15-Phys-203

S 2002

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Quiz 1 Name _____

1. If T_C represents a Celsius temperature and T a Kelvin temperature, then

$$T_C = T - 273.15^\circ$$

The relation between the Celsius and Fahrenheit sclae is

$$T_F = \frac{9}{5}T_C + 32^\circ$$

At what temperature do the following pairs of scales read the same, if ever:

(a) Celsius and Fahrenheit

$$T_F = \frac{9}{5}T_F + 32^\circ$$
$$\frac{4}{5}T_F = -32^\circ$$
$$T_F = -40^\circ F$$

(b) Fahrenheit and Kelvin

$$T_F = \frac{9}{5}\left(T_F - 273.15^\circ\right) + 32^\circ$$
$$T_F = \frac{5}{4}\left(\frac{9}{5} \times 273.15^\circ - 32^\circ\right) = 575^\circ F$$

(c) Celsius and Kelvin

Celsius and Kelvin temperatures can never have the same numerical value

2. If the temperature of a metal rod of length L is raised my an amount ΔT, its length is found to increase by an amount

$$\Delta L = L\alpha\Delta T$$

where α is the coefficient of linear expansion. An aluminum-alloy rod has a length of 10.000 cm at $20.000^\circ C$ and a length of 10.015 cm at $100^\circ C$ (boiling point of water).

(a) What is the coefficient of linear expansion of the rod?

$$\alpha = \Delta L/L\Delta T = \frac{(10.015 \text{ cm} - 10.000 \text{ cm})}{(10.000 \text{ cm})\,(100^\circ - 20.000^\circ C)} = 1.88 \times 10^{-5}/^\circ C$$

(b) What is the length of the rod at $0^\circ C$ (freezing point of water)?

$$L = 10.000 \text{ cm} + (10.000 \text{ cm})\left(1.88 \times 10^{-5}/^\circ C\right)(0^\circ C - 20.000^\circ C) = 9.996 \text{ cm}$$