PART 2

OLYMPIAD WALLAH

NSEJS

CHAMPION SERIES

YOUR COMPLETE SCIENCE PREP GUIDE

FOR NSEJS AND SCIENCE OLYMPIAD ASPIRANTS

FOR 8th–10th STANDARD STUDENTS

Ultimate Resource for NSEJS Preparation

CONTENTS

EXERCISE-1

HEAT AND TEMPERATURE

1. The resistance of a resistance thermometer has values 2.71 and 3.70 ohm at 10°C and 100°C. The temperature at which the resistance is 3.26 ohm is

(A) 40°C (B) 50°C
(C) 60°C (D) 70°C

2. The study of physical phenomenon at low temperatures (below liquid nitrogen temperature) is called

(A) refrigeration (B) radiation
(C) cryogenics (D) pyrometry

3. On which of the following scales of temperature the temperature is never negative:

(A) Celsius (B) Fahrenheit
(C) Reaumur (D) Kelvin

4. The temperature of a body on Kelvin scale is found to be x K. when it is measured by Fahrenheit thermometer. It is found to be xF then the value of x is:

(A) 40 (B) 313
(C) 574.25 (D) 301.25

CALORIMETRY

5. When an object is heated, the molecules that make up the object:

(A) begin to move faster
(B) lose energy
(C) become heavier
(D) becomes lighter

6. Iron glows in red colour when it is heated to very high temperature because:

(A) heat we supply consumes red colour at high temperature
(B) mechanical energy is being converted into heat energy
(C) all metals glow in red colour when heated
(D) heat energy is being converted into light energy

7. When in thermal contact, the quantity of heat lost by the hotter body is _____ the amount of heat gained by the colder body. (Neglect loss of heat due to convection & radiation)

(A) equal to (B) greater than
(C) less than (D) cannot say

8. Ratio of thermal capacity of the body and its water equivalent is:

(A) equal to one (B) less than one
(C) more than one (D) none of these

9. A body of mass 5 kg falls from a height of 30 metre. If its all mechanical energy is changed into heat, then heat produced will be:

(A) 350 cal (B) 150 cal
(C) 60 cal (D) 6 cal

10. A bullet moving with velocity v collides against wall. consequently half of its kinetic energy is converted into heat. If the whole heat is acquired by the bullet, the rise in temperature will be:

(A) $v^2/4S$ (B) $4v^2/2S$
(C) $v^2/2S$ (D) v^2/S

11. The amount of heat required in converting 1 g ice at –10°C into steam at 100°C will be:

(A) 3028 J (B) 6056 J
(C) 721 J (D) 616 J

12. 2 kg ice at –20°C is mixed with 5 kg water at 20°C. Then final amount of water in the mixture would be;
Given specific heat of ice = 0.5 cal/g°C,
Specific heat of water = 1 cal/g°C,
Latent heat of fusion for ice = 80 cal/g.

(A) 6 kg (B) 5 kg
(C) 4 kg (D) 2 kg

13. Two identical masses of 5 kg each fall on a wheel from a height of 10 m. The wheel disturbs a mass of 2 kg water, the rise in temperature of water will be:

(A) 2.6°C (B) 1.2°C
(C) 0.32°C (D) 0.12°C

58. Under steady state, the temperature of a body
(A) Increases with time
(B) Decreases with time
(C) Does not change with time and is same at all the points of the body
(D) Does not change with time but is different at different points of the body

59. The lengths and radii of two rods made of same material are in the ratios 1 : 2 and 2 : 3 respectively; If the temperature difference between the ends for the two rods be the same, then in the steady state, the amount of heat flowing per second through them will be in the ratio:
(A) 1: 3 (B) 4: 3
(C) 8: 9 (D) 3: 2

EXERCISE-2

1. 2000 J of energy is needed to heat 1 kg of paraffin through 1ºC. How much energy is needed to heat 10 kg of paraffin through 2ºC?
(A) 4000 J (B) 10,000 J
(C) 20,000 J (D) 40,000 J

2. 1 kg of substance is supplied 630 kJ of energy. Specific heat of substance is 4200 J/kg ºC. Calculate the rise in temperature of 1 kg substance:
(A) 40º C (B) 60ºC
(C) 80ºC (D) 150ºC

3. 1 kg of water at 20ºC is, mixed with 800 g of water at 80ºC. Assuming that no heat is lost to the surroundings, calculate the final temperature of the mixture:
(A) 24.44º C (B) 46.67ºC
(C) 44.44ºC (D) 54.44ºC

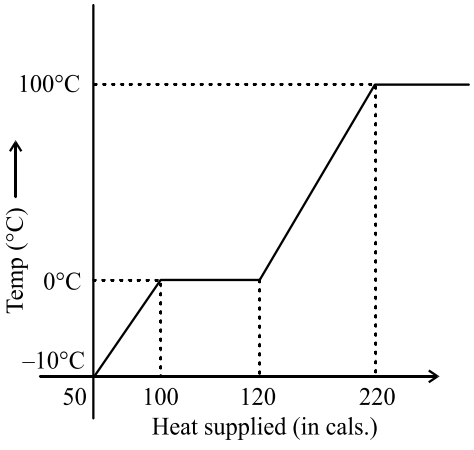
4. How much heat would be required to convert 14 kg of ice at 0ºC into water of 0ºC?
(A) 4704 J (B) 4704 kJ
(C) 336 J (D) 336 kJ

5. Calculate the quantity of heat required to convert 10 kg of ice at 0ºC to water at 50ºC. Specific heat of water is 4200 J/kg ºC.
(A) 4506 kJ (B) 3360 kJ
(C) 5460 J (D) 5460 kJ

6. The specific heat capacity of water is 4200 J/kg ºC. Calculate the heat capacity of 10 kg of water per ºC:
(A) 42 J (B) 420 J
(C) 42 kJ (D) 420 kJ

7. Bunty mixed 440 gm of ice at 0ºC with 540 gm of water at 80ºC. Then what would remain after sometime:
(A) only ice
(B) only water
(C) ice and water in same amount
(D) ice and water will vapourise

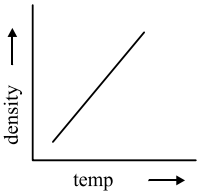
8. For a 5 gm substance the heat supplied (in cals.) and temperature (in ºC) curve is given below. Then the specific heat of substance for liquid state will be:

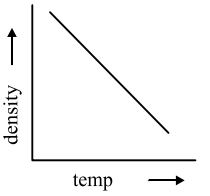


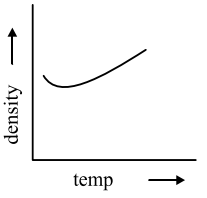
(A) 1 cal/gmºC (B) 0.2 cal/(gmºC)
(C) 2.5 cal/gmºC (D) can't be obtain

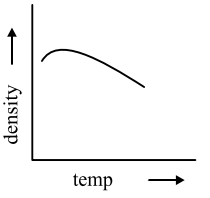
9. Per ºC is unit of:
(A) α (B) β
(C) γ (D) all of these

10. Which of the following curve represent variation of density of water with temperature best:

(A) 

(B) 

(C) 

(D) 

NSEJS PYQ

1. A metal rod of length L at temperature T, when heated to temperature T', expands to new length L'. These quantities are related as $L' = L(1 + \alpha\ [T' - T])$ where α is a constant for that material and called as coefficient of linear expansion. Correct SI unit of α is___. **[NSEJS 2018]**

(A) $m\text{-}K^{-1}$
(B) m-K
(C) K^{-1}
(D) α is a pure number

2. A new linear scale of temperature measurement is to be designed. It is called a 'Z scale' on which the freezing and boiling points of water are 20 Z and 220 Z respectively. What will be the temperature shown on the 'Z scale' corresponding to a temperature of 20º C on the Celsius scale? **[NSEJS 2019]**

(A) 10 Z
(B) 20 Z
(C) 40 Z
(D) 60 Z

3. A doctor measures the temperature of a patient by a digital thermometer as 37.3° C. As a Physics student you will record his temperature in Kelvin as **[NSEJS 2023]**

(A) 310.30 K
(B) 310.45 K
(C) 310.46 K
(D) 310.31 K

Advanced & Olympiad Challenger Questions

1. A coolant in a chemical or nuclear plant is a liquid that is used to prevent different parts of a plant from getting too hot. One important property of coolant is that it:

(A) should have low specific heat
(B) should have high specific heat
(C) high density and low thermal conductivity
(D) low density and high thermal conductivity

2. An Insulated vessel contains 0.4 kg of water at 0ºC. A piece of 0.1 kg ice at –15°C is put into it and steam at 100ºC is bubbled into it until all ice is melted and finally the contents are liquid water at 40ºC. Assume that the vessel does not give or take any heat and there is no loss of matter and heat to the surroundings. Specific heat of ice is 2.2×10^3 J $kg^{-1}K^{-1}$ heat of fusion of water is 333×10^3 J kg^{-1} heat of vaporization of water is 2260×10^3 J kg^{-1}. The amount of steam that was bubbled into the water is:

(A) 34.7 gram
(B) 236 gram
(C) 0.023 gram
(D) 48.01 gram

3. The temperature of a metal coin is increased by 100°C and its diameter increases by 0.15%. Its area increases by nearly:

(A) 0.15% (B) 0.60%
(C) 0.30% (D) 0.0225%

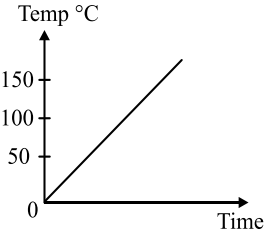
4. A solid cube and a solid sphere of identical material and equal masses are heated to the same temperature and left to cool in the same surroundings. Then;

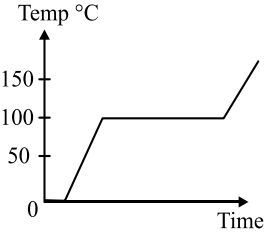
(A) the cube will cool faster because of its sharp edges.
(B) the cube will cool faster because it has a larger surface area.
(C) the sphere will cool faster because it is smooth.
(D) the sphere will cool faster because it has a larger surface area.

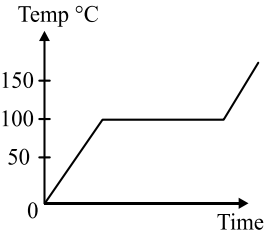
5. We are able to squeeze snow and make balls out of it because of:

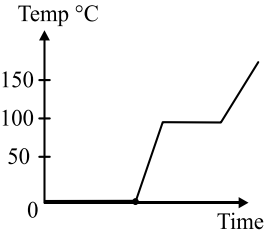
(A) anomalous behavior of water.
(B) large latent heat of ice.
(C) large specific heat of water.
(D) low melting point of ice.

6. Ice at 0º C is put in a closed container and heat is supplied to it continuously at a uniform rate. Which of the following graphs gives the temperature variation with time correctly?

(A) 

(B) 

(C) 

(D) 

7. When 20 kJ of heat is removed from 1.2 kg of ice originally at –15°C, its new temperature is:

(A) – 18°C (B) – 23°C
(C) – 26°C (D) – 35°C

8. A sealed container at a certain temperature is half full of water. The temperature of the container is increases and maintained till equilibrium is re-established. Which statement is correct when the equilibrium is re-established at the higher temperature?

(A) The rate of vaporization is greater than the rate of condensation
(B) The amount of water vapour is greater than the amount of liquid water.
(C) The amount of water vapour is greater than what it was at the lower temperature.
(D) The rate of condensation is greater than the rate of vaporization.

9. The temperature of a substance of mass m (in g) and of specific heat capacity c(in J g^{-1} K^{-1}) increases by t°C. What is the heat change in J?

(A) mct (B) mc(t + 273)
(C) $\frac{mct}{1000}$ (D) $\frac{mct(t+273)}{1000}$

10. Two identical blocks of metal are at 20ºC and 80ºC, respectively. The specific heat of the material of the two blocks increases with temperature. Which of the following is true about the final temperature T_f when the two blocks are brought into contact (assuming that no heat is lost to the surroundings)?

(A) T_f will be 50ºC
(B) T_f will be more than 50ºC
(C) T_f will be less than 50ºC
(D) T_f can be either more than or less than 50ºC depending on the precise variation of the specific heat with temperature

11. A new temperature scale uses X as a unit of temperature, where the numerical value of the temperature t_X in this scale is related to the absolute temperature T by $t_X = 3T + 300$. If the specific heat of a material using this unit is 1400 J kg^{-1} K^{-1} its specific heat in the S.I. system of units is:

(A) 4200 J kg^{-1} K^{-1}
(B) 1400 J kg^{-1} K^{-1}
(C) 466.7 J kg^{-1} K^{-1}
(D) impossible to determine from the information provided

12. The following three objects (1) a metal tray, (2) a block of wood, and (3) a wooden cap are left in a closed room overnight. Next day the temperature of each is recorded as T_1, T_2 and T_3 respectively. The likely situation is:

(A) $T_1 = T_2 = T_3$ (B) $T_3 > T_2 > T_1$
(C) $T_3 = T_2 > T_1$ (D) $T_3 > T_2 = T_1$

13. A certain amount of heat is required to raise the temperature of x gram of a substance through t_1 ºC. The same amount of heat when taken away from y gram of water, it cools through t_2 ºC. Therefore, the specific heat of the substance is

(A) $\frac{yt_1}{xt_1}$ (B) $\frac{xt_2}{yt_1}$
(C) $\frac{yt_2}{xt_1}$ (D) $\frac{xt_1}{yt_1}$

Answer Key

EXERCISE-1

HEAT AND TEMPERATURE

1. (C) **2.** (C) **3.** (D) **4.** (C)

CALORIMETRY

5. (A) **6.** (D) **7.** (A) **8.** (A)

9. (A) **10.** (A) **11.** (A) **12.** (A)

13. (D) **14.** (B) **15.** (D) **16.** (A)

17. (A) **18.** (C) **19.** (C) **20.** (D)

21. (C) **22.** (C) **23.** (A)

THERMAL EXPANSION/TEMPERATURE SCALE

24. (C) **25.** (D) **26.** (B) **27.** (A)

28. (C) **29.** (B) **30.** (A) **31.** (C)

32. (C) **33.** (B) **34.** (A) **35.** (A)

36. (A) **37.** (B) **38.** (C) **39.** (A)

40. (B) **41.** (B) **42.** (B) **43.** (A)

44. (C) **45.** (D)

MODE OF HEAT TRANSFER

46. (B) **47.** (B) **48.** (C) **49.** (A)

50. (A) **51.** (A) **52.** (B) **53.** (A)

54. (D) **55.** (B) **56.** (A) **57.** (B)

58. (D) **59.** (C)

EXERCISE-2

1. (D) **2.** (D) **3.** (B) **4.** (B)

5. (D) **6.** (C) **7.** (B) **8.** (B)

9. (D) **10.** (D) **11.** (A) **12.** (C)

13. (AB) **14.** (C) **15.** (C) **16.** (B)

17. (A) **18.** (A) **19.** (B) **20.** (A)

21. (A) **22.** (A) **23.** (B) **24.** (A)

25. (D) **26.** (C) **27.** (C) **28.** (C)

29. (A) **30.** (B) **31.** (C)

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ABOUT THE WORKBOOK

The NSEJS Module is designed to help students master the National Standard Examination in Junior Science (NSEJS) with:

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- Concept-based & Past Year Questions
- Basic to advanced level questions for smooth adaptation

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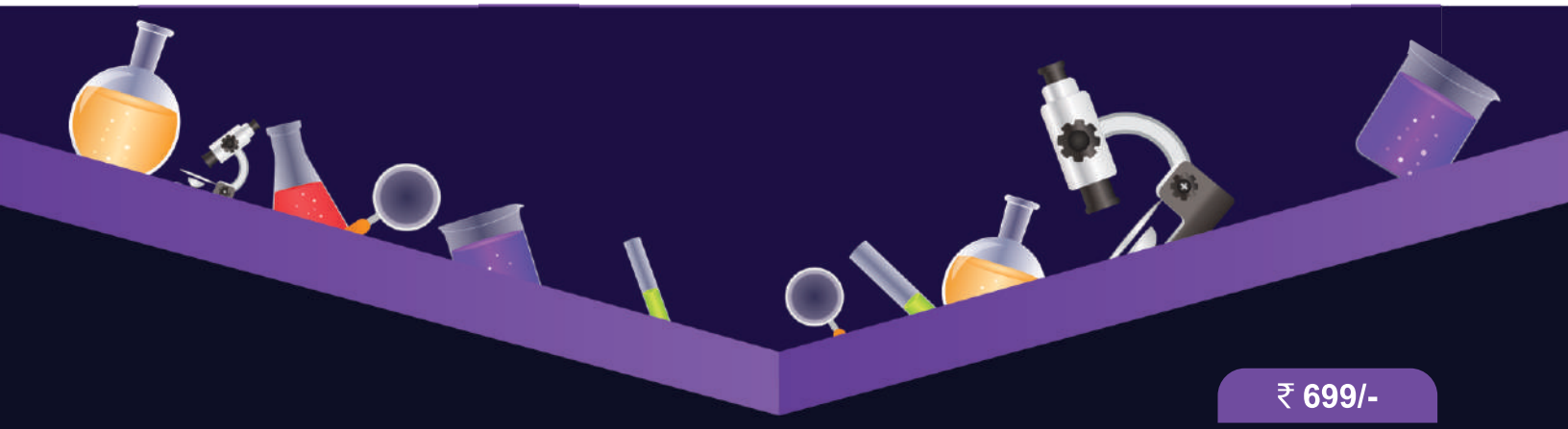

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ISBN 978-93-7153-648-6

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