TUTORIAL ANSWERS (TEMPERATURE)

Example pg 137 KF Chan

$\theta = (-1.60m) / (4.10m) * 100 =$ **-39°C**

Guided example pg 348 Francis

a.)

$\theta = (R_\theta - R_0) / (R_{100} - R_0) * 100$

$\theta = (4.15 - 3.5) / (4.8 - 3.5) * 100$

$\theta =$ **50 °C**

b.)

$\theta = -10$ °C

$-10 = (R_\theta - 3.5) / (4.80 - 3.5) * 100$

$R_\theta =$ **3.37Ω**

Example Q2 pg 143 KF Chan

$T = (P_T / P_{Tr}) * T_{Tr}$

$T = (1.95 \times 10^5 / 1.74 \times 10^5) * 273.16$

$T =$ **306.1 K**

Repeat experiment;

$T = (5.26 \times 10^4 / 4.71 \times 10^4) * 273.16$

$T =$ **305.1 K**

Values of temperatures are slightly different because real gas in thermometer does not behave like ideal gas.

Repeat experiment by continuing reducing the mass of gas. By so doing, pressure and the temperature will also reduce accordingly. Plot all the points (values of respective pressure and temperature) on the graph, and extrapolate the linear straight line. When pressure is close to zero, the value of temperature reading is the thermodynamic temperature.

J 99

b.) i.) No net transfer of energy between them

ii.) Transfer of energy will flow from body H to body C

c.) i.) Find the magnitude of property at 0°C, 100°C and at θ°C.

Then use the equation $(\theta - 0) / (100 - 0) = (x_\theta - x_o) / (x_{100} - x_0)$

Or draw a linear graph.

ii.) Property is assumed to vary linearly with temperature but actually it does not.

Only agree at fixed points. (melting point & boiling point)

J94/P3/Q6

6.) a.) By choosing two experimental fixed points and measuring the values of the thermometric properties at these reference points, all other temperatures can be obtain by linear interpolation.

(for your info: interpolation is a method of constructing new data points form a discrete set of known data points)

b.) i.) One type of liquid in glass thermometer is the mercury in glass thermometer.

It consists of a thin walled bulb to store mercury. When heated the change in volume of the mercury causes it to rise in the capillary tube of the thermometer. By taking readings form the markings on the thermometer, temperature of the object may be found. (Choose two reference points which is the ice point and boiling point of water respectively.) An unknown between these two fixed points can be obtained by using the equation below:

$$(\theta - 0) / (100 - 0) = (x_\theta - x_o) / (x_{100} - x_0)$$

ii.)

Mercury in glass thermometer	Resistance thermometer
Simple, cheap, and portable	Relatively bulky and costly to use
Quick and direct reading can be taken from it	Resistance value has to be measured to compute the temperature. Not suitable for rapid change temperatures
Reading not very accurate	Very accurate resistance values may be measured hence best suited to measure small steady temperature differences.

c.) i.) $\theta = (940 - 3740) / (210 - 3740) * 100 =$ **79.3°C**

ii.) Difference in reading in due to the fact that different thermometric properties will respond differently and uniquely to changes in temperature. The linear behavior of thermometric property with temperature change is assumed.

d.) i.) The absolute scale is a scale of temperature based on ideal gas behavior governed by the equation $pV \alpha T$. The fixed points for the temperature scale are at the natural absolute zero and triple point temperature of water given by value 273.16 K.

e.) When substance experiences change of phase. (i.e.: solid > liquid or liquid > gas) During this phase change, heat supplied to them is used to provide gain in internal potential energy as the molecular separation changes / increases while keeping the mean kinetic energy of the molecules the same. Thus there is an overall gain in internal energy of the molecules without a change in temperature of the molecules.

J96 / P2

5.) a.) 1.) Low expansion rate.

2.) Transparent. *(any other sensible answers)*

b.) 1.) Good thermal conductor

2.) High surface tension.

3.) High boiling point.

4.) High visibility.

5.) Does not wet the glass.

c.) i.) Mercury freezes ar 234 K, thus it cannot be used in very cold condition.

ii.) If amount of heat required is high, then it takes longer time to raise the temperature. Mercury cannot respond quickly to changes in temperature will eventually cause the measured object to cooled down.

iii.) If capillary tube bore diameter is thin / small, then the thermometer is more sensitive. But it reduces the range of temperature that could be measure for a given length of thermometer.

iv.) If volume of mercury is large, this increases the heat capacity. (Amount of heat required to raise 1 K). Thus, this will cause the thermometer to respond less rapidly.