WS-8. 7th foundation +

Thank

(1)

Given $\frac{d_1}{d_2} = \frac{2}{3}$; $\frac{s_1}{s_2} = \frac{1}{2}$.

Thermal capacity / volume = density × specific heat

$\Rightarrow \frac{C_1}{C_2} = \frac{d_1}{d_2} \times \frac{s_1}{s_2} = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$

(2)

Given $d_1 = 400 \text{ kg/m}^3$; $d_2 = 600 \text{ kg/m}^3$

$V_1 = 40 \text{ cc}$ $V_2 = 30 \text{ cc}$.

Given $C_1 = C_2$

$\Rightarrow m_1 s_1 = m_2 s_2$

$\Rightarrow d_1 V_1 s_1 = d_2 V_2 s_2$

$\Rightarrow \frac{s_1}{s_2} = \frac{d_2 V_2}{d_1 V_1}$

$\Rightarrow \frac{s_1}{s_2} = \frac{600 \times 30}{\frac{400}{2} \times 40} = \frac{9}{8}$

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(5)

(3)

Heat $Q = 1000$ cal ; change in temp $d\theta = 70 - 20 = 50^\circ C$

water equivalent = Thermal capacity

$= ms = \frac{dQ}{d\theta} = \frac{1000}{50}$

$= 20$ gms

(4)

Diameter $D_1 = 10$cm ; $D_2 = 20$ cm

we know thermal capacity $= ms$

$\Rightarrow C = dVS = d\frac{4\pi}{3}r^3 S$

$\Rightarrow C = \frac{4\pi}{3} d \left[\frac{D}{2}\right]^3 S$

$\Rightarrow C \propto D^3$

$\Rightarrow \frac{C_1}{C_2} = \left[\frac{D_1}{D_2}\right]^3 = \left[\frac{10}{20}\right]^3 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$

(5)

Given $m = 100$ gm. $\therefore S = 0.03$ cal/gm°C

thermal capacity $C = ms = 100 \times 0.03$

$= 3$ cal/°C

(6)

Given $\frac{r_1}{r_2} = \frac{1}{2}$ $\therefore \frac{d_1}{d_2} = \frac{2}{3}$ $\therefore \frac{S_1}{S_2} = \frac{3}{4}$.

Thermal capacity $= d \times V \times S = \frac{4\pi}{3} r^3 ds$

$\frac{C_1}{C_2} = \frac{d_1}{d_2} \times \frac{S_1}{S_2} \times \left[\frac{r_1}{r_2}\right]^3$

$= \frac{2}{3} \times \frac{3}{4_2} \times \left[\frac{1}{2}\right]^3 = \frac{1}{2} \times \frac{1}{8} = \frac{1}{16}$.

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(7)

$m = 25g$; $Q = 1200$ cal ; $d\theta = 90 - 10 = 80^\circ c$

Thermal Capacity $= ms = \frac{dQ}{d\theta} = \frac{1200}{80} = \frac{30}{2} = 15$ cal/gm

$= 15 \times 4.2$ J/k $\Rightarrow$ 63 J/k

(8)

Given $Vol_A = Vol_B$: $\frac{S_A}{S_B} = \frac{2}{3}$.

Given Thermal capacity of $_A$ = Thermal capacity $_B$

$\Rightarrow m_A S_A = m_B S_B$

$\Rightarrow d_A V_A S_A = d_B V_B S_B$

$\Rightarrow \frac{S_A}{S_B} = \frac{d_B}{d_A} \Rightarrow \frac{d_A}{d_B} = \frac{S_B}{S_A} = \frac{3}{2}$

(9)

$m_1 = x$ gm ; $d\theta_1 = k_1 c$ $m_2 = y$ gm $d\theta_2 = k_2 c$

$Q_1 = Q_2$

$\Rightarrow m_1 s_1 d\theta_1 = m_2 s_2 d\theta_2$

$\Rightarrow \frac{s_1}{s_2} = \frac{m_2 d\theta_2}{m_1 d\theta_1} = \frac{y k_2}{x k_1}$

(10)

Thermal capacity of silver = Thermal capacity of water

$V_w = 1 l$
$= 10^{-3} m^3$

$S_w = 4200$ J/kg

$\Rightarrow m_s S_s = m_w S_w$

$\Rightarrow m_s \times 235.2 = 1 \times 1 \times 4200$

$\Rightarrow m_s = \frac{4200}{235.2} = 17.85$ kg

$m_w = d_w \times V_1$
$= 1000 \times 10^{-3}$
$= 1$ kg

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Advanced level

(6)

$m = 300\,gm$; $S = 0.03\ cal/g°C$.

$C = ms = 300 \times 0.03 = 9\ cal/°C$

(7)

$m = 300\,gm$; $S = 3.5\ cal/g°C$

$C = ms = 300 \times 3.5 = 1050\ cal/°C$

(8)

$m = 2\,kg$; $C = 100\ cal/°C$

$C = ms \Rightarrow S = \frac{C}{m} = \frac{100}{2000} = \frac{1}{20} = 0.05\ cal/gm°C$

L Task

SAQ's

(1)

All container has same liquid : density = constant

$C = ms = dv\,S = dv\,\frac{1}{m}\frac{dQ}{d\theta}$

$S = \frac{1}{m}\frac{dQ}{d\theta} \Rightarrow dQ = ms\,d\theta = \rho ds\,v\,d\theta$

$Q \propto v\,d\theta$

By substitute each and every option in above formula clearly option (C) has largest heat energy

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(2)

$Q = 1680\ J$; $m = 1000\ g = 1\ kg$; $s = 4200\ J/kg$

specific heat $= \frac{1}{m}\frac{dQ}{d\theta}$.

$\rightarrow dQ = ms\,d\theta = 1 \times 4200 \times 1680$

$\rightarrow d\theta = \frac{dQ}{ms} = \frac{1680}{1 \times 4200} = 0.4^{\circ}C.$

(3)

$r_1 = 8\ cm$; $r_2 = 16\ cm$

$C = ms = dVs = d \times \frac{4\pi}{3} r^3 s$

$\rightarrow \frac{C_1}{C_2} = \left[\frac{r_1}{r_2}\right]^3 = \left[\frac{8}{16}\right]^3 = \frac{1}{8}.$

(4)

$m = 100\ gm$

change in temperature $= d\theta = 95 - 5 = 90^{\circ}C$

$S_w = 1\ cal/gm\,^{\circ}C.$

$S_w = \frac{1}{m}\frac{dQ}{d\theta} \Rightarrow dQ = ms\,d\theta$

$= 100 \times 1 \times 90$

$= 9000 = 9 \times kcal$

(5)

$m = 150\ gm$

change in temperature $= 25 - 20 = 5^{\circ}C$

$S_{iron} = 480\ J/kg^{\circ}C.$

$dQ = ms\,d\theta = 150 \times 10^{-3} \times 480 \times 5$

$\rightarrow 75 \times 48 \times 10^{-1} = 360\ J$

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(6)

$Q = 2000\ cal$; $m = 200\ gm$; $s_w = 1\ cal/g°c$

we know $s = \frac{dQ}{d\theta} \times \frac{1}{m}$

$\Rightarrow d\theta = \frac{dQ}{ms} = \frac{2000}{200} = 10\ °c$

(7)

$m_1 = 500\ gm$; $s_1 = 0.1\ cal/gm°c$ $d\theta_1 = 40-30 = 10°C$

$m_2 = m_1$; $d\theta_2 = 40-35 = 5$

$c = \frac{dQ}{d\theta} \Rightarrow c \propto \frac{1}{d\theta} \Rightarrow \frac{c_1}{c_2} = \frac{d\theta_2}{d\theta_1} = \frac{5}{10} = \frac{1}{2}$

(8)

$m = 500gm$; $\theta_1 = 60°C$; $\theta_2 = 40°$; $s_w = 1\ cal/gm°c$
$= 4.2\ J/cal\ gm°c$

From $s = \frac{dQ}{m\,d\theta} \Rightarrow dQ = ms\,d\theta$

$= 500 \times 1 \times (60-40) \times 4.2$

$= 500 \times 20 \times 4.2$

$= 42000\ J$

(9)

$m = 400\ gm$
$= 400 \times 10^{-3}$ $d\theta = 100-30 = 70°$ $s = 390\ J/kg\ °c$

we know $dQ = ms\,d\theta = 400 \times 10^{-3} \times 390 \times 70$

$= 10920\ J$

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(10)

$m = 200 gm$ $\quad d\theta = 80-20 = 60^\circ$ $\quad s = 0.09\ cal/gm^\circ c$

$$dQ = ms\,d\theta$$
$$= 200 \times 60 \times 0.09$$
$$= 1080\ cal$$

Advemced level

(8)

$S_C = 0.4\ J/gm^\circ c$ $\quad : m = 100 g$

Thermal capacity $= ms = 0.4 \times 100$
$= 40\ J/^\circ c$

(9) (10)

$2\ cal = 2 \times 4.2 = 8.4\ J.$

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