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Thermometers + Temperature Scales

A Physics Topic Test

In all calculations, show all your working and give answers to appropriate accuracy.

$\theta\,°C = T\,K - 273$

1. Define... (a) the LFP (1)
   (b) the UFP (2)
   (c) Absolute zero (2) [5]

2. Explain how you would measure an unknown temperature with an unmarked mercury in glass thermometer. (You can use a drawing to help your answer) [7]

3. Convert these temperatures..

θ, °C	62	−196	(c) ____	(d) ____
T, k	(a) ____	(b) ____	400	12

[4]

4. Here is some data from a platinum resistance thermometer...
   R_0 at 0°C; 12.76 Ω R_{100} = 16.42 Ω R at θ°C = 14.98 Ω
   (a) What is temperature θ? (2)
   (b) What assumption do you make in your calculation? (2) [4]

5. Another resistance thermometer is marked:
   " R at 0°C = 8.52 Ω, Temperature coefficient = 0.06 Ω/k"
   If R = 17.34 Ω, what is temperature θ? (2)

6. Here is some data from a gas thermometer...
   V_0 at 0°C = 86.42 cm³ V_{100} = 118.08 cm³
   What will the gas volume be at −39 °C? (3)

7. Is a gas thermometer any good for measuring very low temperatures? Give 2 points in your answer (2)

8. Use this data from a thermistor to find temperature θ.
   R_0 = 260 Ω R_{100} = 80.0 Ω R_θ = 220 Ω
   (a) What is temperature θ? (2)
   (b) The actual temperature when R = 220 Ω is 18 °C.
   Why does the thermistor give an incorrect temperature? (you can use a diagram to help explain.) (4) [6]

TW

12.98

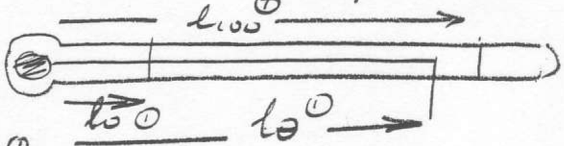
Test - Thermometers - Answers   A Physics

1 (a) LFP - temp. of mixture of pure water / ice (1)

(b) UFP - temp. of steam over pure boiling water (1) ... atm. press. (1)

(c) Abs. zero - lowest possible temp. ... all atomic motion (1) ... stops (1)

2. Thermometer in ... ice / LFP (1)



record l_0 (1) .... in boiling water / UFP (1)

record l_{100} (1) ... in unknown (1) record l_θ (1).

Then use $\theta = (l_\theta - l_0) / l_{100} - l_0 \times 100$ (1) (7)

3. $62°C$ = (a) 335 k (b) $-196°C$ = +77 k (c) 400 k = 127°C (d) 12 k = $-261°C$ (4)

4 (a) $\theta = \dfrac{R_\theta - R_0}{R_{100} - R_0} \times 100$ (1) $= (14.98 - 12.76) / 16.42 - 12.76 \times 100 = \underline{\underline{60.7}}\ °C$ (2)

(b) You assume the resistance changes in a linear way (1) between fixed points (1)

5. $R_\theta - R_0 = 17.34 - 8.52 = 8.82\ \Omega$ (1)

So temp $\theta = 0°C + 8.82 / 0.06 = 0 + 147 = 147°C$ (1) (2)

6. $\theta = \dfrac{V_\theta - V_0}{V_{100} - V_0} \times 100$ (1) so $-39 = \dfrac{(V_\theta - 86.42)}{(118.08 - 86.42)} \times 100 = \dfrac{(V_\theta - 86.42)}{31.66} \times 100$

so $V_\theta - 86.42 = \dfrac{-39 \times 31.66}{100} = -12.35 \Rightarrow V_\theta = +\underline{74.1}\ cm^3$ (2) (3)

[or... change in volume / °C $= (118.08 - 86.42) / 100 = 0.317\ cm^3/°C$

So at $-39°C$ Volume is $86.42 - (39 \times 0.317) = 74.1\ cm^3$)

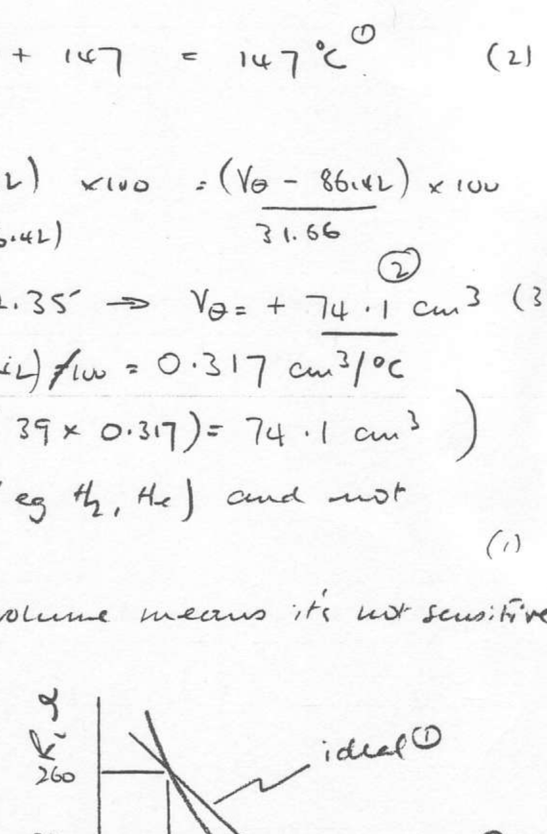
7. Yes! - because gas can stay gaseous (eg H_2, He) and not condense or freeze (1)

No! because gas contracts, and small volume means it's not sensitive. (1)

8 (a) $\theta = (R_\theta - R_0 / R_{100} - R_0) \times 100$

$= \dfrac{(220 - 260)}{(80 - 260)} \times 100 = \dfrac{-40}{-180} \times 100$

$= +22.2\ °C$



(b) Resistance does not vary in a linear way (1) with temperature

The calculation is based on a linear relationship (1) (4)

TJN 1.99. Q.1/5 2/7 3/4 4/4 5/2 6/3 7/2 8/6 Total /28.