Phy 102 · Temp & Thermometry.

Fraction (Introduction)

Physics Assignment Exercises.

Key note: The triple point of water: This is the point at which saturated water vapour, pure water and melting ice are all in equilibrium, $T = 273.16K$

ice point = $273.15K$ ($4.6mmHg$ pressure trip point & $760mmHg$ ice point)

Four major Temp Scales.

(a) Celsius scale: $0°C$ ice & $100°C$ steam. (100 parts)

(b) Fahrenheit scale: $32°F$ ice & $212°F$ steam. (180 divisions)

(c) Kelvin scale: $273.16K$ ice & $373.16K$ steam. (100 parts) tripple points of water.

(d) Rankine Scale: $492°R$ ice & $672°R$ steam. (180 divisions)

Temperature conversions from scale to scale

a) Fahrenheit to celsius = $C = \frac{5}{9}(F - 32)$, $F = \frac{9}{5}C + 32$

b) Fahrenheit to kelvin = $F = \frac{9}{5}(K - 273) + 32$, $K = \frac{5}{9}(F - 32) + 273$

c) Celsius to kelvin = $C = K - 273$, $K = C + 273$

d) Fahrenheit to Rankin = $F = R - 460$, $R = F + 460$

Example 14.3

100°	280
T?	204
0°	190

$$\frac{T - 0}{100 - 0} = \frac{204 - 190}{280 - 190}$$

$$\frac{T(90)}{90} = \frac{1400}{90} = 15.56°C$$

100 = 100

80

Types
a) Liquid -
b) Gas th
c) Resisto
d) The th
e) Pyrom

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Types of Thermometers

a) Liquid-in-glass thermometer

b) Gas thermometer (constant volume & constant pressure gas thermometer)

c) Resistance thermometer

d) The thermoelectric thermometer

e) Pyrometer

Why we use mercury for thermometer

1) It is easily seen, even in very narrow bore.

2) It has a uniform coefficient of expansion over a wide range of temperature (-39°C ice & 357°C b.point).

3) It does not wet glass.

4) It is a good conductor of heat

5) It has low specific heat.

Disadvantages.

1) It's narrow limit within which its readings are acurate (-39°C & about 300°C). the upper lim can be extended to 1000° by introducing inert gas like Nitrogen. ∴ Temp up to 600°C can be recorded.

* ~~pentane~~ Alcohol is used when there are lower. temperature. alcohol has ~~ice point~~ freezing point.

Ex. 14.4

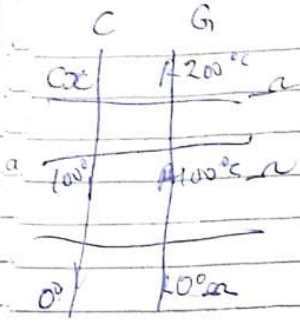
$R_t = R_0(1 + aT + bT^2)$ at $T°C = \theta_1$

$a = 3.8 \times 10^{-3}$

$b = -5.6 \times 10^{-7}$

$T_2 = 200°C$ = gas, T_2 Platinum.

C	G
[illegible]	R 200°C
100°C	R 100°C
[illegible]°	R ?°C



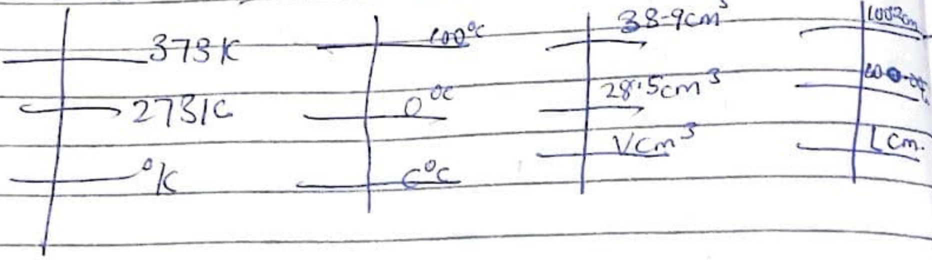
$$\frac{C-0}{100-0} = \frac{R_{200}-R_0}{R_{100}-R_0}$$

$$C(R_{100}) = R_{200}\,00$$

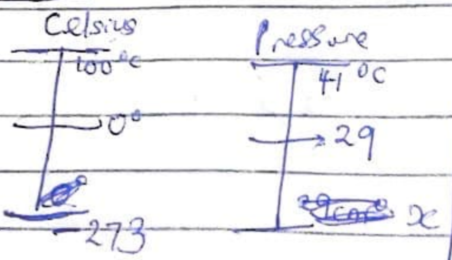
$$\frac{C\,R_{100}}{R_{100}} = \frac{R_{200}\,00}{R_{100}}$$

$$C = 200$$

Kelvin scale - Celsius scale Air scale Iron Rod Scale



Example 10.9



$$\frac{0+273}{100+273} = \frac{29-x}{41-x}$$

$273(41-x) = 373(29-x)$

$11,193 - 273x = 10,817 - 373x$

CLT

$11,193 - 273x = 10,817 - 373x$

$11,193 - 10,817 = -373x + 273x$

$$\frac{376}{-100} = \frac{-100x}{-100}$$

$x = -3.76\ cm^3.$

$$\frac{R_0}{1} + \frac{10}{100} R_0$$

$\frac{100R_0}{100} = \frac{106}{}$

$\frac{3}{16}$

$1.1 - 1 = 3.8 \times 10^{-3}(T - T_0)$

~~$1.1 - 1 = 3.8 \times 10^{-3}(T - T_0)$~~

~~3.8×10^{-3}~~

$T - T_0 = \frac{0.1}{3.8 \times 10^{-3}}$

$\therefore T - T_0 = \Delta T = 26.3K$

Example 14.12

C & F give same reading

$\frac{C}{1} \times \frac{5(F-32)}{9}$

$9C = 5F - 160$

$9C = 5F - 160$

$9F - 5F = -160$

$\frac{4F}{4} = \frac{-160}{4}$

$F = -40^\circ F,\ C = -40^\circ C$

moment of Inertia

L^2

$I = MR^2$

mass radius

T - Period.

$I = \frac{ML^2}{T}$

$I = ML^2T^{-1}$

volume

$V =$

$d =$

$x =$

L

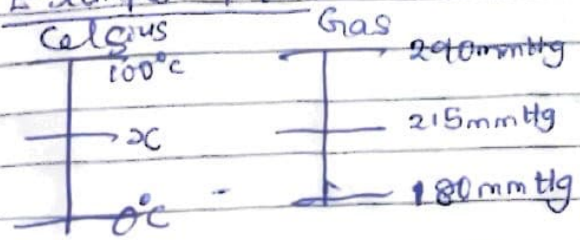
L

Ex

14

5

Example 14.10



$$\frac{x-0}{100-0} = \frac{215-180}{290-180}$$

$$x(110) = 100(35)$$

$$\frac{110x}{110} = \frac{3500}{110}$$

$$x = 31.8°c.$$

Example 14.11

$$R = R_0[1+\alpha(T-T_0)]$$

Where R_0 = resistance at temperature T_0.

$R_0 = +10\%$ find the change in temperature

$(\alpha = 3.8 \times 10^{-3}\ K^{-1})$

Solution

$$R = R_0[1+\alpha(T-T_0)]$$

$$R = R_0 + 10\% R$$

$$R = 1.1R_0$$

$$\therefore 1.1R_0 = R_0[1+3.8\times10^{-3}(T-T_0)]$$

$$\frac{1.1R_0}{R_0} = 1+38\times10^{-3}(T-T_0)$$

volume of a

v = vol

d = diameter.

$\cancel{\frac{x}{T}} = \frac{g t^2}{2}$

L T

$\frac{L}{T^2} = \frac{g \cancel{T^2}}{\cancel{2}}$

$g = \frac{L}{T^2}$

$$\boxed{\frac{g \cancel{t^2}}{\cancel{t^2}} = \frac{2x}{t^2} \quad g = \frac{2x}{t^2} \quad g = 2x t^{-3}}$$

Ex.

14.1 - 2.66 R_1, 3.62 R_2, 3.15 R_3

$T_1 = 0°c$, $T_2 = 100°c$, $T_3 = 55°c$

55°c

$C = 15 - 273$

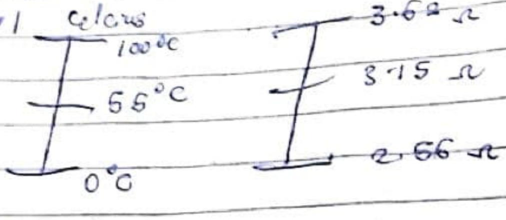
14.3 = 18.2

1273 - 15 = 158

= 18.2

Exercises

14.1 celcius



R = R

PHY 101

$W = \int mg + ma \cos\theta \, R \, d\theta$

$W = \int mg \frac{\sin\theta}{\cos\theta} \times \tan\theta \, R \, d\theta$

$W = mg R \int_{0}^{\theta} \sin\theta \, d\theta$

$W = \int F \cos\theta \, ds$

$F = T \sin\theta$

$\frac{mg}{\cancel{\cos}} = T \cos\theta$

$S = R\theta$

$ds = R \, d\theta$

$W = mg R \left[-\cos\theta \right]_{0}^{\theta}$

$\left[-\cos\theta - (-\cos 0) \right]$

$\left[-\cos\theta + \cos 0 \right]$

$-\cos\theta + 1 = 0$ ~~$\cos\theta = 1$~~

55.68°

$\Rightarrow 1 - \cos\theta$

15×60 $\cancel{60}$ 15 300 900

Power

Power may be defined as the rate of doing work or the rate at which work could be done.

$$P = \frac{W}{t}, \quad P = \frac{dw}{dt}, \quad P = \frac{d(f \times d)}{dt}$$

$$P = \frac{F\,ds}{dt} = P = F \times \underbrace{\left(\frac{ds}{dt}\right)}_{\text{velocity}}$$

$$P = F \times V$$

① - A marathon runner with mass 50.0kg runs up the stairs to the top of a 443m tall building. In order to lift himself to the top in 15.0 mins, what must be his average power in watts and in horse power. ($g = 9.8m/s^2$).

Solution.

$m = 50.0kg$

$h = 443m$ (1 horse power = 750 watts).

$g = 9.8 m/s^2$

$t = 900$ secs

Sol. $P = \frac{W}{t} = \frac{mgh}{t}$

$$P = \frac{50 \times 9.8 \times 443}{900}$$

$$= \frac{217070}{900} = 241\ W.$$

$1\ hp = 750\ W$

$x = 241\ W$

$$\frac{750x}{750} = \frac{241}{750}$$

$x = 0.321\ hp$