PHYSICS

BOOKS - MODERN PUBLICATION

Thermal expansion and Calorimetry

Example

1. Calculate the temperature which has same numerical value on Celsius and Fahrenheit scale.

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2. A copper bar is 80cm long at $15^{\circ}C$. what is increase in length when heated $35^{\circ}C$? The coefficient of linear expansion for copper is $\left(1.7 \times 10^{-5}\right)^{\circ}C^{-1}$

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3. A sheet of brass is 50 cm long and 10cm broad at $0^{\circ}C$. The area of the surface

increases by $1.9cm^2$ at $100^\circ C$. Find the coefficient of linear expansion of brass

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4. The density of mercury is $13.6gcm^3$ at $0^\circ C$ and its coefficient of cubical expansion is $\left(1.82 \times 10^{-4}\right)^\circ C^{-1}$.Calculate the density of Mercury at $50^\circ C$

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5. A coper block of mass 2.5 kg is heated in a furnace to a temperature of $500^{\circ}C$ and then placed on a large ice block. What is the maximum amount of ice that can melt? (specific heat of copper $= 0.39Jg^{-1}C^{-1}$, heat of fusion of watter $=335Jg^{-1}$).

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6. A faulty thermometer has its fixed points marked as 5° and 95°. the temperature of a

body as measured by the faulty thermometer is 59° find the correct temperature of the body on Celsius scale

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7. A brass rod of length 40 cm is joined to a copper rod of length 50 cm. the two roads are of the same thickness and at initial temperature of $40^\circ C$. what is a change in length of the combined rodd when the same is heated at $280^\circ C$. coefficient of linear

expansion of brass and copper are $(1.9 \times 10^{-5})^{\circ} C^{-1}$ and $(1.7 \times 10^{-5})^{\circ} C^{-1}$ respectively

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8. A steel beam is 5 m long at a temperature of $20^{\circ} C$. On a hot day, the temperature rises to $40^{\circ} C$. What is the change in the length of the beam due to thermal expansion ? Given, coefficient of linear expansion of steel =

$\left(1.2 \times 10^{-5}\right)^{\circ} C^{-1}$ and Young's modulus of steel = $2.0 \times 10^{11} Nm^{-2}$

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9. A steel beam is 5 m long at a temperature of $20^{\circ} C$. On a hot day, the temperature rises to $40^{\circ} C$. (b) Suppose that the ends of the beam are initially in contact with rigid verical supports. How much force will the expanded beam exert on the supports, if it has a cross sectional area of $60 cm^2$. Given, coefficient of

linear expansion of steel = $\left(1.2 \times 10^{-5}\right)^{\circ} C^{-1}$ and Young's modulus of steel = $2.0 \times 10^{11} Nm^{-2}$

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10. A circular sheet of copper of radius 35 cm is at $20^{\circ} C$ on heating its area increases by $14.5 cm^2$. If coefficient of linear expansion of copper is $\left(1.7 \times 10^{-5}\right)^{\circ} C^{-1}$ find the temperature to which the sheet was heated.

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11. The coefficient of volume expansion of glycerine is 49×10^{-5} ^ $\circ C^{-1}$. What is the fractional change in its density for $30^{\circ} C$ rise in temperature?

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12. In a experiment on the specific heat of a metal, a 0.20 kg block of the metal at $150^{\circ} C$ is dropped in a copper calorimeter (of water equivalent 0.025 kg) containing 150 cc of water

at $27^{\circ}C$. The final temperature is $40^{\circ}C$. Compute the specific heat of the metal. If heat losses to the surroundings are not negligible, is your answer greater or smaller than the actual value for specific heat of the metal?

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13. It takes 15 minutes to rise a certain amount of water from 0^@C to boiling point using a heater. Then it takes 1 hour and 20 minutes to convert all the water into vapour. the specific

heat of water is $\left(1 cal g^{-1}\right)^{\circ} C^{-1}$, the latent heat of vapourization of water is:

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14. At what temperature do the Celsius and Fahrenheit scales coincide?

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15. At what temperature do the Celsius and Fahrenheit scales coincide?

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16. What should be lengths of steel and copper rod, so that the length of steel rod is 5 cm longer than the copper rod at all temperatures ? (α for copper = $\left(1.7 \times 10^{-5}\right)^{\circ} C^{-1}$ α for steel = $\left(1.1 \times 10^{-5}\right)^{\circ} C^{-1}$

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17. A bimetallic strip is formed out of two identical strips, one of copper and the other of brass. The coefficients of linear expansion of the two metals are α_C and α_B ($\alpha_B > \alpha_C$). On heating the bimetallic strip through temperature ΔT, the strip bends into an arc of a circle. Find the radius of curvature of the bimetallic strip.

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18. A uniform pressure p is exerted on all sides of a solid cube of a material at temprature t^(@)C. By what amount should the temperature of the cube be raised in order to bring its original volume back to the value it had before the pressure was applied ? K is the bulk modulus and alpha is the coefficient of linear expansion of material of solid cube.

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19. A piece of metal weighs 46g in air. When it is immersed in a liquid of specific gravity 1.24 at $27^{\circ}C$, it weighs 30 g. When the temperature of the liquid is raised to $42^{\circ}C$, the metal piece weighs 30.5g. The specific gravity of the liquid at $42^{\circ}C$ is 1.20. Calculate the coefficient of linear expansion of the metal.

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20. Using the following data, calculate at what temperature will the wood just sink in benzene Density of wood at $0^{\circ}C$ = $8.8 \times 10^{2} kg/m^{3}$ Density of benzene at $0^{\circ}C$ = $9 \times 10^{2} kgm^{-3}$ Cubical expansivity of wood = $\left(1.5 \times 10^{-4}\right)^{\circ}C^{-1}$ Cubical expansivity of benzene = $\left(1.2 \times 10^{-3}\right)^{\circ}C^{-1}$

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21. A piece of metal floats on mercury. The coefficients of volume expansion of the metal and mercury are γ_1 and γ_2 respectively. If the temperatures of both mercury and the metal are increased by an amount ΔT, what is the the factor by which the fraction of the volume of the metal submerged in mercury changes?

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22. Earth receives $1400W/m^2$ of solar power. If all the solar energy falling on a lens of area $0.2m^2$ is focused on to a block of ice of mass 280 grams, calculate the time taken to melt the ice. (Latent heat of fusion of ice= $3.3 \times 10^5 J/kg$)

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23. A lead bullet just melts when stopped by an obstacle. Assuming that 25 per cent of the

heat is absorbed by the obstacle, find the velocity of the bullet if its initial temperature is $27^{\circ}C$. (Melting point of lead=$327^{\circ}C$, specific heat of lead = $0.03cal$ or $ies\left(gm^{-1}\right)^{\circ}C^{-1}$, latent jeat of fusion of lead= $6cal$ or ies/gm, J= $4.2joe\underline{s}/cal$ or ie).

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24. A steel drill making 180 rpm is used to drill a hole in a block of steel. The mass of the steel

block and the drill is 180 gm. If the entire mechanical work is used up in producing heat and the rate of raise in temperature of the block and the drill is $0.5^{\circ}\frac{C}{s}$. Find the rate of working of the drill in watts. Specific heat of steel = $0.1\left(calg^{-1}\right)^{\circ}\hat{}-1$

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25. A steel drill making 180 rpm is used to drill a hole in a block of steel. The mass of the steel block and the drill is 180 gm. If the entire

mechanical work is used up in producing heat and the rate of raise in temperature of the block and the drill is $0.5^{\circ}\frac{C}{s}$. Find the couple required to drive the drill. Specific heat of steel = $0.1\left(calg^{-1}\right)^{\circ}\ \hat{}\ -1$

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26. 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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27. About 5g of water at $30^{\circ}C$ and 5g of ice at $-20^{\circ}C$ are mixed together in a calorimeter. Calculate final temperature of the mixture. Water equivalent of the calorimeter is negligible. Specific heat of ice = $0.5cal\left(g^{-1}\right)^{\circ}C^{-1}$ and latent heat of ice = $80calg^{-1}$

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28. 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=$1cal\left(g^{-1}\right)^{\circ}C^{-1}$ Latent heat of vapourization=$540cal/g$)?

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29. A piece of copper of mass 7.5 g at $27^{\circ}C$ is dropped in boling liquid oxygen (boling point $-183^{\circ}C$). The released oxygen oc cupies 1.89 letres at $20^{\circ}C$ and a pressure of 750 mm. Find the latent heat of vaporisation of oxygen. Given that specific heat of copper= $0.08g\left(cal^{-1}\right)^{\circ}C^{-1}$ and density of oxygen at NTP is $1.429calg^{-1}$

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30. What is the cause of hotness of body?

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31. What physical changes may be observed, if an object is heated?

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32. A body is said to be in equilibrium

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33. What is the principle of a Thermometer?

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34. What is the normal temperature of a human body?

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35. Do the values of coefficients of expansion differ, when the lengths are measured in cgs

system or in SI ?

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36. Are coefficients of thermal expansion constant for a given solid?

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37. Of metal and alloy, which has greater value of temperature coefficient?

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38. is the value of temperature coefficient of resistance always positive?

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39. There is a hole in a metal disc . What happens to the size of the hole if metal disc is heated?

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40. How do internal diameter of a metal washer differs (increase, decrease or remain the same) when the washer is heated ?

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41. How do volume of a metal washer differs (increase, decrease or remain the same) when the washer is heated ?

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42. How do density of a metal washer differs (increase, decrease or remain the same) when the washer is heated ?

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43. How do mass of a metal washer differs (increase, decrease or remain the same) when the washer is heated ?

Watch Video Solution

44. How do internal diameter of a metal washer differs (increase, decrease or remain the same) when the washer is heated ?

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45. A metal ball is heated through a certain temperature. Out of mass, radius, surface area and volume, which will undergo largest percentage increase and which one the least?

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46. The top of a lake is frozen. Air in contact is at $-15^{\circ}C$. What do you expect the maximum temperature of water at the bottom of the lake?

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47. The top of a lake is frozen. Air in contact is at $-15^{\circ}C$. What do you expect the maximum temperature of water at the bottom of the lake?

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48. Can a substance contract on heating?

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49. In laying a railway line , a small gap is always left between the iron rails . Why ?

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50. Why telephone wires between two poles become taut in winter?

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51. Why the pipes carrying steam should have loops?

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52. A glass stopper could be loosened by warming the neck of a bottle. Explain

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53. Do water and ice have the same specific heats?

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54. Is the specific heat of sand greater than that of water?

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55. Tea gets cooler when sugar is added to it , why ?

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56. it is sometimes harmful to put on wet clothes why?

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57. Hot water bottles are usedfor fomentation. Why?

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58. In cold countries juice bottles are placed under water so as to avoid freezing why?

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59. water is used as an effective coolant why?

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60. Ditinguish clearly between temperature and heat.

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61. should a thermometer bulb have large heat capacity for small heat capacity explain

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62. Two thermometer sa constructed in the same way except that one has a spherical bulb and the other a cylindrical bulb. which will respond quickly to temperature changes?

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63. What is wrong in taking the melting point of ice and the boiling point of water as standard fixed point?(as was originally done in Celsius scale)

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64. At what temperature have the celcius and fahrenheit reading the same numerical value?

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65. The difference between length of a certain brass rod and that of a steel rod is claimed to be constant at all temperature. is this possible?

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66. Why thick glass tumbler cracks when boiling liquid is put in it?

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67. iron rims are heated Red hot before planting on cartwheels why?

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68. Two identical rectangular strips of copper and the other of Steel are together to form a bimetallic rod. what will happen on heating?

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69. Pendulum clocks may run slow in summer and fast in winter .Why?

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70. why is clock pendulum made of invar?

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71. A circular piece is cut from a flat metal sheet. the cities then placed in a furnace. build

a size of whole become larger or smaller? explain

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72. how does the diameter of the opening in the cast iron plate of a kitchen stove changed when the stove is heated?

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73. a specific gravity bottle is marked with its volume along with a temperature value why?

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74. An alloy consists of n metals of masses $m_1, m_2, m_3 \ldots\ldots, m_n$ and specific heats $c_1, c_2, c_3, \ldots . c_n$ respectively. what is the specific heat of the alloy?

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75. Ice is put into a tumbler containing water at room temperature. for faster cooling should the ice be allowed to float naturally On The Water or be pushed to the bottom of the container with a stick and held there? Explain.

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76. how the fishes can survive in the extreme winter when ponds and lakes are frozen?

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77. Normal temperature of the human body is $98.4^{\circ} F$. Find the temperature on Celsius and absolute scale.

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78. A Celsius thermometer and a Fahrenheit thermometer are put in a hot bath. The reading on Fahrenheit thermometer is just three times the reading on Celius

thermometer. What is the temperature of the bath?

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79. When a Centigrade thermometer is taken from the melting ice to a warm liquid, the mercury level rises to 2/5 th of the distance between the lower and the upper fixed points. Find the temperature of liquid in $\hat{}\ \circ C$ and K.

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80. A metal bar measures 30 cm at $0^{\circ}C$ and 50.048 cm at $80^{\circ}C$. Find the coefficient of linear expansion of the metal.

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81. How much the temperature of a brass rod should be increase service increase its length by 1 percentage? α of brass = $0.00002^{\circ}C^{-1}$

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82. A steel tape is calibrated at $20^{\circ}C$. On a cool day, when the temperature is $-15^{\circ}C$, what will be the percentage error in the tape ? For steel, $aplha$ = $\left(1.1 \times 10^{-5}\right)^{\circ}C^{-1}$

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83. An iron scale is correct at $0^{\circ}C$ an at this temperature, a zinc rod measures 1m on this scale. What will be the length of the zinc rod as measured by the iron scale when both the

are at $100^\circ C$? (Linear expansivity of zinc = $\left(26 \times 10^{-6}\right)^\circ C^{-1}$ and linear expansivity of iron =$\left(12 \times 10^{-6}\right)^\circ C^{-1}$

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84. A steel tape measures that length of a copper rod as 90.0 cm when both are at $10^\circ C$, the calibration temperature, for the tape. What would the tape read for the length of the rod when both are at $30^\circ C$. Given

$\alpha_s teel = \left(1.2 \times 10^{-5}\right)^{\circ} C^{-1}$ and

$\alpha_{Cu} = 1.7 \times 10^{-5}\ \hat{}\ \circ C^{-1}$

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85. It is required to prepare a steel metre scale, such that the millimetre intervals are to be ac curate within 0.0005 mm at a certain temperature. Determine the maximum temperature variation allowable during the rulling of millimetre marks. Given, alpha for steel $=\left(1.322 \times 10^{-5}\right)^{\circ} C^{-1}$

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86. A cylinder of diameter exactly 1 cm at $30^{\circ} C$ is to be slided into a hole in a steel plate. The hole has a diameter of 0.99970 cm at $30^{\circ} C$. To what temperature must the plate be heated? For steel $\alpha = 1.1 \times 10^{-5}$ ^ $\circ C^{-1}$

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87. The volume of a thin brass vessel and the volume of a solid cube are both equal to 1

litre. what will be the change in the volumes of The vessel and the cube upon be heated to $25^{\circ}C$? Given $\alpha_{brass} = \left(1.9 \times 10^{-5}\right)^{\circ} C^{-1}$

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88. A block of material weighing 500 grams at $100^{\circ}C$ is dropped into hundred gram of water at$12^{\circ}C$. if the water is contained in copper calorimeter (specific heat = $\left(0.093 calg^{-1}\right)^{\circ} C^{-1}$) weighing hundred gram

and the temperature rises to $49^{\circ}C$ what is the specific heat of the substance?

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89. A piece of iron of mass 100g is kept inside a furnace till it attains the temperature of the furnace. the hot piece of iron is then dropped into a calorimeter containing 240g of water at 20 degrees celsius. the mixture attains an equilibrium at a temperature of 60 degree Celsius. find the temperature of the furnace.

water equivalent of calorimeter = 10g and specific heat of iron $470 Jkg^{-1}c^{-1}$

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90. An electric heater of power 1000 W raises the temperature of 5 kg of a liquid from 25 to 31 degrees celsius in 2 minutes. calculate heat capacity of the liquid and its specific heat.

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91. A refrigerator convert 50 gram of water at 15 degree Celsius into ice at -15 degree celsius in 1 hour. determine the quantity of heat removed per minute. specific latent heat of ice is $336 J g^{-1}$ and specific heat of ice is $2.1 J\left(g^{-1}\right)^{\circ} C^{-1}$

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92. Determine the resulting temperature when 150 gram of ice at zero degree celsius is mixed

with 300 grams of water at 50 degree Celsius. latent heat of fusion of ice $336 Jg^{-1}$.

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93. 1 kg of ice at -10 degree Celsius is heated until the whole of it evaporates. how much heat is required? latent heat of fusion of ice = $336 \times 10^3 Jkg^{-1}$, specific latent heat of steam = $2268 \times 10^3 Jkg^{-1}$, specific heat capacity of ice = $2.1 \times 10^3 Jkg^{-1}$ and specific heat capacity of water = $4.2 \times 10^3 Jkg^{-1}k^{-1}$

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94. the temperature of hundred gram of water is to be raised from 24 to 90 degree Celsius by adding steam to it. calculate the mass of the steam required for this purpose. specific heat of water is $4.2 \times 10^3 J\left(kg^{-1}\right)^{\circ} C^{-1}$ and latent heat of vapourization= $2268 \times 10^3 Jkg^{-1}$

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95. the temperature of hundred gram of water is to be raised from 24 to 90 degree Celsius by adding steam to it. calculate the mass of the steam required for this purpose. specific heat of water is $4.2 \times 10^3 J\left(kg^{-1}\right)^{\circ} C^{-1}$ and latent heat of vapourization= $2268 \times 10^3 Jkg^{-1}$

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96. steam at hundred degree celsius is passed over 1000 gram of ice at zero degree celsius. after sometime 600 gram of ice at zero degree celsius is left and 450 gram of water at zero degree celsius is formed. calculate the specific latent heat of vaporization of steam. specific heat capacity of water = $4200 J\left(kg^{-1}\right)^{\circ} C^{-1}$ and latent heat of fusion of ice $336 J g^{-1}$.

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97. A thermometer has wrong calibrations (of course at equal distances and the capillary is of uniform diameter). It reads the melting point of ice as -10°. It reads 60° in place of $50^{\circ}C$. What is the temperature of boiling point of water on this scale?

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98. The design of some physical instrument requires that there be a constant difference in

length of 10 cm between an iron rod and a copper cylinder laid side by side at all temperature find their lengths

$\alpha_{Fe} = \left(11 \times 10^{-6}\right)^{\circ} C^{-1}$,

$\alpha_{Cu} = \left(17 \times 10^{-6}\right)^{\circ} C^{-1}$

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99. A brass rod of length 40 cm is joined to a copper rod of length 50 cm. the two roads are of the same thickness and at initial temperature of $40^{\circ} C$. what is a change in

length of the combined rodd when the same is heated at $280^{\circ}C$. coefficient of linear expansion of brass and copper are $\left(1.9 \times 10^{-5}\right)^{\circ}C^{-1}$and $\left(1.7 \times 10^{-5}\right)^{\circ}C^{-1}$ respectively

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100. The brass scale of a barometer gives correct reading at $0^{\circ}C$. Coefficient of thermal expansion of brass is $\left(20 \times 10^{-6}\right)^{\circ}C^{-1}$. The

barometer reads 75 cm at $27^\circ C$. What is the atmospheric pressure at $27^\circ C$?

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101. A steel wire 2mm in diameter is stretched between two clamps, when its temperature is 40^@C Calculate the tension in the wire, when its temperature falls to 30^@C Given, coefficient Y for steel = (21 xx 10^11)dyne//cm^2`

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102. When a building is constructed at $25^{\circ}C$, a steel beam of area of cross section $45cm^2$ is put in place with its ends cemented in pillars. If the sealed ends cannot move, what will be the compressional force in the beam, when the temperature is $-10^{\circ}C$? For steel, $\alpha = \left(1.1 \times 10^{-5}\right)^{\circ}C^{-1}$ and Y = $2 \times 10^{11} Nm^{-2}$.

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103. A clock with an iron pendulum keeps correct time at $20^{\circ}C$. How much will it lose or gain, if temperature changes to $40^{\circ}C$? Given that coefficient of cubical expansion of iron = $\left(36 \times 10^{-6}\right)^{\circ}C^{-1}$

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104. A glass tube of length 133 cm and of uniform cross section is to be filled with mercury, so that the volume of the tube

unoccupied by mercury remains the same at all temperatures. If coefficients of cubical expansion for glass and mercury are respectively $\left(2.6 \times 10^{-5}\right)^{\circ} C^{-1}$ and $\left(18.2 \times 10^{-5}\right)^{\circ} C^{-1}$, calculate the length of mercury column.

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105. A one litre flask contains some mercury. It is found that at different temperatures the volume of air inside the flask remains the

same. The volume of mercury in the flask is $\left(\alpha_{glass} = \left(9 \times 10^{-6}\right)^{\circ} C^{-1},\right.$ gamma_(Hg)= (1.80xx10^-4)^@C^-1`

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106. A metallic bob weights 50 g in air. If it is immersed in a liquid at a temperature of $25^{\circ} C$, it weights 45 g . When the temperature of the liquid is raised to $100^{\circ} C$, it weights 45.1 g. Calculate the coefficient of cubical expansion of the liquid. Given that coefficient

of cubical expansion of the metal is $\left(12 \times 10^{-6}\right)^{\circ} C^{-1}$

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107. A sphere of diameter 7.0 cm and mass 266.5 g floats in a bath of liquid. As the temperature is raised, the sphere begins to sink at a temperature of $35^{\circ} C$. If the density of liquid is $1.527 gcm^{-3}$ at $0^{\circ} C$, find the coefficient of cubical expansion of the liquid. Neglect the expansion of the sphere

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108. Water flows at the rate of $0.1500 kg / \min$ through a tube and is heated by a heater dissipating 25.2W. The inflow and outflow water temperatures are $15.2^{\circ} C$ and $17.4^{\circ} C$, respectively. When the rate of flow is increased to $0.2318 kg / \min$ and the rate of heating to 37.8W, the inflow and outflow temperature are unaltered. Find the specific heat capacity of water.

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109. Water flows at the rate of $0.1500 kg/\ \min$ through a tube and is heated by a heater dissipating 25.2W. The inflow and outflow water temperatures are $15.2^{\circ} C$ and $17.4^{\circ} C$, respectively. When the rate of flow is increased to $0.2318 kg/\ \min$ and the rate of heating to 37.8W, the inflow and outflow temperature are unaltered. Find the rate of loss of heat from the tube.

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110. 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.

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111. A lump of ice of 0.1 kg at $-10^{\circ}C$ is put in 0.15 kg of water at $20^{\circ}C$. How much water and ice will be found in the mixture whenit has reached thermal equilibrium? Specific heat of ice $=\left(0.5kcalkg^{-1}\right)^{\circ}C^{-1}$ and its latent heat of melting $=80kcalkg^{-1}$

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Exercise

1. Do the values of coefficients of expansion differ, when the lengths are measured in cgs system or in SI ?

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2. What is the effect of temperature on solids? And also define coefficients of linear, superficial and cubical expansion and write relation between them.

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3. What is meant by coefficient of linear and cubical expansion? Derive the relation between the two.

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4. Show that $\alpha = \frac{\beta}{2} = \frac{\gamma}{3}$, where symbols have their usual meanings.

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5. What is meant by coefficient of linear expansion, superficial expansion and cubical expansion? Derive the relation between them.

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6. Are coefficients of thermal expansion constant for a given solid?

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7. What is thermal expansion ? Explain thermal expansion on the basis of intermolecular forces.

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8. How does the density of liquids vary with temperatury? Show that on increasing temperature by ΔT density of a liquid is given by $(\rho)' = \rho(1 - \gamma\Delta T)$ where ρ is initial

density of the liquid and γ is its coefficient of cubical expansion.

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9. Describe an experiment to show that water has its maximum density at $4^{\circ} C$.

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10. At what temperature, the density of water is maximum?

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11. What is anomalous expansion of water and its use in nature?

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12. Define Heat

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13. Define temperature

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14. Define thermal capacity

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15. Define water equivalant

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16. Define specific heat.

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17. Define latent heat.

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18. Define specific heat of a substance. Give its units.

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19. Define latent heat of fusion of a substance

Give its SI units.

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20. State and explain principle of calorimetry.

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21. Define what is meant by coefficient of linear superficial and cubical expansion of a solid. give its units. find the relationship between them

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22. What is meant by coefficient of linear expansion, superficial expansion and cubical expansion? Derive the relation between them.

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23. State and explain principle of calorimetry.

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24. Define latent heat.

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