



DPP – 2 (Calotimetry)

Video Solution on Website:-

<https://physicsaholics.com/home/courseDetails/56>

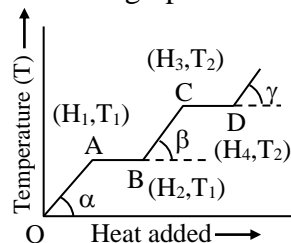
Video Solution on YouTube:-

<https://youtu.be/h86icvIVYrA>

Written Solution on Website:-

<https://physicsaholics.com/note/notesDetalis/31>

- Q 1. Ice at 0°C is added to 200gm of water initially at 70°C in a vacuum flask. When 50 gm of ice has been added and has all melted, the temperature of flask and contents is 40°C , When a further 80 gm of ice is added and has all melted, the temperature of whole becomes 10°C . Neglecting heat lost to surroundings the latent heat of fusion of ice is :
- (The specific heat of water is = 1 calorie/gram $^{\circ}\text{C}$)
- (A) 80 cal/gm (C) 90 cal/gm
(B) 70 cal/gm (D) 540 cal/gm
- Q 2. Water of volume 2 litre in a container is heated with a coil of 1 kW at 27°C . The lid of the container is open and energy dissipates at rate of 160 J/s. In how much time temperature will rise from 27°C to 77°C ?
- [Given specific heat of water is 4.2 kJ/K-kg]
- (A) 8 min 20 s (C) 6 min 2 s
(B) 7 min (D) 14 min
- Q 3. 2 kg ice at -20°C is mixed with 5 kg water at 20°C in an insulating vessel having negligible heat capacity. Calculate the final mass of water remaining in container.
- Given sp. heat water = $4.186 \text{ kJ K}^{-1} \text{ kg}^{-1}$
sp. heat Ice = $2.092 \text{ kJ K}^{-1} \text{ kg}^{-1}$
Latent heat of fusion of ice = 334.7 kJ kg^{-1}
- (A) 7 kg (C) 6 kg
(B) 4 kg (D) 2 kg
- Q 4. The accompanying graph shows the variation of temperature (T) of one kilogram material with Heat (H) supplied to it. At O, the substance is in solid state. Which of the following interpretation from the graph is correct –



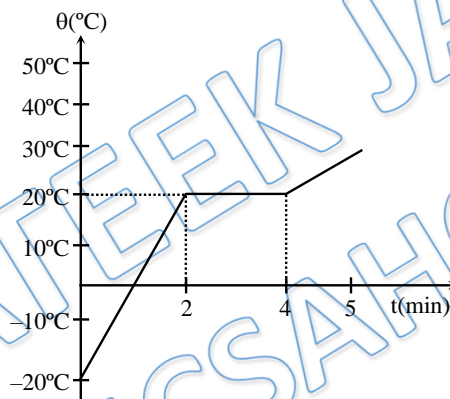
- (A) T_2 is the melting point of the solid
(B) BC represents the change of state from solid to liquid.
(C) $(H_2 - H_1)$ represent the latent heat of fusion of the substance.
(D) $(H_3 - H_1)$ represents the latent heat of vaporisation of the liquid.



- Q 5. Steam at 100°C is passed into 1.1 kg of water contained in a calorimeter of water equivalent 0.02 kg at 15°C , till the temperature of the calorimeter and its contents rises to 80°C . The mass of steam condensed (in kg) is (Take latent heat of steam = 540 cal g^{-1} , sp. Heat of water = $4.2 \text{ kJ K}^{-1} \text{ kg}^{-1}$) :
- (A) 0.13 (C) 0.065
(B) 0.26 (D) 0.135

- Q 6. When 10 gm of ice at -20°C is mixed with 10 gm of water at 50°C , the amount of ice melted is –
The latent heat of fusion for ice is 80 cal/gm , The specific heat of ice is $0.5 \text{ cal/gm}^{\circ}\text{C}$,
The specific heat of water is $1 \text{ cal/gm}^{\circ}\text{C}$
- (A) 2 gm (C) 3 gm
(B) 4 gm (D) 5 gm

- Q 7. Heat is supplied to 2kg of solid (initially at -20°C) at the constant rate of 5 kJ/min . Temperature is plotted as a function of time as shown in the figure. Latent heat of fusion for solid is –



- (A) 10 kJ/kg (C) 2.5 kJ/kg
(B) 5 kJ/kg (D) 7.5 kJ/kg

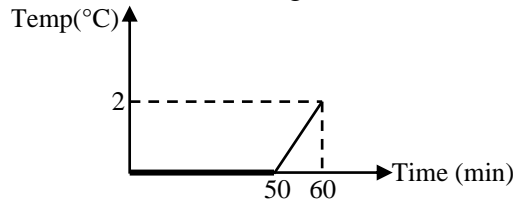
- Q 8. An earthen pitcher loses 1 gm of water per minute due to evaporation. If the water equivalent of pitcher is 0.5 kg and pitcher contains 9.5 kg of water, calculate the time required for the water in pitcher to cool to 28°C from original temperature of 30°C . Neglect radiation effects. Latent heat of vaporization in this range of temperature is 580 Cal/gm and specific heat of water is $1 \text{ Cal/gm}^{\circ}\text{C}$.
- (A) 30.5 min (C) 41.2 min
(B) 38.6 min (D) 34.5 min

- Q 9. A mixture of 250 gm of water and 200 gm of ice at 0°C is kept in calorimeter of water equivalent 50 gm. If 200 gm of steam at 100°C is passed through the mixture then the final amount of water in the mixture will be (Latent Heat of ice = 80 cal/gm , latent Heat of vaporisation of water = 540 cal/gm and specific heat of water = $1 \text{ cal/gm}^{\circ}\text{C}$) -
- (A) 450 gm (C) 622 gm
(B) 572 gm (D) 650 gm

- Q 10. A bucket contains a mixture of water and ice and total mass of content is 10 kg. Now this mixture is provided heat at uniform rate. The temperature Vs time graph is

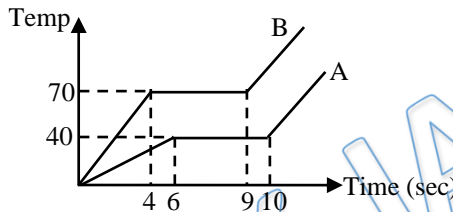


plotted. The initial amount of ice in the bucket will be [specific heat of water = 4.2 kJ/kg-K and latent heat of ice = 340 kJ/kg] –



- (A) 1.2 kg (C) 5 kg
 (B) 2.4 kg (D) 3.6 kg

Q 11. Two solid bodies of equal masses are heated at the same rate under identical condition. The change in temperature is shown graphically as a function of time. The ratio of specific heat in solid form should be (S_A/S_B) –



- (A) 4/3 (C) 21/8
 (B) 15/8 (D) 3/4

Q 12. A body of mass 25 kg is dragged on a rough horizontal floor for one hour with a speed of 2 kmh⁻¹. The coefficient of friction for the surface in contact is 0.5 and half the heat produced is absorbed by the body. If specific heat of body is 0.1 cal g⁻¹ (°C⁻¹) and g = 9.8 ms⁻², then the rise in temperature of body is:

- (A) 39 K (C) 59.5 K
 (B) 84.5 K (D) 11.6 K

Answer Key

| | | | | |
|--------|--------|-------|-------|--------|
| Q.1 c | Q.2 a | Q.3 c | Q.4 c | Q.5 a |
| Q.6 d | Q.7 b | Q.8 d | Q.9 b | Q.10 a |
| Q.11 c | Q.12 d | | | |



NEET UG subscription

PLUS

ICONIC**

- ✓ India's Best Educators
- ✓ Interactive Live Classes
- ✓ Structured Courses & PDFs
- ✓ Live Tests & Quizzes
- ✗ Personal Coach
- ✗ Study Planner

24 months ₹2,100/mo >
 No cost EMI +10% OFF ₹50,400

18 months ₹2,363/mo >
 No cost EMI +10% OFF ₹42,525

12 months ₹2,888/mo >
 No cost EMI +10% OFF ₹34,650

6 months ₹4,200/mo >
 No cost EMI +10% OFF ₹25,200

To be paid as a one-time payment

[View all plans](#)



Awesome! **PHYSICSLIVE** code applied



PHYSICSLIVE

Use code **PHYSICSLIVE** to get 10% OFF on Unacademy PLUS and learn from India's Top Faculties.



NEET UG subscription

PLUS

ICONIC**

- ✓ India's Best Educators
- ✓ Interactive Live Classes
- ✓ Structured Courses & PDFs
- ✓ Live Tests & Quizzes
- ✗ Personal Coach
- ✗ Study Planner

24 months ₹2,100/mo >
 No cost EMI +10% OFF ₹50,400

18 months ₹2,363/mo >
 No cost EMI +10% OFF ₹42,525

12 months ₹2,888/mo >
 No cost EMI +10% OFF ₹34,650

6 months ₹4,200/mo >
 No cost EMI +10% OFF ₹25,200

To be paid as a one-time payment

[View all plans](#)



Awesome! **PHYSICSLIVE** code applied



NEET & JEE Main Physics DPP - Solution

DPP-2 calorimetry

By Physicsaholics Team

Solution: 1

Let latent heat of fusion of ice = L

+ heat capacity of flask = C
S.P.

mass of flask = M .

given; specific heat capacity of water = $1 \text{ cal/g}^\circ\text{C}$

Now; when 50 gm of ice at 0°C is mixed

final temp = 40°C .

$$\therefore 50L + 50 \times 1 \times (40 - 0) = 200 \times 1 \times (70 - 40) + MC(70 - 40)$$

$$50L + 2000 = 6000 + 30MC$$

$$\boxed{50L = 4000 + 30MC} \quad \text{--- (1)}$$

New total mass of water = $200 + 50$
 $= 250 \text{ gm.}$

Now; when 80 gm of ice at 0°C is mixed
final temperature = 10°C

$$\therefore 80L + 80 \times 1 \times (10 - 0) = 250 \times 1 \times (40 - 10) + MC(40 - 10)$$

$$80L + 800 = 7500 + 30MC$$

$$\boxed{80L = 6700 + 30MC} \quad \text{--- (2)}$$

$$\text{(2) - (1)} \Rightarrow 30L = 2700 + 0$$

$$L = \frac{2700}{30}$$

$$\boxed{L = 90 \text{ cal/gm.}}$$

Ans. c

Solution: 2

Energy require to rise the temperature from 27°C to $77^\circ\text{C} = Q$

$$Q = m s \Delta T$$

$$= (\rho V) s \Delta T$$

$$= (1000 \times (2 \times 10^{-3})) \times 4.2 \times 10^3 \times (77 - 27)$$

$$\left[\begin{array}{l} \because \rho_w = 1000 \text{ kg/m}^3 \\ \text{and } V = 2 \text{ L} = 2 \times 10^{-3} \text{ m}^3 \end{array} \right]$$

$$\Rightarrow Q = 2 \times 4.2 \times 10^3 \times 50$$

$$Q = 420 \times 10^3 \text{ J}$$

Power of heating coil = 1 kW
 $= 10^3 \text{ J/s} = 1000 \text{ J/sec}$

rate of energy dissipation = 160 J/s

\therefore rate of energy used to rise temp of water = $1000 - 160$
 $= 840 \text{ J/s}$

$$\therefore t = \frac{420 \times 10^3}{840}$$

$$t = \frac{10^3}{2} = \frac{1000}{2} = 500 \text{ sec}$$

$$t = \frac{500}{60} = \frac{50}{6} \text{ min}$$

$$t = \frac{48}{6} + \frac{2}{6} = 8 \text{ min} + \frac{2}{6} \text{ min}$$

$$t = 8 \text{ min} + \frac{2}{6} \times 60 \text{ sec}$$

$$t = 8 \text{ min } 20 \text{ sec}$$

Ans. a

Solution: 3

ice
2 kg
at -20°C
 $S_i = 2.092 \text{ kJ/K}\cdot\text{kg}$
 $L = 334.7 \text{ kJ/kg}$

water
5 kg
at 20°C
 $S_w = 4.186 \text{ kJ/K}\cdot\text{kg}$

heat required to take ice from -20°C
to ice at 0°C

$$Q_1 = 2 \times (2.092) \times (20) = 83.68 \text{ kJ}$$

heat released in taking water from
 20°C to water at 0°C

$$Q_2 = 5 \times 4.186 \times (20) = 418.6 \text{ kJ}$$

$$\begin{aligned}\text{Excess heat remaining} &= 418.6 - 83.68 \\ &= 334.9 \text{ kJ.}\end{aligned}$$

this heat will convert ice into water
let m mass of ice is melted
to 0°C water

$$m \times 334.7 = 334.9$$

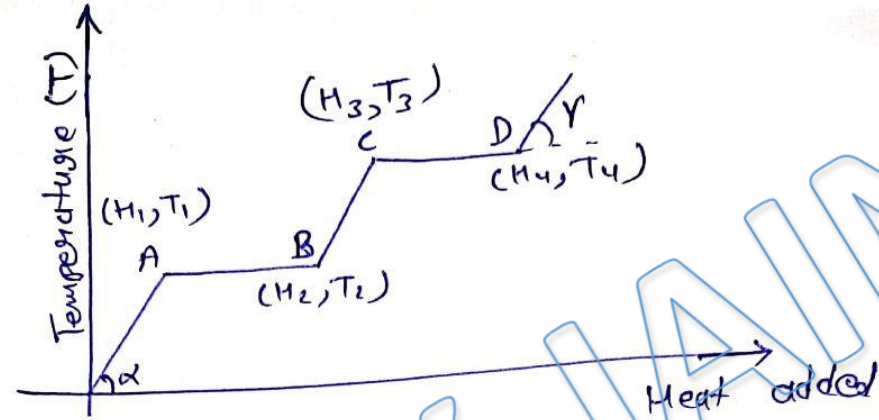
$$m = 1 \text{ kg}$$

\therefore New Total mass of water = $5 + 1$

$$\boxed{\text{Total mass of water} = 6 \text{ kg}}$$

Ans. c

Solution: 4



$O \rightarrow A$
 Temperature is increasing
 at 'O' \rightarrow substance is solid
 so, 'OA' \Rightarrow substance is solid and
 its temperature is increasing to T_1

$AB \Rightarrow$ Temperature is constant
 [Thus substance will change its state
 from solid to liquid]

at A \rightarrow solid
 B \rightarrow complete liquid

$\therefore AB \Rightarrow H_2 - H_1 = \text{latent heat of fusion.}$

$BC \Rightarrow$ Temperature increasing in liquid state

$CD \rightarrow$ substance is vaporizing

Ans. c

Solution: 5

Water equivalent of Calorimeter = 0.02 kg

So, The mass of water & the Calorimeter = (1.1 + 0.02)
= 1.12 kg

Specific heat capacity of water = 4.2×10^3 kJ/kg·K

Heat gained by calorimeter + water is

$$Q = 1.12 \times (4.2 \times 10^3) \times 60$$

$$Q = 305.76 \text{ kJ} \text{ or } \frac{305.76}{4.2} = 72.8 \text{ kcal}$$

Let mass of steam condensed = m

$$m \times 1 \times 20 + m \times 540 = 72.8 \times 10^3 \text{ cal}$$

$$m = \frac{72.8 \times 10^3}{560}$$

$$m = 0.13 \times 10^3 \text{ gm}$$

$$m = 0.13 \text{ kg}$$

Ans. a

Solution: 6

heat gained by ice to melt in water at 0°C

$$Q_1 = 10 \times 0.5 \times 20 + 10 \times 80$$

$$Q_1 = 900 \text{ J.}$$

heat released by water if it is taken to 0°C water

$$Q_2 = 50 \times 1 \times (50 - 0) = 2500 \text{ J.}$$

$\therefore Q_1 < Q_2$
means all ice will not melt.

Let mass of ice melt = m (in gm)

$$\text{So, } 10 \times 0.5 \times 20 + m \times 80 = 500$$

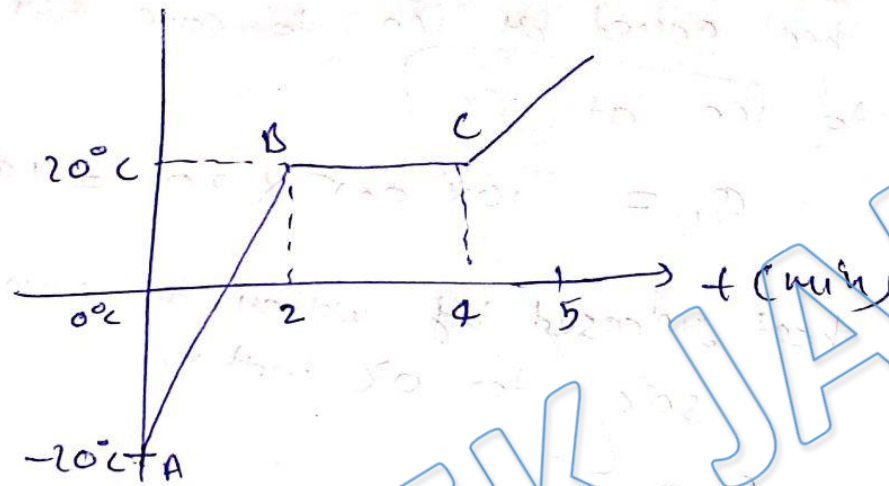
$$100 + m \times 80 = 500$$

$$m = \frac{400}{80}$$

$$\boxed{m = 5 \text{ gm}}$$

Ans. d

Solution: 7



In process B to C substance is changing its state from solid to liquid.

∴ Latent heat of fusion = $\frac{\text{Energy gained}}{\text{mass}}$
in time $t = 2 \text{ min}$
to $t = 4 \text{ min}$
($\Delta t = 2 \text{ min}$) for 2 kg .

$$(L) \text{ Latent heat of fusion} = \frac{5 \text{ kJ/min} \times 2 \text{ min}}{2 \text{ kg}}$$
$$= \frac{10}{2} \text{ kJ/kg}$$

$$\boxed{L = 5 \text{ kJ/kg}}$$

Ans. b

Solution: 8

water equivalent of pitcher = 0.5 kg

$$\begin{aligned}\text{mass of water \& pitcher} &= 9.5 + 0.5 \\ &= 10 \text{ kg}\end{aligned}$$

heat to be extracted from (water + pitcher)
for decreasing its temperature from

30°C to 28°C is:

$$Q_1 = 10 \times 1 \times (30 - 28)$$

$$Q_1 = 10 \times 1 \times 2$$

$$Q_1 = 20 \text{ kCal}$$

Heat extracted from the pitcher through
evaporation in t - ~~time~~ minutes.

$$Q_2 = mL$$

mass evaporated in time t will be
 $m = 1 \times t = t \text{ gm.}$

$$Q_2 = t \times 580 \text{ cal}$$

$$Q_1 = Q_2$$

$$20 \times 10^3 \text{ cal} = t \times 580 \text{ cal}$$

$$t = 34.48 \text{ min}$$

$$\boxed{t = 34.5 \text{ min}}$$

Ans. d

Solution: 9

water
250 gm

(+ 50 gm.
of water
equivalent of
calorimeter)

$250 + 50 = 300 \text{ gm}$
at 0°C

heat gained by ice to converted into water at 0°C

$$Q_1 = 200 \times 80 = 16,000 \text{ cal}$$

heat gained by water + calorimeter to rise
its temp from 0°C to 100°C

$$\text{Total mass of water} = 300 + 200 = 500 \text{ gm}$$

$$Q_2 = 500 \times 1 \times (100)$$

$$Q_2 = 50,000 \text{ cal}$$

ice

200 gm
at 0°C

steam.

200 gm.
at 100°C

$$\text{Total heat gained} = Q = Q_1 + Q_2 = 66,000 \text{ cal}$$

Let 'm' mass of steam is converted in
water at 100°C

$$\text{So; } m \times 540 = 66,000 \text{ cal}$$

$$m = 122.22 \text{ gm.}$$

\therefore 122 gm of 200 gm steam is converted
into water.

$$\therefore \text{Total mass of water} = 500 + 122 \\ = 622 \text{ gm.}$$

but in 622 gm 50 gm is of
water equivalent of calorimeter

$$\therefore \text{Total mass of water} = 622 - 50 \\ = 572 \text{ gm.}$$

Ans. b

Solution: 10

Let; mass of water = m_1

mass of ice = m_2

$$m_1 + m_2 = 10 \text{ kg.}$$

Let; rate of heat = x J/min.

then heat gained by ice in
 $t = 50$ min (to convert in water)

$$= x \times 50 = 50x \text{ J.}$$

$$m_2 \times L = 50x$$

$$m_2 \times 340 = 50x$$

$$m_2 = \frac{50x}{340} \text{ kg}$$

for $t = 50$ to $t = 60$

$$\Delta t = 10 \text{ min}$$

in these 10 minutes heat gained by
water is = $10 \times x = 10x \text{ J.}$

rise in temp = 2°C

$$(m_1 + m_2) \Delta T = 10x$$

$$10 \times 4.2 \times 2 = 10x$$

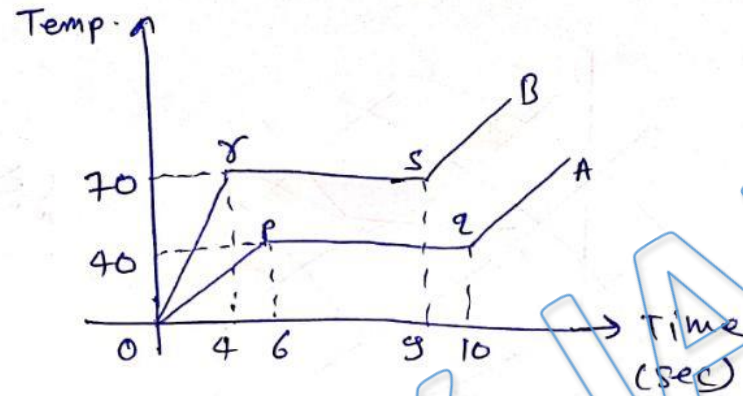
$$x = 8.4 \text{ J/min}$$

$$\text{So; } m_2 = \frac{50}{340} \times 8.4$$

$$m_2 = 1.23 \text{ kg}$$

Ans. a

Solution: 11



Let mass of bodies = m [Let the rate of heat gain = $x \text{ J/s}$]

\Rightarrow melting point of A = 40°C
 melting point of B = 70°C

For A
 time in solid state (solid state) = 6 sec.
 Energy/heat gained = $6x \text{ J}$.

$$6x = m S_A (40 - 0) \quad \text{--- (1)}$$

For B
 time in solid state (solid state) = 4 sec
 Energy/heat gain = $4x \text{ J}$.

$$4x = m S_B (70 - 0) \quad \text{--- (2)}$$

$$\frac{\text{(1)}}{\text{(2)}} \Rightarrow \frac{6x}{4x} = \frac{m S_A (40)}{m S_B (70)}$$

$$\Rightarrow \frac{3}{2} = \frac{S_A}{S_B} \times \frac{4}{7}$$

$$\boxed{\frac{S_A}{S_B} = \frac{21}{8}}$$

Ans. c

Solution: 12

$$\text{Heat Produced} = |\text{work done by friction}| = (\mu mg)(vt)$$

$$\text{Heat absorbed} = \frac{1}{2} \mu mgvt$$

$$\Delta Q = mc \Delta T = \frac{\mu mgvt}{2} \Rightarrow \Delta T = \frac{\mu gvt}{2c}$$

$$\Delta T = \frac{5 \times 9.8 \times 2 \times \frac{5}{18} \times 3600}{2 \times 1 \times 462 \times 10^3} = \frac{25 \times 9.8 \times 200}{42 \times 10^3}$$

$$= \frac{350}{30} = 11.6^\circ\text{C}$$

Ans. d

For Video Solution of this DPP, Click on below link

Video Solution
on Website:-

<https://physicsaholics.com/home/courseDetails/56>

Video Solution
on YouTube:-

<https://youtu.be/h86icvIVYrA>

Written Solution
on Website:-

<https://physicsaholics.com/note/notesDetails/31>

 **SUBSCRIBE**



[@Physicsaholics](#)

[@Physicsaholics_prateek](#)

[@NEET_Physics](#)
[@IITJEE_Physics](#)

[physicsaholics.com](#)

[Unacademy](#)



CLICK

Chalo Niklo