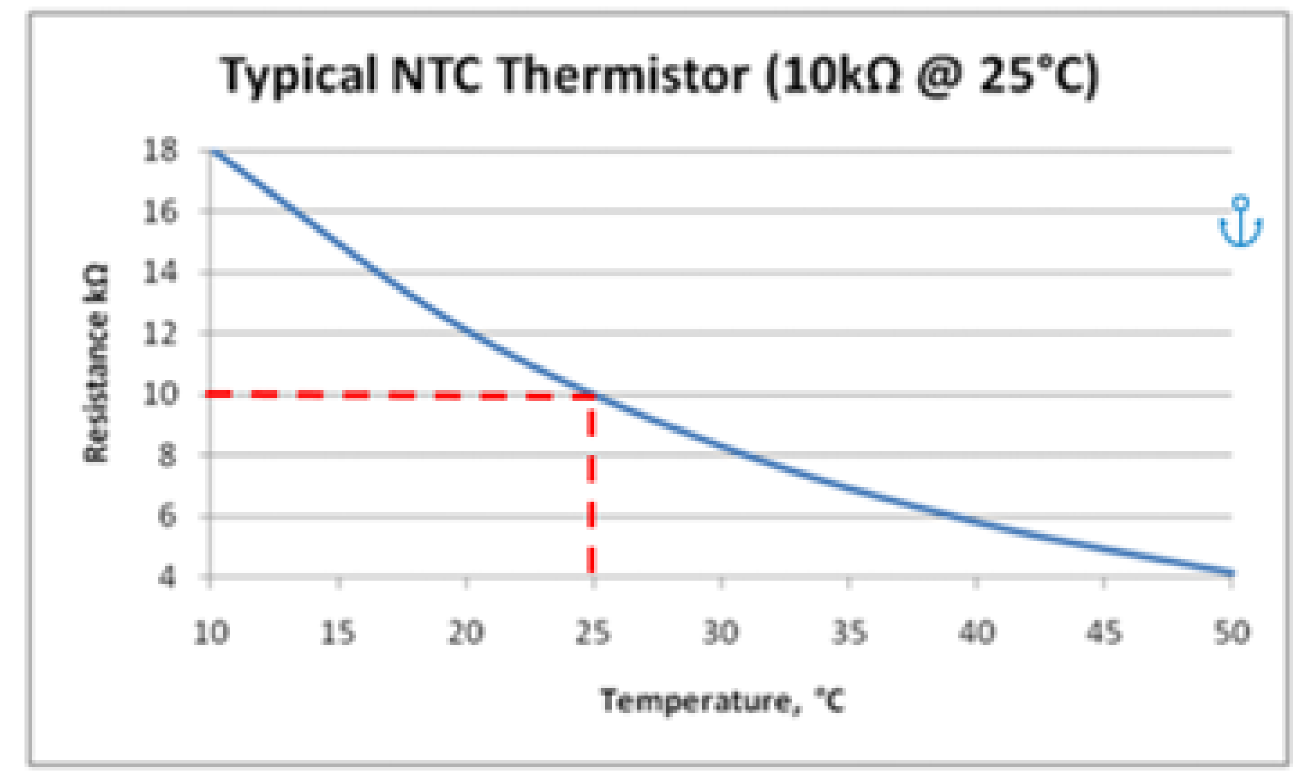

http://esp8266tutorials.blogspot.com/2016/09/esp8266-ntc-temperature-thermistor.html

4. Which of the following is the cheapest Temperature Sensor. (Still accurate, but costs the least)?

a. RTD
b. Thermistor
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COMPARISON OF BASIC TEMPERATURE-SENSOR CHARACTERISTICS							
Sensor	Temperature range (°C)	Accuracy	Sensitivity	Linearity	Power consumption	Support circuitry	Cost
RTD	–250 to +750	Excellent	Poor	Good	High	Complex	High
Thermocouple	–250 to +2300	Good	Poor	Good	High	Complex	High
Thermistor	–100 to +500	Fair	Excellent	Poor	High	Moderate	Medium
IC sensor	–55 to +200	Good	Good	Excellent	Low	Simple	Low

https://www.electronicdesign.com/analog/improved-ic-temp-sensors-challenge-traditional-sensor-devices

5. Which of the following exhibits the slowest response to changes in ambient temperatures?

a. RTD
b. Thermistor
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Parameter	RTD	Thermistor	Thermocouple	IC Sensor
Temperature Range (Typical)	-200°C to 850°C	-100°C to 325°C	-200°C to 1750°C	-55°C to 150°C
Accuracy	Best (0.1°C-1°C)	Good (0.05-1.5°C)	Good (0.5°C-5°C)	Better (0.5-1.0C)
Linearity	Linear	Exponential	Non-linear	Linear
Sensitivity	Low	Best	Worst	Good
Response Time	Slow (1 s - 50 s)	Fast (0.1 s - 5 s)	Fast (0.1 s - 10 s)	Slow (5 s - 60 s)
Long Term Stability	Best	Good	Variable	Good
Circuitry	Complex	Simple to complex	Complex	Simplest
Power Requirement	Constant voltage or current	Constant voltage or current	Self-powered	Constant voltage or current
Cost	High	Low to moderate	Low	Low

https://www.electronicproducts.com/Sensors_and_Transducers/Sensors/Flexible_sensors_bring_new_benefits_for_temperature_measurement.aspx

6. Which of the following Temperature Sensors is the best choice for environments where the sensor will have to withstand the heat of an open flame?

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	Accuracy	Temp Range (approximate)	Cost	Measurement Complexity	Notes
Thermocouple	low	-200 to 1800°C	Low	Medium	Rugged and Reliable
RTD	High	-200 to 850°C	High	Complex	Accurate but expensive
Low cost Thermistor	Very low	-40 to 120°C	Very low	Complex	Often Fragile
High Accuracy Thermistor	High	-80 to 150°C	High	Complex	Fragile but highest accuracy
Semiconductor Temp Sensor	Medium	-55 to 125°C	Low	Simple	Easy to use and low cost

https://ueidaq.wordpress.com/2013/10/28/real-world-temperature-measurements-for-data-aquisition/

7. Which of the following Temperature Sensors has the fastest response time?

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b. Thermistor
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Typical Temperature Sensor Characteristics				
Typical Characteristics	Thermistor General Purpose	Resistance Temperature Devices (RTDs)	Thermocouples (TCs)	Semiconductor Temperature Sensors
Temperature Range	- 55 C to + 125 C	- 200 C to + 850 C	- 600 C to + 2000 C	- 50 C to + 150 C
Linearity	Exponential	Fairly Linear	Fairly Linear	Best
Sensitivity	High	Low	Medium	Highest
Response Time	Fast	Slow	Fast to Slow	Slow
Excitation or Power	Needed	Needed	Not Needed	Not Needed
Long-Term Stability	Low	High	High	Medium
Self-Heating	Yes	Yes	No	Yes
Cost	Low	Low (film) High (wire wound)	Moderate to High	Low to Moderate

https://sg.element14.com/a-guide-to-temperature-sensor-design

8. Which of the following Temperature Sensors exhibit Self-Heating?

a. RTD
b. Thermistor
c. Thermocouple
d. RTD & Thermistor

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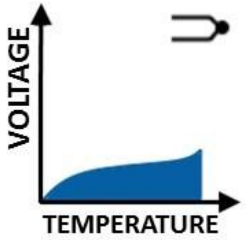
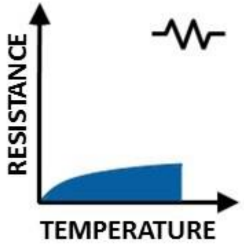
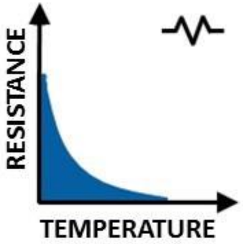
	Advantages	Disadvantages
THERMOCOUPLES 	✓ Simple ✓ Rugged ✓ Inexpensive ✓ No external power ✓ Wide temperature range ✓ Variety of styles	× Nonlinear response × Small sensitivity × Small output voltage × Requires CJC × Least stable
RTD 	✓ Most stable ✓ Good Linearity ✓ Most accurate	× Low sensitivity × Externally powered × Costly × Small output resistance × Self-heating error
THERMISTOR 	✓ Fast ✓ High output ✓ Minimal lead resistance error	× Limited temperature range × Externally powered × Nonlinear × More fragile × Self-heating error

https://www.ni.com/en-ca/innovations/white-papers/06/overview-of-temperature-sensors.html

9. Which of the following Temperature Sensors is considered to be the most expensive?

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b. Thermistor
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10. Which of the following Temperature Sensors is the most susceptible to electrical noise?

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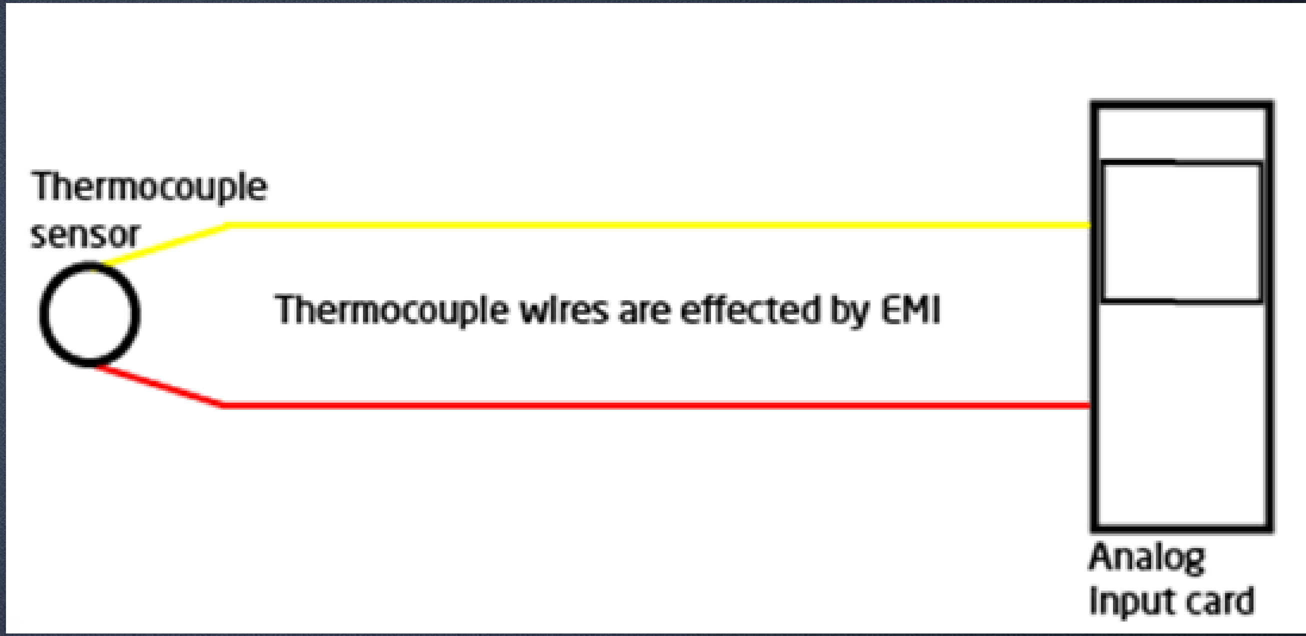

https://www.prelectronics.com/support/pr-knowledge-library/tips-and-tricks/advantages-of-converting-rtd-and-thermocouple-signals-to-4-20-ma-current/

11. Which of the following accurately describes what a Thermistor is?

a. A coil of Platinum wound around a ceramic core
b. Two dissimilar metals joined at one end
c. Thermally sensitive paste that changes colour due to temperature changes
d. A solid state device made from highly sensitive metal oxides

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NTC
5D-11

12. Which of the following accurately describes what an RTD is?

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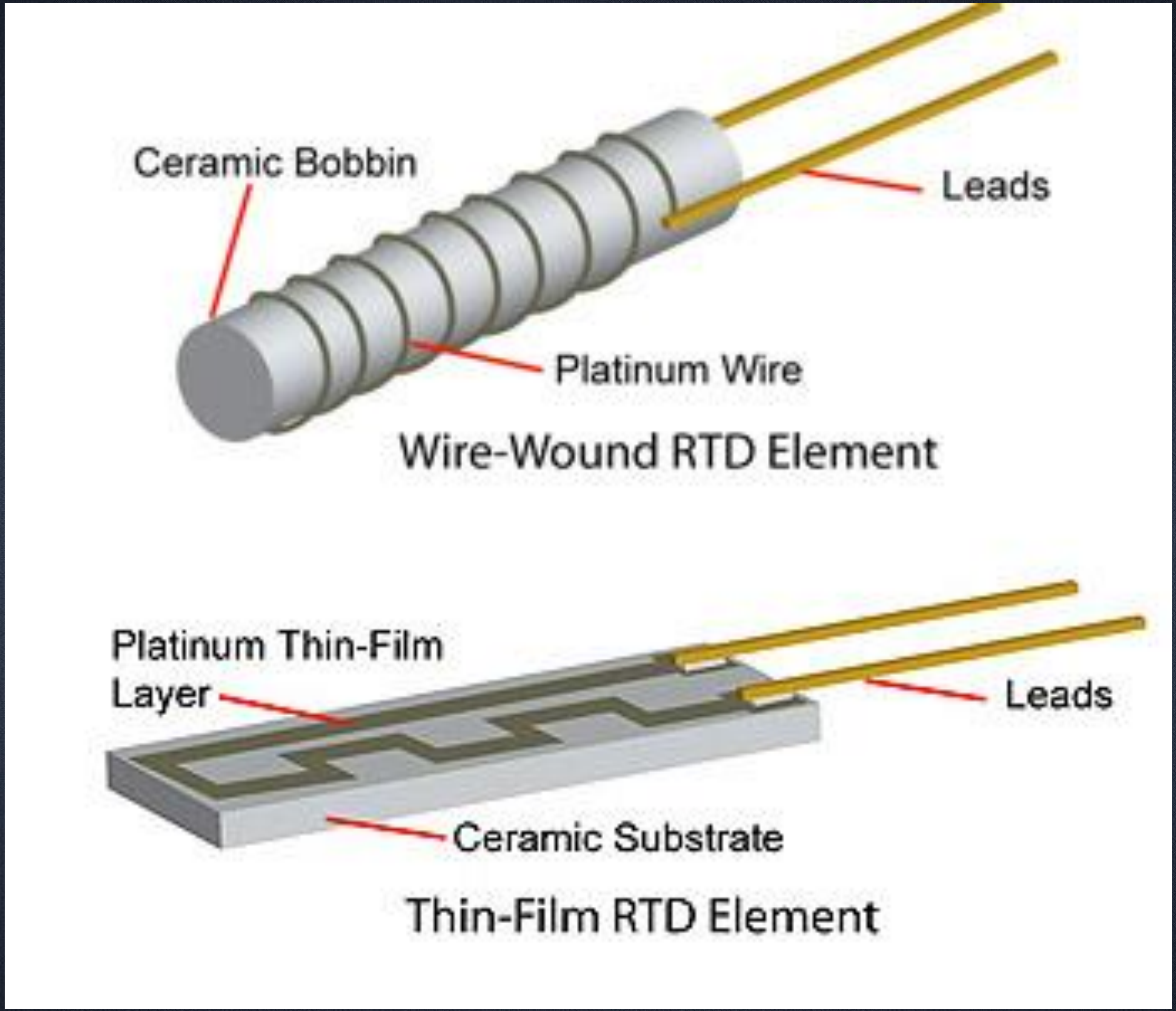
Ceramic Bobbin
Leads
Platinum Wire
Wire-Wound RTD Element
Platinum Thin-Film
Layer
Leads
Ceramic Substrate
Thin-Film RTD Element

13. Which of the following accurately describes what a Thermocouple is?

a. A coil of Platinum wound around a ceramic core
b. Two dissimilar metals joined at one end
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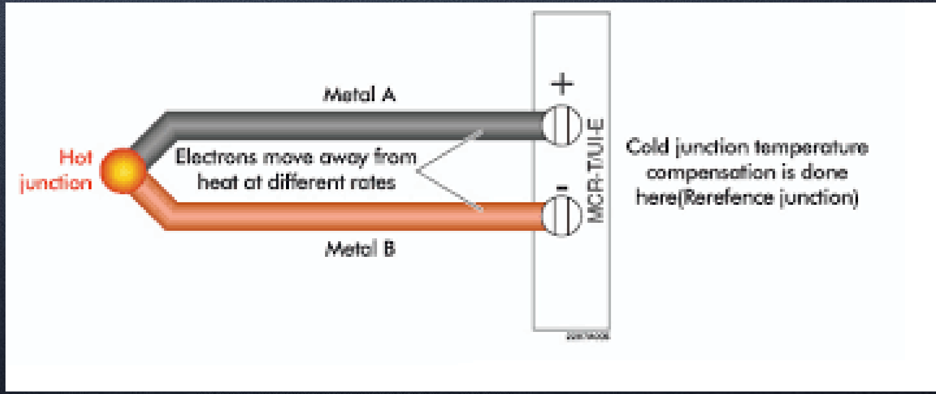

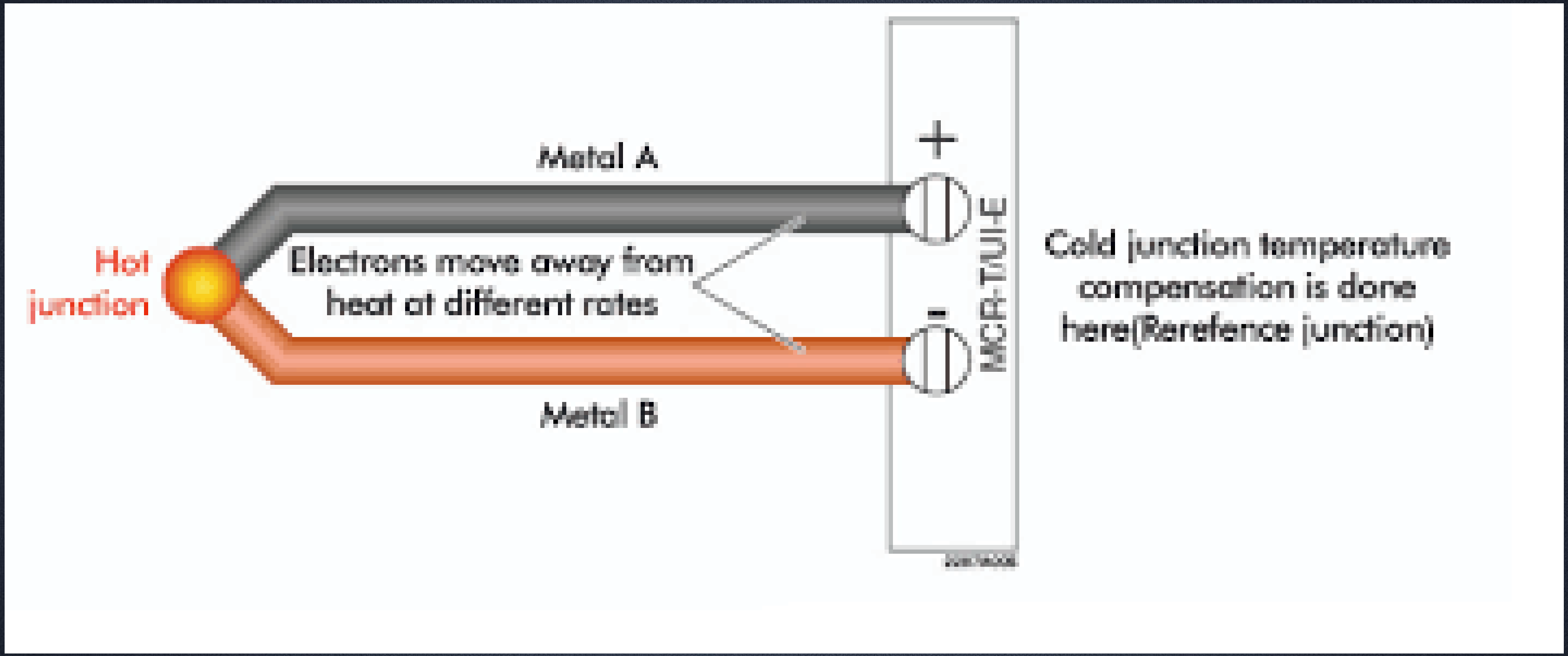
Metal A
Hot junction
Electrons move away from heat at different rates
Metal B
+
-
MCR-T/UI-E
Cold junction temperature compensation is done here(Rerefence junction)

14. Which type of Temperature Sensor is shown below?

a. Thermistor
b. Thermocouple
c. RTD

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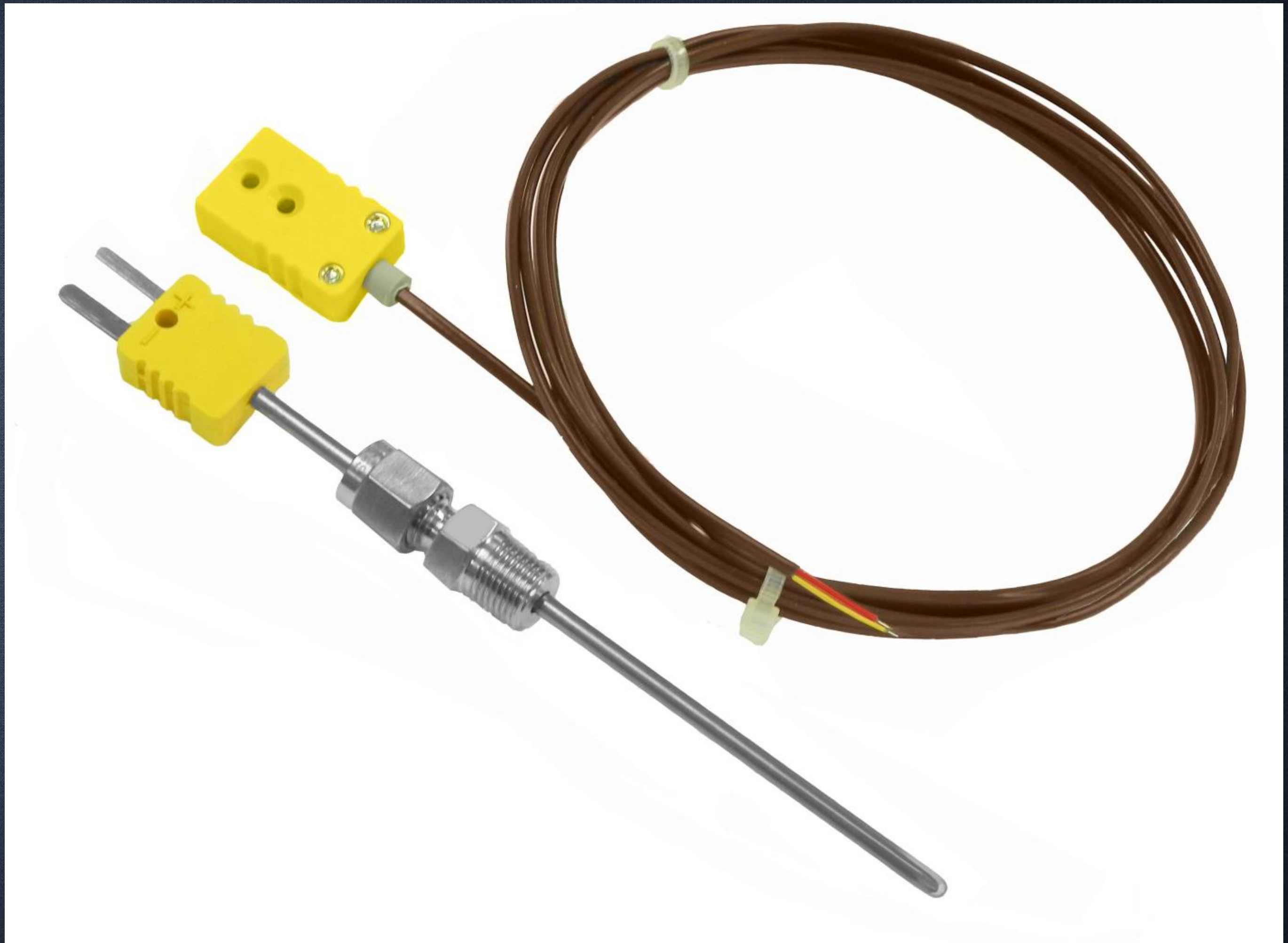
b. Thermocouple
c. RTD

15. Which type of Temperature Sensor is shown below?

a. Thermistor
b. Thermocouple
c. RTD



15. Which type of Temperature Sensor is shown below?

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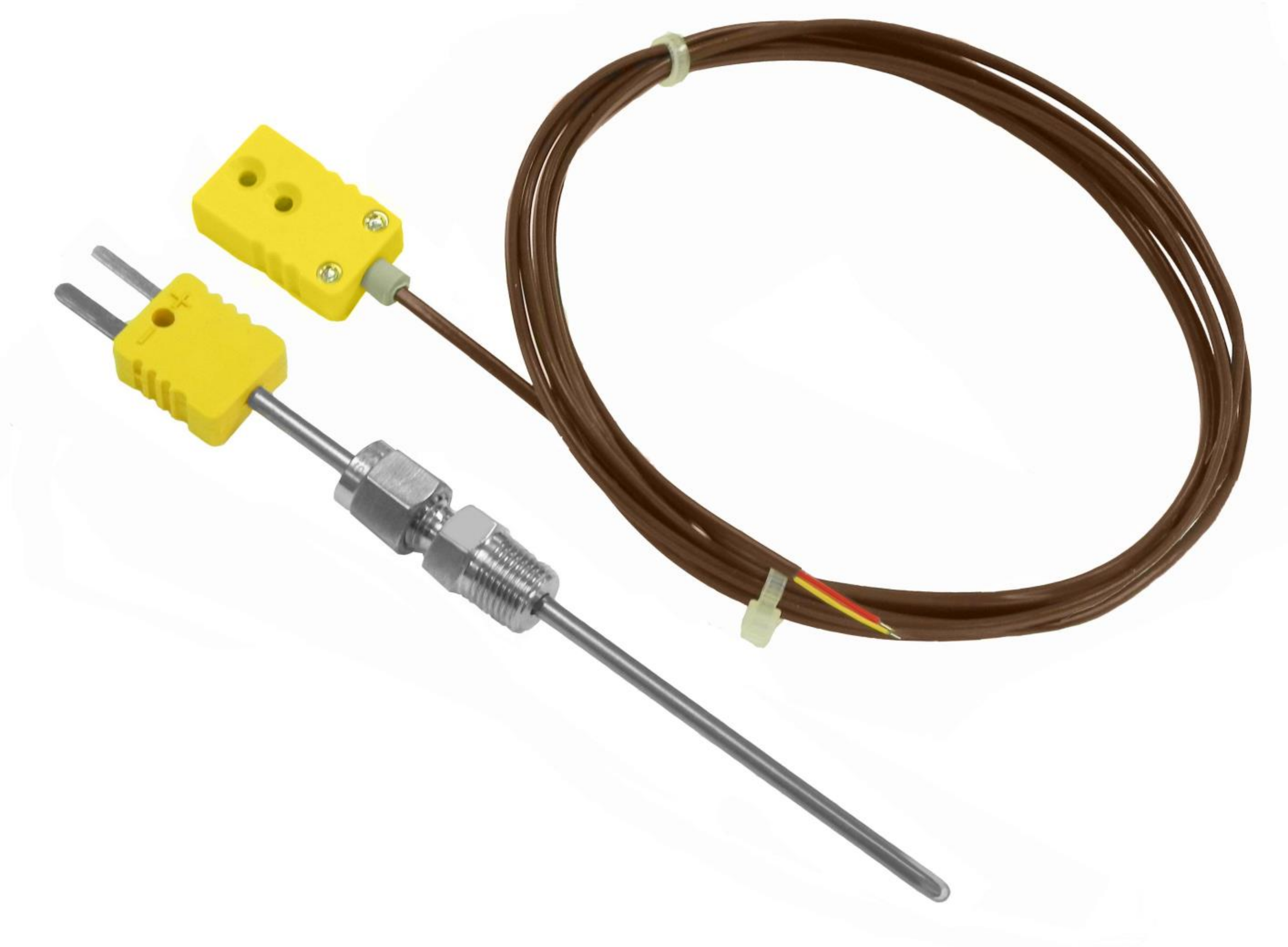
c. RTD



16. Which type of Temperature Sensor is shown below?

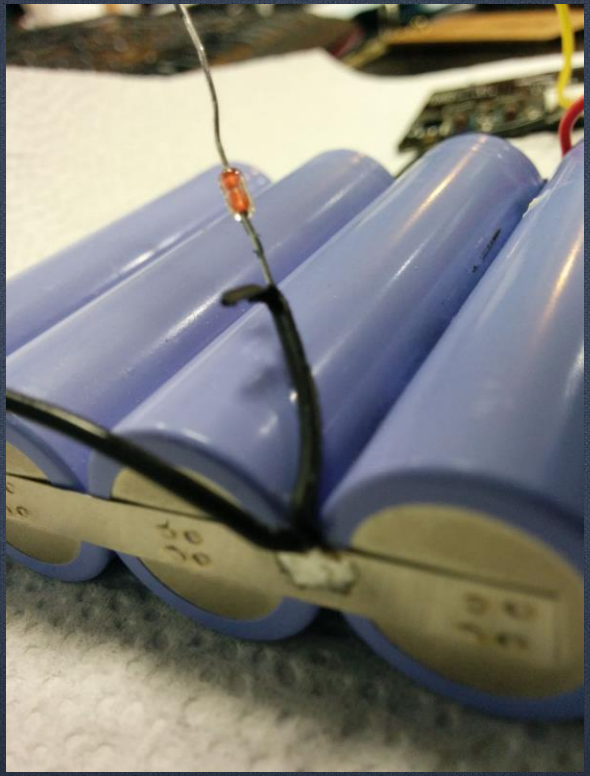
a. Thermistor
b. Thermocouple
c. RTD

16. Which type of Temperature Sensor is shown below?

a. Thermistor
b. Thermocouple
c. RTD

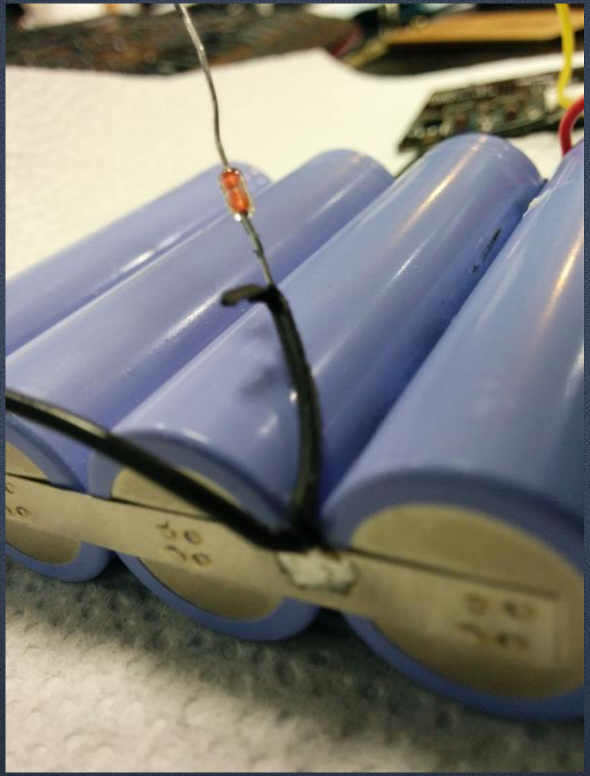
17. Which type of Temperature Sensor is shown below in the following applications?

a. Thermistor
b. Thermocouple
c. RTD



17. Which type of Temperature Sensor is shown below in the following applications?

a. Thermistor
b. Thermocouple
c. RTD



18. Which type of Temperature Sensor is normally found in your household appliances?

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b. Thermocouple
c. RTD

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c. RTD

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b. Thermocouple
c. RTD

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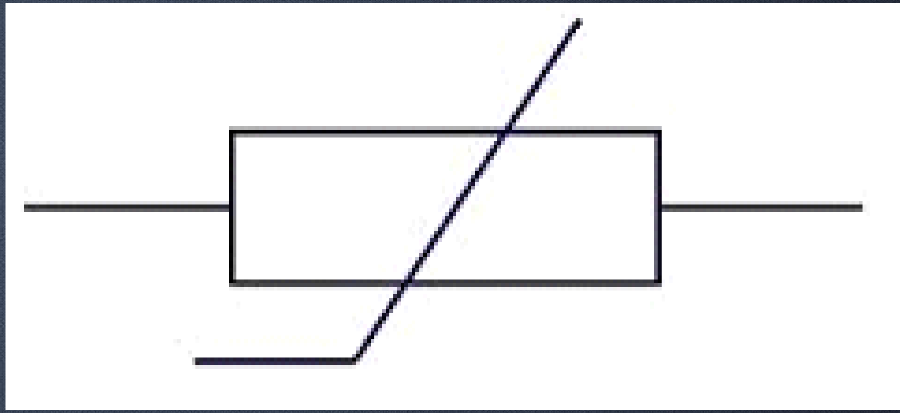
c. RTD

20. Which type of Temperature Sensor is depicted by the Symbol below?

a. Thermistor
b. Thermocouple
c. RTD



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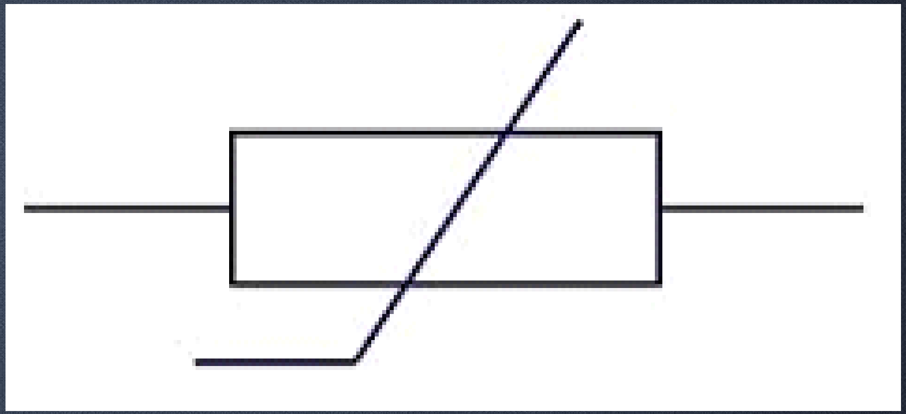

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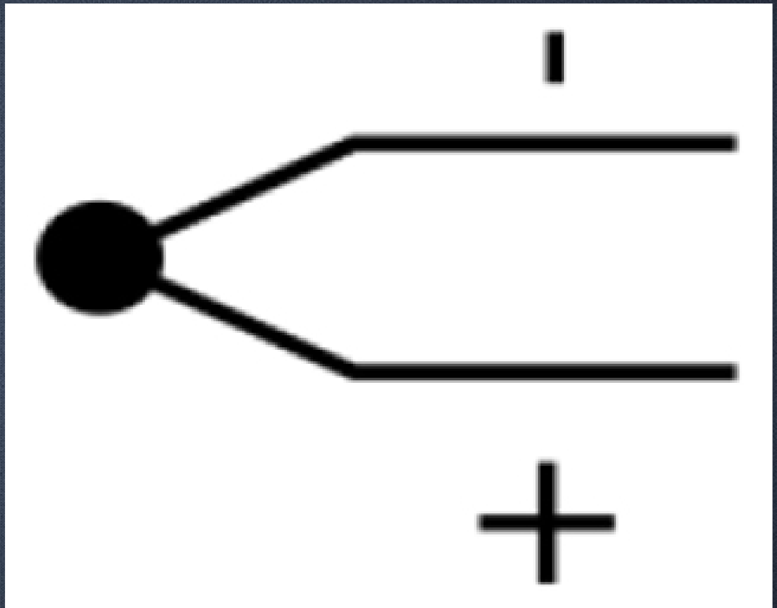

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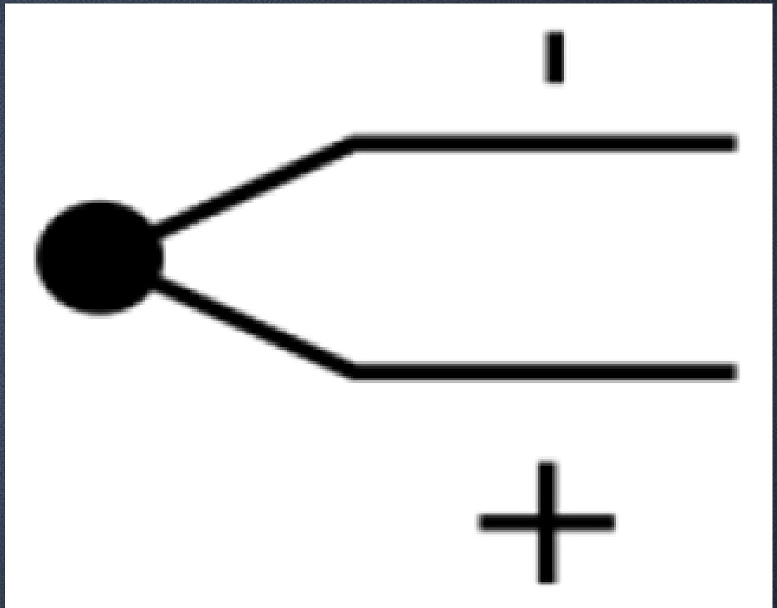

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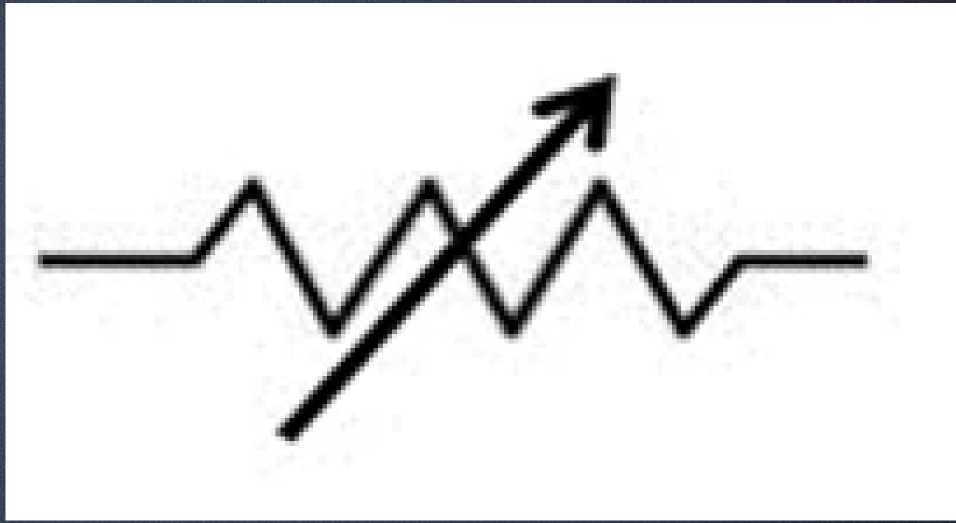

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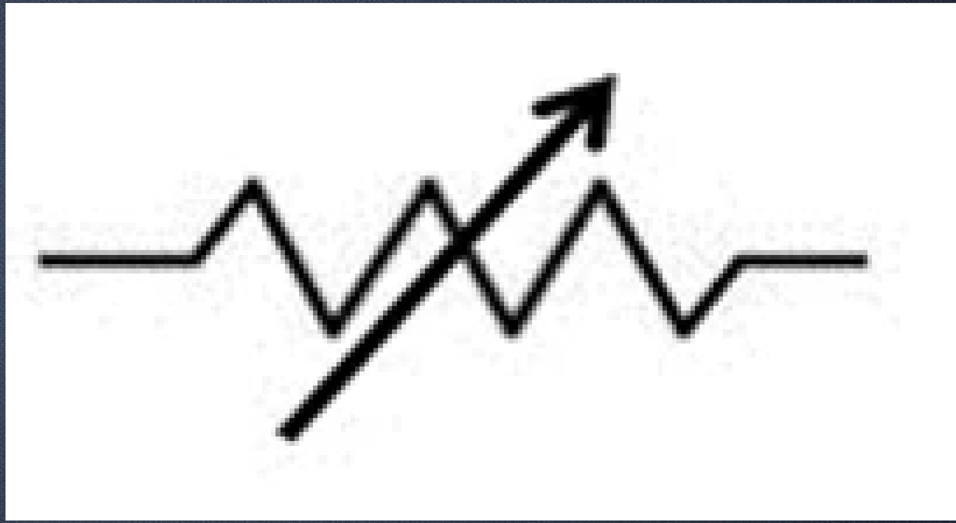

23. Which of the following temperature sensors produces a large change in its resistance with temperature changes, but is very non-linear?

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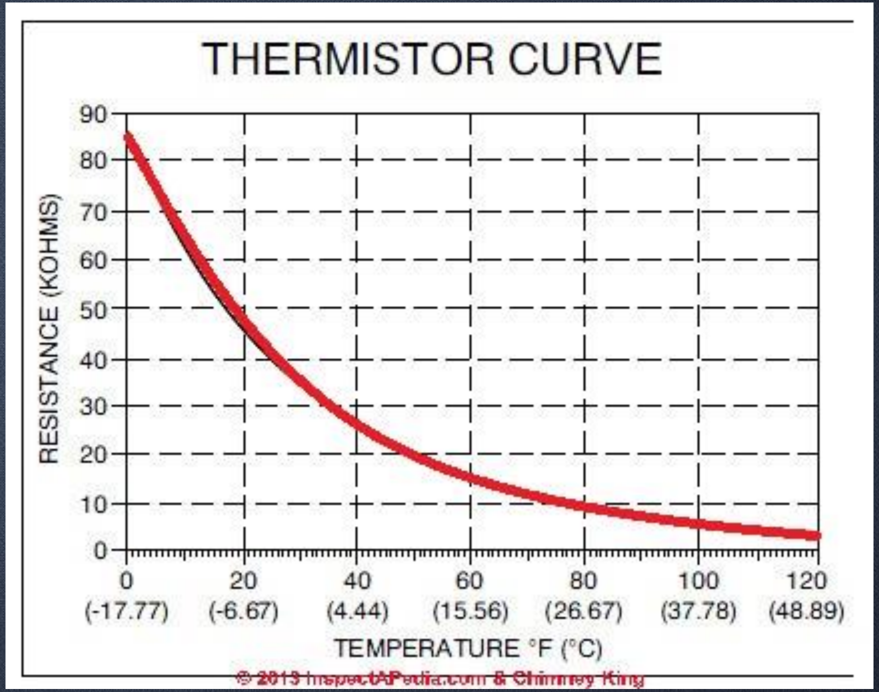

https://inspectapedia.com/electric/Thermistors.php

24. A thermistor's __________ changes when the temperature to which it is exposed varies.

a. Resistance
b. Output Voltage

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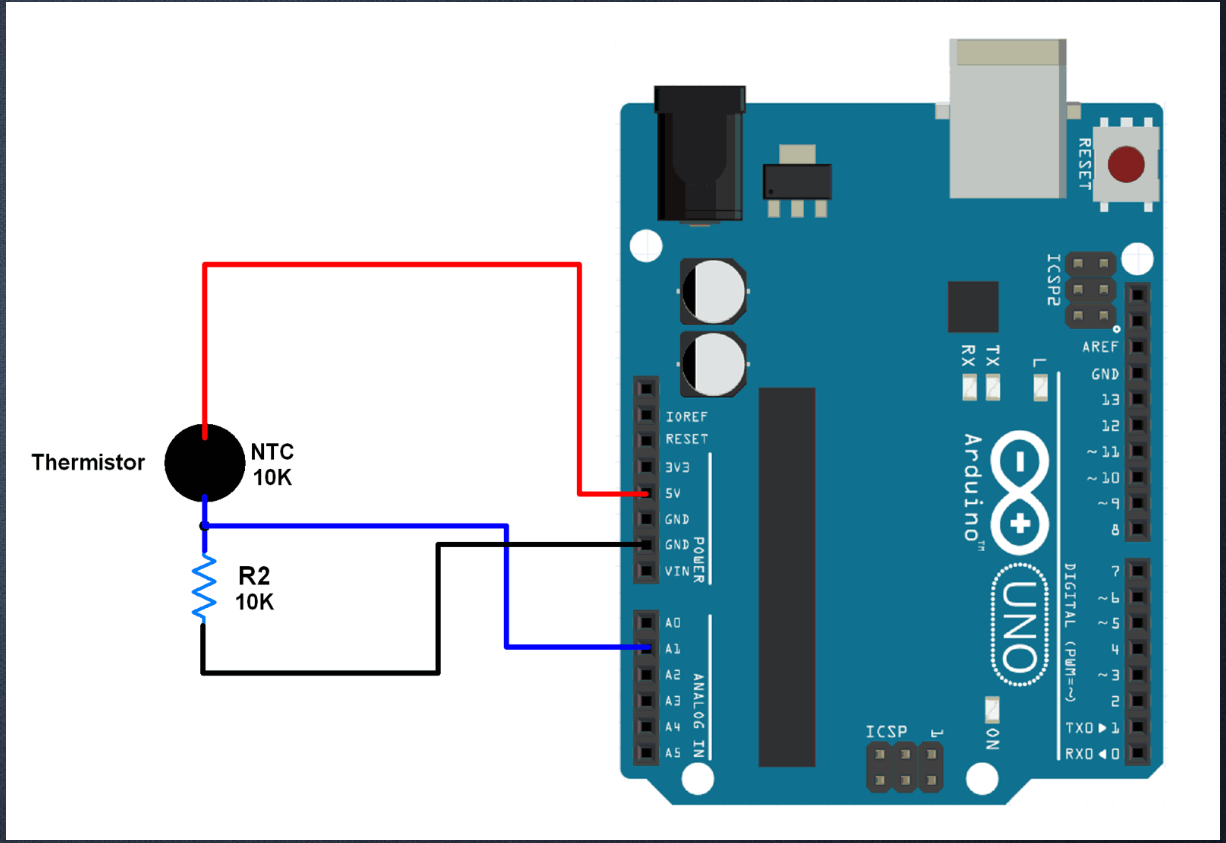
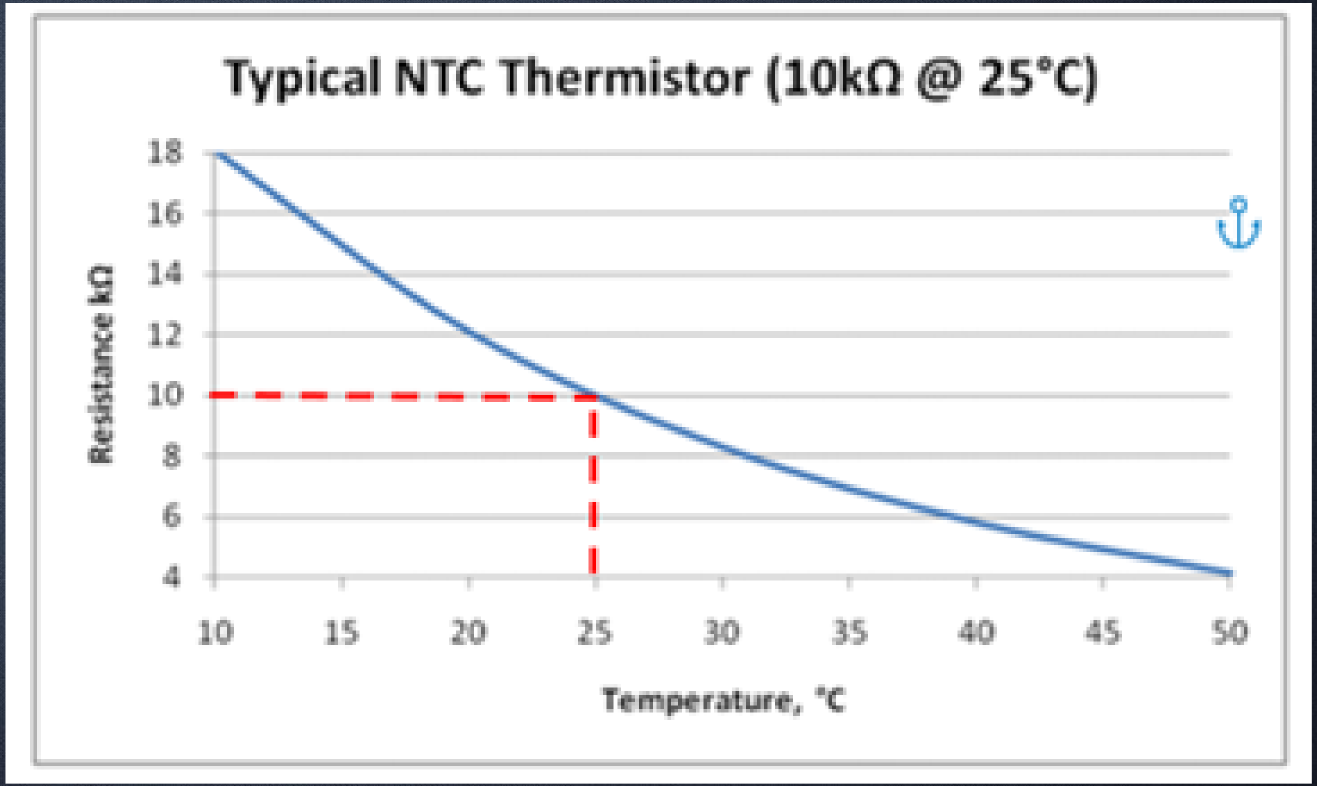


https://www.electronicwings.com/arduino/thermistor-interfacing-with-arduino-uno

25. NTC thermistors' resistance decreases as their temperature ___________.

a. Increases
b. Decreases



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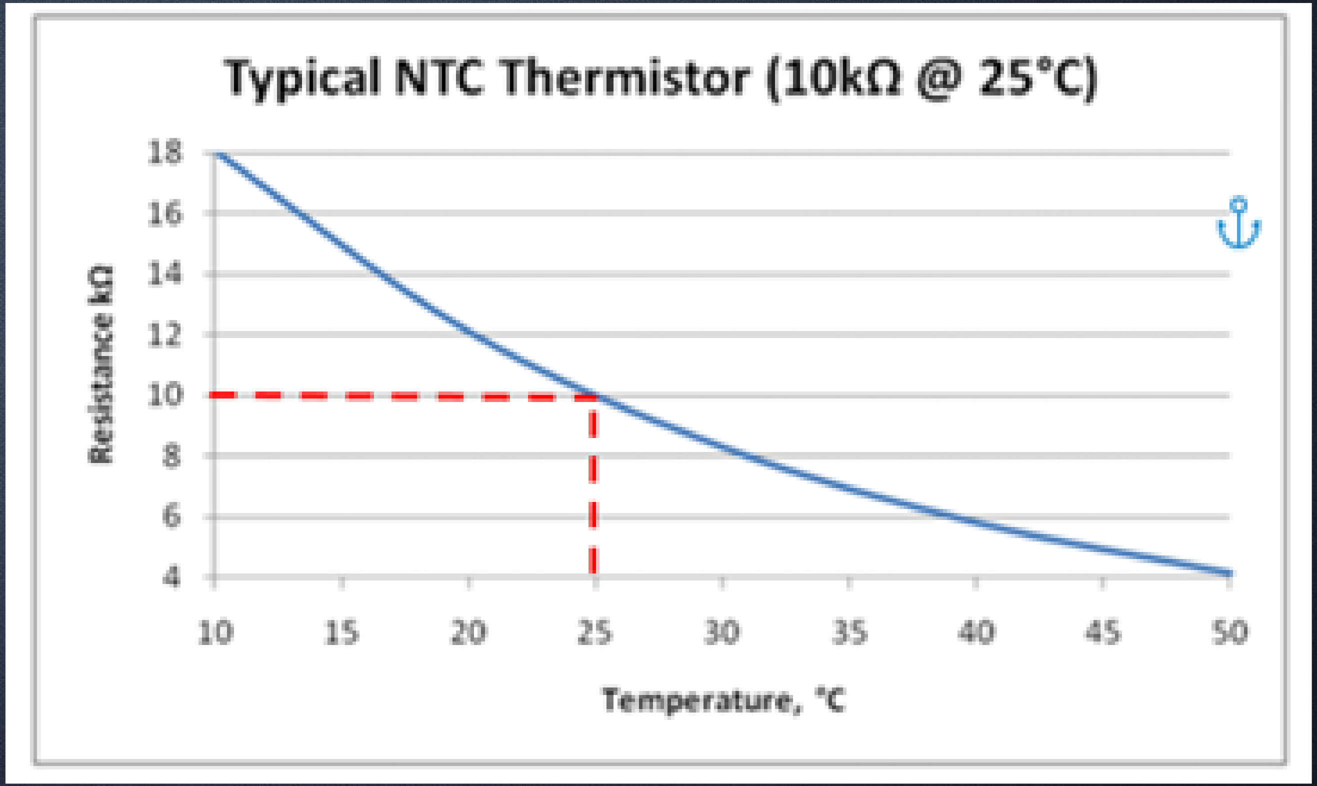

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a. Increases
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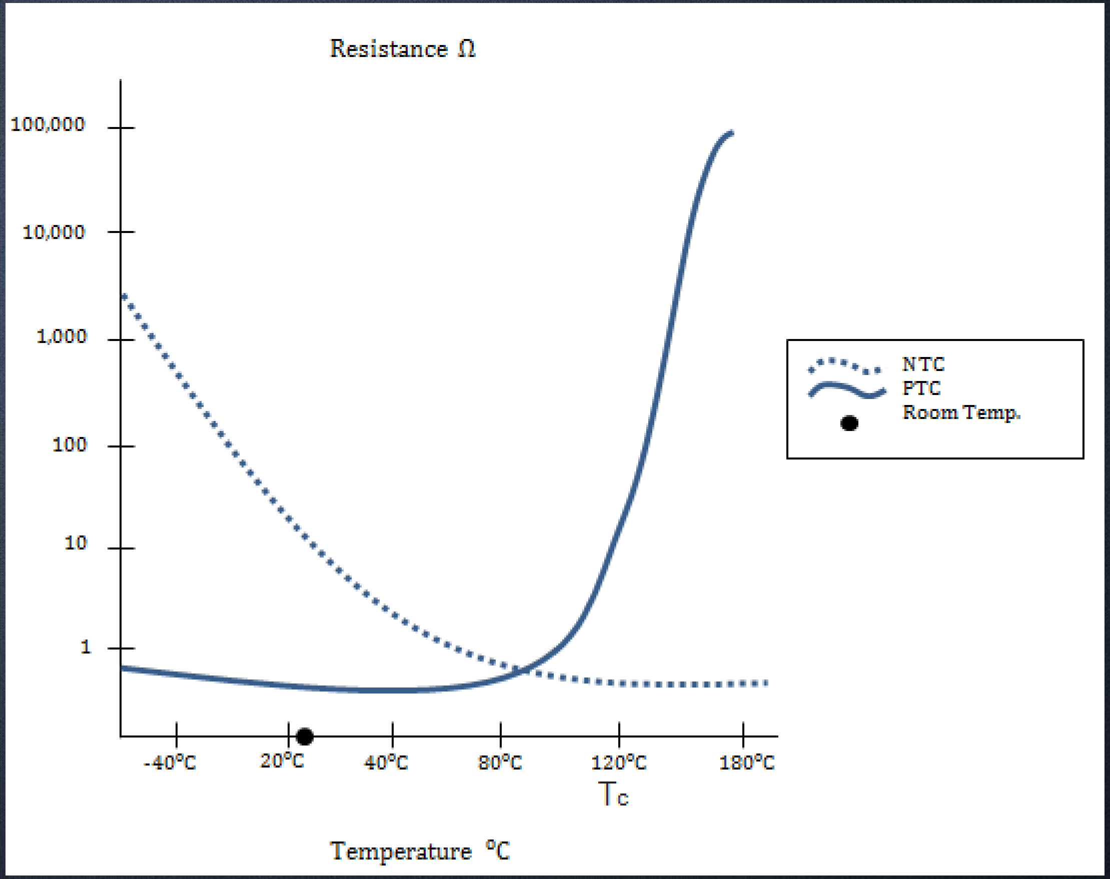

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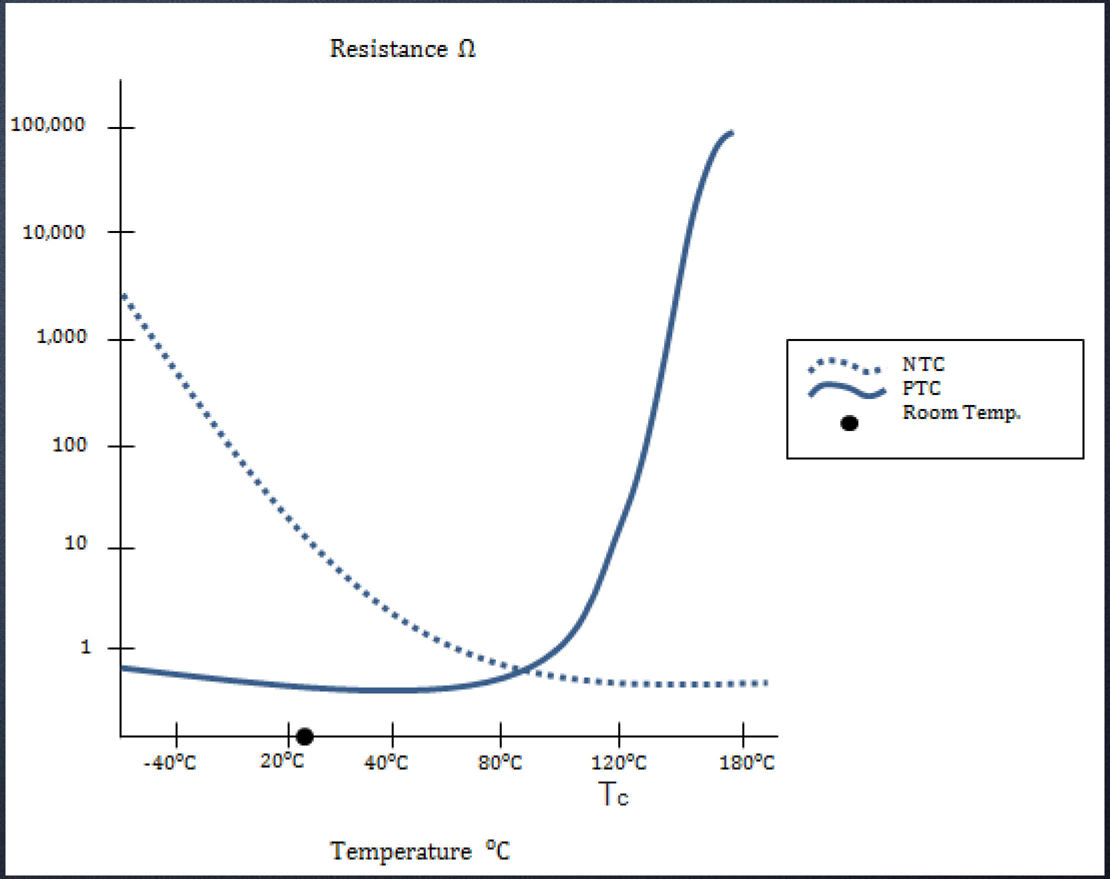

27. How many leads does a Thermistor have?

a. 2
b. 3
c. 4
d. 2, 3 or 4 depending on the accuracy you require

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28. NTC Thermistors have a ________ temperature coefficient.

a. Negative
b. Positive

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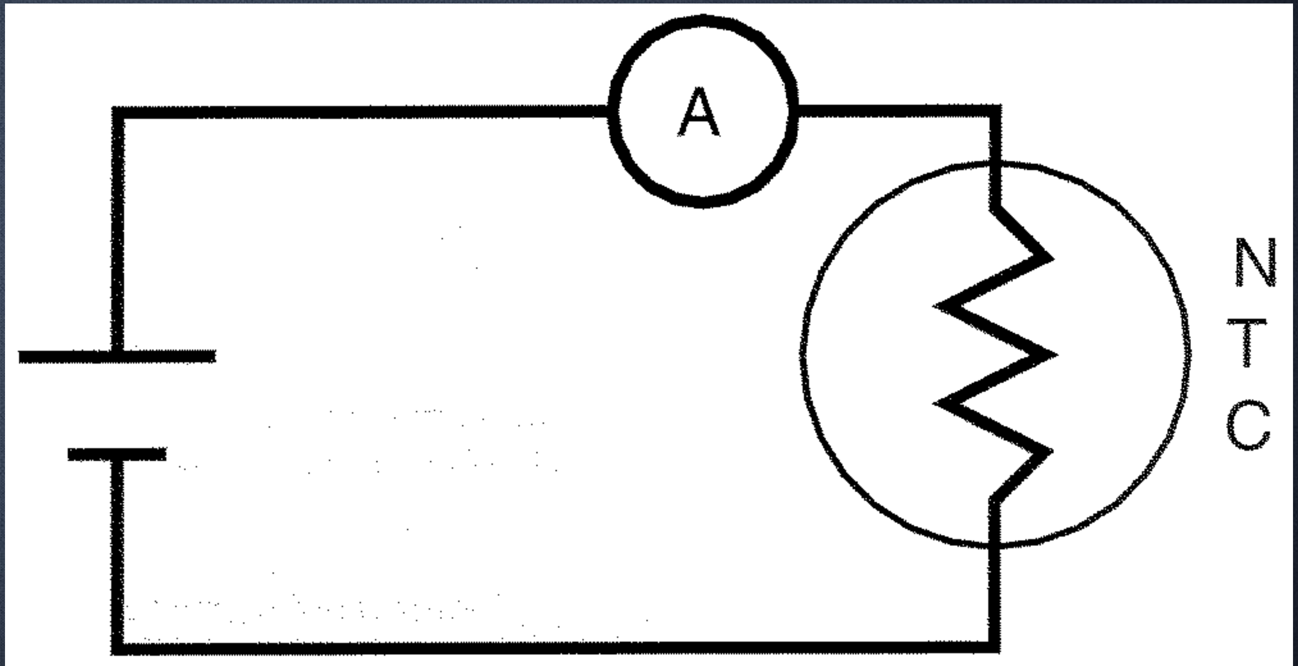
29. If the temperature in Figure below increases, current in the circuit will ____.

a. Increase
b. Decrease



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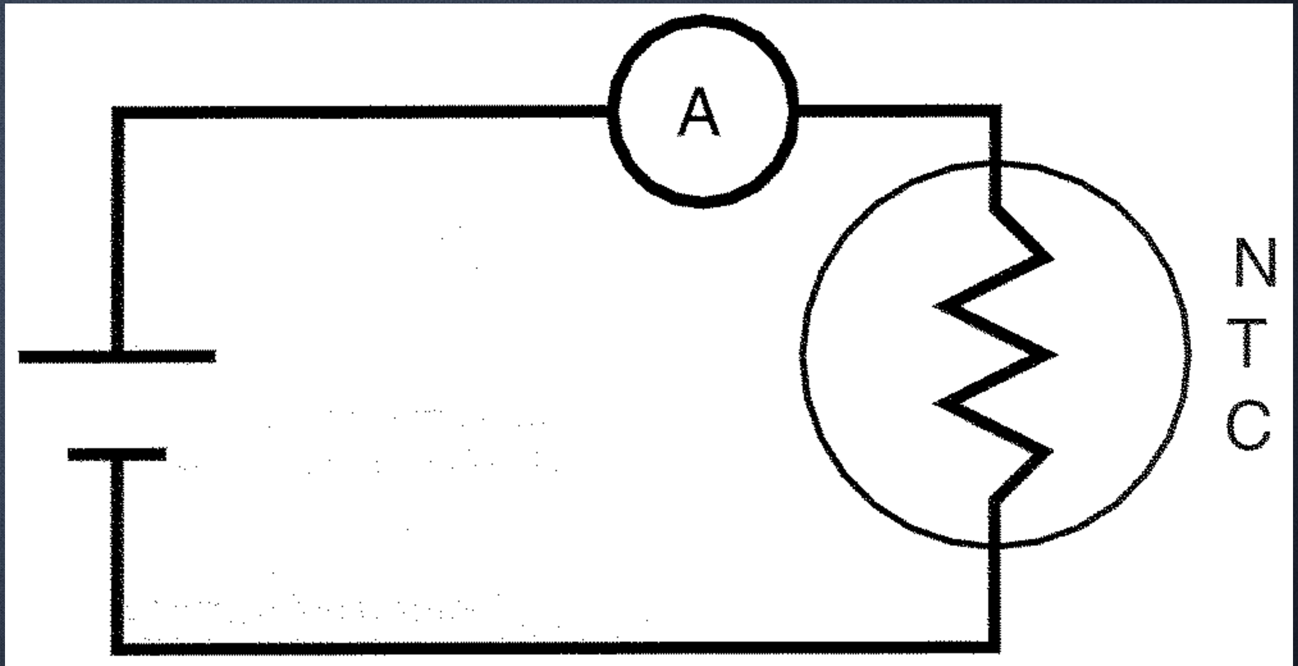
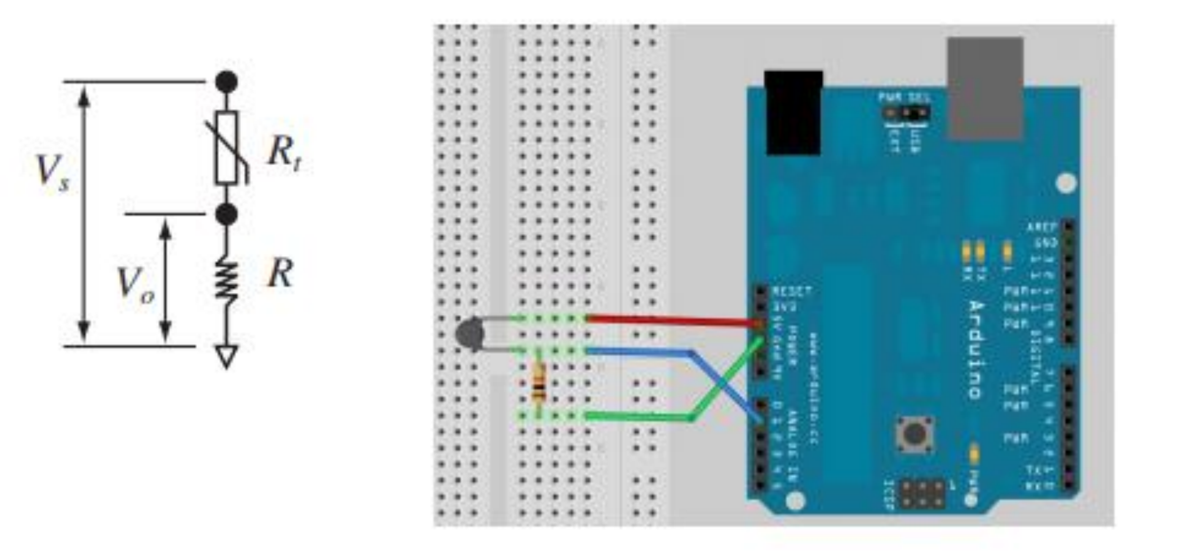


30. A simple technique for converting the (variable) resistance of the thermistor to a voltage is to use the thermistor in a circuit called a ________________.

a. Voltage Regulator
b. Capacitive Dielectric
c. Current Regulator
d. Voltage Divider



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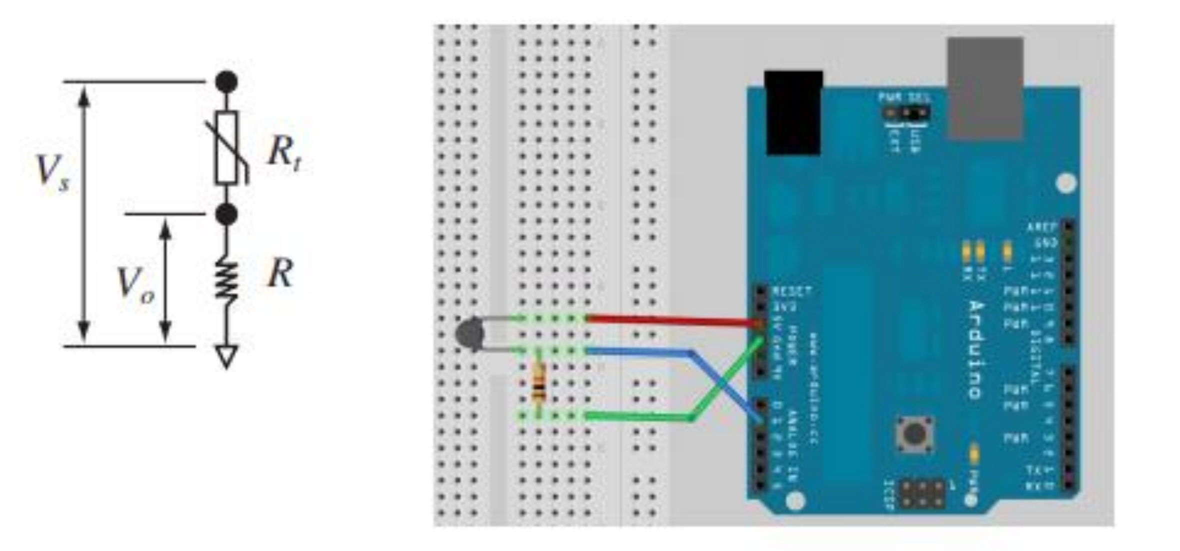
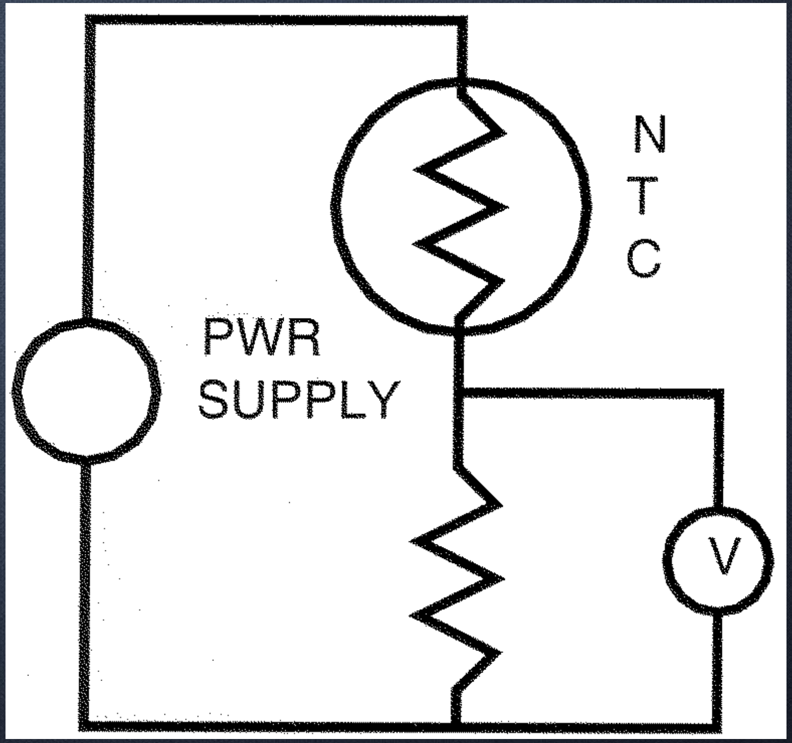


31. If the temperature to which the circuits in the Figure below is exposed increases, the voltage measured by the meter will ____.

a. Increase
b. Decrease
c. Stay the same



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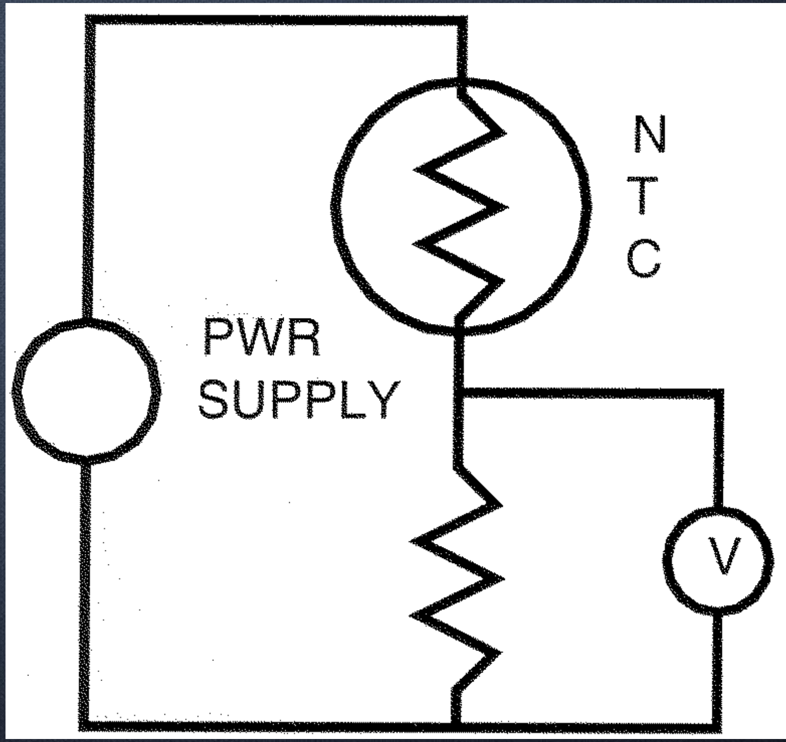

32. Thermistors are accurate to approximately ________ within their specified temperature range.

a. ± 0.05°C to ± 1.5°C
b. ± 1.0°C to ± 1.5°C
c. ± 2.0°C to ± 2.5°C
d. ± 0.001°C to ± 0.005°C

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c. ± 2.0°C to ± 2.5°C
d. ± 0.001°C to ± 0.005°C

33. The working temperature range for most thermistors is between ______________

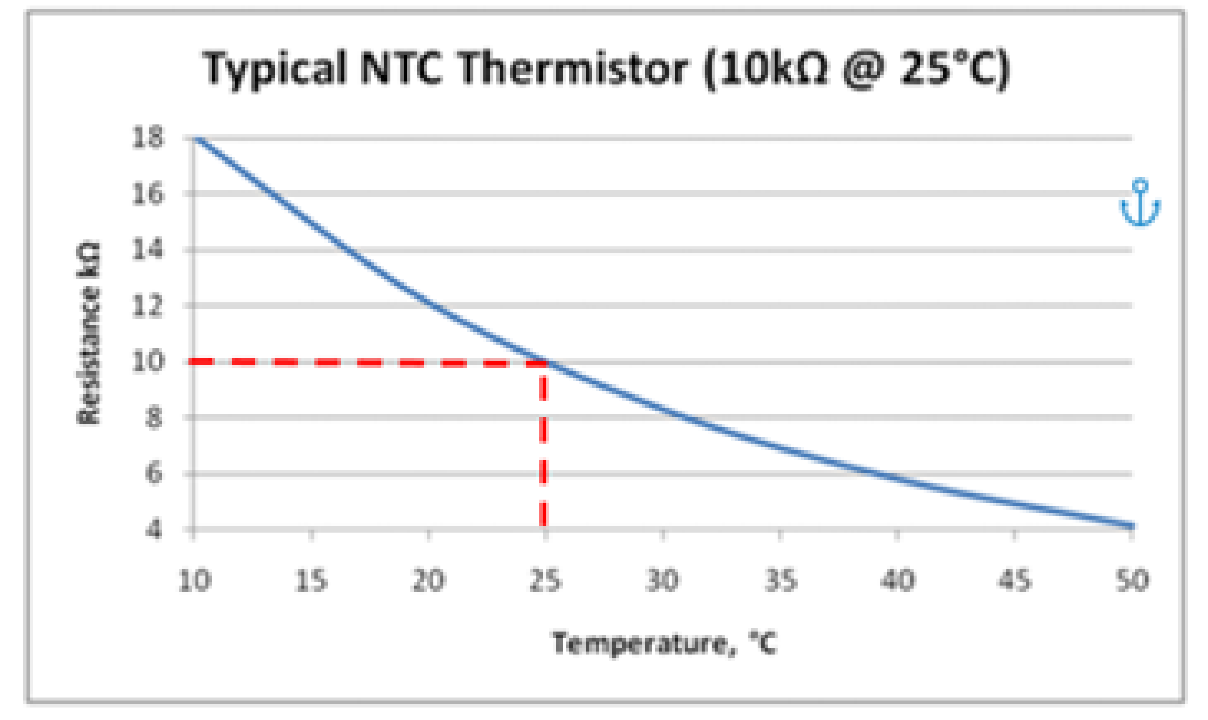
a. 0°C and 24°C
b. 0°C and 200°C
c. 0°C and 1000°C
d. 0°C and 3700°C

33. The working temperature range for most thermistors is between ______________

a. 0°C and 24°C
b. 0°C and 200°C
c. 0°C and 1000°C
d. 0°C and 3700°C

34. A 10 kW Thermistor will exhibit this nominal resistance typically at what temperature?

a. 0 °C
b. 25 °C
c. 200 °C
d. 1000 °C



http://esp8266tutorials.blogspot.com/2016/09/esp8266-ntc-temperature-thermistor.html

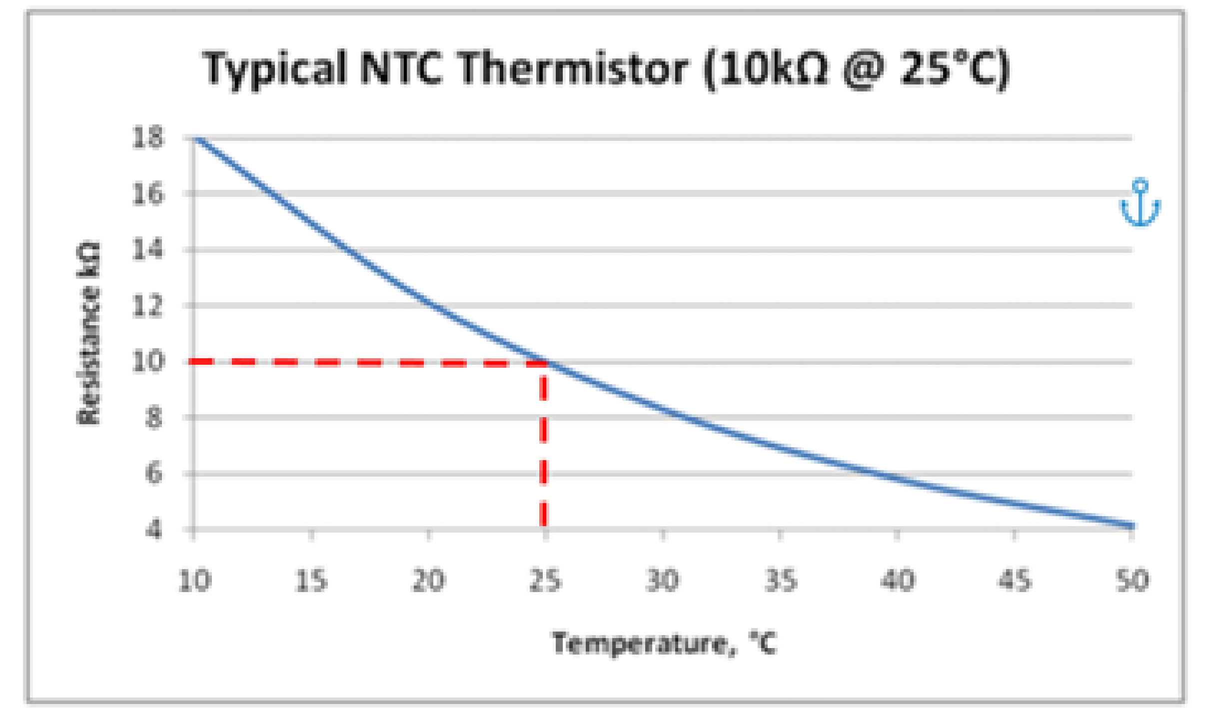
34. A 10 kW Thermistor will exhibit this nominal resistance typically at what temperature?

a. 0 °C

b. 25 °C

c. 200 °C

d. 1000 °C



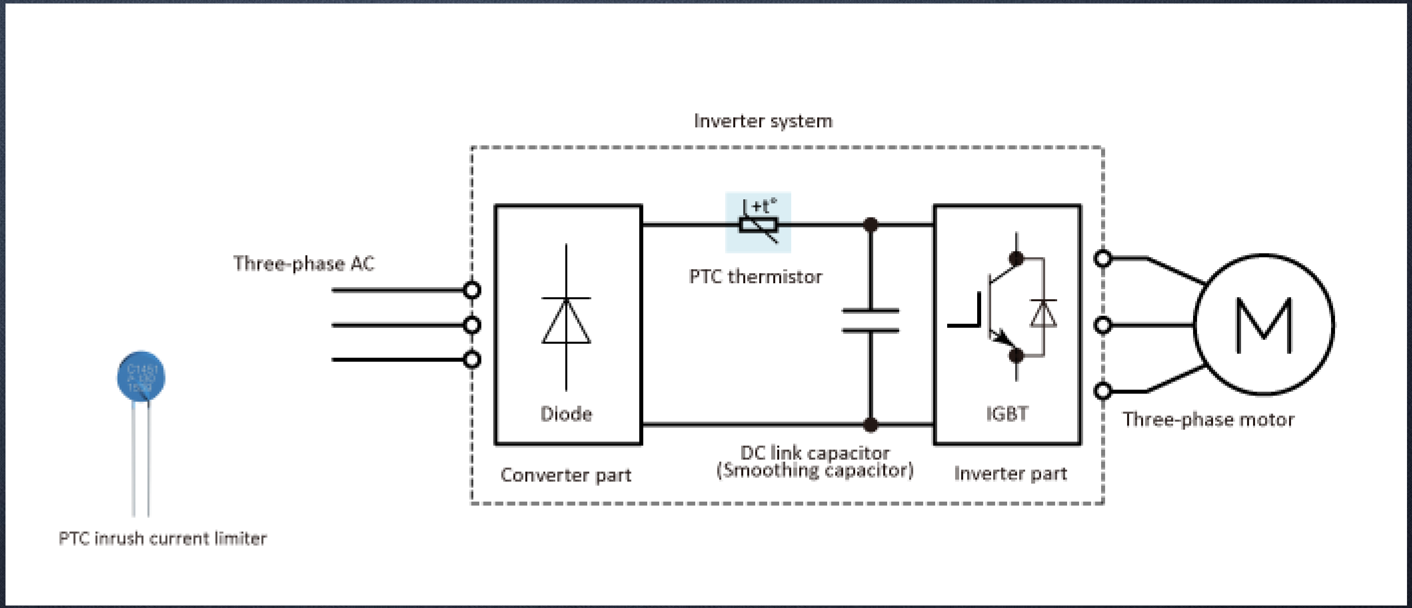
http://esp8266tutorials.blogspot.com/2016/09/esp8266-ntc-temperature-thermistor.html

35. While the primarily use of thermistors are as resistive temperature sensors, being resistive devices belonging the the resistor family, PTC thermistors can also be used in series with a component or device to control the current flowing through them. In other words, they can also be used as current-limiting devices.

a. True
b. False

35. While the primarily use of thermistors are as resistive temperature sensors, being resistive devices belonging the the resistor family, PTC thermistors can also be used in series with a component or device to control the current flowing through them. In other words, they can also be used as current-limiting devices.

a. True
b. False



36. When a high current is applied to a load in series with a PTC thermistor, the resultant resistance of the PTC thermistor is ________.

a. Low
b. High

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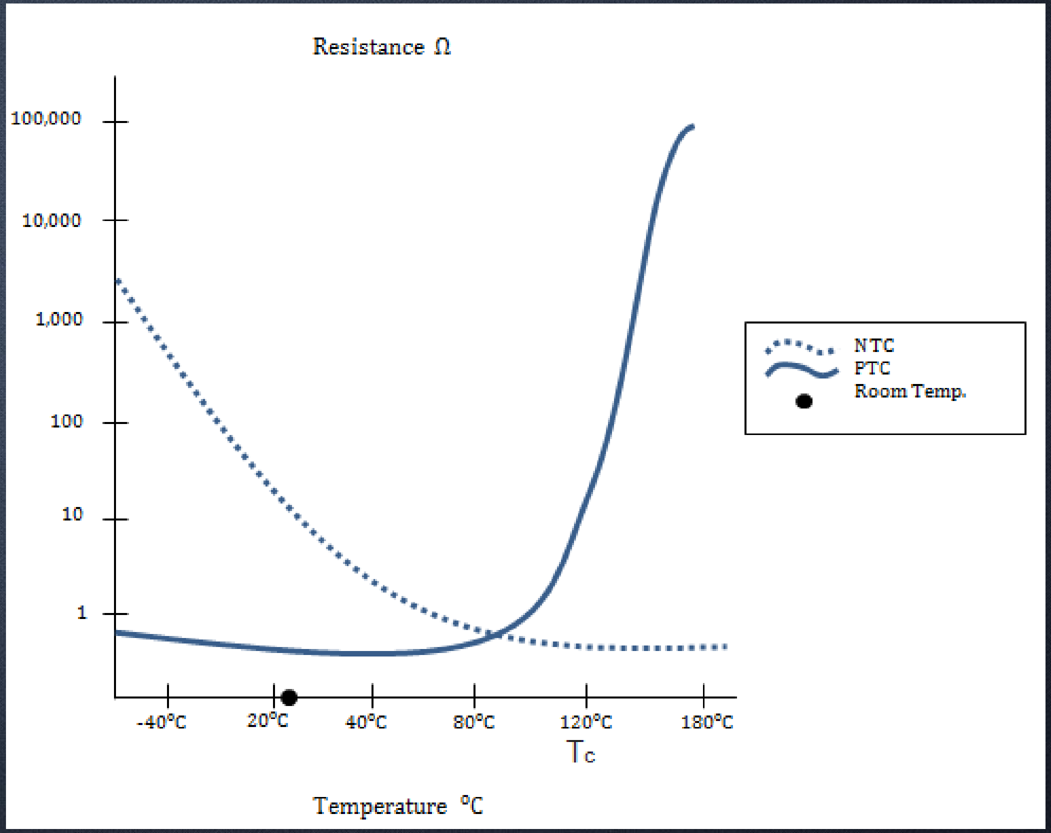
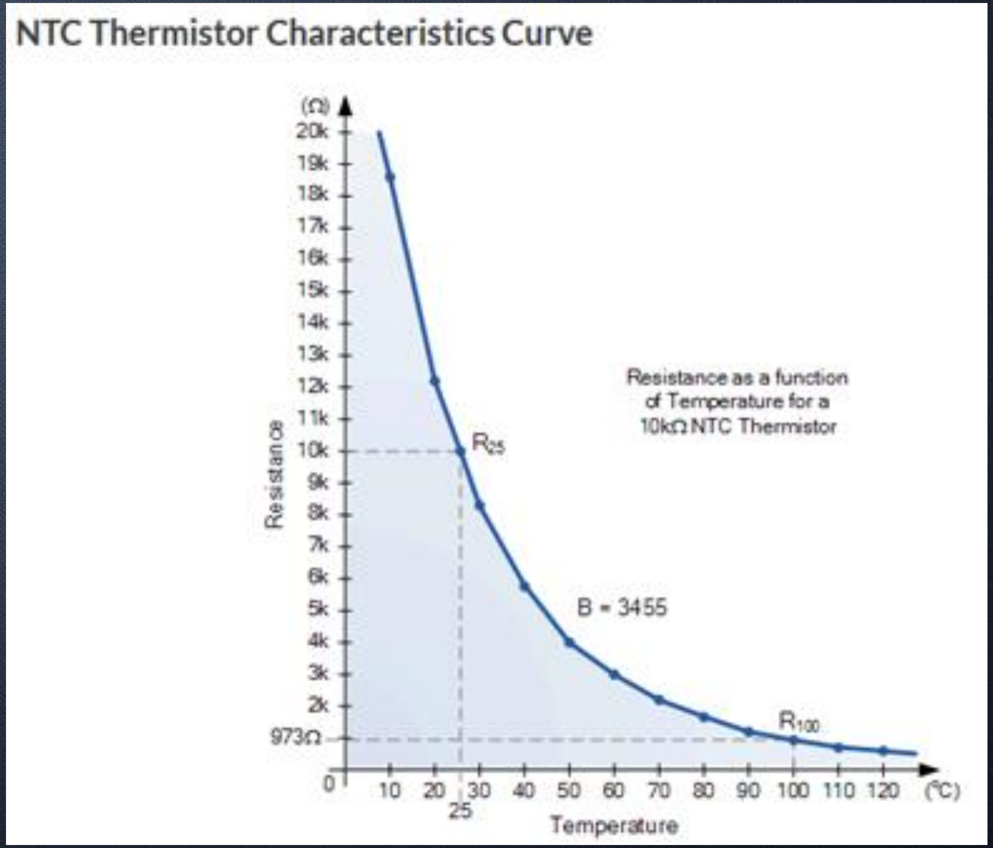
a. Low
b. High



https://www.ametherm.com/ptc-thermistors-vs-ntc-thermistors-for-inrush-current

37. The change in resistance vs. ambient temperature for thermistors is a non-linear exponential curve. Therefore, in order to obtain an accurate signal that corresponds to the temperature of the thermistor, the ________________ equation is used.



a. Steinhart-Hart
b. Harper-Johnson
c. Putin-Trump
d. Blair-Bush

37. The change in resistance vs. ambient temperature for thermistors is a non-linear exponential curve. Therefore, in order to obtain an accurate signal that corresponds to the temperature of the thermistor, the _________________ equation is used.

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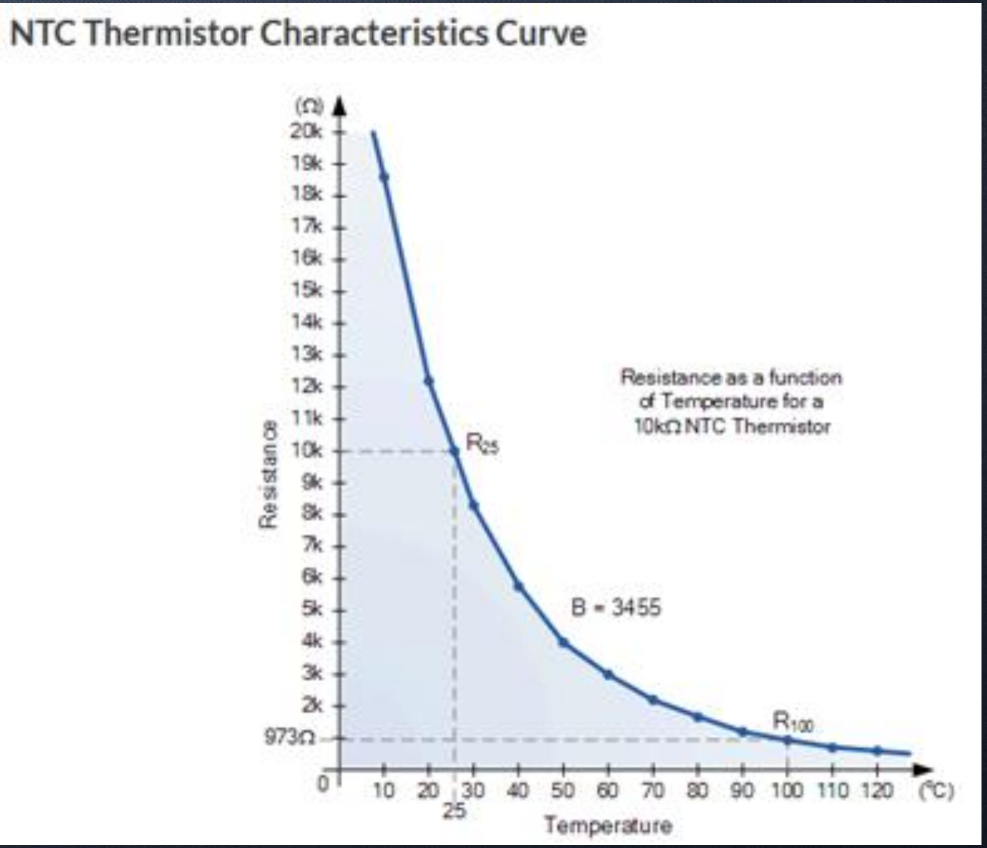

38. For the Steinhart-Hart Equation, the resultant temperature of this equation is in which temperature units?

a. Celsius
b. Fahrenheit
c. Rankine
d. Kelvin

$$\frac{1}{T} = A + B\ln(R) + C(\ln(R))^3$$

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b. Fahrenheit
c. Rankine
d. Kelvin

$$\frac{1}{T} = A + B\ln(R) + C(\ln(R))^3$$

39. An RTD is basically:

a. a precision voltage regulator
b. a precision resistor whose resistance changes with temperature
c. a device that measures differential voltage
d. a precise pressure sensor

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a. a precision voltage regulator
b. a precision resistor whose resistance changes with temperature
c. a device that measures differential voltage
d. a precise pressure sensor

40. RTD’s have the following characteristic change in resistance vs. ambient temperature change:

a. PTC Positive Temperature Coefficient & a linear increase in resistance as the ambient temperature increases
b. PTC Positive Temperature Coefficient & an exponential (non-linear) increase in resistance as the ambient temperature increases
c. NTC Negative Temperature Coefficient & a linear decrease in resistance as the ambient temperature increases
d. NTC Negative Temperature Coefficient & an exponential (non-linear) decrease in resistance as the ambient temperature increases

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41. A PT100 RTD has a resistance of 100 ohms at an ambient temperature of _______.

a. 0 ºC
b. 0 ºF
c. 100 ºC
d. 32 ºC

41. A PT100 RTD has a resistance of 100 ohms at an ambient temperature of _______.

a. 0 ºC

b. 0 ºF

c. 100 ºC

d. 32 ºC

°C	0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-200	18.520	-	-	-	-	-	-	-	-	-
-190	22.825	22.397	21.967	21.538	21.108	20.677	20.247	19.815	19.384	18.952
-180	27.096	26.671	26.245	25.819	25.392	24.965	24.538	24.110	23.682	23.254
-170	31.335	30.913	30.490	30.067	29.643	29.220	28.796	28.371	27.947	27.552
-160	35.543	35.124	34.704	34.284	33.864	33.443	33.022	32.601	32.179	31.757
-150	39.723	39.306	38.889	38.472	38.055	37.637	37.219	36.800	36.382	35.963
-140	43.876	43.462	43.048	42.633	42.218	41.803	41.388	40.972	40.556	40.140
-130	48.005	47.593	47.181	46.769	46.356	45.944	45.531	45.117	44.704	44.290
-120	52.110	51.700	51.291	50.881	50.470	50.060	49.649	49.239	48.828	48.416
-110	56.193	55.786	55.378	54.970	54.562	54.154	53.746	53.337	52.928	52.519
-100	60.256	59.850	59.445	59.039	58.633	58.227	57.821	57.414	57.007	56.600
-90	64.300	63.896	63.492	63.088	62.684	62.280	61.876	61.471	61.066	60.661
-80	68.325	67.924	67.552	67.120	66.717	66.315	65.912	65.509	65.106	64.703
-70	72.335	71.934	71.534	71.134	70.733	70.332	69.931	69.530	69.129	68.727
-60	76.328	75.929	75.530	75.131	74.732	74.333	73.934	73.534	73.134	72.735
-50	80.306	79.909	79.512	79.114	78.717	78.319	77.921	77.523	77.125	76.726
-40	84.271	83.875	83.479	82.083	82.687	82.290	81.894	81.497	81.100	80.703
-30	88.222	87.827	87.432	87.038	86.643	86.248	85.853	85.457	85.062	84.666
-20	92.160	91.767	91.373	90.980	90.586	90.192	89.798	89.404	89.010	88.616
-10	96.086	95.694	95.302	94.909	94.517	94.124	93.732	93.339	92.946	92.553
0	100.000	99.609	99.218	98.827	98.436	98.044	97.653	97.261	96.870	96.478

42. The most common metal used for RTDs is:

a. Gold
b. Platinum
c. Silver
d. Aluminum

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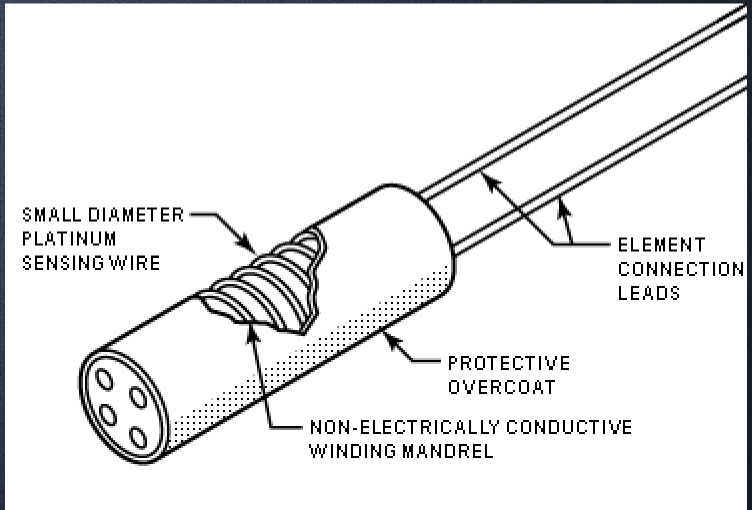
a. Gold
b. Platinum
c. Silver
d. Aluminum



http://www.rdfcorp.com/anotes/pa-r/pa-r_01.shtml

43. A/an _____ has a positive temperature coefficient.

a. NTC Thermistor
b. RTD
c. Thermocouple
d. Thermopile

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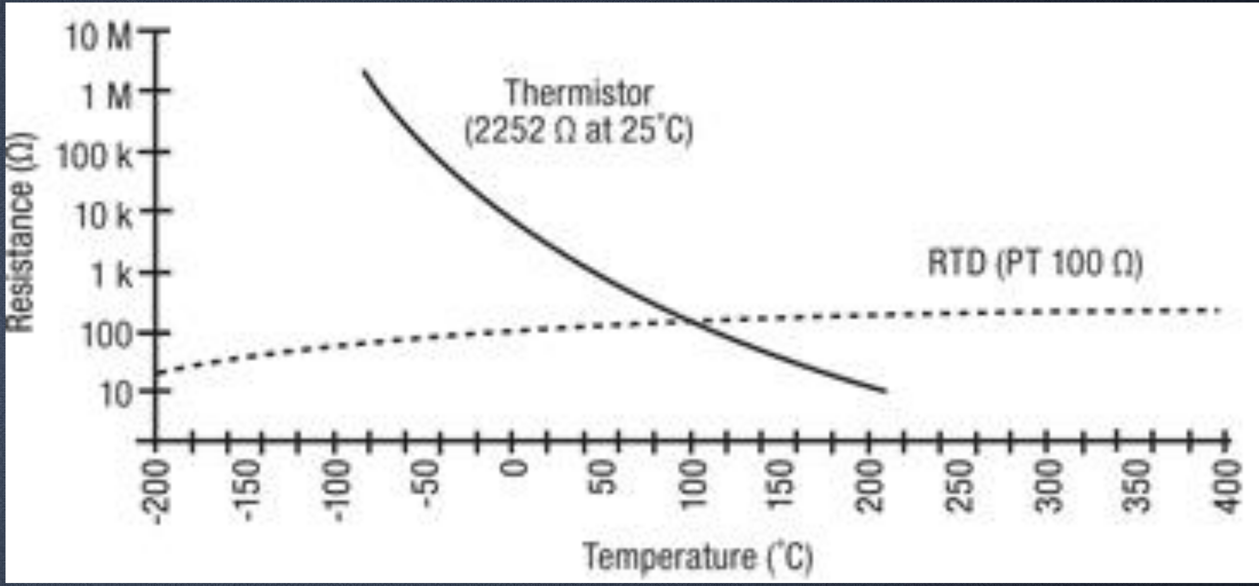

https://www.digikey.com.au/en/articles/techzone/2011/sep/rtds-ptcs-and-ntcs-how-to-effectively-decipher-this-alphabet-soup-of-temperature-sensors

44. From the following PT100 (Resistance/Temperature Chart)... What is the expected Resistance measurement from a PT100 RTD at an ambient temperature of 100 degrees C?

a. 100.0 ohms
b. 109.35 ohms
c. 138.51 ohms
d. 142.29 ohms

0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	103.90	0
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	119.40	40
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	123.24	50
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	127.08	60
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	130.90	70
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	134.71	80
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	138.51	90
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	142.29	100
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69	146.07	110
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46	149.83	120
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21	153.58	130
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95	157.33	140

44. From the following PT100 (Resistance/Temperature Chart)... What is the expected Resistance measurement from a PT100 RTD at an ambient temperature of 100 degrees C?

a. 100.0 ohms

b. 109.35 ohms

c. 138.51 ohms

d. 142.29 ohms

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10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	119.40	40
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	123.24	50
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	127.08	60
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	130.90	70
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	134.71	80
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	138.51	90
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	142.29	100
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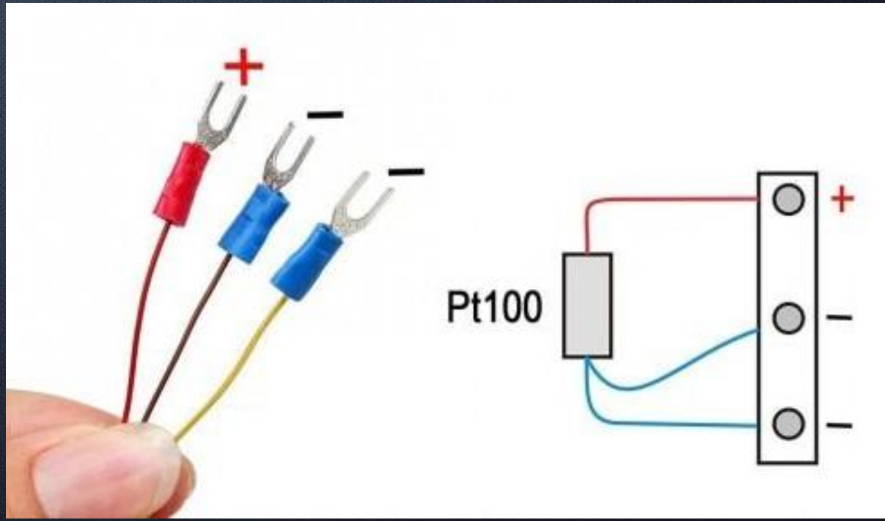
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46	149.83	120
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21	153.58	130
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95	157.33	140

45. Which configuration is the most common RTD found in industry?

a. 2 Wire (White & Red leads)
b. 3 Wire (1 White & 2 Red leads)
c. 4 Wire (2 White & 2 Red leads)
d. 2 Wire (Yellow & Red leads)

45. Which configuration is the most common RTD found in industry?

a. 2 Wire (White & Red leads)
b. 3 Wire (1 White & 2 Red leads)
c. 4 Wire (2 White & 2 Red leads)
d. 2 Wire (Yellow & Red leads)



46. The working temperature range for most RTD’s is between ____________

a. 0°C to 100°C
b. -200°C to 200°C
c. -200°C to 850°C
d. 0°C and 1500°C

46. The working temperature range for most RTD's is between ___________

a. 0°C to 100°C
b. -200°C to 200°C
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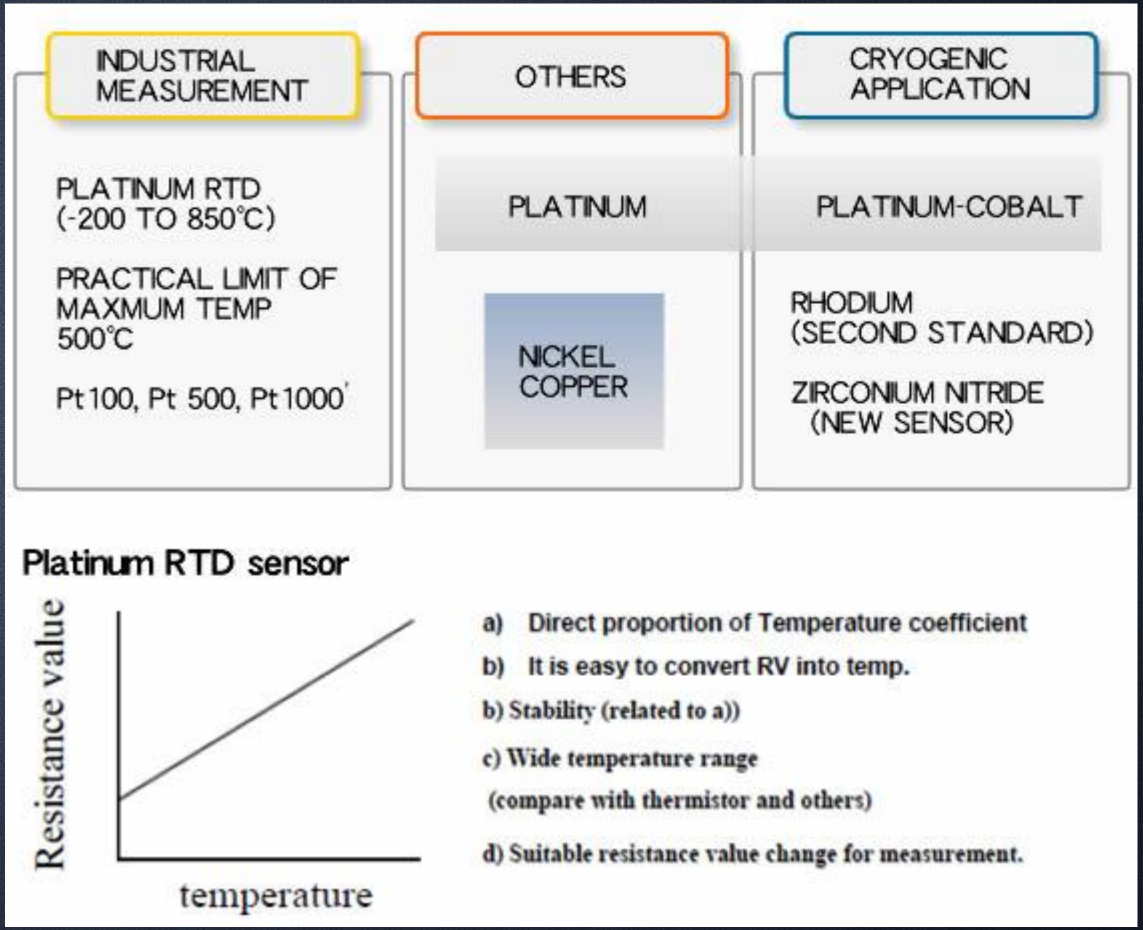

https://hayashidenko.co.jp/en/info04.html

47. A PT100 has a characteristic change in resistance due to changes in the ambient temperature. This is called the Alpha Value. Typically for a PT100 RTD, for every 1 °C change in temperature, the resistance will increase by ________________.

a. 100.0 ohms
b. 0.385 ohms
c. 0.369 ohms
d. 1000.0 ohms

0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	103.90	0
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	119.40	40
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	123.24	50
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	127.08	60
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	130.90	70
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	134.71	80
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	138.51	90
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	142.29	100
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69	146.07	110
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46	149.83	120
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21	153.58	130
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47. A PT100 has a characteristic change in resistance due to changes in the ambient temperature. This is called the Alpha Value. Typically for a PT100 RTD, for every 1 °C change in temperature, the resistance will increase by _________________.

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d. 1000.0 ohms

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10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	119.40	40
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	123.24	50
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	127.08	60
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	130.90	70
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	134.71	80
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	138.51	90
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	142.29	100
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140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95	157.33	140

48. The most common RTD is the:

a. PT24 This element measures 24 Ohms @ 0 Degrees C

b. PT100 This element measures 100 Ohms @ 0 Degrees C

c. PT1000 This element measures 1000 Ohms @ 0 Degrees C

d. PT10000 This element measures 10 kOhms @ 0 Degrees C

48. The most common RTD is the:

a. PT24 This element measures 24 Ohms @ 0 Degrees C

b. PT100 This element measures 100 Ohms @ 0 Degrees C

c. PT1000 This element measures 1000 Ohms @ 0 Degrees C

d. PT10000 This element measures 10 kOhms @ 0 Degrees C

49. The issue with 2 Wire RTD's is:

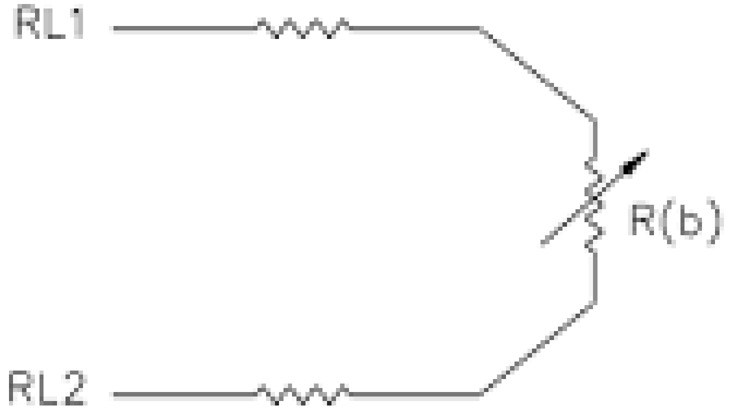
a. This configuration provides an exponential rather than a linear output

b. Self Heating of the RTD due to current flow through the platinum resistive element distorts the accuracy of the RTD

c. Cold Junction Compensation is required for accurate readings

d. The resistance of the lead wires distorts the accuracy of the RTD

Two Wire RTD



Measured resistance $R_t = R_1 + R_2 + R_b$

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c. Cold Junction Compensation is required for accurate readings

d. The resistance of the lead wires distorts the accuracy of the RTD

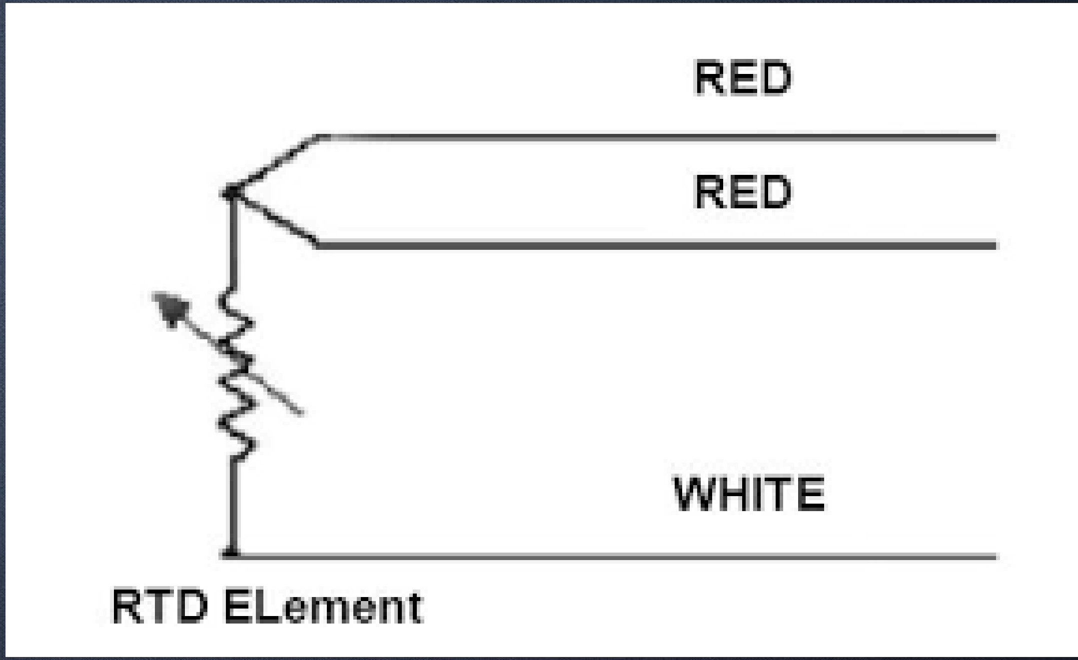
50. What is the expected resistance reading between the two Red Leads of a 3-Wire RTD?

a. 10 - 20 ohms

b. 24 ohms

c. 109 ohms

d. 0.6 - 1.0 ohm



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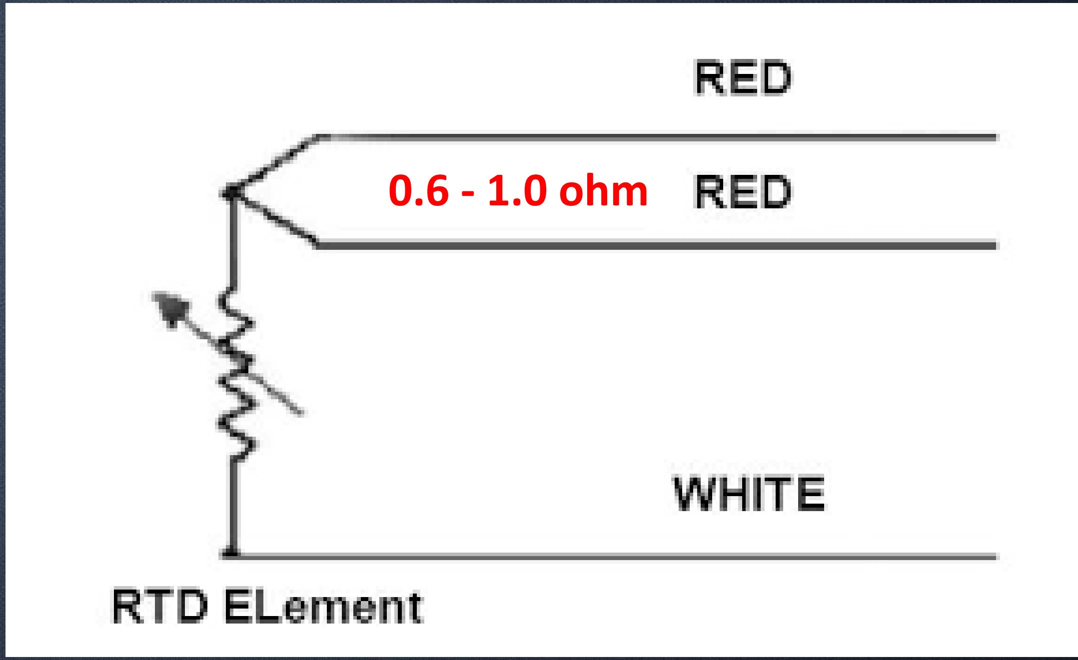


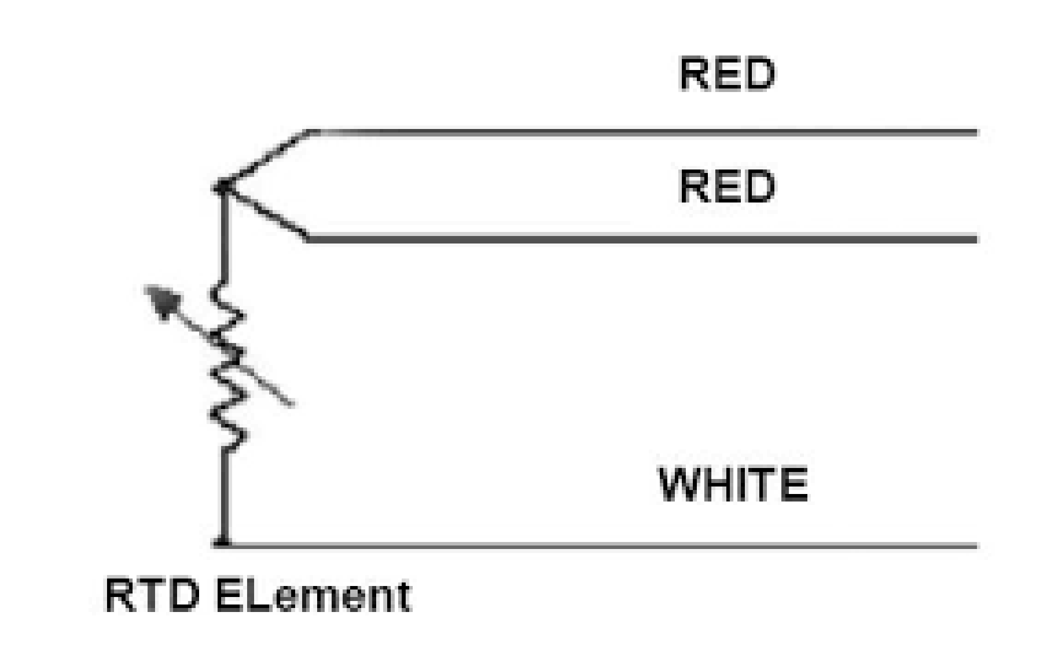
51. What is the expected resistance reading between any of the Red Leads & the White Lead of a 3-Wire RTD @ 24 Degrees Celsius?

a. 10 - 20 ohms

b. 24 ohms

c. 109 ohms

d. 0.6 - 1.0 ohm



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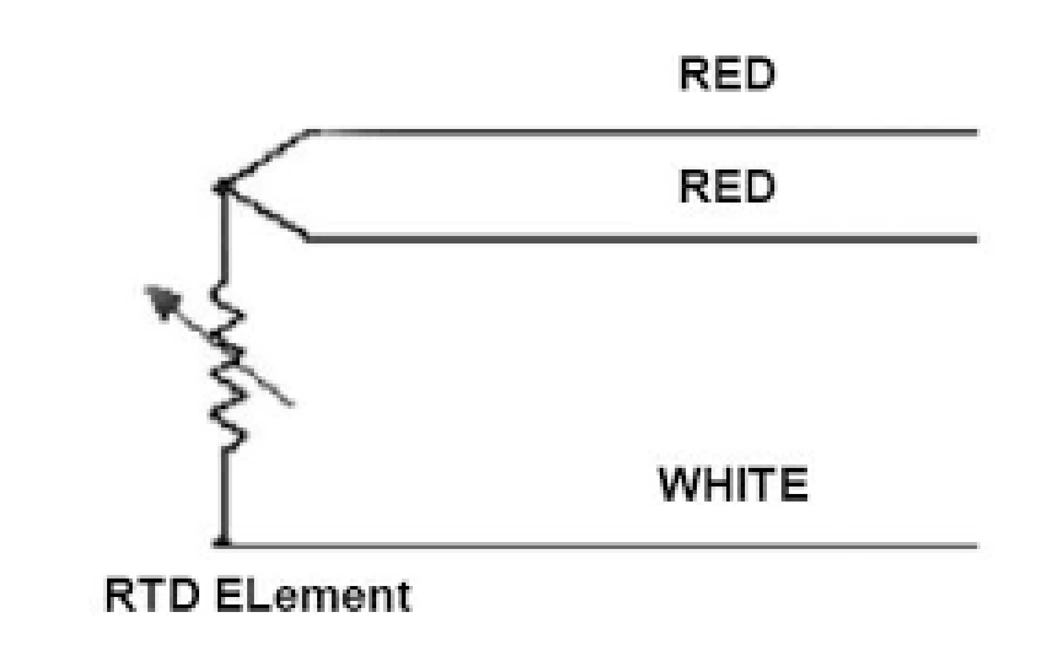
a. 10 - 20 ohms

b. 24 ohms

c. 109 ohms

d. 0.6 - 1.0 ohm



52. Thermocouples consist of a pair of wires made of dissimilar metals joined together at one or more junctions that generate a voltage when subjected to a temperature gradient . This phenomenon is known as the __________

a. Seebeck Effect

b. Piezoelectric Effect

c. Photovoltaic Effect

d. Seinfeld Effect

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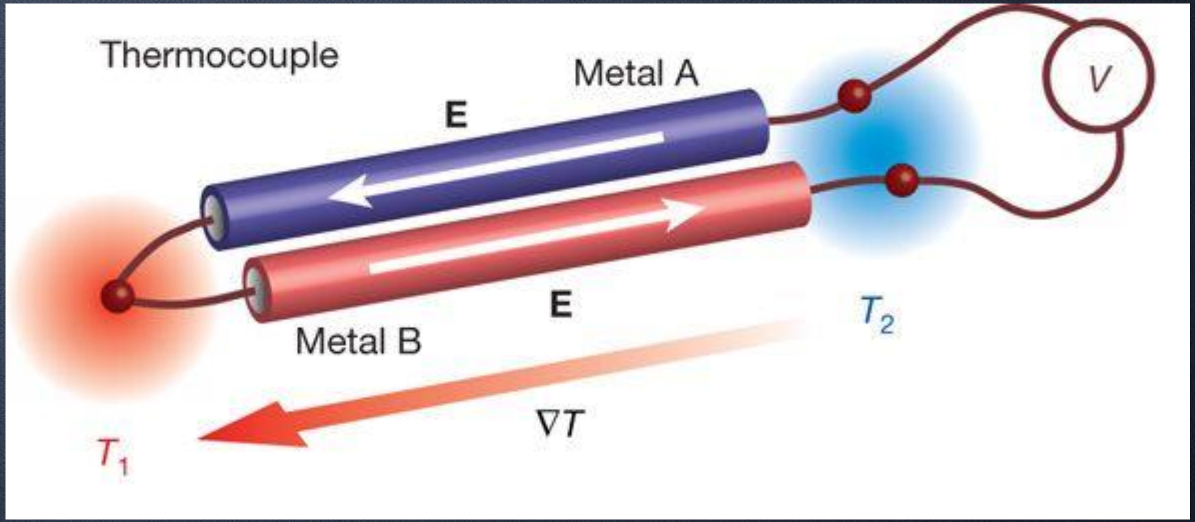

53. If we were to open one end of a Seebeck Circuit and apply heat to the closed end...

a. A current will develop between the two junctions in proportion to the resistance difference

b. A current will develop between the two junctions in proportion to the temperature difference

c. A voltage will develop between the two junctions in proportion to the temperature difference

d. A voltage will develop between the two junctions in proportion to the resistance difference

53. If we were to open one end of a Seebeck Circuit and apply heat to the closed end...

a. A current will develop between the two junctions in proportion to the resistance difference

b. A current will develop between the two junctions in proportion to the temperature difference

c. A voltage will develop between the two junctions in proportion to the temperature difference

d. A voltage will develop between the two junctions in proportion to the resistance difference

54. A Thermocouple consists of :

a. Two wires of dissimilar metals

b. Three wires of dissimilar metals

c. Four wires of dissimilar metals

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55. A thermocouple produces a voltage that is proportional to ____.

a. the difference in temperature between the hot and cold junction
b. the temperature of the hot junction
c. the temperature of the cold junction
d. the resistance of the cold junction

55. A thermocouple produces a voltage that is proportional to _____.

a. the difference in temperature between the hot and cold junction
b. the temperature of the hot junction
c. the temperature of the cold junction
d. the resistance of the cold junction

56. When using a multimeter (instead of a calibrator) connected to a Thermocouple to obtain the temperature of a liquid, the ambient temperature at the terminals must be corrected by adding the mV that corresponds to the ambient temperature to the mV indicated on the meter. This is known as:

a. Cold Junction Condensation

b. Hot Junction Compensation

c. Hot Junction Comparison

d. Cold Junction Compensation

56. When using a multimeter (instead of a calibrator) connected to a Thermocouple to obtain the temperature of a liquid, the ambient temperature at the terminals must be corrected by adding the mV that corresponds to the ambient temperature to the mV indicated on the meter. This is known as:

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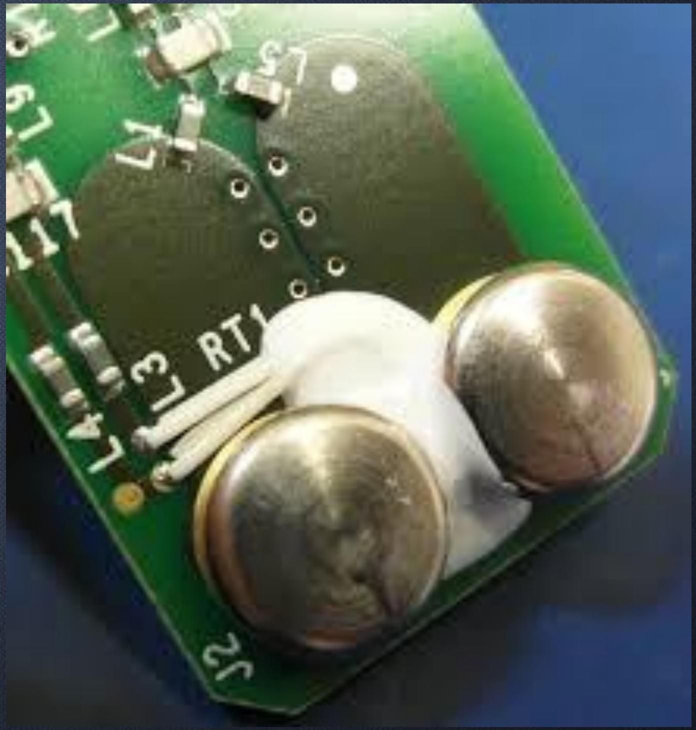

57. The name for the end of the Thermocouple where the two dissimilar metals are joined is the:

a. Cold Junction

b. Hot Junction

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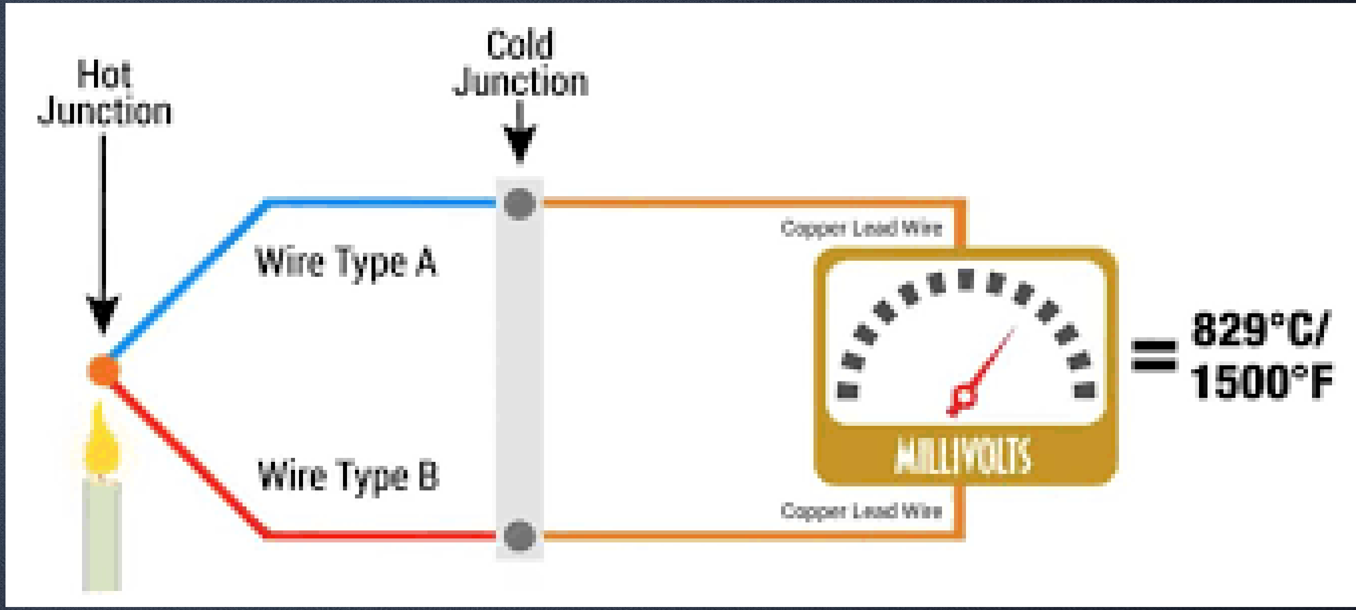

58. Type J Thermocouples are constructed using these two types of dissimilar metals:

a. Iron - Constantan

b. Chromel - Alumel

c. Copper - Constantan

d. Platinum - Rhodium

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THERMOCOUPLE CH

ANSI/ASTM	Symbol Single	Generic Names	Color Individual Conductor
T	TP TN	Copper Constantan, Nominal Composition: 55% Cu, 45% Ni	Blue Red
J	JP JN	Iron Constantan, Nominal Composition: 55% Cu, 45% Ni	White Red
E	EP EN	Chromel®, Nominal Composition: 90% Ni, 10% Cr Constantan, Nominal Composition: 55% Cu, 45% Ni	Purple Red
K	KP KN	Chromel, Nominal Composition: 90% Ni, 10% Cr Alumel®, Nominal Composition: 95% Ni, 2% Mn, 2% Al	Yellow Red

https://www.thermometricscorp.com/typej.html

59. Type K Thermocouples are constructed using these two types of dissimilar metals:

a. Iron - Constantan

b. Chromel - Alumel

c. Copper - Constantan

d. Platinum - Rhodium

59. Type K Thermocouples are constructed using these two types of dissimilar metals:

a. Iron - Constantan

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K	KP KN	Chromel, Nominal Composition: 90% Ni, 10% Cr Alumel®, Nominal Composition: 95% Ni, 2% Mn, 2% Al	Yellow Red

https://www.thermometricscorp.com/typej.html

60. What is the colour code & polarity for a Type J Thermocouple (in North America)?

a. Yellow (+), White (-)

b. White (+), Red (-)

c. Yellow (+), Red (-)

d. Blue (+), Red (-)

60. What is the colour code & polarity for a Type J Thermocouple (in North America)?

a. Yellow (+), White (-)

b. White (+), Red (-)

c. Yellow (+), Red (-)

d. Blue (+), Red (-)

THERMOCOUPLE CH

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https://www.thermometricscorp.com/typej.html

61. What is the colour code & polarity for a Type K Thermocouple (in North America)?

a. Yellow (+), White (-)

b. White (+), Red (-)

c. Yellow (+), Red (-)

d. Blue (+), Red (-)

61. What is the colour code & polarity for a Type K Thermocouple (in North America)?

a. Yellow (+), White (-)

b. White (+), Red (-)

c. Yellow (+), Red (-)

d. Blue (+), Red (-)

THERMOCOUPLE CH

			Color
ANSI/ASTM	Symbol Single	Generic Names	Individual Conductor
T	TP TN	Copper Constantan, Nominal Composition: 55% Cu, 45% Ni	Blue Red
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https://www.thermometricscorp.com/typej.html

62. Based on your 2 previous answers, what polarity is the Red Conductor of a Thermocouple (in North America)?

a. Positive

b. Negative

62. Based on your 2 previous answers, what polarity is the Red Conductor of a Thermocouple (in North America)?

a. Positive

b. Negative

	Thermocouple Grade	Extension Grade	Conductor Colors		Alloys		
ANSI Code	Jacket Color	Jacket Color	Positive	Negative	Positive	Negative	Temperature Range
J	Brown	Black	White	Red	Iron	Constantan Copper-Nickel	-210° to 1,200° C -346° to 2,193° F
K	Brown	Yellow	Yellow	Red	Nickel-Chromium	Nickel-Aluminum	–270° to 1,372°C –454° to 2,501°F
T	Brown	Blue	Blue	Red	Copper	Constantan Copper-Nickel	–270° to 400° C –454° to 752° F
E	Brown	Purple	Purple	Red	Nickel-Chromium	Constantan Copper-Nickel	–270° to 1,000° C –454° to 1,832° F

Table 1: Thermocouple Wire and Thermocouple Extension Wire Types

https://www.anixter.com/en_ca/resources/literature/wire-wisdom/thermocouple-and-rtd-wire.html

63. When the reference junction is the same temperature as the measurement junction in a thermocouple circuit, the output voltage (measured by the sensing instrument) will indicate:

a. Zero mV

b. Reverse Polarity

c. OL

d. 100 ohms

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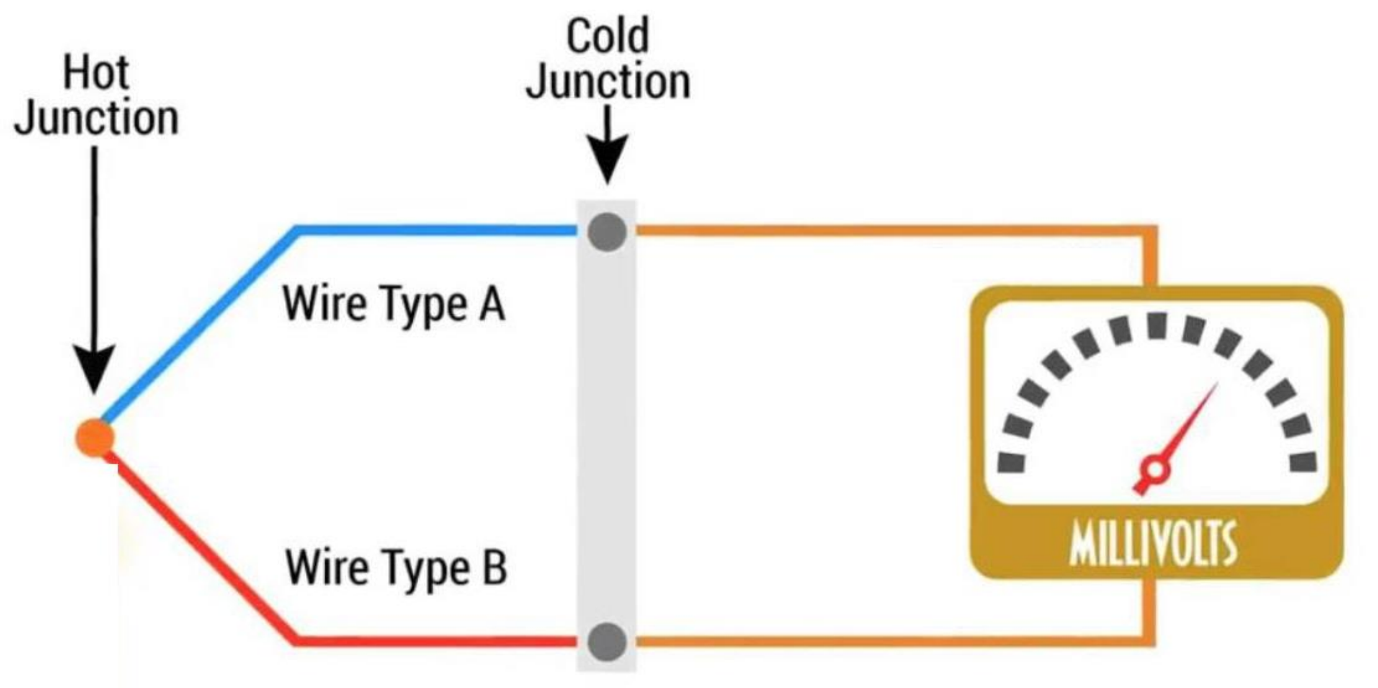

64. In thermocouple circuits, cold junction compensation is used to eliminate error due to the effects of _____.

a. hysteresis

b. dead band

c. varying ambient temperature

d. open circuits

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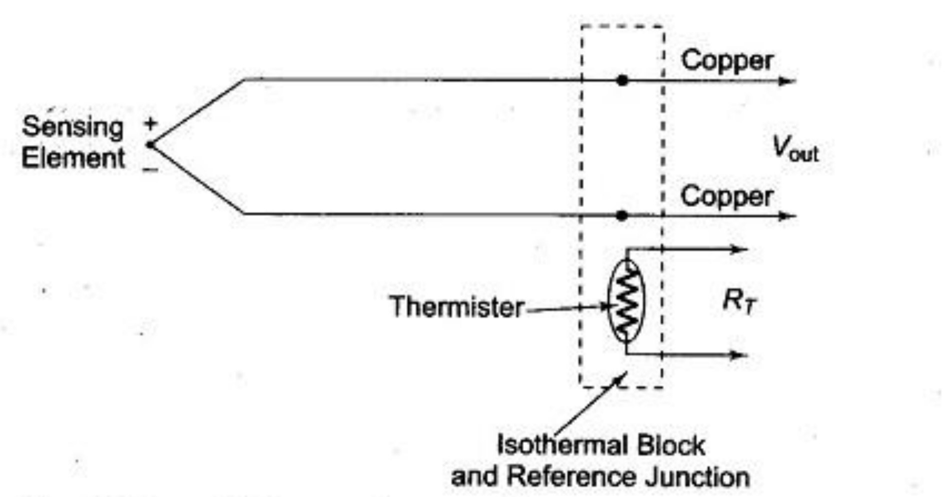

Fig. 13.46 Reference Junction Compensation used in Industry

65. An arrangement of several thermocouples wired in series for the purpose of increasing sensitivity is referred to as a/an _____.

a. enhancer

b. thermopile

c. stack

d. piggy back

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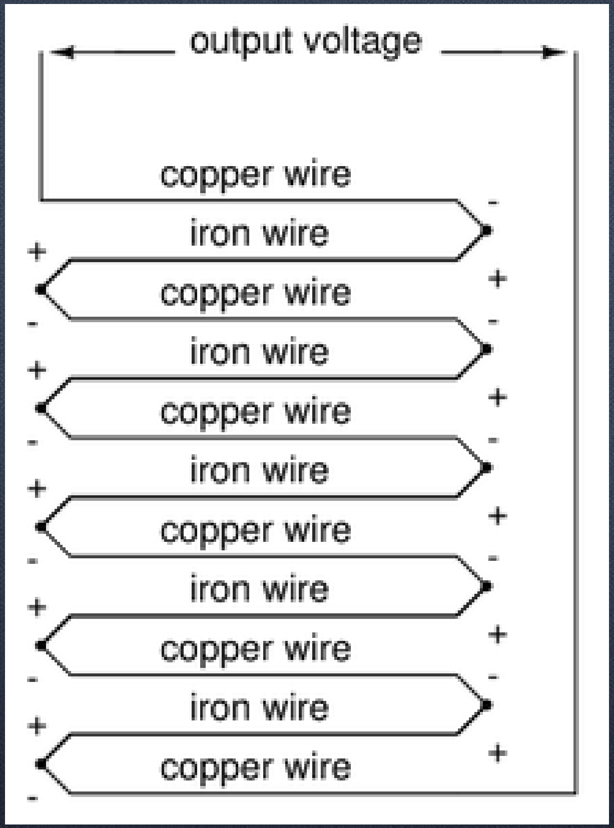


66. The _____ junction of the thermocouple is considered the reference junction.

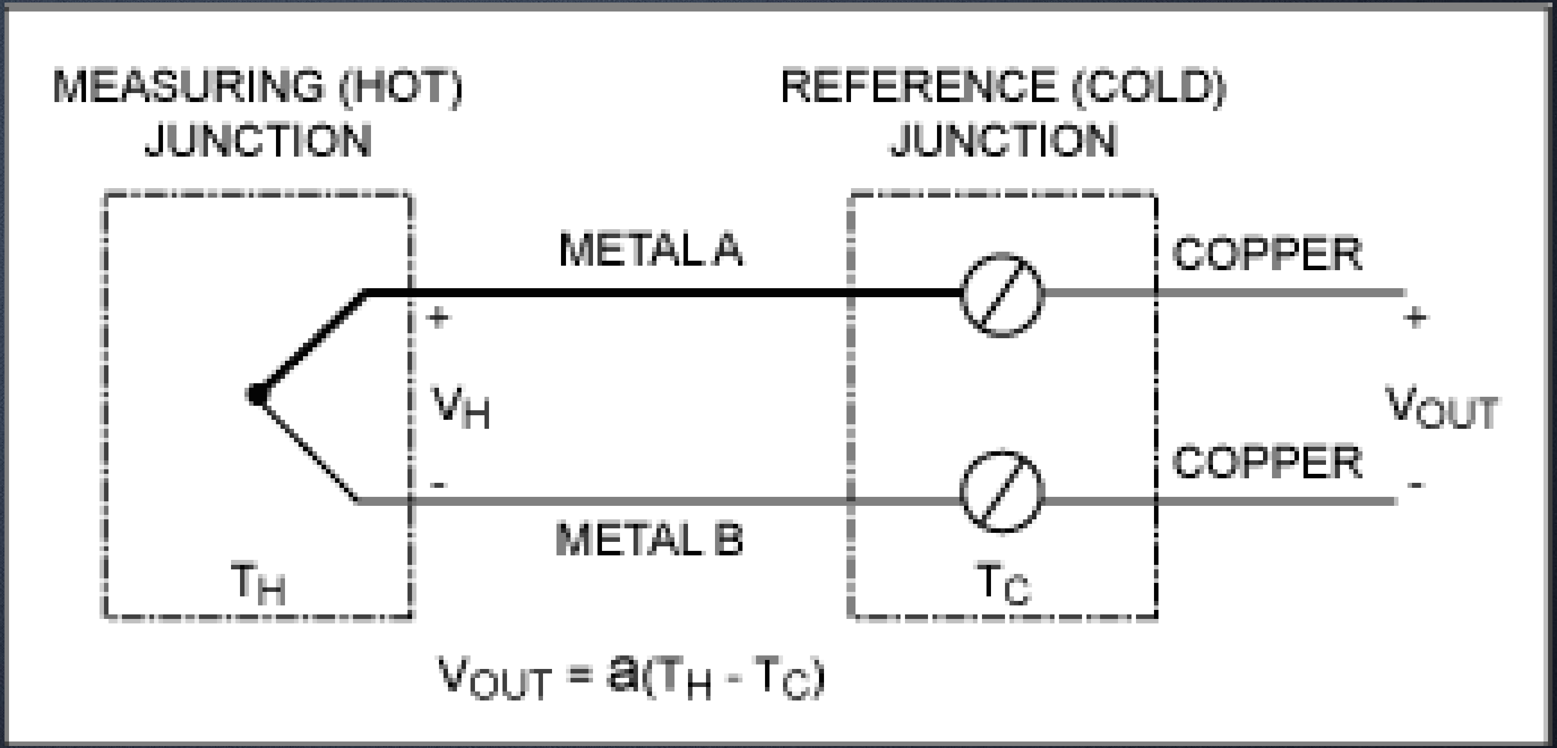
a. Cold

b. Hot

66. The _____ junction of the thermocouple is considered the reference junction.

a. Cold

b. Hot



67. A Thermocouple is basically:

a. two dissimilar metals joined at one end and open at the other

b. two of the same metals joined at one end and open at the other

c. a specific metal wound into a coil

d. two dissimilar metals that have varying resistances

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68. An increased Thermocouple output voltage can be obtained by wiring two or more Thermocouples in parallel.

a. True

b. False

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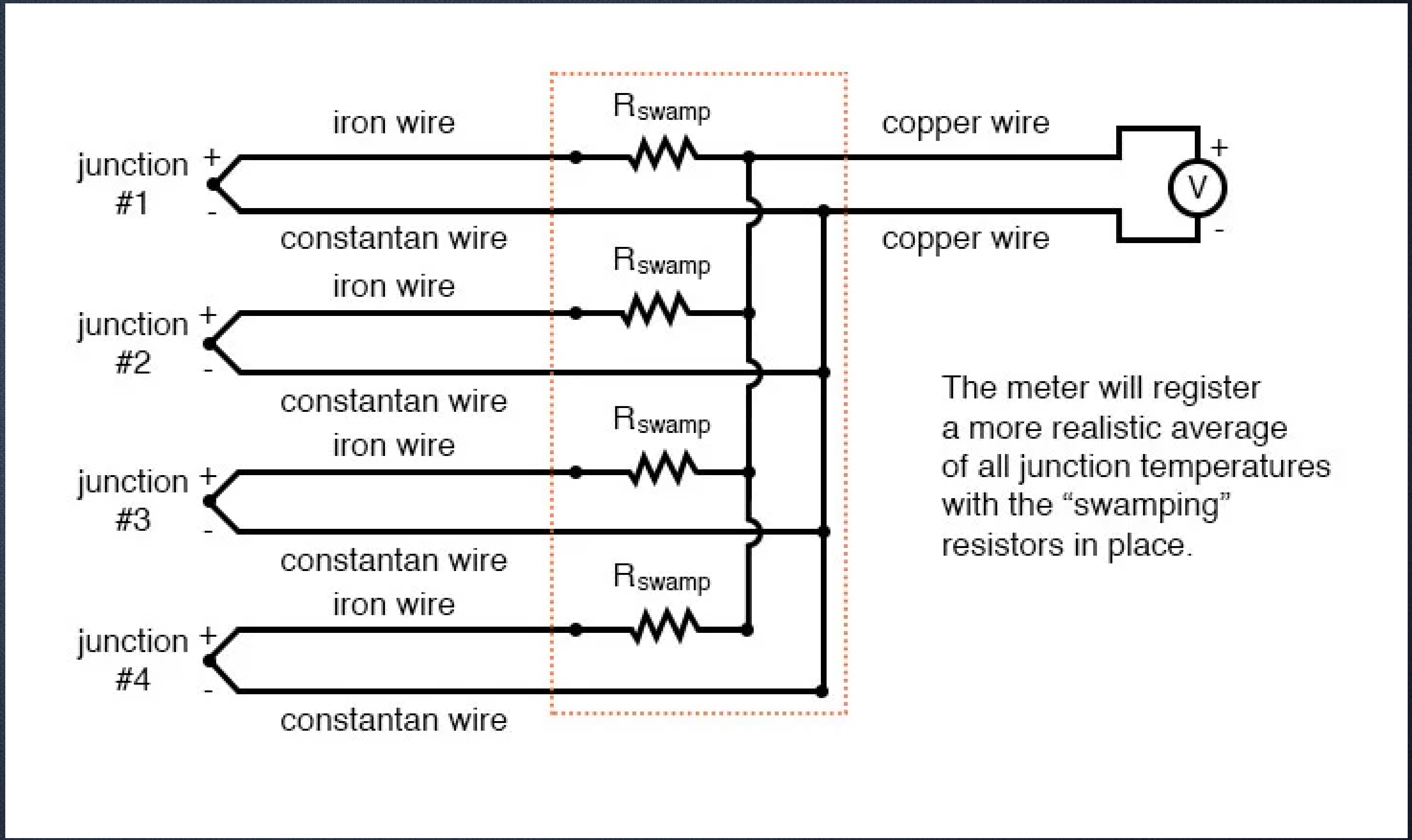
a. True

b. False



https://www.allaboutcircuits.com/textbook/direct-current/chpt-9/thermocouples/

69. The higher the temperature of the heat applied to the closed end of a Thermocouple...

a. The lower the voltage will be generated at the open leads

b. The lower the current will be generated at the open leads

c. The higher the voltage will be generated at the open leads

d. The higher the current will be generated at the open leads

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a. The lower the voltage will be generated at the open leads

b. The lower the current will be generated at the open leads

c. The higher the voltage will be generated at the open leads

d. The higher the current will be generated at the open leads

70. Which of the following is NOT a temperature scale?

a. Celsius

b. Seebeck

c. Kelvin

d. Rankine

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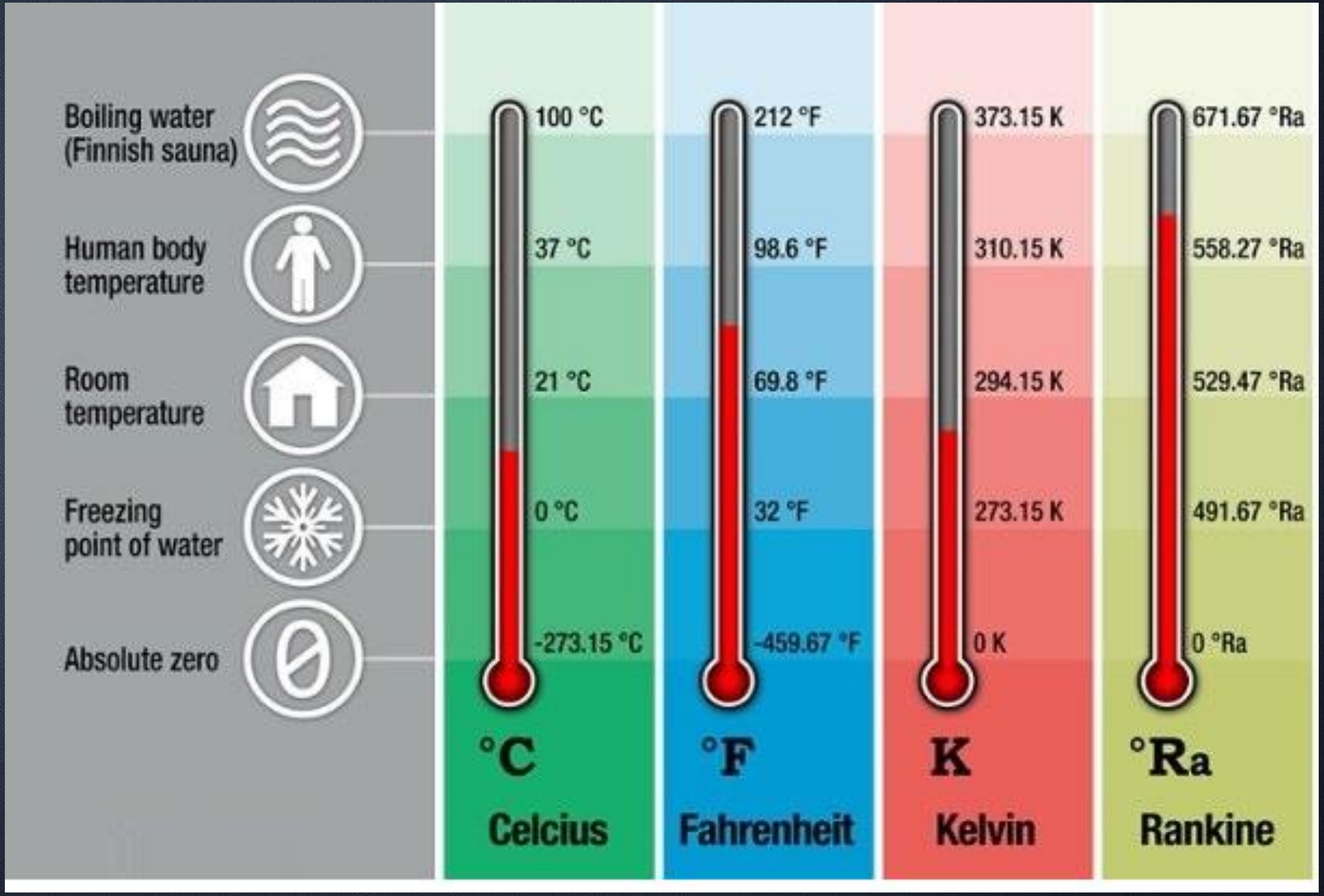

71. The __________ temperature scale has the same slope as the Celsius scale, but has been modified to have the lowest value (Absolute Zero) equal to zero

a. Celsius

b. Seebeck

c. Kelvin

d. Rankine

71. The __________ temperature scale has the same slope as the Celsius scale, but has been modified to have the lowest value (Absolute Zero) equal to zero

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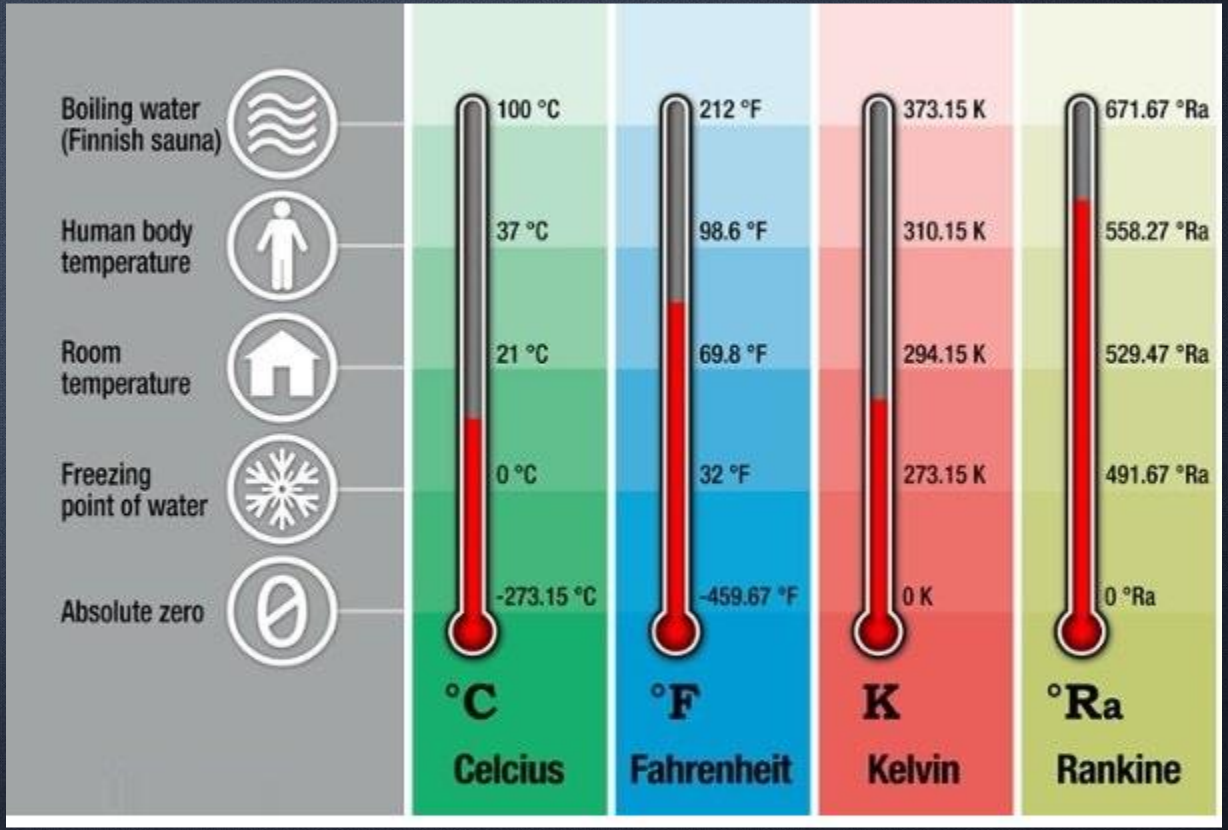
d. Rankine



72. The _________ temperature scale has the same slope as the Fahrenheit scale, but has been modified to have the lowest value (Absolute Zero) equal to zero

a. Celsius
b. Seebeck
c. Kelvin
d. Rankine

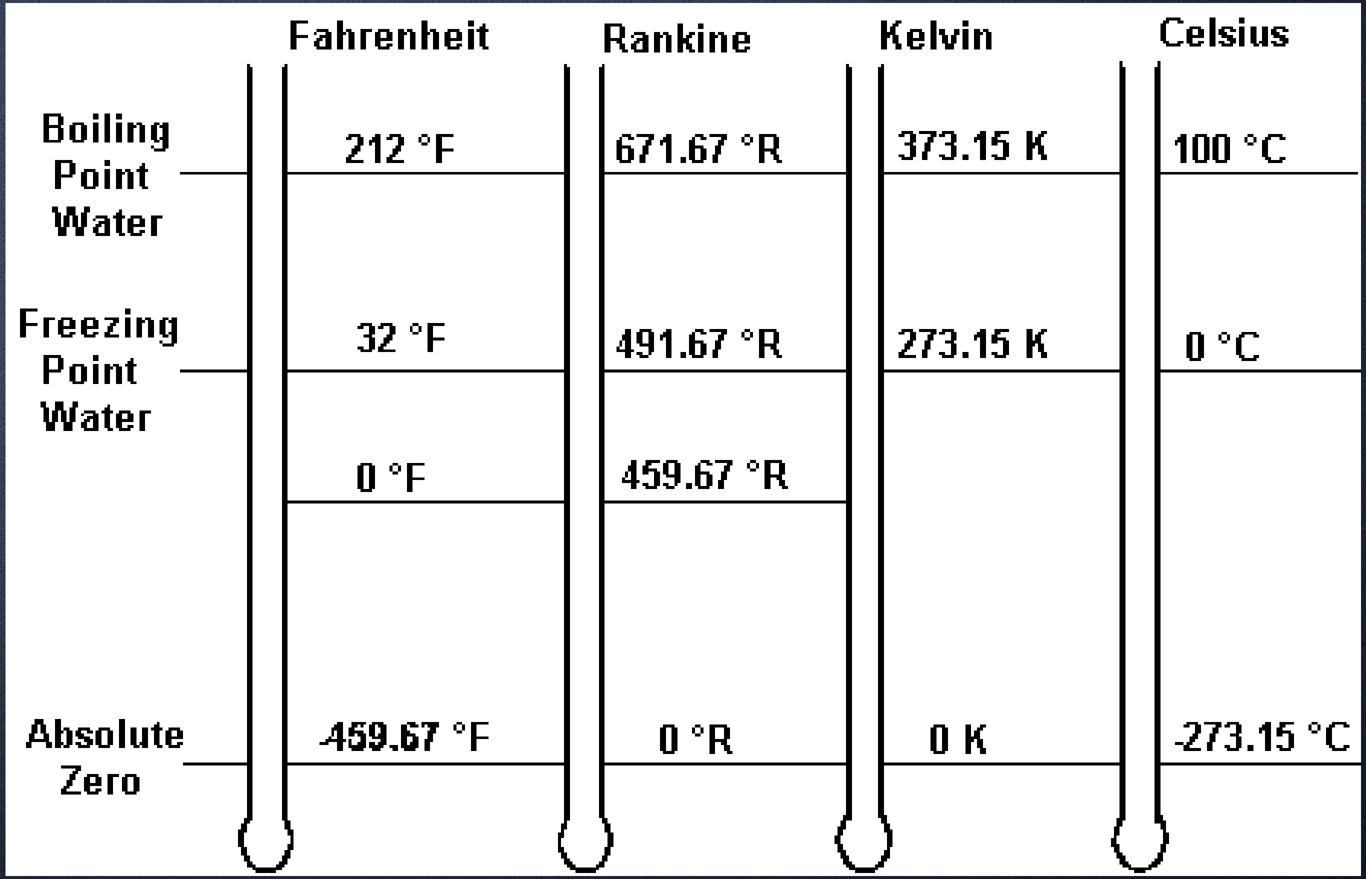
72. The _________ temperature scale has the same slope as the Fahrenheit scale, but has been modified to have the lowest value (Absolute Zero) equal to zero

a. Celsius

b. Seebeck

c. Kelvin

d. Rankine



73. What is the correct Fahrenheit to Celsius conversion equation?

a. Deg C = (Deg F – 32) * 1.8

b. Deg C = (Deg F – 32) + 1.8

c. Deg C = (Deg F + 32) / 1.8

d. Deg C = (Deg F – 32) / 1.8

Fahrenheit To Celsius

$$C = \frac{5}{9}(F - 32)$$

73. What is the correct Fahrenheit to Celsius conversion equation?

a. Deg C = (Deg F – 32) * 1.8

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d. Deg C = (Deg F – 32) / 1.8

Fahrenheit To Celsius

$$C = \frac{5}{9}(F - 32)$$

74. What is the correct Celsius to Fahrenheit conversion equation?

a. Deg F = (Deg C * 1.8) - 32

b. Deg F = (Deg C + 1.8) +32

c. Deg F = (Deg C / 1.8) - 32

d. Deg F = (Deg C * 1.8) +32

Celsius To Fahrenheit

$$F = \frac{9}{5}C + 32$$

74. What is the correct Celsius to Fahrenheit conversion equation?

a. Deg F = (Deg C * 1.8) - 32

b. Deg F = (Deg C + 1.8) +32

c. Deg F = (Deg C / 1.8) - 32

d. Deg F = (Deg C * 1.8) +32

Celsius To Fahrenheit

$$F = \frac{9}{5}C + 32$$

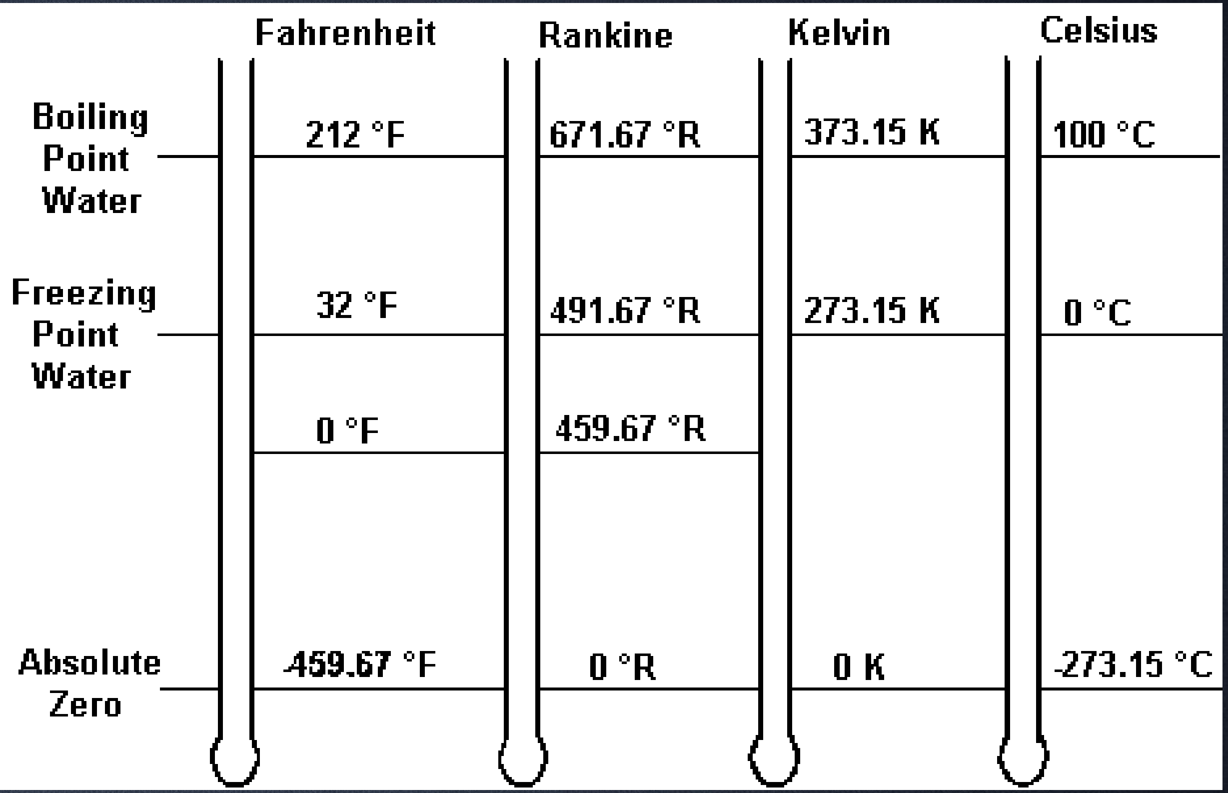
75. Absolute Zero on the Kelvin scale is equal to:

a. 373.51 K

b. 273.15 K

c. 0 K

d. None of the above



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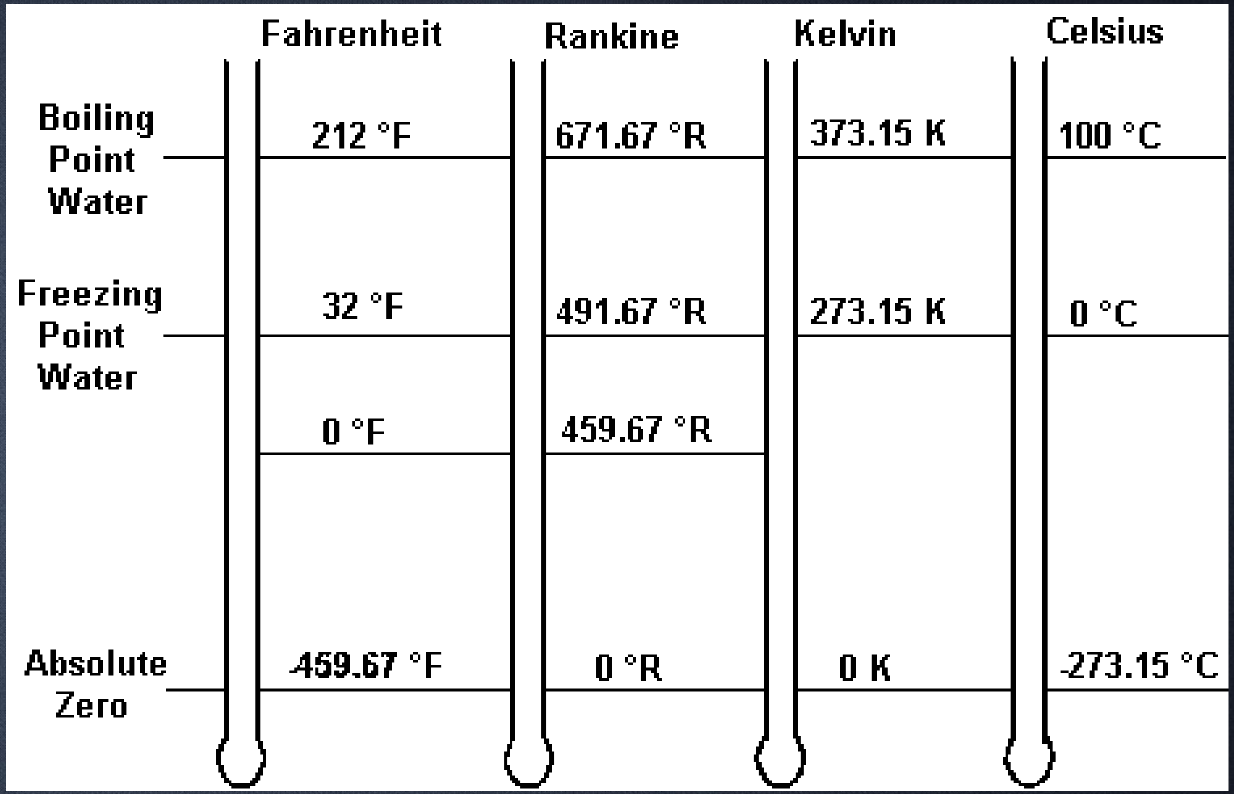


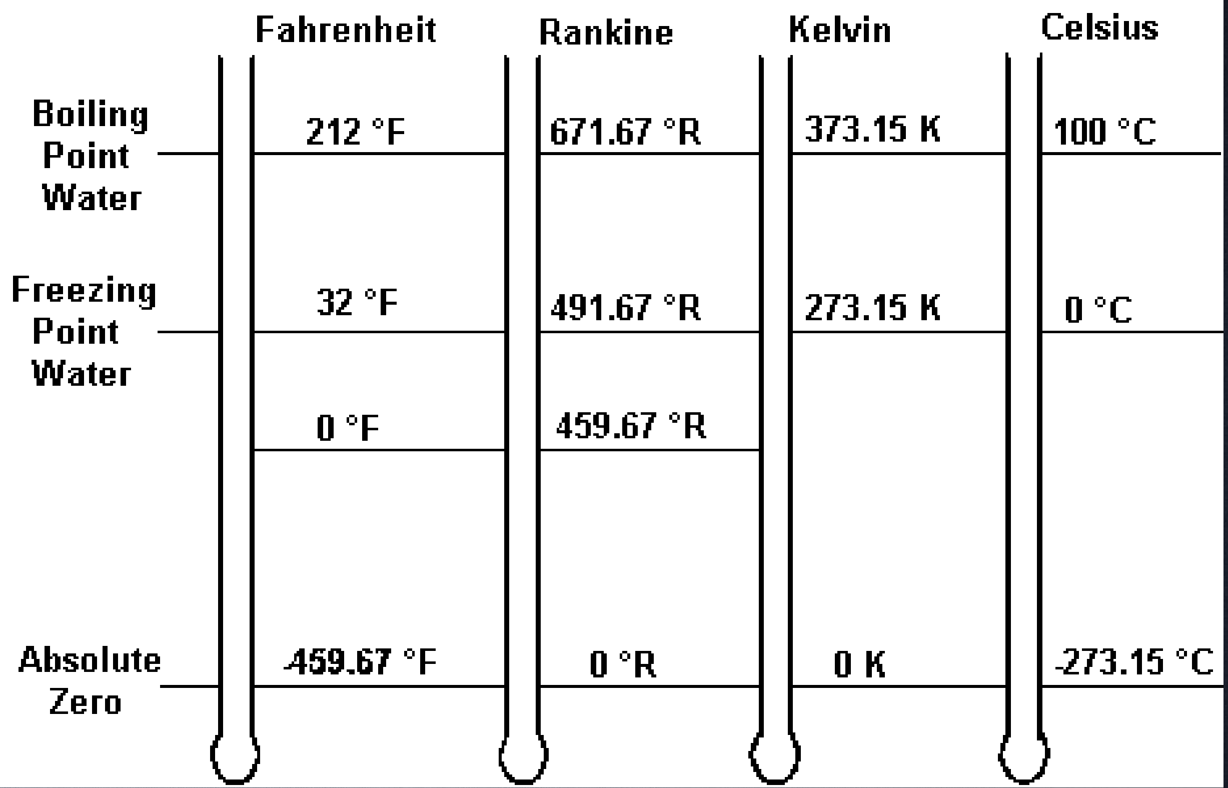
76. Absolute Zero on the Celsius scale is equal to:

a. - 459.67 ºC

b. - 273.15 ºC

c. 0 ºC

d. None of the above



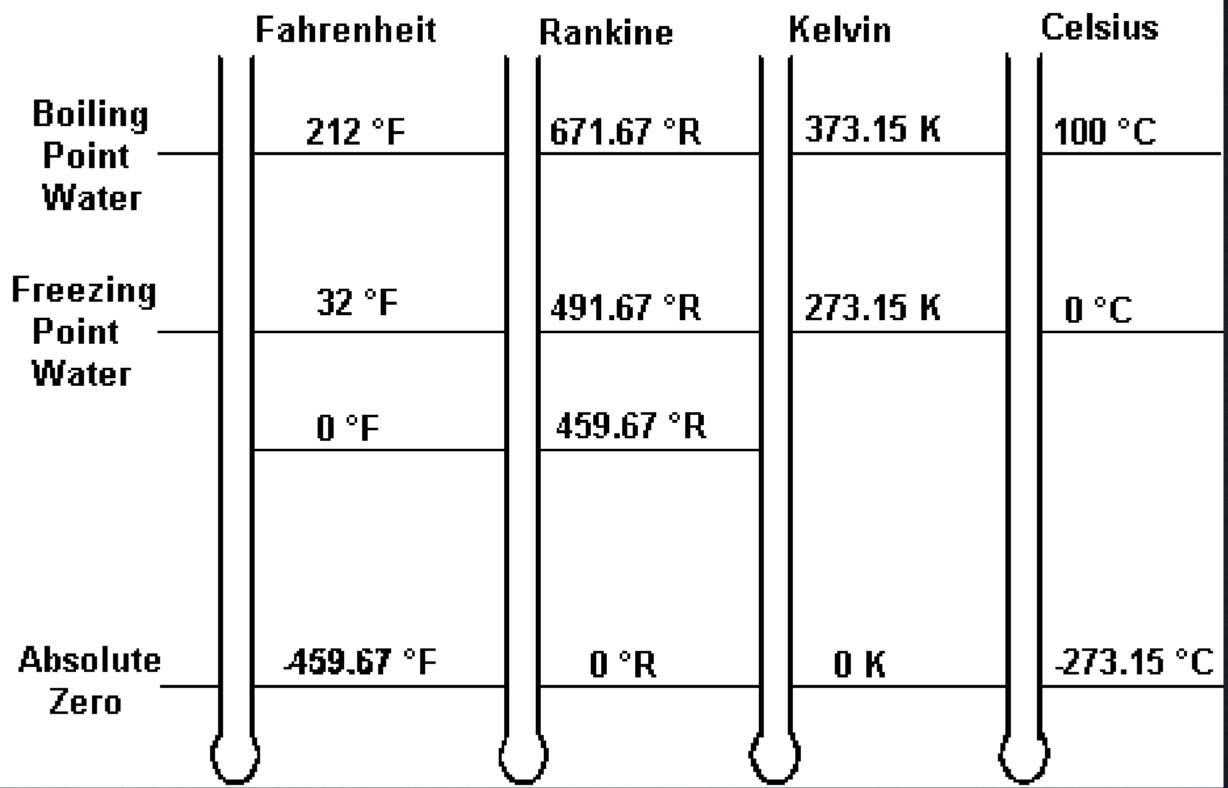
76. Absolute Zero on the Celsius scale is equal to:

a. - 459.67 ºC

b. - 273.15 ºC

c. 0 ºC

d. None of the above



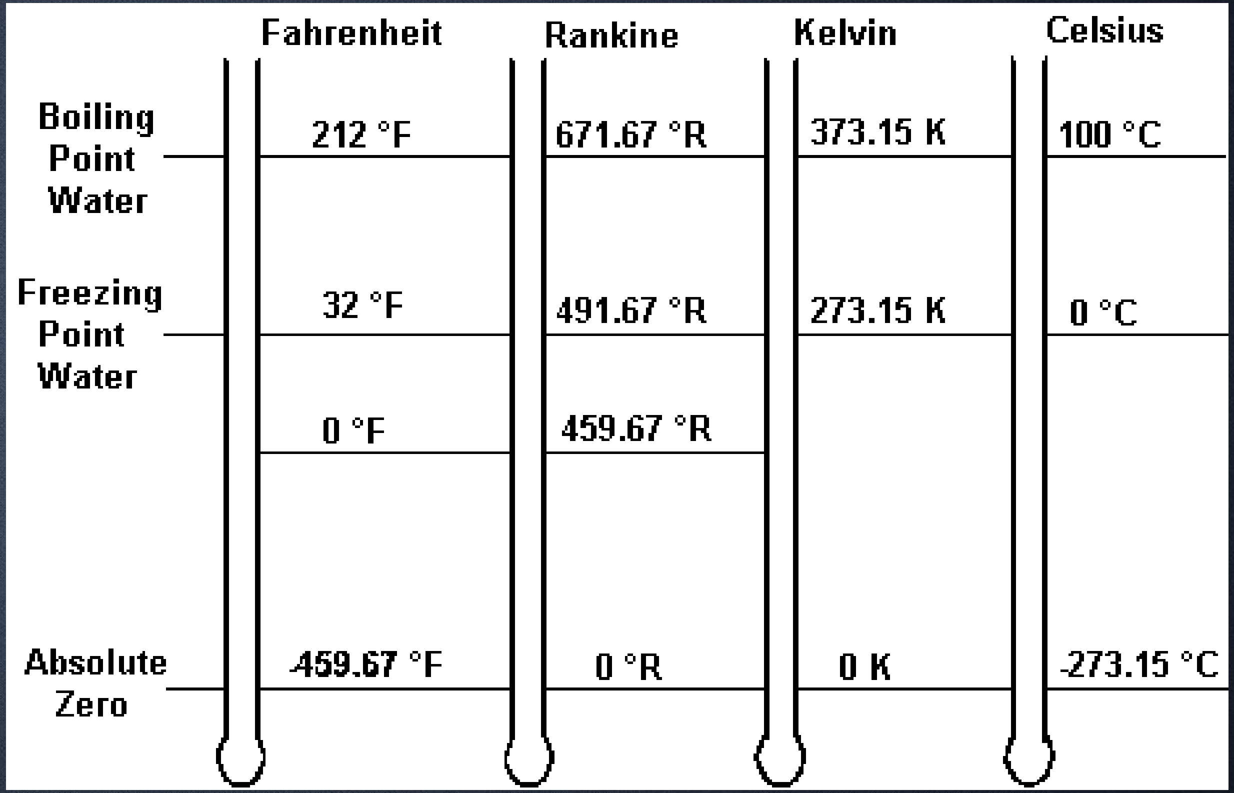
77. What is the equivalent Rankine Temperature value for Absolute Zero?

a. 0 R

b. 32 R

c. - 273.15 R

d. - 459.67 R



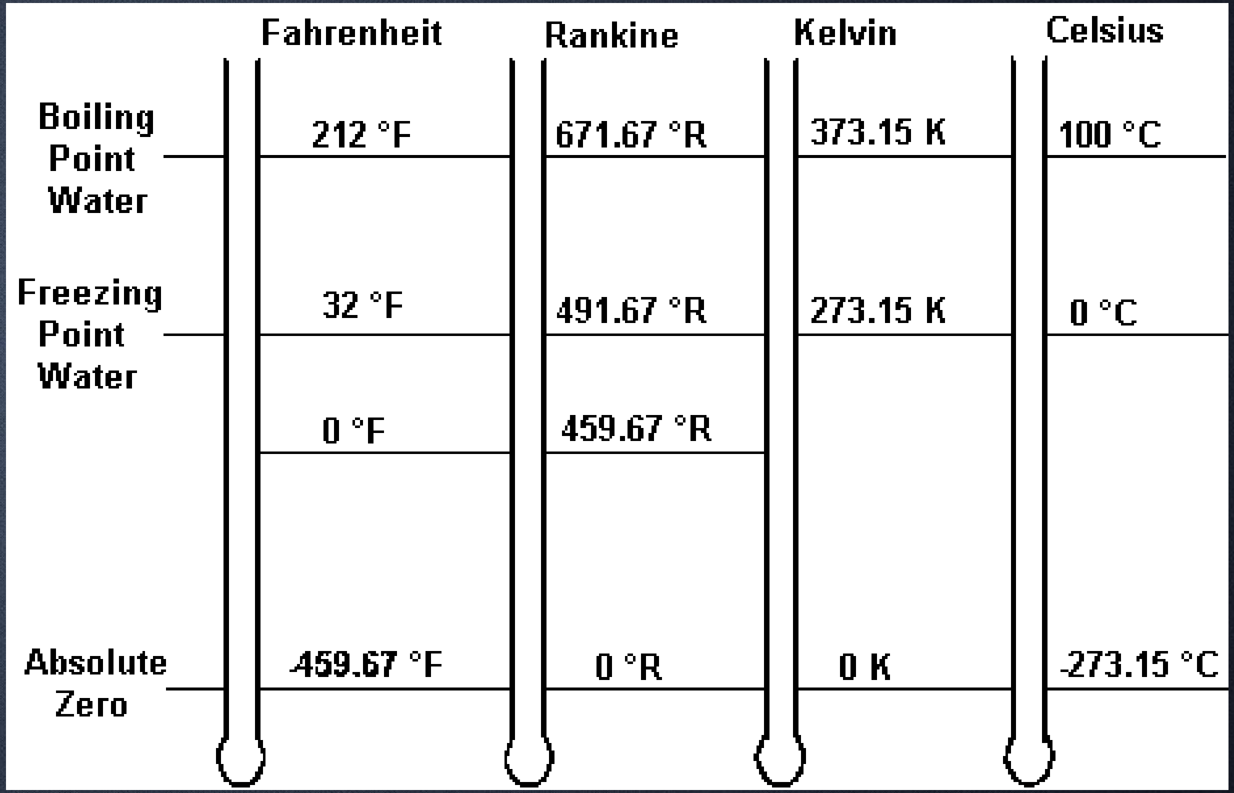
77. What is the equivalent Rankine Temperature value for Absolute Zero?

a. 0 R

b. 32 R

c. - 273.15 R

d. - 459.67 R



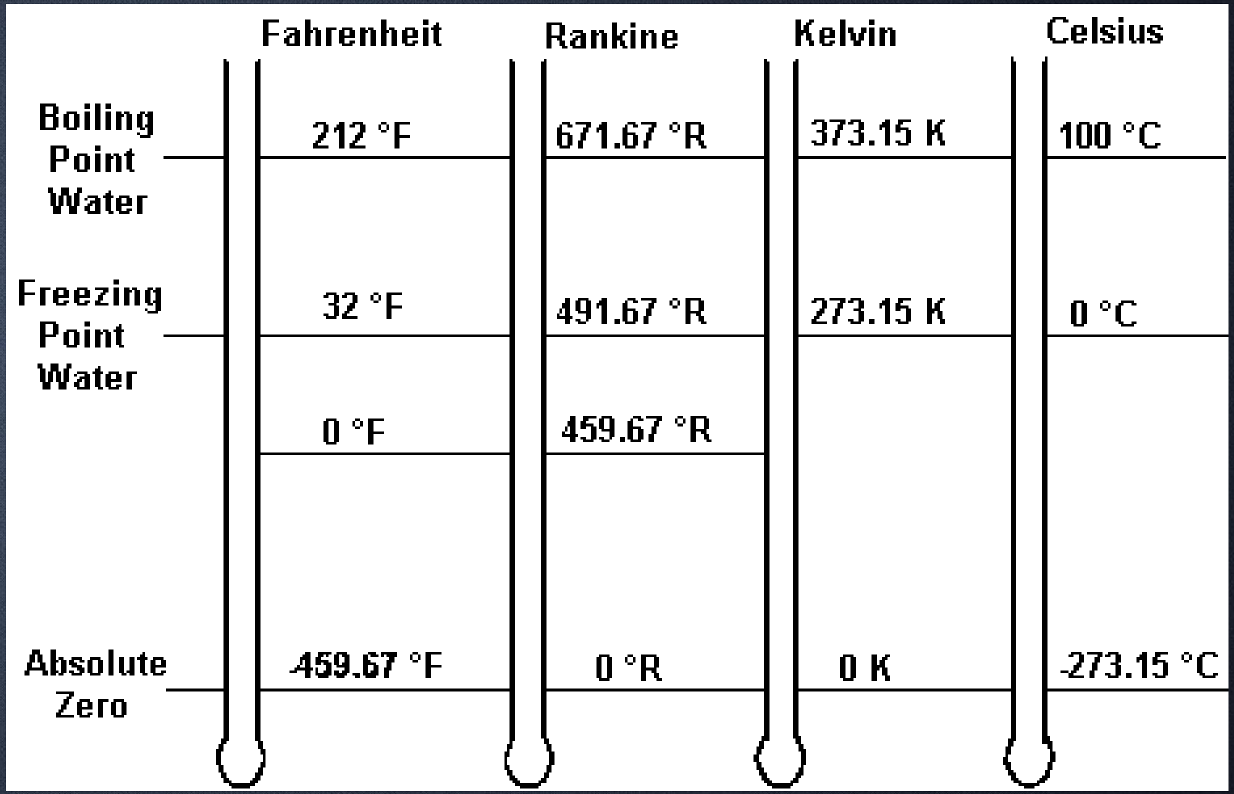
78. Absolute Zero on the Kelvin scale is equal to:

a. - 459.67 K

b. - 273.15 K

c. 0 K

d. None of the above



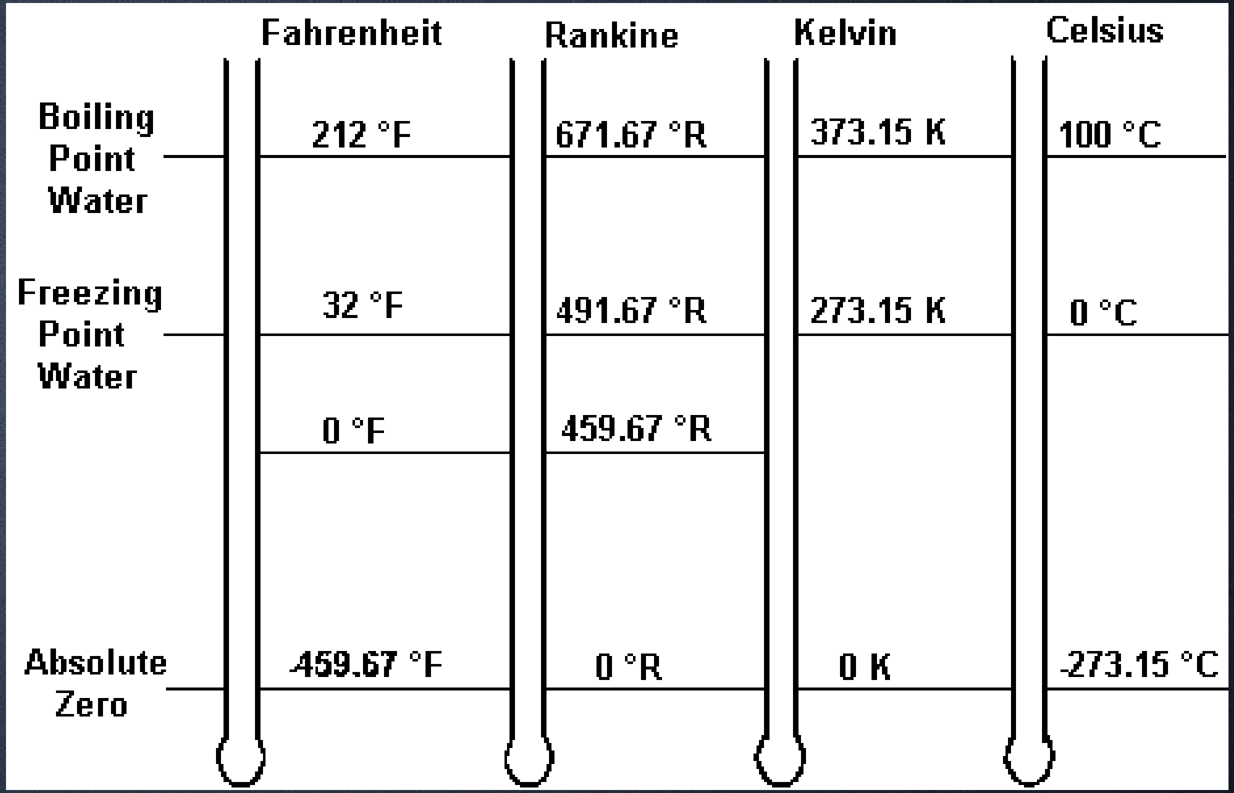
78. Absolute Zero on the Kelvin scale is equal to:

a. - 459.67 K

b. - 273.15 K

c. 0 K

d. None of the above



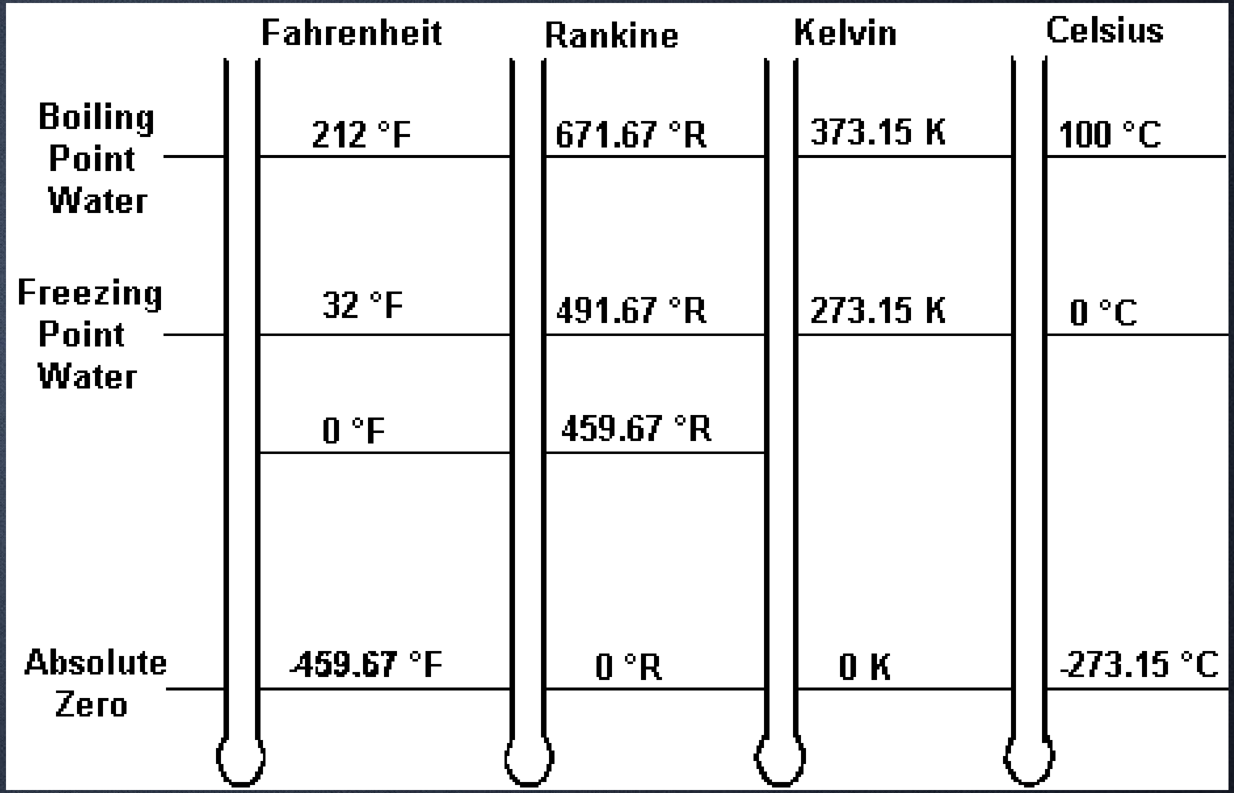
79. Absolute Zero on the Fahrenheit scale is equal to:

a. - 459.67 ºF

b. - 273.15 ºF

c. 0 ºF

d. 32 ºF



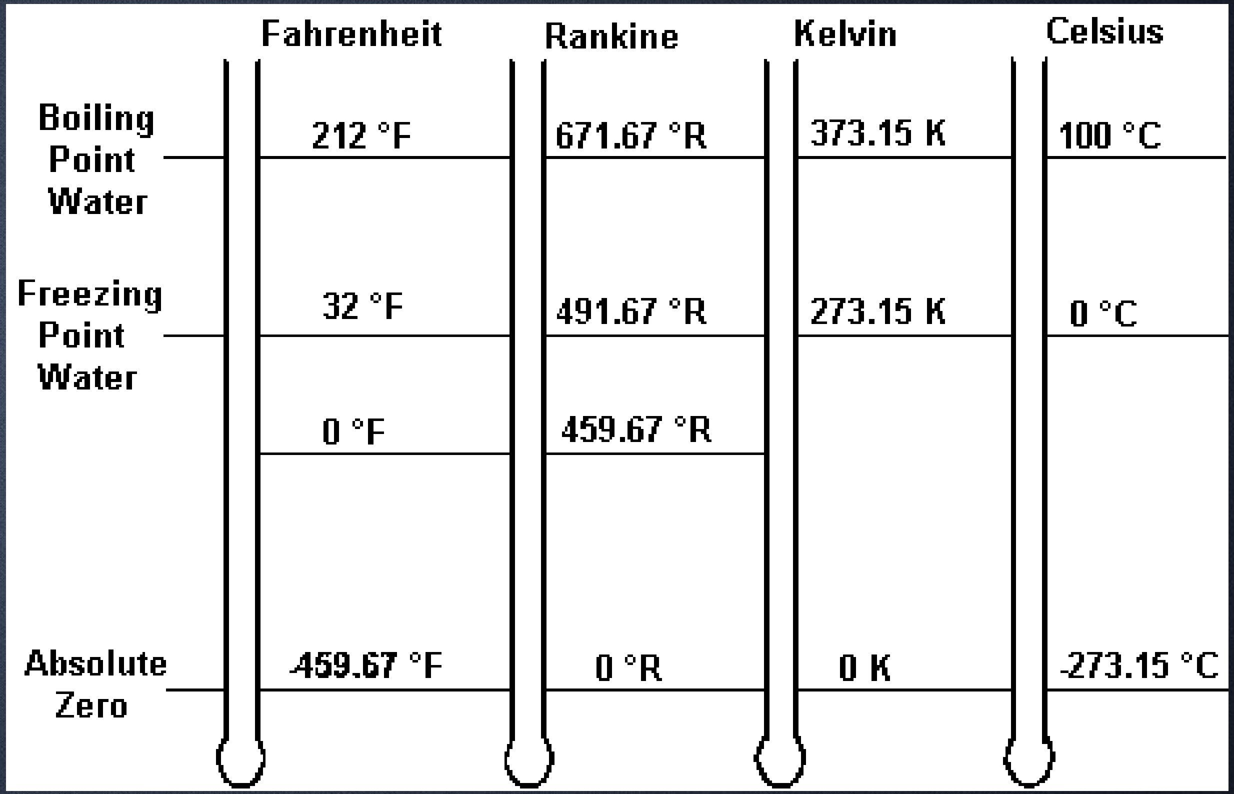
79. Absolute Zero on the Fahrenheit scale is equal to:

a. - 459.67 ºF

b. - 273.15 ºF

c. 0 ºF

d. 32 ºF



80. What is the equivalent Fahrenheit Temperature value for 100 ºC?

a. 0 ºF

b. 100 ºF

c. 212 ºF

d. 273 ºF

Celsius To Fahrenheit

$$F = \frac{9}{5}C + 32$$

80. What is the equivalent Fahrenheit Temperature value for 100 ºC?

a. 0 ºF

b. 100 ºF

c. 212 ºF

d. 273 ºF

Celsius To Fahrenheit

$$F = \frac{9}{5}C + 32$$

End of Presentation… thanks for your patience.

Good luck on your test!