Physicsaholics

DPP – 1 (Calorimetry)

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Q 1. If specific heat of a substance is infinite, it means--
(A) Heat is given out
(B) Heat is taken in
(C) No change in temperature takes place whether heat is taken in or given out
(D) All of the above

Q 2. Two spheres made of same substance have diameters in the ratio 1 : 2. Their thermal capacities are in the ratio of -
(A) 1 : 2 (B) 1 : 8
(C) 1 : 4 (D) 2 : 1–

Q 3. Liquids A and B are at 30°C and 20°C. When mixed in equal masses, the temperature of the mixture is found to be 26°C. Their specific heats are in the ratio of -
(a) 3 : 2 (B) 1 : 1
(C) 2 : 3 (D) 4 : 3

Q 4. The temperature of equal masses of three different liquids A,B and C are 12°C, 19°C and 28°C respectively . The temperature when A and B are mixed is 16°C, when B and C are mixed is 23°C; what is the temperature when A and C are mixed ?
(A) 31°C (B) 20.26°C
(C) 19.5°C (D) 28°C

Q 5. Heat required to convert one gram of ice at 0ºC into steam at 100ºC is (given L_{steam} = 536 cal/gm)-
(A) 100 calorie (B) 0.01 kilocalorie
(C) 716 calorie (D) 1 kilocalorie

Q 6. 300 gm of water at 25ºC is added to 100 gm of ice at 0ºC. The final temperature of the mixture is - :-
(A) 0 ºC (B) 2 ºC (C) 1 ºC (D) 3 ºC

Q 7. A 1 g of ice is mixed with 1 g of steam. After thermal equilibrium is achieved, the temperature of the mixture is : -
A) 100°C (B) 55°C
(C) 75°C (D) 0°C

Q 8. If x grams of steam at 100ºC becomes water at 100ºC which converts y grams of ice at 0ºC into water at 100ºC, then the ratio x/y will be –
(A) 1/3 (B)1/ 2

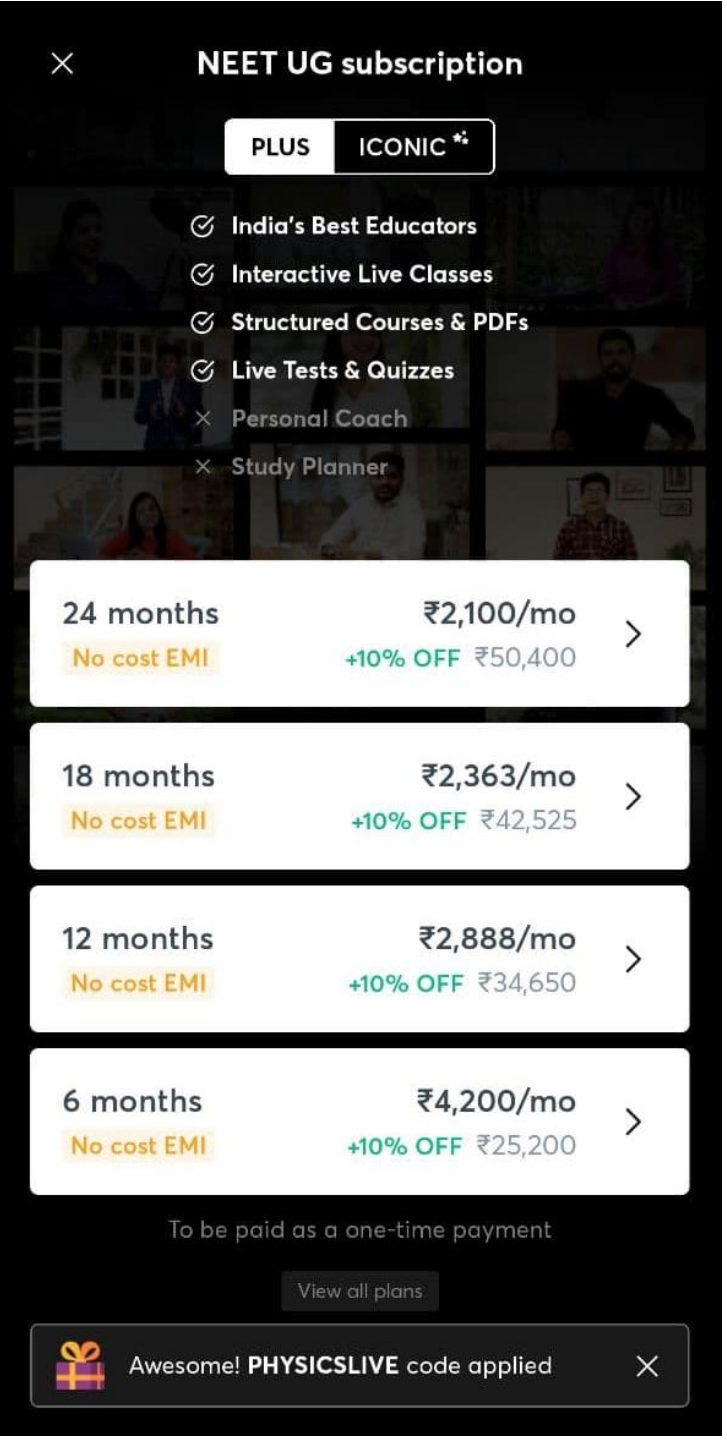
(C) 1/4 (D) none

Q 9. 5 g of steam at 100ºC is passed into 6 g of ice at 0ºC. If the latent heats of steam and ice are 540 cal/g and 80 cal/g, then the final temperature is–
(A) 0ºC (B) 50ºC
(C) 30ºC (D) 100ºC

Q 10. The amount of heat required to raise the temperature of 1 kg of water through 1°C is called
(A) kilocalorie (B) calorie
(C) B.T.U. (D) calorie/°C

Answer Key

Q.1 c	**Q.2 b**	**Q.3 a**	**Q.4 b**	**Q.5 c**
Q.6 a	**Q.7 a**	**Q.8 a**	**Q.9 d**	**Q.10 a**



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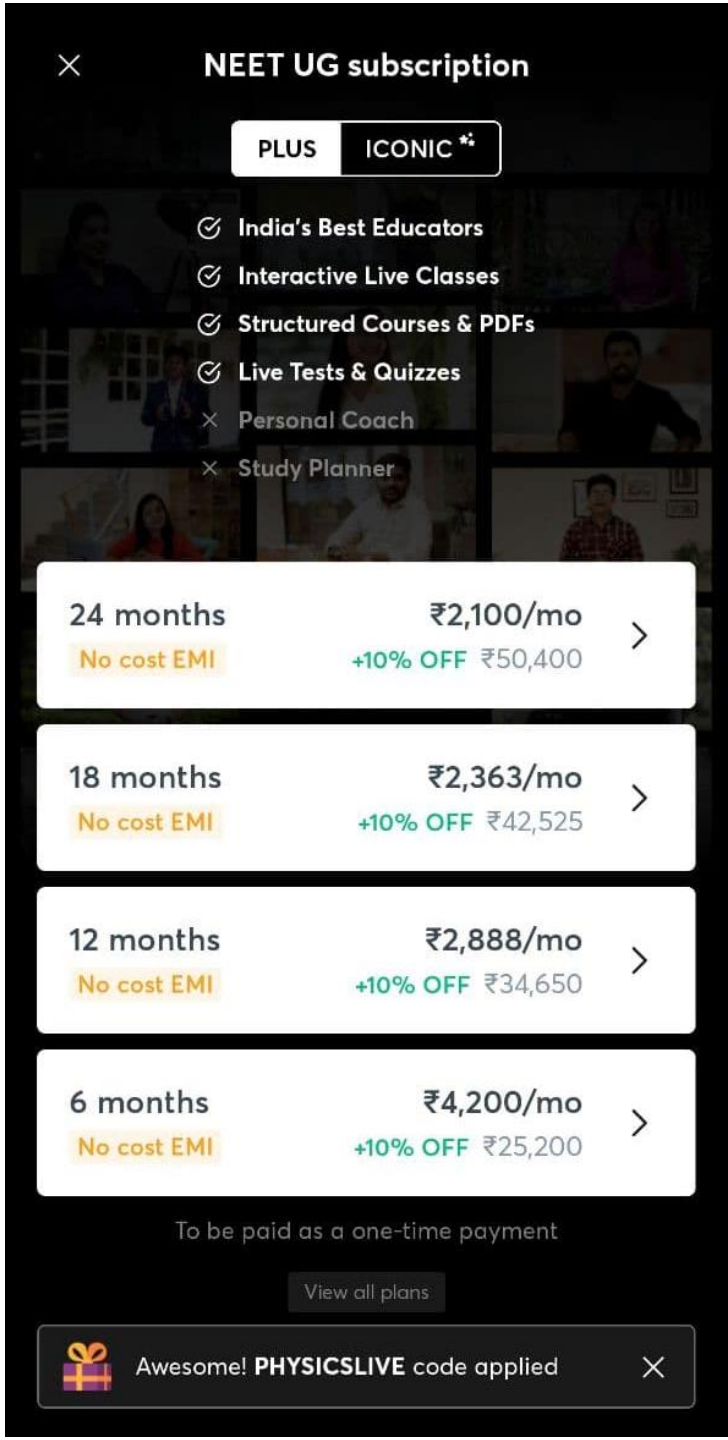

NEET & JEE Main
Physics DPP - Solution

DPP-1 calorimetry

By Physicsaholics Team

Solution: 1

$$Q = m\ c.\Delta\theta \Rightarrow c = \frac{Q}{m.\Delta\theta} \text{ ;when } \Delta\theta = 0 \Rightarrow c = \infty$$

Ans. c

Solution: 2

formula for heat capacity $\Rightarrow ms$

$\Rightarrow 5 \times 4/3 \pi R^3 . s$

$\Rightarrow H.C \propto R^3$

$\Rightarrow \dfrac{(H.C)_1}{(H.C)_2} = \dfrac{1}{8}$

Ans. b

Solution: 3

Heat given = Heat taken

$m S_A (30 - 26) = m S_B (26 - 20)$

$$\frac{S_A}{S_B} = \frac{6}{4} = 3:2$$

Ans. a

Solution: 4

Let m be the mass of each liquid and S_A, S_B, S_C be specific heats of liquids A, B and C respectively.

When A and B are mixed. The final temperature is $16^\circ C$.

$\therefore$ Heat gained by A = heat lost by B

i.e., $mS_A = (16 - 12) = mS_B(19 - 16)$

i.e., $S_B = \frac{4}{3}S_A .....(i)$

When B and C are mixed. Heat gained by B = Heat lost by C

i.e., $mS_B = (23 - 19) = mS_C(28 - 23)$

i.e., $S_C = \frac{4}{5}S_B .....(ii)$

From eq. (i) and (ii)

$S_C = \frac{4}{5} \times \frac{4}{3}S_A = \frac{16}{15}S_A$

When A and C are mixed, let the final temperature be θ

$\therefore mS_A(\theta - 12) = mS_C(28 - \theta)$

i.e., $\theta - 12 = \frac{16}{15}(28 - \theta)$

By solving, we get,

$\theta = \frac{628}{31} = 20.26^\circ C.$

Ans. b

Solution: 5

Mass of ice=1 g

Temperature of ice = 0 °C

- The ice at 0°C is needed to convert to water at the same temperature i.e. 0°C

Heat required at this stage

= Mass of the ice x Latent heat of fusion of ice

=1 x 80 = 80 cal

- Now increase the water temperature from 0°C to 100°C by using the formula.

Heat required = Mass of water x rise in temperature x specific heat of water

= 1 x 100 x 1 = 100 cal

- Now convert water into vapour state at 100°C

Heat required for this

= Mass of water x Latent heat

= 1 x 536 =536 cal

Total heat required

=80 +100 +536 = 716 cal

Ans. c

Solution: 6

We know that latent heat of fusion of ice is 79.7 Cal per gram.

Let final temperature be T.

Then

$m_1 S\Delta T = m_2 L$

$300 \times 1 \times (25 - T) = 100 \times 75$

$(25 - T) = \dfrac{100 \times 75}{300}$

$25 - T = 25$

$T = 0^\circ\text{C}$

After that total energy left $= 4.7 \times 100$

Total mass of water $= 400$ g

Amount of water again converted into ice

$m = \dfrac{470}{79.7}$

$m = 5.9$ g

Thus whole mass is converted into water at 0°C,and about 5.9 gwater is again converted into ice whose temperature is also 0°C.

After achieving the temperature of 0°C, latent heat of fusion is required firstly for conversion of water into ice then further lowering of temperature is possible. So the final temperature will be 0°C.

Ans. a

Solution: 7

Total heat gained by ice is equal to the total heat lost by steam.

For ice to completely convert into water, heat required is $m_1 L_f = 1 \times 80 = 80cal$

For steam to completely convert into water, heat released is $m_2 L_v = 1 \times 540 = 540\ cal$

Hence, first 80 calories will not be enough for the steam to condense completely.

Now, to convert melted water to 100^oC from 0^oC, heat required is $m_1 s(100 - 0) = 1 \times 1 \times 100 = 100cal$

So, total energy required to heat ice to water 100^oC is $100 + 80 = 180\ cal$.

Hence, even this amount of energy is not enough for the steam to condense completely. Hence, the final temperature of the mixture will be 100^oC.

Note- finally the mixture will consist of both steam and water at 100^oC.

Ans. a

Solution: 8

Heat released by steam = Heat taken by ice

x gms $\qquad$ y gms

$$x \cdot L_{steam} = y \cdot L_{ice} + y\, s_w \Delta T$$

$$x \cdot 540 = y \cdot 80 + y \cdot 1 \cdot 100$$

$$x\,540 = 180\, y$$

$$x/y = 1:3$$

Ans. a

Solution: 9

Total heat gained by ice is equal to the total heat lost by steam.

For ice to completely convert into water, heat required is $m_1 L_f = 1 \times 80 = 80cal$

For steam to completely convert into water, heat released is $m_2 L_v = 1 \times 540 = 540\ cal$

Hence, first 80 calories will not be enough for the steam to condense completely.

Now, to convert melted water to 100^oC from 0^oC, heat required is $m_1 s(100 - 0) = 1 \times 1 \times 100 = 100cal$

So, total energy required to heat ice to water 100^oC is $100 + 80 = 180\ cal$.

Hence, even this amount of energy is not enough for the steam to condense completely. Hence, the final temperature of the mixture will be 100^oC.

Note- finally the mixture will consist of both steam and water at 100^oC.

Ans. d

Solution: 10

$$\rightarrow Q = m s \Delta T$$

$$= 1000\,gm \times 1\,\frac{cal}{gm\,^\circ C} \times 1\,^\circ C$$

$$= 1000\,cal = 1\,kcal$$

Ans. a

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