DPP - 1 CALORIMETRY

Symbols:-

H = Heat absorbed/released **m** = mass of the body **C** = specific heat capacity

θ_i =initial temperature of body θ_f = final temperature of body

$\Delta\theta$ = Change in temperature { Bada – Chota }

 # kaise pahchane: During heating [rise in temperature] → $\theta_f > \theta_i$ **# Savdhan**

During cooling [fall in temperature] → $\theta_i > \theta_f$ **$\Delta\theta$ hamesha "+ve" chahiye**

Formula for practice: -

To be learned:- Specific heat capacity of water, C_w = 1 cal/g^0C = 4.2 J/g^0C = 4200 J/kg^0C

Specific heat capacity of ice, C_{ice} = 2.1 J/g^0C = 2100 J/kg^0C

Specific heat capacity of copper, C_{cu} = 0.4 J/g^0C = 400 J/kg^0C

Boiling point of water = 100 ^{0}C

Freezing point of water = 0 ^{0}C

1. Find out amount of heat energy absorbed by 1 kg of water to raise its temperature from 10 ^{0}C to 60 ^{0}C?
   i. in Joules ii. in kJ iii. in Calorie
2. How much heat energy is gained when 0.8 kg of copper is brought to 600 ^{0}C to 100 ^{0}C?
3. How much heat energy is gained when 200 g of water at 25 ^{0}C to 55 ^{0}C, i) in Joules, ii) calorie?
4. What amount of heat energy is required to raise temperature of 300 g ice by 30 ^{0}C?
5. Find out the amount of heat energy released from a solid having mass of 20 g and specific heat capacity 1.25 J/g^0C when it cools down from 50 ^{0}C to 10 ^{0}C?
6. How much energy is lost from, copper ball of mass 10 g if its temperature falls from 500 ^{0}C to 50 ^{0}C?
7. If temperature of 6 kg water falls by 50 ^{0}C, find amount of heat energy lost in surrounding?

8. If heat energy lost by a solid mass of 1 kg having specific heat capacity 200 J/kg^{0}C is 2 kJ so that its final temperature is 30 ^{0}C, find initial temperature?

9. 50 g of mercury at room temperature [specific heat capacity = 0.04 calorie/g^{0}C] is given 210 J heat energy find final temperature of mercury?

10. 600 g of water is given 300 calorie heat energy so that its temperature reaches 30 ^{0}C, find initial temperature?

11. Heat energy lost by 20 g of copper so that its temperature falls to 150 ^{0}C is 400 J, find final temperature of the body?

12. 200 g of water at 50 ^{0}C is kept for long time in open so that its temperature falls by 30 ^{0}C, find its final temperature?

13. On heating a metal ball of mass 50 g its temperature rises by 150 ^{0}C, if final temperature is 200 ^{0}C, find its initial temperature?

14. Find heat capacity of solid of mass 60 g and specific heat capacity 2400 J/kg^{0}C?

15. How much heat is required for 75 g water to raise its temperature by 1 ^{0}C?

16. Find heat capacity of ice if its temperature rises by 40 ^{0}C after absorbing 840 J of heat energy?

17. How much mass of water will have heat capacity of 630 J/^{0}C?

18. What mass of a solid object will absorb 3.3 kJ of heat energy to raise its temperature to 80 ^{0}C from 78 ^{0}C specific heat capacity of is 220 J/kg^{0}C?

19. Find heat energy required for 0.63 kg of water at 20 ^{0}C to boil it?

20. 0.6 kg of lead at 273 ^{0}C is cooled by 250 ^{0}C, when it gives of 22500 calories of energy. Calculate specific heat capacity of lead in i) calories, ii) Joules?

DPP - 2 CALORIMETRY

1. A solid of mass 0.15 kg is heated from 10 ^{0}C to 90 ^{0}C. If the specific heat capacity of the solid is 390 J kg^{-1} ^{0}C^{-1} find the heat absorbed by the solid.
2. 0.50 kg of lead at 327 ^{0}C is cooled to 27 ^{0}C, when it gives off 22500 calories of energy. Calculate the specific heat capacity of lead in (i) calories (ii) joules.
3. 272 calories of heat energy is required to heat 0.02 kg of metal of specific heat capacity 170 cal kg^{-1} ^{0}C^{-1} to a temperature T. If the initial temperature of the metal is 20 ^{0}C, calculate the final temperature T.
4. 3.75 x 10^5 calories of heat is given out by 5 kg of water at 100 ^{0}C. Calculate the temperature of cooled water. Specific heat capacity of water is 1000 cal kg^{-1} ^{0}C^{-1}.
5. A liquid of mass 100 g loses heat at a rate of 200 Js^{-1} for 1 minute. If the temperature of the liquid drops by 100 ^{0}C, calculate the specific heat capacity of the liquid.
6. A heater, rated 1000 W, is used to heat 1.5 kg of water at 40 ^{0}C to its boiling point. Calculate the time in which the water starts to boil. Specific heat capacity of water is 4200 J kg^{-1} ^{0}C^{-1}
7. 400 g of mercury of specific heat capacity 0.14 Jg^{-1} is heated by a 200 W heater for 1 min. and 40 s. If initially mercury is at 0 ^{0}C, calculate its final temperature.
8. A power drill of 400 W makes a hole in a lead cube of specific heat capacity 0.13 J g^{-1} ^{0}C^{-1} in 80 s. If the temperature of lead rises from 27 ^{0}C to 327 ^{0}C, calculate the mass of the lead cube.
9. A solid of mass 150 g at 200 ^{0}C is placed in 0.4 kg of water at 20 ^{0}C till a constant temperature is attained. If the S.H.C. of the solid is 0.5 J g^{-1} K^{-1} find the resulting temperature of the mixture.
10. A liquid of mass 100 g at 120 ^{0}C is poured in water at 20 ^{0}C, when the final temperature recorded is 40 ^{0}C. If the specific heat capacity of the liquid is 0.8 J g^{-1} ^{O}C^{-1}, calculate the initial mass of water.
11. A solid of mass 50 g at 150 ^{0}C is placed in 100 g of water at 11 ^{0}C, when the final temperature recorded is 20 ^{0}C. Find the specific heat capacity of the solid.
12. 20 g of hot water at 80 ^{0}C is poured into 60 g of cold water, when the temperature of cold water rises by 20 ^{0}C. Calculate the initial temperature of cold water.
13. 50 g of a hot solid of specific heat capacity 0.25 J g^{-1} ^{0}C^{-1} and at 100 ^{0}C is placed in 80 g of cold water, when the temperature of cold water rises by 3 ^{0}C. Find the initial temperature of cold water.
14. What mass of a solid of specific heat capacity 0.75 J g^{-1} ^{0}C^{-1} will have heat capacity 93.75 J g^{-1} ^{0}C^{-1}?

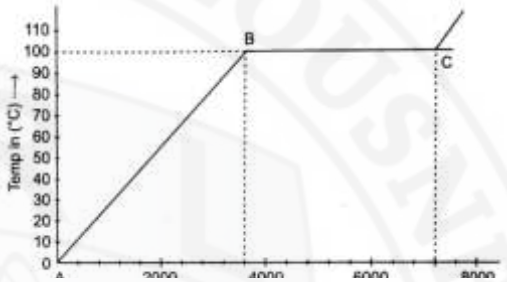
DPP - 3 CALORIMETRY

1. A solid of mass 0.15 kg and at 100 ^{0}C is placed in 0.25 kg of water, contained in a copper calorimeter of mass 0.12 kg, at 10 ^{0}C. If the final temperature of the mixture is 20 ^{0}C, calculate the sp. heat capacity of the solid. [Given S.H.C. of water 4200 J kg^{-1} K^{-1} , S.H.C. of copper 400 J kg^{-1} K^{-1}]
2. A piece of brass of mass 200 g and at 1000C, is placed in 400 g of turpentine oil, contained in a copper calorimeter of mass 50 g at 15 ^{0}C. The final temperature recorded is 23 ^{0}C. Find the sp. heat capacity of turpentine oil. [S.H.C. for brass 370 J kg^{-1} K^{-1} , S.H.C. of copper 390 J kg^{-1} K^{-1}]
3. A copper vessel contains 200 g of water at 24 ^{0}C. When 112 g of water at 42 ^{0}C is added, the resultant temperature of water is 30 ^{0}C. Calculate the thermal capacity of the calorimeter.
4. A copper calorimeter contains 50 g of water at 16 ^{0}C. When 40 g of water at 36 ^{0}C is added, the resulting temperature of the mixture is 24 ^{0}C. Calculate the heat capacity of the calorimeter.
5. A liquid X of specific heat capacity 1050 J kg^{-1} K^{-1} and at 90 ^{0}C is mixed with a liquid Y of specific heat capacity 2362.5 J kg^{-1} K^{-1} and at 20 ^{0}C, when the final temperature recorded is 50 ^{0}C. Find in what proportion the weights of the liquids are mixed.
6. You are required to make a water bath of 50 kg at 45 ^{0}C, by mixing hot water at 90 ^{0}C, with cold water at 20 ^{0}C. Calculate the amount of hot water required. Hint : Let amt. of hot water = x kg ; Amount of cold water (50 - x) kg
7. Heat energy is given to 80 g of alcohol (sp. heat capacity 2200 J kg^{-1} K^{-1}) when its temperature rises by 20 K. If the same heat energy is given to 200 g of mercury of sp heat capacity 140 J kg^{-1} K^{-1} what is the rise in temperature?
8. A copper ball is dropped from a vertical height of 1200 m. If the initial temperature of copper ball at the height is 12 ^{0}C, what is its temperature on reaching the ground? Assume all its kinetic energy changes to heat energy and sp. heat capacity of copper is 400 J kg^{-1} ^{0}C^{-1} and g 10 ms^{-2}.
9. A waterfall is 1.5 km high. If the temperature of water at its top is 20 ^{0}C find its temperature at the bottom of waterfall, assuming all the kinetic energy is converted into heat energy. [Take g = 10 ms^{-2} and sp. heat capacity of water 4200 J kg^{-1} ^{0}C^{-1}]
10. 4000 calories of heat energy is supplied to crushed ice at 0 ^{0}C, such that it completely melts to form water at 0 ^{0}C. If sp. latent heat of fusion of ice is 80 cal g^{-1} what is the mass of ice?
11. A solid of mass 80 g and at 80 ^{0}C melts completely to form liquid at 80 ^{0}C by absorbing 640 J of heat energy. What is the sp. latent heat of fusion of solid?
12. 100 g of ice at -10 ^{0}C is heated on a gas stove till it forms water at 80 ^{0}C. Calculate: (i) Heat energy required to bring the ice to 0 ^{0}C. (ii) Heat energy required to melt the ice (iii) Heat

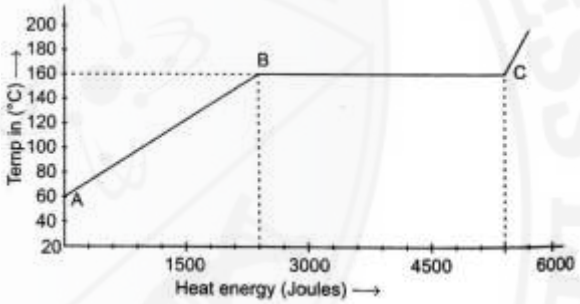
energy required to bring water to 80 ^{0}C. [sp. heat capacity of ice = 2 J g^{-1} ^{0}C^{-1}. sp. heat capacity of water = 4.2 J g^{-1} ^{0}C^{-1} and sp. latent heat of fusion of ice is 336 Jg^{-1}]

13. 400 g of wax at 10 ^{0}C is heated to 80 ^{0}C, when it starts melting. On complete melting wax is further heated so that temperature rises to 130 ^{0}C. Calculate (i) Heat energy required to bring the wax to its melting point (ii) Heat energy required to melt the wax (iii) Heat energy required to bring the molten wax to 130 ^{0}C.
[sp. heat capacity of solid wax = 1.5 J g^{-1} ^{0}C^{-1}. sp. heat capacity of liquid wax 1.8 J g^{-1} ^{0}C^{-1} and sp. latent heat of wax 80 Jg^{-1}]

14. A solid initially at 0 ^{0}C is heated. The graph shows variation in temperature with the amount of heat energy supplied. If the specific heat capacity of solid 0.8 J g^{-1} ^{0}C^{-1} from the graph, calculate (i) the mass of solid and (ii) specific latent heat of fusion of solid.



15. A solid initially at 60 ^{0}C is heated. The graph shows variation in temperature with the amount of heat energy supplied. If the specific heat capacity of solid is 1.2 J g^{-1} ^{0}C^{-1} from the graph, calculate (i) the mass of solid and (ii) specific latent heat of fusion of solid.



16. Water at 80 ^{0}C is poured into a bucket containing 1.5 kg of crushed ice at 0 ^{0}C, such that all the ice melts and the final temperature recorded is 0 ^{0}C. Calculate the amount of hot water added to the ice. [Take specific heat capacity of water 4200 J kg^{-1} K^{-1} and sp. latent heat of ice 336 x 10^3 J kg^{-1}]

17. 1.6 kg of boiling water at 100 ^{0}C is poured into 2 kg of crushed ice at 0 ^{0}C, such that final temperature recorded is 0 ^{0}C. Calculate the specific latent heat of ice. [sp. Heat capacity of water = 4200 J kg^{-1}K^{-1}]

18. 40 g of ice at -10 ^{0}C is heated by a heater of power 250 W, such that water formed from it, attains the temperature equal to the boiling point of water. For how long is the heater switched on? [S.H.C. of ice 2 J g^{-1} ^{0}C^{-1}; sp. latent heat of ice 340 Jg^{-1}]

19. An immersion heater is placed in crushed ice at – 40 ^{0}C, contained in a perspex jar, such that water at 50 ^{0}C is formed. If the power of the heater is 200 W and it is switched on for 3 min. and 20 s, calculate the initial mass of ice. S.H.C. of ice = 2.1 J g^{-1} ^{0}C^{-1} and latent heat of ice = 336 Jg^{-1}

DPP - 4 CALORIMETRY

1. A burner supplies heat energy at a rate of 434 Js^{-1} for 60 seconds when 40 g of ice at 0 ^0C changes to water at 75 ^0C. Calculate the latent heat of ice.
2. A vessel of mass 80 g (S.H.C. 0.8 J g^{-1} $^0C^{-1)}$ contains 250 g of water at 35 ^0C. Calculate the amount of ice at 0 ^0C, which must be added to it, so that the final temperature is 5 ^0C.
3. A vessel of mass 100 g (S.H.C. 0.2 cal g^{-1} $^0C^{-1}$) contains 500 g of water at 37 ^0C. Calculate the amount of ice, which should be added to the vessel, so that the final temperature is 17 ^0C. [S.H.C. of water = 1 cal g^{-1} $^0C^{-1}$ and S.L.H. of ice = 80 cal g^{-1}]
4. 10 g of ice at 0 ^0C is added to 10 g of water at 80 ^0C, such that the temperature of the mixture is 0 ^0C. Calculate the sp. latent heat of ice. [S.H.C. of water 4.2 J g^{-1} $^0C^{-1}$]
5. A metal ball of mass 0.5 kg and at 900 ^0C is placed on a block of ice, till it attains the temperature of ice. If the S.H.C. of the metal ball is 850 J $kg^{-1}K^{-1}$, calculate the amount of ice, which melts. Take S.L.H. of ice 34 x 10^4 J kg^{-1}.
6. Calculate the temperature of a furnace, when a 400 g of a copper ball, taken out from it, melts only 400 g of ice to form water at 0 ^0C. Take S.H.C. of copper = 0.4 J g^{-1} $^0C^{-1}$ and S.L.H. of ice = 336 Jg^{-1}.
7. A metal ball of 0.20 kg and at 200 ^0C, when placed on an ice block melts 100 g of ice, when its temperature stops falling. If sp. latent heat of ice is 340 Jg^{-1}, calculate specific heat capacity of the metal ball.
8. A 30 watt immersion heater just keeps 600 g of molten metal at its melting point. The heater is switched off and the temperature starts falling after 6 min. Calculate sp. latent heat of fusion of the metal.
9. A hydrocarbon of mass 1.5 kg is just kept in the molten state by a heater of 500 W. If the heater is switched off, the temperature starts dropping after 4 mins. Calculate sp. latent heat of fusion of the hydrocarbon.
10. 500 g of water at 60 ^0C is contained in a vessel of negligible heat capacity. Into this water is added 400 g of ice at 0 ^0C. Calculate the amount of ice which does not melt. [Take SHC of water = 4.2 J g^{-1} $^0C^{-1}$ and S.L.H. of ice = 336 Jg^{-1}]
11. 2 kg of water at 100 ^0C is contained in a vessel of negligible heat capacity. Into this water is added 3 kg of ice at 0 ^0C. Calculate the amount of water at 0 ^0C at the end of experiment. [Take SHC of water = 4.2 x 10^3 J and SLH of ice = 336 x 10^3 J]
12. A vessel with a negligible heat capacity contains 1000 g ice at 0 ^0C. Into it is poured 100 g of water at 100 ^0C. What would be the result at the end of experiment? [SHC of water = 4.2 J g^{-1} $^0C^{-1}$ and SLH of ice = 336 Jg^{-1}]
13. What will be the result when 400 g of copper clips at 500 ^0C are placed in 800 g of crushed ice at 0 ^0C?