

Names _____

Objectives:

- 1) Develop an understanding of thermocouples (TCs)
- 2) Understand sources of error in temperature measurement with thermocouples
- 3) Construct and use temperature measurement systems based on type-K, type E, and type-T thermocouples

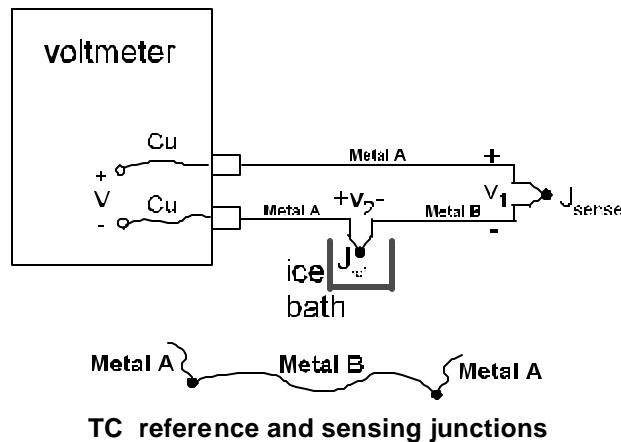
Deliverables

1. Measure the temperature of boiling water with the following TC systems.
 - type-T** i)with ref. junction in ice bath and ii)with ref. junction at RT
 - type-K** i)with ref. junction in ice bath and ii)with ref. junction at RT
 - type-E** i)with ref. junction in ice bath and ii)with ref. junction at RT
2. Attach one or two sheets with the work necessary to show the errors involved in steps 2, 5, and 8 when the fact that the reference junction is not at 0 °C is not properly treated. Include a brief discussion of this error...what size and sense is it? By "sense", does not accounting for nonzero degree reference junction tend to make the temperature measured too high or too low?

Procedure

Type-T thermocouple—build your own or use one built by another group

1. Use the diagram shown below to construct the thermocouples circuits.



	Type T	Type K	Type E
Metal A (+)	copper Blue	chromel (Ni-Cr) yellow	chromel (Ni-Cr) purple
Metal B (-)	constantan (Ni-Cu) R	alumel (Ni-Al) R	constantan (Ni-Cu) R

2. Measure the TC voltage when the sensing junction is in boiling water and the reference junction at room temperature (RT).
3. Measure the TC voltage when the sensing junction is in boiling water and the reference junction in an ice bath.

Type-K—build your own or use one built by another group

Type-K is the most widely used TC.

4. Construct (or use one constructed by another group) a type-K thermocouple system that has a reference junction.
5. Measure the TC voltage when the sensing junction is in boiling water and the reference junction at room temperature (RT).
6. Measure the TC voltage when the sensing junction is in boiling water and the reference junction in an ice bath.

Type-E—build your own or use one built by another group

Type-E is the most sensitive TC.

7. Construct (or use one constructed by another group) a type-E thermocouple system that has a reference junction.
8. Measure the TC voltage when the sensing junction is in boiling water and the reference junction at room temperature (RT).
9. Measure the TC voltage when the sensing junction is in boiling water and the reference junction in an ice bath.

	voltage readings		temperature from tables	
	ref. in ice	ref. at RT	ref. in ice*	ref. at RT**
type-T				
type-K				
type-E				

* assume ice bath is at 0 °C.

** give temperature as if you were not aware of the issues involved with reference junctions not being at 0 °C. For the attached calculations giving the errors associated with this, assume the actual RT is 21° C