PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

THERMAL PROPERTIES OF MATTER

One Mark Questions And Answers

1. What is heat?

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2. What is meant by temperature?


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3. What determines the flow of heat in a medium?


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4. How does quantity of heat in a body depend on its mass?

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5. Name the device used to measure the temperature of a body.

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6. What is ice point in a thermometer?

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7. What is the steam point in a thermometer?

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8. Give the formula to convert Fahrenheit temperature into Celsius scale of temperature.

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9. Give the relation connecting absolute scale (Kelvin scale) of temperature and Celsius scale of temperature.

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10. epresent the relation between 'C' and 'F' scales of temperature graphically.

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11. Represent the relationship between Kelvin scale of temperature and Celsius scale of temperature graphically

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12. What is an ideal gas?

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13. Name any one physical quantity that describes the thermal behaviour of a gas.

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14. Give the mathematical form of Boyle's law.

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15. Give the mathematical form of Charles' Jaw.

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16. Give the mathematical form of combined gas law.

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17. Write the value of the universal gas constant.

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18. Define absolute zero of temperature.

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19. State Boyle's law.

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20. State Charles' law.

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21. State Gay Lussac's law.

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22. At what temperature does extrapolation of P-T curve of all ideal gases at low density meet .

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23. What is the least possible temperature on Fahrenheit scale of temperature ?

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24. What is meant by thermal expansion?

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25. Define coefficient of linear expansion of solids

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26. Define coefficient of superficial (aerial) expansion of solids.

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27. Define coefficient of volume expansion of solids.

Watch Video Solution

28. Define coefficient of linear expansion of solids

Watch Video Solution

29. Define coefficient of superficial (aerial) expansion of solids.

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30. Define coefficient of volume expansion of solids.

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31. Give the relation among $\propto$, β and γ

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32. Give the relation aroone

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33. Express thermal stress in terms of coefficient of linear expansion.

34. Define specific heat of a substance

35. Write the SI unit of specific heat of a substance.

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36. Define heat capacity .

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37. Mention the SI unit of thermal capacity of a substance.

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38. Define molar specific heat or a substance.

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39. Write the SI unit of molar specific beat of a substance.

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40. Write the SI unit of molar specific beat of a substance.

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41. Explain molar specific heat of a gas at constant (i) pressure and (ii) volume. Write the relation between them in terms of gas constant.

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42. Write any one practical significance of the large value of specific heat of water

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43. Name the device to measure heat.

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44. State the principle of calorianetry.

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45. What is melting?

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46. What is the melting point of a substance?

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47. What is the boiling point of a substance?

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48. What is meant by regelation?

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49. What is meant by vapourisation?

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50. What is meant by sublimation?

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51. Define latent heats of fusion and vapourisation of a substance.

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52. What does it mean to say that latent heat of ice equals $3.36 \times 10^5 Jkg^{-1}$?

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53. What is meant by heat conduction?

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54. When is steady state said to be attained by a conductor?

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55. Define coefficient of thermal conductivity.

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56. Mention the SI unit of thermal conductivity

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57. Write the dimensional formula for thermal conductivity.

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58. Write the expression for thermal resistance of a conductor

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59. Two conductor one of silver with $K = 406 W m^{-1} K^{-1}$ and the other of copper with K $= 385 W m^{-1} K^{-1}$ are selected. Which is a better conductor of heat ?

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60. Which is a poorer conductor of heat between ice (K=1.6) and water (0.8) ?`

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61. Two conductors the of same lengths and areas of cross-section are connected in series. Give the expression for common (junction) temperature.

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62. Two conductors of identical dimensions of length and area of cross section are connected in series. What will be their equivalent thermal conductivity?

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63. Two conductors of identical dimensions of length and area of cross-section are connected in parallel. What will be their equivalent thermal conductivity?

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64. Give the expression for the amount of heat conducted in a steady state.

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65. Define temperature gradient in a conductor.

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66. What is meant by heat convection?

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67. Give a few consequences of convection of heat.

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68. What does radiation of heat mean?

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69. What is the speed of radiant heat?

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70. State Newton's law of cooling.

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71. Give the mathematical form for Newton's law of cooling

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72. Represent Newton's law of cooling graphically.

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73. Give the formula to calculate the time of cooling of a body through a particular range of temperature.

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74. Write any three properties of thermal radiation.

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Two Marks Question And Answers

1. Write Vander-Waal equation arid explain the symbols used.

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2. Cutting of ice by a taut thread is more feasible than with a taut metal string. Explain

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3. Mention any two substances which sublime.

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4. Define thermal conductivity. Write its SI unit.

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5. Why is the bottom of cooking vessel made of steel, coated with copper?

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6. The walls of buildings facing east or west are usually built with hollow bricks. Explnin Why.

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7. Explain briefly convection air currents setting up a sea breeze.

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8. Explain land breeze.

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9. What are trade winds? Explain.

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10. What are black bodies?

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11. The bottom of the cooking vessel is usually roughened or blackened. Explain why.

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12. Solar water heaters use cadmium black as a coating material on copper water pipes. Explain why

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13. Distinguish between specific bent and thermal conductivity or a substance.

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14. The bottom of the skis/skates is sharp. Explain why.

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15. Explain the term triple point of the substance.

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16. What is a phase diagram? Draw a phase diagram with regard to water.

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17. Explain why,

a body with large reflectivity is a poor emitter.

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18. Explain why,

a brass tumbler feels much colder than a wooden tray on a chilly day

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19. Explain why,

an optical pyrometer calibrated for an ideal black body radiation gives a very low value for the temperature of a red hot iron piece in the open, but gives a correct value for the

temperature when the same piece is in the furnace

20. Explain why,

the Earth without its atmosphere would be inhospitably cold.

21. Explain why,

heating systems based on circulation of steam are more efficient in warming a building than those based on circulation of hot water

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Three Marks Questions And Answers

1. Explain anomalous expansion of water

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2. Explain how marine animals can survive under ice on a frozen sea.

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3. State and explain Boyle's law.

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4. State and explain Charles' law

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5. Show that the average kinetic energy of a gas moJecrule is directly proportional to the temperature of the gas.

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6. State and explain the laws of thermal conductivity and hence mention the SI unit of coefficient of thermal conductivity.

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7. Distinguish between the spetific heat capacity and the molar specific heat capacity of a substance

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8. Explain the variation of temperature with heat for water at 1 atm with a graph.

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9. Show that $\beta = 2 \propto$ where symbols have their usual meaning.

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10. Show that $\gamma = 3 \propto$ where symbols have their usual meaning.

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11. Show that the volume coefficient of on ideal gas at constant pressure equals T^{-1} where T is the absolute temperature

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12. Deduce combined gas law

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Four Marks Questions And Answers

1. Show that R=8.314 $Jmol^{-1}K^{-1}$

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2. If the coefficient of linear expansion of iron is $1.20 \times 10^{-5}K^{-1}$ and diameters of the wooden and the iron rings are $1.472m$ and $1.398m$, then calculate the temperature to which the iron ring has to be heated from 27° C, so that the iron ring fits over the wooden ring.

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3. Given that molar specific heats of gas at' constant pressure and volume as 20.8 J $mol^{-1}K^{-1}$ and 12.5$Jmol^{-1}K^{-1}$ .Calculate their dirference and the ratio of specific heats of the gas.

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4. Two metal rods made up of iron $\left(K_1 = 79Wm^{-1}K^{-1}\right)$ and brass

$\left(K_2 = 109 W m^{-1} K^{-1}\right)$ are of identical shape and size. These are fused at the junction. If the temperature at the free end of iron is at a steam point and brass at ice point then calculate the temperature at the junction, when the steady state is attained.

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5. The thickness of a brick wall is 0.25m. The temperatures inside and outside or 24° C and 42°C. Given Thermal conductivity of brick =

$0.15 Wm^{-1}K^{-1}$, then calculate the total amount of heat conducted in a time interval of 30 minutes due to a $25 m^2$ wall.

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6. Find the amount of heat required to convert 10 kg ice at $-10^{\circ}C$ to water at $50^{\circ}C$. Given specific heat of ice $2100 Jkg^{-1}K^{-1}$, specific heat of water $4200 Jkg^{-1}K^{-1}$ and latent heat of ice $3.36 \times 10^5 Jkg^{-1}$

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7. A body cools from $80^{\circ}C$ to 50°C in 5 minutes. Calculate the time it takes to cool from $60^{\circ}C$ to $30^{\circ}C$. The temperature of the surroundings is $20^{\circ}C$

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8. A cubical ice box of thermocol has each side 30 cm and thickness 5 cm , 4 kg of ice is put in the box , if outside temperature is $45^{\circ}C$ and coefficient of thermal conductivity is

$0.01 Js^{-1}m^{-1}K^{-1}$. Calculate the mass of ice left after 6 hrs . Take latent heat of fusion of ice as $335 \times 10^3 JK^{-1}$

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9. A brass boiler has a base area of $0.15m^2$ and thickness 1 cm. It boils water at the rate of 6 kg per minute when placed on a gas stove. Estimate the temperature of the part of the flame in contact with the boiler. Thermal conductivity of brass is $= 109 Js^{-1}m^{-1}K^{-1}$,

Heat of vapourisation of water is $2256 \times 10^3 Jkg^{-1}$

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10. Estimate the temperature on the surface of the Sun from the following data.

Average distance of the orbit $= 1.5 \times 10^8$ km

Average radius of the sun $= 7.0 \times 10^5$ km

solar constant $= 1400 Wm^{-2}$

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11. A body cools from $80^{\circ}C$ to 50°C in 5 minutes. Calculate the time it takes to cool from $60^{\circ}C$ to $30^{\circ}C$. The temperature of the surroundings is $20^{\circ}C$

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12. Sun emits maximum radiant energy at 5461A and Moon at 10μm. If the surface temperature of Sun is 5890 K, then find that of the Moon.

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13. Luminosity of a distant star is 16000 times that of the Sun. If the surface temperature of the Sun is 5890 K, then find the surface temperature of the star.

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14. The thickness of a filament wire is 0.15 mm and length 10 cm. The filament ts heated to incandescence at 2000K. Calculate the energy

radiated per second. If the power rating of the bulb is 40W, then calculate the relative emittance or surface emissivity.

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15. A small cavity of diameter 2 mm whose tempe_rature is 3000K acts as a black body. calculate the intensity of radiation emitted by it. If the temperature of the surroundings is J00K, then calculate the rate of radiant heat emitted to the surroundings.

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16. Two vessels of different materials are identical in size and wall thickness. They are filled with equal quantities of ice at $0^{o}C$. The ratio of their thermal conductivities is 5 : 2. If it takes 10 minutess for the ice to melt in the first vessel, then find what time the ice in the vessel takes to melt.

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17. At what rate a layer of ice will be formed if the surrounding temperature is at $-10^{\circ}C$? Thermal conductivity of ice $= 1.6Wm^{-1}K^{-1}$. Initial thickness of ice is 1mm

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18. Initial ice layer on a pond is 10 mm. What time will it take to form an addition of 5 mm on it? Given K of ice $= 1.6Wm^{-1}K^{-1}$,

temperature=$-10^{\circ}C$ and density of water $=10^{3}kgm^{-3}$

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19. One end of a thick copper rod is immersed into a steam chamber and the other end h:as metal coiled tube through which cold water at 15° C is circulated. · If the length of the rod is 0.30 m, thickness 0.04 m, K of copper is 375 $Wm^{-1}K^{-1}$ and specific heat of water 4200 $Jkg^{-1}K^{-1}$, then calculate the final

temperature of 0.10 kg of water at the end of 10 minutes, the temperatllre at the other end being 80° C.

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20. If the thermal conductivity of the material of a conductor is 375 $Wm^{-1}K^{-1}$, then calculate the thermal resistance of a 20 mm thick and 1.5 m length of the rod. If an identically shaped rod but of thermal conductivity $600Wm^{-1}K^{-1}$ is connected in

(1) series and (2) parallel, then calculate the effective conductivities of the combinations.

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21. A copper plate has an area of 250 cm^2 at 0° C. Calculate the area of this plate at $60^\circ C$ .Given coefficient of linear expansion of copper=1.7×10^{-5} ^ (∘)C

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22. A brass boiler has a base area of $0.15m^2$ and thickness 1 cm. It boils water at the rate of 6 kg per minute when placed on a gas stove. Estimate the temperature of the part of the flame in contact with the boiler. Thermal conductivity of brass is $= 109Js^{-1}m^{-1}K^{-1}$, Heat of vapourisation of water is $2256 \times 10^3 Jkg^{-1}$

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