WS-13 [illegible] foundation

(1)

we know $C = \frac{5}{9}(F-32)$

and also $C = K-273$ Given $K=0^\circ$

$\therefore \quad K-273 = \frac{5}{9}(F-32)$

$\Rightarrow 0-273 = \frac{5}{9}(F-32)$

$\Rightarrow -273 \times 9 = 5(F-32)$ (54.6)

$\Rightarrow F-32 = -491.4$

$\Rightarrow F = -491.4 + 32 = -459.6^\circ F$

(2)

$L.F.P_1 = 3^\circ \quad U.F.P_1 = 102^\circ \quad \therefore \theta = 80^\circ$

If we compare this faulty thermometer with celsius scale then

$$\frac{\theta - L.F.P}{U.F.P - L.F.P} = \frac{\theta - L.F.P_1}{U.F.P_1 - L.F.P_1}$$

$$\Rightarrow \frac{C-0}{100-0} = \frac{80-3}{102-3}$$

$$\Rightarrow \frac{C}{100} = \frac{77}{99}$$

$$\Rightarrow C = \frac{77}{99} \times 100 = \frac{7}{9} \times 100 = 77.8^\circ C$$

Given $F = 2C \Rightarrow C = \frac{F}{2}$

we know that $C = \frac{5}{9}(F-32)$

$\therefore \frac{F}{2} = \frac{5}{9}(F-32)$

$\Rightarrow 9F = 10F - 320$

$\Rightarrow F = 320^\circ F$

(4)

Given Readings of celsius thermometer $C = 60^\circ$ and Fahrenheit thermometer $F = 141^\circ F$.

If we measure Fahrenheit temperature corresponding to 60° we can get error in Fahrenheit scale

$\therefore$ From $C = \frac{5}{9}(F-32)$

$\Rightarrow 60 = \frac{5}{9}(F-32)$

$\Rightarrow 12 = \frac{1}{9}(F-32) \Rightarrow F-32 = 108$

$\Rightarrow F = 108 + 32 = 140^\circ F$

Error $= 141 - 140 = 1^\circ F$

(5)

Given $C = F$

From $C = \frac{5}{9}(F-32)$

$= \frac{5}{9}(C-32)$

$\Rightarrow 9C = 5C - 160$

$\Rightarrow 4C = -160 \Rightarrow C = -\frac{160}{4} = -40^\circ C$

⑥

Steam point $U.F.P_1 = 80^\circ$; Ice point $L.F.P_1 = 20^\circ$

$\theta = 32^\circ$

Now we measure this temperature on celsius thermometer by using [here $L.F.P_{celsius} = 0^\circ$; $U.F.P_{Cels} = 100^\circ C$]

$$\left(\frac{C - L.F.P}{U.F.P - L.F.P}\right)_{Celsius} = \left[\frac{\theta - L.F.P_1}{U.F.P_1 - L.F.P_1}\right]_{Given}$$

$$\Rightarrow \frac{C-0}{100-0} = \frac{32-20}{80-20} \Rightarrow \frac{C}{100} = \frac{12}{60}$$

$$\Rightarrow C = 20^\circ C.$$

⑦

Given

Steam point $U.F.P_1 = 92^\circ C$; Ice poin $L.F.P_1 = 2^\circ C$

In case of actual Celsius thermometer $L.F.P = 0^\circ C$ & $U.F.P = 100^\circ C$

∴ By using

$$\left[\frac{C - L.F.P_1}{U.F.P_1 - L.F.P_1}\right]_{faulty} = \left[\frac{C - L.F.P}{U.F.P - L.F.P}\right]_{original}$$

$$\Rightarrow \frac{C-2}{92-2} = \frac{C-0}{100-0} \Rightarrow \frac{C-2}{90} = \frac{C}{100}$$

$$\Rightarrow \frac{C-2}{9} = \frac{C}{10} \Rightarrow 10(C-2) = 9C$$

$$\Rightarrow 10C - 20 = 9C$$

$$\Rightarrow C = 20^\circ C.$$

⑨

For Scale X → $L.F.P_1 = 40^\circ$; $U.F.P_1 = 120^\circ$

For scale Y → $L.F.P_2 = -30^\circ$; $U.F.P_2 = 130^\circ$

$X = 50^\circ$

From Relation

$$\left[\frac{x - L.F.P_1}{U.F.P_1 - L.F.P_1}\right] = \left[\frac{Y - L.F.P_2}{U.F.P_2 - L.F.P_2}\right]$$

$$\Rightarrow \frac{50-40}{120-40} = \frac{Y+30}{130+30}$$

$$\Rightarrow \frac{10}{80} = \frac{Y+30}{160}$$

$$\Rightarrow Y + 30 = \frac{160}{8} \times 2 = 20$$

$$\Rightarrow Y = 20 - 30 = -10^\circ$$

(11)

Given $F = 113^\circ F$ & $C = 44^\circ C$

But for $F = 113^\circ F$ the corresponding celsius scale thermometer reading was determined by using

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

$$\Rightarrow C' = \frac{5}{9}(113-32)$$

$$\Rightarrow C' = \frac{5}{9} \times 81 = 5 \times 9 = 45^\circ C$$

$$\text{Error} = C' - C = 45 - 44 = 1^\circ C$$

$$\begin{array}{r} 113 \\ -32 \\ \hline 81 \end{array}$$

(12)

Solids expands on heating because the interatomic distances increases so as a result its dimensions are also expands.

(13)

water is having some peculiar behavior (ie) Anamalous expansion. due to this

on heating water from $0 \rightarrow 4^\circ C$, it contracts by cooling water from $4^\circ \rightarrow 0^\circ$ it expands due to increase in density

(14)

Here expansion of a circular metal ring occurs tangentially and radially outwards therefore if there is a gap in it then the length of the gap will increase. and Radius also increases at same rate. so length of gap increases only

'a' (a) is correct

(16)

Given $k = F$

we know the relation between k & F as

$$\Rightarrow k - 273 = \frac{5}{9}(F - 32)$$

$$\Rightarrow F - 273 = \frac{5}{9}(F - 32)$$

$$\Rightarrow 9(F - 273) = 5(F - 32)$$

$$\Rightarrow 9F - 9 \times 273 = 5F - 160$$

$$\Rightarrow 9F - 5F = 9 \times 273 - 160$$

$$\Rightarrow 4F = 4 \times 574.6$$

$$\Rightarrow F = 574.6^\circ F$$

(17)

For faulty thermometer $L.F.P_1 = 5^\circ$; $U.F.P_1 = 95^\circ$

$\theta = 59^\circ$

we use the relation $\frac{\theta - L.F.P_1}{U.F.P_1 - L.F.P_1} = \frac{C - L.F.P}{U.F.P - L.F.P}$ for measuring correct temperature.

$$\Rightarrow \frac{59 - 5}{95 - 5} = \frac{C - 0}{100 - 0} \Rightarrow \frac{54^6}{9\cancel{0}} = \frac{C}{100}$$

$$\Rightarrow C = 6 \times 10 = 60^\circ C$$

(18)

$k = 200\ k$

$C = k - 273 = 200 - 273 = -73^\circ C$

(19)

Given $C = 37 \Rightarrow k = 273 + 37 = 310\ k$.

(20)

Given $F = 100^\circ F$ we know $\frac{F - 32}{9} = \frac{R}{4}$

$$\Rightarrow \frac{100 - 32}{9} = \frac{R}{4} \Rightarrow \frac{68}{9} \times 4 = R \Rightarrow R = 30.2^\circ R$$

(21)

100° is equal to $80\ R$.

LTask

See main level

①

For faulty thermometer L.F.P$_1$ = 5° ; U.F.P$_1$ = 95° , θ = 59°

we use Relation $\frac{\theta - L.F.P_1}{U.F.P_1 - L.F.P_1} = \frac{C - L.F.P}{U.F.P - L.F.P}$ for measuring

correct temperature $\Rightarrow \frac{59-5}{95-5} = \frac{C-0}{100-0}$

$\Rightarrow \frac{54}{90} = \frac{C}{100} \Rightarrow C = \frac{54}{90} \times 100$

$\Rightarrow C = 60°C$

Error $\Rightarrow C - \theta = 60 - 59 = \underline{1°C}$

②

melting point of ice L.F.P = 10°C

Here thermometer reading is in 10° a head of it's original level

so boiling point of water is in general 100°C → so reading is 110°C.

③

Given $F = 3C$. $\Rightarrow C = \frac{F}{3}$

From $C = \frac{5}{9}(F-32)$

$\Rightarrow \frac{F}{3} = \frac{5}{9_3}(F-32)$

$\Rightarrow F = \frac{5}{3}(F-32)$

$\Rightarrow 3F = 5F - 160$

$\Rightarrow 3F - 5F = -160$

$\Rightarrow -2F = -160 \Rightarrow F = 80°F$

④

$C = \frac{1}{10} F \Rightarrow F = 10C$

From $C = \frac{5}{9}(F-32)$

$\Rightarrow C = \frac{5}{9}(10C-32)$

$\Rightarrow 9C = 50C - 160$

$\Rightarrow 9C - 50C = -160$

$\Rightarrow -41C = -160 \Rightarrow C = \frac{160}{41} = 3.9°C$

⑤

Given $C = 60°C \Rightarrow F = 141°F$

let us calculate the corresponding fahrenheit temperature related to 60°C

$\therefore$ From $C = \frac{5}{9}(F-32)$

$\Rightarrow 60 = \frac{5}{9}(F-32)$

$\Rightarrow 12 = \frac{1}{9}(F-32) \Rightarrow 108 = F-32$

$\Rightarrow F = 108+32 = 140°F$

$\therefore$ Error $= 141° - 140 = 1°F$

⑥

Given $K = 20K$.

From $K-273 = \frac{5}{9}(F-32) \Rightarrow F-32 = -455.4$

$\Rightarrow 20-273 = \frac{5}{9}(F-32) \Rightarrow F = -455.4+32$

$\Rightarrow -253 = \frac{5}{9}(F-32) = -423.4°F$

$\Rightarrow -50.6 = \frac{1}{9}(F-32)$

(7)

L.F.P$_1$ = 3° ; U.F.P$_1$ = 102° ; θ = 80°

For celsius thermometer L.F.P = 0°C ; U.F.P = 100°C

From

$$\frac{C - L.F.P}{U.F.P - L.F.P} = \frac{\theta - L.F.P_1}{U.F.P_1 - L.F.P_1}$$

$$\Rightarrow \frac{C-0}{100-0} = \frac{80-3}{102-3} \Rightarrow \frac{C}{100} = \frac{77}{99} = \frac{7}{9}$$

$$\Rightarrow C = \frac{7}{9} \times 100 = 77.8^\circ C$$

(8)

Given F = 2C.

From $C = \frac{5}{9}(F-32)$

$$\Rightarrow \frac{F}{2} = \frac{5}{9}(F-32)$$

$$\Rightarrow 9F = 10(F-32) \Rightarrow 9F = 10F - 320^\circ F$$

$$\Rightarrow F = 320^\circ F$$

(9)

Given C = -39°C.

we know $\frac{C}{100} = \frac{R}{80}$

$$\Rightarrow \frac{C}{5} = \frac{R}{4}$$

$$\Rightarrow R = 4 \times \frac{C}{5} = 4 \times \left(-\frac{39}{5}\right) = -31.2^\circ$$

$$= 4 \times 7.8$$

$$\Rightarrow -31.2^\circ R.$$

(10)

$K = 200\,K$.

From $C = \frac{5}{9}(F-32)$ we know $C = K-273$

$\Rightarrow K-273 = \frac{5}{9}(F-32)$

$\Rightarrow 200-273 = \frac{5}{9}(F-32)$

$\Rightarrow -73 = \frac{5}{9}(F-32)$

$\Rightarrow -73 \times 9 = 5F - 160$

$\Rightarrow 5F = -657 + 160$

$5F = -497$

$F = \frac{-497}{5} = -99.4^\circ F$ = option D

(18)

L.F.P = $0^\circ R$ U.F.P = $80^\circ R$. $C = 367^\circ C$

From $\frac{C}{100} = \frac{R}{80}$

$\Rightarrow \frac{C}{5} = \frac{R}{4} \Rightarrow R = 4 \times \frac{C}{5} = 4 \times \frac{367}{5}$

$R = 4 \times 73.4$

$= 293.6^\circ R$.