PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

CALORIMETRY

Solved Example

1. A lead piece of mass $25g$ gives out 1200 calories of heat when it is cooled from $90^\circ C$ to $10^\circ C$. What is its

(i) specific heat

(ii) thermal capacity

(iii) water equivalent.

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2. The specific heat of a substance varies as $\left(3\theta^2+\theta\right)\times 10^3 calg^{-10}C^{-1}$. What is the amount of heat required to rise the temperature of $1kg$ of substance frm $10^\circ C$ to $20^\circ C$?

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3. Find the water equivalent of copper block of mass $200g$. The specific heat of copper is $0.09calg^0C$.

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4. Two sphere of radii in the ratio $1:2$, have specific heats in the ration $2:3$. The densities are in the ratio $3:4$. Find the ration of their thermal capacities.

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5. 10 litres of hot water at $70^\circ C$ is mixed with an equal volume of cold water at $20^\circ C$. Find the resultant temperature of the water. (Specific heat of water $= 4200 J/kg - K$).

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6. A sphere of aluminium of mass 0.047 kg placed for sufficient time in a vessel containing boling water, so that the sphere is at $100^{\circ}C$. It is then immediately transferred to 0.14 kg copper calorimeter containing 0.25 kg of water at $20^{\circ}C$. The temperature of water rises and attains a steady state at $23^{\circ}C$. calculate the specific heat capacity of aluminum. Specific heat capacity of copper = $0.386 \times 10^{3} Jkg^{-1}K^{-1}$.

Specific heat capacity of water = $4.18 \times 10^{-3} Jkg^{-1}K^{-1}$

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7. The temperature of equal masses of three different liquids A,B and C are $12^\circ C, 19^\circ C$ and $28^\circ C$ respectively. The temperature when A and B are mixed is $16^\circ C$ and when B and C are mixed it is $23^\circ C$. What should be the temperature when A and C are mixed?

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8. The melting point of ice $0^\circ C$ at $1atm$. At what pressure will it be $-1^\circ C$?

(Given, $V_2 - V_1 = \left(1 - \frac{1}{0.9}\right) \times 10^{-3} m^3$).

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9. A piece of ice of mass $100g$ and at temperature $0^\circ C$ is put in $200g$ of water of $25^\circ C$. How much ice will melt as the temperature of the water reaches $0^\circ C$? (specific heat capacity of water $= 4200 Jkg^{-1}K^{-1}$ and latent heat of fusion of ice $= 3.4 \times 10^5 JKg^{-1}$).

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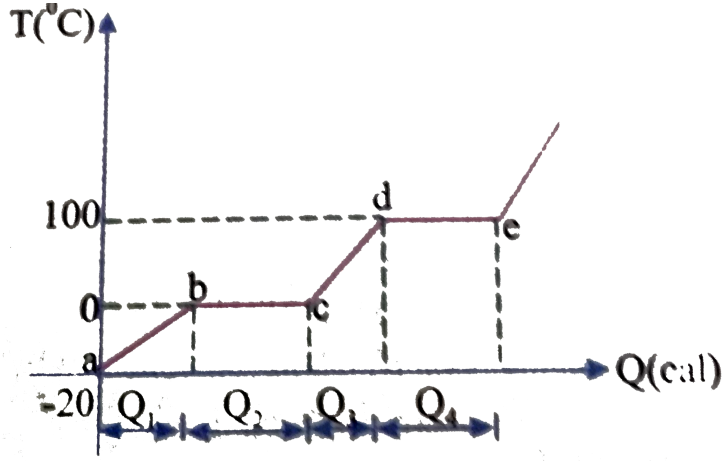
10. The following graph represents change of state of 1 gram of ice at $-20^\circ C$. Find the net heat required to convert ice into steam at $100^\circ C$.

$S_{ice} = 0.53 cal/g - ^\circ C$



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11. A calaorimeter of water equivalent $83.72Kg$ contains $0.48Kg$ of water at $35^\circ C$. How much mass of ice at $0^\circ C$ should be added to decrease the temperature of the calorimeter to $20^\circ C$.

$(S_w = 4186J/Kg - K$ and $L_{ice} = 335000J/Kg)$.

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12. A steam at $100^\circ C$ is passed into $1kg$ of water contained in a calorimeter of water equivalent $0.2kg$ at $9^\circ C$ till the temperature of the calorimeter and water in it is increased to $90^\circ C$. Find the mass of steam condensed in $kg(S_w = 1cal/g^\circ C, \&L_{\text{steam}} = 540cal/g)(EAM = 14E)$.

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13. $1g$ steam at $100^\circ C$ is passed in an insulating vessel having $1g$ ice at $0^\circ C$. Find the equilibrium composition

of the mixture. (Neglecting heat capacity of the vessel).

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14. $20g$ of steam at $100^\circ C$ is passes into $100g$ of ice at $0^\circ C$. Find the resultant temperature if latent heat if steam is $540cal/g$,latent heat of ice is $80cal/g$ and specific heat of water is $1cal/g^\circ C$.

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15. $6gm$ of steam at $100^\circ C$ is mixed with $6gm$ of ice at $0^\circ C$. Find the mass of steam left uncondensed.

$\left(L_f = 80cal/g, L_v = 540cal/g, S_{water} = 1cal/g - {}^\circ C\right)$

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16. A piece of ice (heat capacity $= 2100Jkg^{-1}.{}^\circ C^{-1}$ and latent heat $= 3.36 \times 10^5 Jkg^{-1}$) of mass m grams is at $-5.{}^\circ C$ at atmospheric pressure. It is given 420 J of heat so that the ice starts melting. Finally when the ice . Water mixture is in equilibrium, it is found that 1 gm of ice has melted. Assuming there is no other heat exchange in the process, the value of m in gram is

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17. When a small ice crystal is placed in overcooled water it begins to freeze instantaneously.

i. What amount of ice is formed from 1 kg of water over cooled to $-8^{\circ}C$? L of water $= 336 \times 10^{3} J/kg$ and s of water $= 4200 J/kg/K$.

ii. What should be the temperature of the overcooled water in order that all of it be converted into ice at $0^{\circ}C$?

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CUQ

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 whether heat is taken in (or) given out

D. all of the above

Answer: C

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2. The heat capacity of a body depends on

A. the structure of a matter

B. temperature of matter

C. density of matter

D. specific heat of water

Answer: D

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3. Heat required to raise the temperature of one gram of water through $1^{\circ}C$ is

A. $0.001Kcal$

B. $0.01Kcal$

C. $0.1Kcal$

D. $1.0Kcal$

Answer: A

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4. If temperature scale is changed from $'^{\circ} C$ to $'^{\circ} F$, the numerical value of specific heat

A. decrease

B. increase

C. remain constant

D. be converted to heat capacity

Answer: A

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5. The gases have two principal specific heats but solids and liquied have only one specific heat. Why ?

A. Solid

B. Gas

C. Liquid

D. Vapour

Answer: B

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6. What is specific heat of gas in isothermal changes?

A. infinity

B. zero

C. negative

D. remain constant

Answer: A

7. At a given temperature, the specific heat of a gas at constant pressure is always greater than its specific heat at constant volume.

A. There is greater inter molecular attraction at constant pressure

B. At constant pressure molecular oscillation are more violent

C. External work need to be done for alllowing expansion of gas at constant pressure

D. Due to more reasons other than those mentioned in the above

Answer: C

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8. The ratio $[C_p / C_v]$ of the specific heats at a constant pressure and at a constant volume of any perfect gas

A. can't be greater than $5/4$

B. can't be greater than $3/2$

C. can't be greater than $5/3$

D. can have any value

Answer: C

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9. During melting process, the heat given to a solid is used in (generally)

A. increasing the temperature

B. increasing the density of material

C. increasing the average distance between the molecules

D. increasing the average $K.E$ of the molecules

Answer: C

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10. when two blocks of ice are pressed against each other then they stick together (coalesce) because

A. cooling is produced

B. heat is produced

C. increase in pressure, increase in melting point

D. increase in pressure, decrease in melting point

Answer: D

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11. Ice is found to be slippery when a man walks on it This is so because

A. increase in presence causes ice to melt faster

B. increase in pressure causes ice to melt slower

C. its surface is smooth and cold

D. ice is colder

Answer: A

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12. Cooking is difficult on mountains because

A. water boils at low temperature

B. water boils at high temperature

C. water does not boil

D. it is cool there

Answer: A

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13. Paraffin wax expands on melting. The melting point of wax with increasing pressure.

A. increase

B. decreases

C. remains same

D. we can't say

Answer: A

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14. Explain why cooking is faster in a pressure cooker.

A. the cooker does not absorb any heat

B. it has a safety valve

C. boiling point of water rises due to increased pressure

D. it is a pretige to cook in a cooker

Answer: C

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15. A large block of ice is placed on a table when the surroundings are at $0^{\circ}C$.

A. ice melts at the sides

B. ice melts at the top

C. ice melts at the bottom

D. ice does not melt at all

Answer: C

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16. Which of the following at $100^{\circ}C$ produces most sever burns ?

A. Hot air

B. Water

C. Stream

D. Oil

Answer: C

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17. The latent heat of fusion of a substance is always less than the latent heat vapourization or latent heat of sublimation of the same substace. Explain.

A. On vaporisation much larger increase in volume takes place

B. Increase in kinetic energy is much larger on boiling

C. Kinetic energy decreases on boiling

D. Volume deceases when the ice melts.

Answer: A

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18. The latent heat of fusion of a substance is always less than the latent heat vapourization or latent heat of

sublimation of the same substace. Explain.

A. greater than its latent of fusion

B. greater than its latent heat of sublimation

C. equal to its latent heat of sublimation

D. less than its latent heat of fusion

Answer: A

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19. A piece of ice at $0^\circ C$ is dropped into water at $0^\circ C$. Then ice will

A. melt

B. be converted to water

C. not melt

D. partially melt

Answer: C

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Level I C W

1. The ratio of densities of two substances is $2:3$ and that of specific heats is $1:2$. The ratio of thermal capacities per unit volume is

A. $1:2$

B. $2:1$

C. $1:3$

D. $3:1$

Answer: C

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2. Two sphere of copper of diameters $10cm$ and $20cm$ will have thermal capacities in the ratio

A. $\frac{1}{8}$

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. $\frac{1}{6}$

Answer: A

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3. Two liquids A and B of equal volumes have their specific heats in the ration $2:3$. If they have same thermal capacity, then the ratio of their densities is

A. $1:1$

B. $2:3$

C. $3:2$

D. $5:6$

Answer: C

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4. Specific heat of aluminum is $0.25 cal/g^0 c$. The water equivalent of an aluminum vessel of mass one kilogram is

A. $40 cal/^0 C$

B. $250 g$

C. $250 cal/^0 C$

D. $40 g$

Answer: B

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5. The quantity of heat which can rise the temperature of xgm of a substance through $t_1^\circ C$ can rise the temperature of ygm of water through $t_2^\circ C$ is same. The ratio of specific heats of the substances is

A. yt_1 / xt_2

B. xt_2 / yt_1

C. yt_2 / xt_1

D. xt_1 / yt_2

Answer: C

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6. Two liquids A and B are at $30^\circ C$ and $20^\circ C$, respectively When they are mixied in equal masses, the temperature of the mixture is found to be $26^\circ C$. The ratio of their specific heat is

A. $4:3$

B. $3:4$

C. $2:3$

D. $3:2$

Answer: D

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7. Mg of ice at $0^\circ C$ is mixed with Mg of water at $10^\circ c$.

The final temperature is

A. $8^\circ C$

B. $6^\circ C$

C. $4^\circ C$

D. $0^\circ C$

Answer: D

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8. A beaker contains 200 g of water. The heat capacity of the beaker is equal to that of 20 g of water. The initial temperature of water in the beaker is $20^\circ C$ .If 440 g of hot water at $92^\circ C$ is poured in it, the final temperature (neglecting radiation loss) will be nearest to

A. $58^\circ C$

B. $68^\circ C$

C. $73^\circ C$

D. $78^\circ C$

Answer: B

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9. If $10g$ of the ice at $0^\circ C$ is mixed with $10g$ of water at $100^\circ C$, then the final temperature of the mixture will be

A. $5^\circ C$

B. $10^\circ C$

C. $100K$

D. $0^\circ C$

Answer: B

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10. 10 grams of stream at $100^\circ C$ is mixed with $50gm$ of ice at $0^\circ C$ then final temperature is

A. $20^\circ C$

B. $50^\circ C$

C. $40^\circ C$

D. $100^\circ C$

Answer: C

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11. The heat energy required to vapourise $5kg$ of water at $373K$ is

A. $2700K.\ cal$

B. $1000K.\ cal$

C. $27K.\ cal$

D. $270K.\ cal$

Answer: A

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12. Two liquids A and B are at temperatures of $75^\circ C$ and $150^\circ C$ respectively. Their masses are in the ratio of $2:3$ and specific heats are in the ratio $3:4$. The resultant temperature of the mixture, when the above

liquids, are mixed (Neglect the water equivalent of container) is

A. $125^\circ C$

B. $100^\circ C$

C. $50^\circ C$

D. $150^\circ C$

Answer: A

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13. $1g$ of ice at $0^\circ C$ is mixed $1g$ of steam at $100^\circ C$. The mass of water formed is

A. $1.33g$

B. $1g$

C. $0.133g$

D. $13.3g$

Answer: A

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14. A piece of metal of mass $112g$ is heated to $100^\circ C$ and dropped into a copper calorimeter of mass $40g$ containing $200g$ of water at $16^\circ C$. Neglecting heat loss, the specific heat of the metal is nearly, if the

equilibrium temperature reached is $24^{\circ}C$.

$(S_{cu} = 0.1cal/g - .^{\circ}C)$.

A. $0.292cal/g - .^{\circ}C$

B. $0.392cal/g - .^{\circ}C$

C. $0.192cal/g - .^{\circ}C$

D. $0.492cal/g - .^{\circ}C$

Answer: C

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15. Three liquids with masses m_1,m_2,m_3 are throughly mixed. If their specific heats are c_1,c_2,c_3 and their

temperature T_1, T_2, T_3, respectively, then the temperature of the mixture is

A. $\frac{S_1\theta_1 + S_2\theta_2 + S_3\theta_3}{m_1S_1 + m_2S_2 + m_3S_3}$

B. $\frac{m_1S_1\theta_1 + m_2S_2\theta_2 + m_3S_3\theta_3}{m_1S_1 + m_2S_2 + m_3S_3}$

C. $\frac{m_1S_1\theta_1 + m_2S_2\theta_2 + m_3S_3\theta_3}{m_1\theta_1 + m_2\theta_2 + m_3\theta_3}$

D. $\frac{m_1\theta_1 + m_2\theta_2 + m_3\theta_3}{S_1\theta_1 + S_2\theta_2 + S_3\theta_3}$

Answer: B

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Level Ii C W

1. A metal block absorbs $4500cal$ of heat when heated from $30^\circ C$ to $80^\circ C$. Its thermal capacity is

A. 90 gm

B. $90cal/^0C$

C. 9 gm

D. $9cal/^0C$

Answer: B

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2. Two beakers A and B contain liquids of mases $300g$ and $420g$ respectively and specific heats

$0.8cal/g - .^0C$ and $0.6cal/g - .^0C$. The amount of heat on them is equal. If they are joined by a metal rod

A. heat flows from the beaker B to A

B. heat flows from A to B

C. not heat flows

D. heat flows neither from A to B not B to A.

Answer: B

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3. Three liquids A, B and C of masses $400gm$, $600gm$ and $800gm$ are at $30^\circ C$, $40^\circ C$ and $50^\circ C$ respectively.

When A and B are mixed resultant temperature is $36^\circ C$ when B and C are mixed resultant temperature is $44^\circ C$ Then ration of their specific heats are

A. $2:1:1$

B. $3:2:1$

C. $2:2:1$

D. $1:4:9$

Answer: C

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4. $1gm$ of ice at $0^\circ C$ is converted to steam at $100^\circ C$ the amount of heat required will be $(L_{\text{steam}} = 536cal/g)$.

A. 756 cal

B. 12000 cal

C. 716 cal

D. 450 cal

Answer: C

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5. 50 g of copper is heated to increase its temperature by $10^{\circ}C$. If the same quantity of heat is given to $10g$ of water, the rise in its temperature is (specific heat of copper $= 420J/kg^{\circ}/C$)

A. $5^{\circ}C$

B. $6^{\circ}C$

C. $7^{\circ}C$

D. $8^{\circ}C$

Answer: A

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6. A liquid of mass M and specific heat S is at a temperature $2T$. Another liquid of thermal capacity $1.5 \times$ the first liquid at a temperature $\frac{T}{3}$ is added to it. The resultant temperature of the mixture will be

A. $\frac{4}{3}t$

B. t

C. $\frac{t}{2}$

D. $\frac{2}{3}t$

Answer: B

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7. Boiling water at $100^\circ C$ and cold water at $t^\circ C$ are mixed in the ratio $1:3$ and the resultant maximum temperature was $37^\circ C$. Assuming no heat losses, the value of 't' is

A. $4^\circ C$

B. $9^\circ C$

C. $12^\circ C$

D. $16^\circ C$

Answer: D

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8. The fraction of ice that melts by mixing equal masses of ice at $-10^{\circ}C$ and water at $60^{\circ}C$ is

A. $\frac{6}{11}$

B. $\frac{11}{16}$

C. $\frac{5}{16}$

D. $\frac{11}{15}$

Answer: B

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9. Power of a man who can chew $0.3kg$ ice in one minute is (in cal/s).

A. 400

B. 4

C. 24

D. 240

Answer: A

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10. The final temperature, when $10g$ of steam at $100^\circ C$ is passed into an ice block of mass $100g$ $(L_{steam} = 540cal/g, L_{ice} = 80cal/g, S_{water} = 1cal/g^\circ C)$ is

A. $0^\circ C$

B. $15.7^\circ C$

C. $16.9^\circ C$

D. $4^\circ C$

Answer: A

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Level Iii C W

1. $30kg$ ice at $0^\circ C$ and $20g$ of steam at $100^\circ C$ are mixed. The composition of the resultant mixture is

A. $40g$ of water and $10g$ steam at $100^\circ C$

B. $10g$ of ice and $40g$ of water at $0^\circ C$

C. $50g$ of water at $100^\circ C$

D. $35g$ of water and $15g$ of steam at $100^\circ C$

Answer: A

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2. $30gms$ of water at $30^\circ C$ is in a beaker. Which of the following, when added to water, will have greatest cooling effect ? (Specific heat of copper $= 0.1cal/gm^\circ C$)

A. $100gm$ of water at $10^\circ C$

B. $15gm$ of water at $0^\circ C$

C. $3gm$ of ice at $0^\circ C$

D. $18gm$ of copper at $0^\circ C$

Answer: A

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3. n' number of liquids of masses $m, 2m, 3m, 4m, \ldots$ Having specific heats $S, 2S, 3S, 4S, \ldots$ Are at temperatures $t, 2t, 3t, 4t \ldots$ Are mixed. The resultant temperature of mixture is

A. $\frac{3n}{2n+1}t$

B. $\frac{2n(n+1)}{3(n+1)}t$

C. $\frac{3n(n+1)}{2(n+1)}t$

D. $\frac{3n(n+1)}{(2n+1)}t$

Answer: C

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4. Steam is passed into a calorimeter with water having total thermal capacity $110cal/gm$ and initial temperature $30^\circ C$. If the resultant temperature is $90^\circ C$, the increase in the mass of the water is

A. 12 gm

B. $1.2gm$

C. 5 gm

D. $12.4gm$

Answer: A

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5. 2kg of ice at $20^\circ C$ is mixed with 5kg of water at $20^\circ C$ in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container. It is given that the specific heats of water & ice are $1kcal/kg/^\circ C$ and 0.5

$kcal/kg/^{\circ}C$ while the latent heat of fusion of ice is $80kcal/kg$

A. 7 kg

B. 6 kg

C. 4 kg

D. 2 kg

Answer: B

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6. A thermal insulated vessel contains some water at $0^{\circ}C$. The vessel is connected to a vaccum pump to pum

out water vapour. This results in some water getting frozen. It is given latent heat of vaporization of water at $0^\circ C = 21 \times 10^5 J/kg$ and latent heat of freezing of water $= 3.36 \times 10^5 J/kg$. the maximum percentage amount of water vapour that will be solidified in this manner will be:

A. $86.2\ \%$

B. $33.6\ \%$

C. $21\ \%$

D. $24.36\ \%$

Answer: A

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7. The specific heat of a substance varies with temperature $t(.^{\circ} C)$ as

$c = 0.20 + 0.14t + 0.023t^2 (cal / g^{\circ} / C)$

The heat required to raise the temperature of 2 g of substance from $5^{\circ} C$ to $15^{\circ} C$ will be

A. 24 cal

B. 56 cal

C. 82 cal

D. 100 cal

Answer: C

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8. In an industrial process 10 kg of water per hour is to be heated from $20^\circ C$ to $80^\circ C$. To do this steam at $150^\circ C$ is passed from a boiler into a copper coil immersed in water. The steam condenses in the coil and is returned to the boiler as water at $90^\circ C$. How many kilograms of steam is required per hour (specific heat of steam $= 1cal/g^\circ C$, Latent heat of vapourization $= 540cal/g$)?

A. 1 gm

B. 1 kg

C. 10 gm

D. 10 kg

Answer: B

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9. A heater melts $0^\circ C$ ice in a bucket completely into water in 6 minutes and then evaporates all that water into steam in 47 minutes $30\,\text{sec}$. If latent heat of fusion of ice is $80 cal/gram$, latent heat of steam will be (specific heat of water is $1 cal/gam-^\circ C$)

A. $536 Cal/gram$

B. $533.3 Cal/gram$

C. $540 Cal/gram$

D. $2.268 \times 10^6 J/Kg$

Answer: B

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10. Ice at $0^\circ C$ is added to 200 g of water initially at $70^\circ C$ in a vacuum flask. When 50 g of ice has been added and has all melted the temperature of the flask and contents is $40^\circ C$. When a further 80 g of ice has been added and has all melted the temperature of the whole becomes $10^\circ C$. Find the latent heat of fusion of ice.

A. $80 cal / gm$

B. $90 cal / gm$

C. $70 cal / gm$

D. $540 cal / gm$

Answer: B

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11. A kettle with 2 litre water at $27^{\circ} C$ is heated by operating coil heater of power 1 kW. The heat is lost to the atmosphere at constant rate $160 J / s$, when its lid is open. In how much time will water heated to $77^{\circ} C$ with the lid open ? (specific heat of water = $4.2 kJ /^{\circ} C . kg$)

A. $8 \min 20 \sec$

B. $6 \text{ min } 2 \text{ sec}$

C. 7 min

D. 14 min

Answer: A

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Ncert Single Correct

1. 100 g of water is supercooled to - $10^{\circ} C$. At this point, due to same disturbance mechanised or otherwise some of it suddenly freezes to ice. What will be the temperautre of the resultant mixture and how

much mass would freeze ?

$\left[s_w = 1cal/g/.^\circ C \text{ and } L^w_{Fusion} = 80cal/g\right]$

A. $10^\circ C$

B. $0^\circ C$

C. $-5^\circ C$

D. $-2^\circ C$

Answer: B

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2. Three copper blocks of masses M_1, M_2 and $M_3 kg$ respectively are brought into thermal contact till they

reach equlibrium. Before contact, they were at $T_1, T_2, T)(3), (T_1 > T_2 > T_3)$. Assuming there is no heat loss to the surroundings, the equilibrium temperature T is $(sisspec \quad \text{if} \quad icheatofcopper)$

A. $T = \dfrac{T_1 + T_2 + T_3}{3}$

B. $T = \dfrac{M_1T_1 + M_2T_2 + M_3T_3}{M_1 + M_2 + M_3}$

C. $T = \dfrac{M_1T_1 + M_2T_2 + M_3T_3}{3(M_1 + M_2 + M_3)}$

D. $T = \dfrac{M_1T_1s + M_2T_2s + M_3T_3s}{M_1 + M_2 + M_3}$

Answer: B

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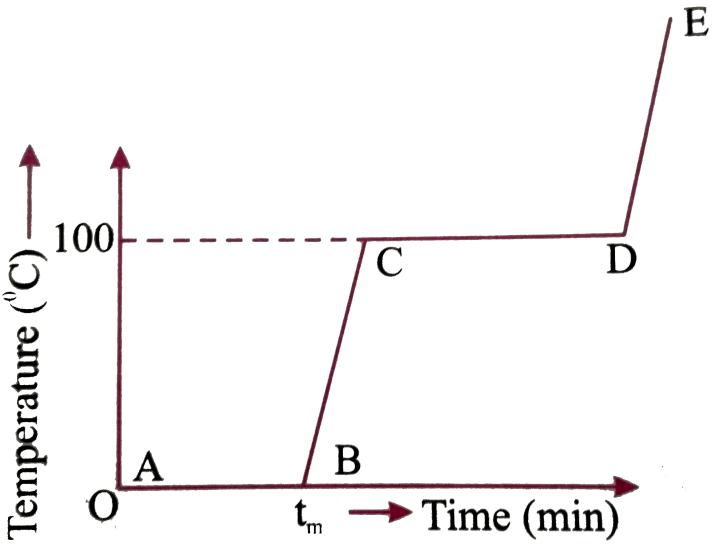
Ncert Multi Correct

1. Refer to the plot of temperature versus time (figure) showing the changes in the state if ice on heating (not to scale). Which of the following is correct ?



A. The region AB represents ice and water in thermal equilibrium.

B. At B water starts boiling

C. At C all the water gets converted into steam

D. C to D represents water and steam in equilibrium at boiling point.

Answer: A::D

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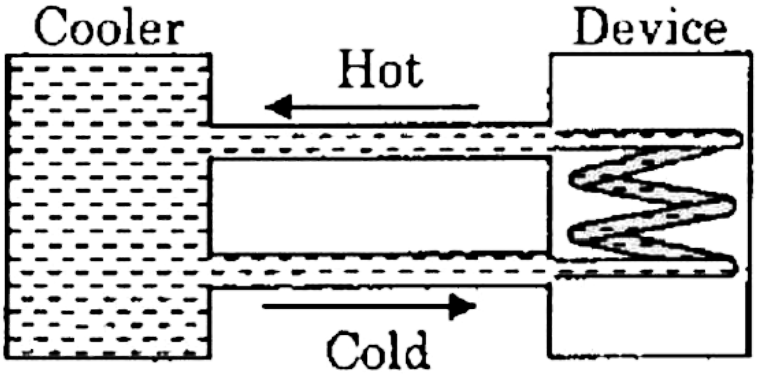
Level V Single Correct

1. A water cooler of storages capacity 120 liters can cool water at a constant rate of P watts. In a closed circulation system (as shown schematically in the figure), the water from the cooler is used to cool an

external device that generates constantly 3kW of heat (thermal load). The temperature of water fed into the device cannot exceed $30^{\circ}C$ and the entire stored 120 liters of water is initially cooled to $10^{\circ}C$. The entire system is thermally insulated. The minimum value of P (in watts) for which the device can be operated for 3hours is



(Specific heat of water is $4.2kJkg^{-1}K^{-1}$ and the density of water is $1000kgm^{-3}$)

A. 1600

B. 2067

C. 2533

D. 3933

Answer: B

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2. A copper ring has a diameter of exactly $25mm$ at its temperature is $0^\circ C$. An aluminium sphere has a diameter is exactly $25.05mm$ and its temperature it $100^\circ C$. The sphere is placed on top of the rind and two allowed to come to thermal equilibrium. The ratio of

the mass of the sphere and ring is

(given

$\alpha_{cu} = 17 \times 10^{-6}.^{\circ} C^{-1} \alpha_{Al} = 2.3 \times 10^{-5}.^{\circ} C^{-1}$

specific heat of Cu is $0.0923 cal / g^{\circ} C$ and for Al is $0.215 cal / g^{\circ} C.$

A. $1 / 5$

B. $23 / 108$

C. $23 / 54$

D. $216 / 23$

Answer: C

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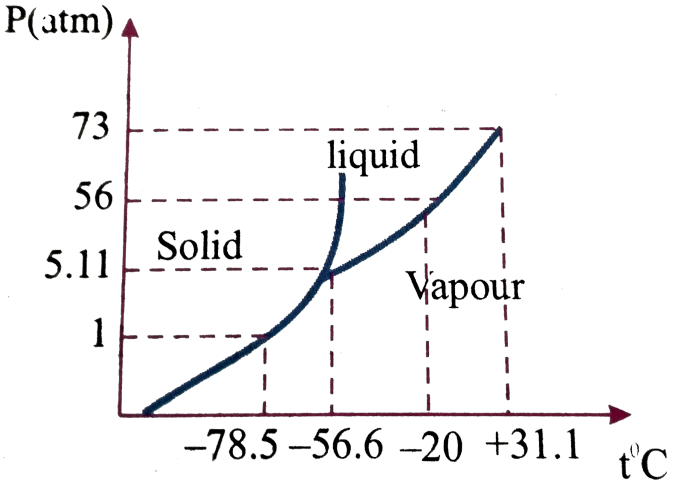
Level V Multi Correct

1. From the given $P-T$ graph of CO_2, you may conclude that it will be



A. Vapour at $-79^{\circ}C$ under 1 atm

B. Liquid at $-20^{\circ}C$ and 56 atm

C. solid at $-60^{\circ}C$ and 70 atm

D. Co-existing in three phase at $-56.6^{\circ}C$ and 5.11 atm.

Answer: A::B::C::D

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Level I H W

1. The densities of two substances are in the ratio $5:6$ and the specific heats are in the ratio $3:5$ respectively. The ratio of their thermal capacities per unit volume is

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: B

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2. Two sphere with radii in the ratio $1:2$ have specific heats in the ratio $x:y$ and densities in the ratio $z:x$. The ratio of their thermal capacities is

A. $z:2y$

B. $zy:8$

C. $z:8y$

D. $xy:2z$

Answer: C

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3. Density of a liquid 'A' is $0.5g/c.c$ and that of liquid 'B' is $0.6g/c.c.$ Heat capacity of 8 litres of 'A' is equal to that of 10 litres of 'B'. Then the specific heats ratio of A and B is

A. $4:5$

B. $1:1$

C. $2:3$

D. $3:2$

Answer: D

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4. A copper block of mass $500gm$ and specific heat $0.1cal/gm^\circ C$ heated from $30^\circ C$ to $290^\circ C$, the thermal capacity of the block is

A. $50cal/^\circ C$

B. $50gm$

C. $5cal/^\circ C$

D. $5gm$

Answer: A

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5. $75gm$ of copper is heated to increase its temperature by $10^{\circ}C$. If the same quantity of heat is given to 'm' gm of water, to have same rise in temperature is (specific heat of copper $= 420J/Kg-^{\circ}C$).

A. 7.5 gm

B. 5 gm

C. 10 gm

D. 25 gm

Answer: A

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6. Two liquids are at $40^\circ C$ and $30^\circ C$. When they are mixed in equal masses, the temperature of the mixture is $36^\circ C$. Ratio of their specific heats is

A. $3:2$

B. $2:3$

C. $4:3$

D. $3:4$

Answer: A

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7. If $10g$ of the ice at $0^\circ C$ is mixed with $10g$ of water at $100^\circ C$, then the final temperature of the mixture will be

A. $5^\circ C$

B. $0^\circ C$

C. $100^\circ C$

D. $40^\circ C$

Answer: B

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8. $5gm$ of steam at $100^\circ C$ is passed into calorimeter containing liquid. Temperature of liquid rises from $32^\circ C$ to $40^\circ C$. Then water equivalent of calorimeter and contents is

A. 40 g

B. 375 g

C. 300 g

D. 160 g

Answer: B

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9. M gram of ice at $0^\circ C$ is mixed with $3M$ gram of water at $80^\circ C$ then the final temperature is.

A. $30^\circ C$

B. $40^\circ C$

C. $50^\circ C$

D. $60^\circ C$

Answer: B

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10. $50g$ of steam at $100^\circ C$ is passed into $250g$ of at $0^\circ C$. Find the resultant temperature (if latent heat of steam is $540cal/g$, latent heat of ice is $80cal/g$ and specific heat of water is $1cal/g - .^\circ C$).

A. $40^\circ C$

B. $30^\circ C$

C. $20^\circ C$

D. $10^\circ C$

Answer: A

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11. Quantity of heat lost in condensation of $10gm$ of steam at $100^\circ C$ is

A. $2.26 \times 10^5 J$

B. $2.26 \times 10^4 J$

C. $22.6J$

D. $44.52 \times 10^4 J$

Answer: B

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12. Two liquids at temperature $60^\circ C$ and $20^\circ C$ respectively have masses in the ratio $3:4$ their specific

heat in the ratio $4:5$. If the two liquids are mixed, the resulatant temperature is.

A. $70^\circ C$

B. $50^\circ C$

C. $40^\circ C$

D. $35^\circ C$

Answer: D

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13. Steam is passes into 22 g of water at $20^\circ C$. The mass of water that will be present when the water

acquires a temperature of $90^\circ C$ (Latent heat of steam is $540 cal/g$) is

A. $27.33g$

B. $24.8g$

C. $2.8g$

D. $30g$

Answer: B

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14. A calorimeter of water equivalent 100 grams contains 200 grams of water at $10^\circ C$. A solid of mass

500 grams at $45^\circ C$ is added to the calorimeter. If equilibrium temperature is $25^\circ C$ then, the specific heat of the solid is $(\text{in cal}/g - .^\circ C)$.

A. 0.45

B. 0.1

C. 4.5

D. 0.01

Answer: A

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15. Two liquids of masses m and $5m$ at temperatures $3\theta, 4\theta$ are mixed, If their specific heats are $2S, 3S$ respectively, the resultant temperature of mixture is

A. $\frac{66}{17}\theta$

B. $\frac{55}{17}\theta$

C. $\frac{44}{17}\theta$

D. $\frac{33}{17}\theta$

Answer: A

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Level Ii H W

1. A calorimeter takes $200cal$ of heat to rise its temperature through $10^{\circ}C$. Its water equivalent in gm is

A. 2

B. 10

C. 20

D. 40

Answer: C

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2. Three different substances have the specific heats in the ratio $1:2:3$ and the temperature increases in the ratio $3:2:1$ when the same heat is supplied to the three substances. The ratio of their masses is

A. $1:1:1$

B. $1:2:3$

C. $3:2:1$

D. $4:3:4$

Answer: D

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3. Equal masses of 3 liquids A, B and C have temperatures $10^\circ C, 25^\circ C$ and $40^\circ C$ respectively. If A and $B$are mixed, the mixture has a temperature of $15^\circ C$. If B and C are mixed, the mixture has a temperature of $30^\circ C$. If A & C are mixed the temperature of the mixture is

A. $16^\circ C$

B. $35^\circ C$

C. $20^\circ C$

D. $25^\circ C$

Answer: A

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4. 1 gram of ice at $-10^{\circ}C$ is converted to steam at $100^{\circ}C$ the amount of heat required is $(S_{ice} = 0.5cal/g-^{\circ}C)$ $\left(L_v = 536cal/g \& L_f = 80cal/g,\right).$

A. 861 cal

B. 12005 cal

C. 721 cal

D. 455 cal

Answer: C

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5. 30 gram copper is heated to increase its temperature by $20^\circ C$ if the same quantity of heat is given to 20 gram of water the rise in its temperature.

$(S_w = 4200 J/kg - K \& S_{cu} = 420 J/kg - K).$

A. $5^\circ C$

B. $6^\circ C$

C. $3^\circ C$

D. $8^\circ C$

Answer: C

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6. A liquid of mass m and specific heat c is heated to a temperature 2T. Another liquid of mass m/2 and specific heat 2 c is heated to a temperature T. If these two liquids are mixed, the resulting temperature of the mixture is

A. $(2/3)T$

B. $(8/5)T$

C. $(3/5)T$

D. $(3/2)T$

Answer: D

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7. A tap supplies water at $10^\circ C$ and another tap at $100^\circ C$. How much hot water must be taken so that we get $20kg$ of water at $35^\circ C$

A. $40/9kg$

B. $50/9kg$

C. $20/9kg$

D. $130/9kg$

Answer: B

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8. The amount of heat supplied to decrease the volume of an ice water mixture by $1cm^3$ without any change in temperature, is equal to: $(\rho_{\text{ice}} = 0.9, \rho_{\text{water}} = 80cal/gm)$

A. 360 cal

B. 500cal

C. 72 cal

D. 720 cal

Answer: C

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9. The power of a system which can convert $10kg$ of water at $30^\circ C$ into ice $0^\circ C$ in one minute $(L_{ice} = 336000J/Kg$ and $S_{water} = 4200J/kg/K)$ will be

A. 77 kW

B. 55 kW

C. 38.5 kW

D. 40 kW

Answer: A

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10. The amount of steam at $100^\circ C$ that should be passed into $600g$ of water at $10^\circ C$ to make the final temperature as $40^\circ C$ will be

A. 40 g

B. 30 g

C. 20 g

D. 45 g

Answer: B

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11. M' kg of water 't' $0^{\circ}C$ is divided into two parts so that one part of mass 'm' kg when converted into ice at $0^{\circ}C$ would release enough heat to vapourise the other part, then $\frac{m}{M}$ is equal to [Specific heta of water $= 1calg^{-1}.^{\circ}C^{-1}$,

Latent heat of fusion of ice $= 80calg^{-1}$,

Latent heat of steam $= 540calg^{-1}$].

A. $640 - t$

B. $\frac{720 - t}{640}$

C. $\frac{640 + t}{720}$

D. $\frac{640 - t}{720}$

Answer: D

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