CBSE

THERMAL PROPERTIES OF MATTER WS 2

Class 11 - Physics

Section A

1. If absolute zero is -273.15° C on Celsius temperature scale, then the absolute zero on the Fahrenheit scale is **[1]**

   a) -491.67°F
   b) -459.67°F
   c) -273.15°F
   d) -453.15°F

2. For measuring temperatures in the range of 2,000 to 2,500°C, we should employ: **[1]**

   a) gas thermometer
   b) pyrometer
   c) barometer
   d) platinum-rhodium thermometer

3. The common physical property which is to be used as the basis for constructing thermometer is **[1]**

   a) the variation of the resistance of a wire with temperature
   b) the variation of the pressure of a gas with temperature
   c) the variation of the volume of a liquid with temperature
   d) All of these

4. If boiling point of a liquid is 95 °F, what will be the reading at Celsius scale? **[1]**

   a) 63^oC
   b) 65^oC
   c) 7^oC
   d) 35^oC

5. The triple points of neon are 24.57 K. Express this temperature on the Celsius and Fahrenheit scales: **[1]**

   a) -208.58^o C = -355.44^o F
   b) -238.58^o C = -315.44^o F
   c) -248.58^o C = -415.44^o F
   d) -218.58^o C = -335.44^o F

6. The electrical resistance in ohms of a certain thermometer varies with temperature according to the approximate law: $R = R_o [1 + \alpha (T - T_o)]$ The resistance is 101.6 Ω at the triple-point of water 273.16 K, and 165.5 Ω at the normal melting point of lead (600.5 K). What is the temperature when the resistance is 123.4 Ω? **[1]**

   a) 364.8 K
   b) 384.8 K
   c) 404.8 K
   d) 344.8 K

7. Two absolute scales A and B have triple points of water defined to be 200 A and 350 B. What is the relation between T_A and T_B? **[1]**

   a) $T_A = (\frac{5}{9}) T_B$
   b) $T_A = (\frac{4}{7}) T_B$
   c) $T_A = (\frac{3}{7}) T_B$
   d) $T_A = (\frac{2}{7}) T_B$

8. The Celsius temperature at absolute zero is equal to: **[1]**

   a) 273^o C
   b) -273^o C

c) -100^{o} C

d) 100^{o} C

9. Mercury thermometer can be used to measure temperature upto **[1]**

a) 100°C

b) 360°C

c) 260°C

d) 500°C

10. On a day when the temperature reaches 50^{o}F, what is the temperature in degrees Celsius and in kelvins? **[1]**

a) 12^{o} C, 303 K

b) 8^{o} C, 273 K

c) 10^{o} C, 283 K

d) 14^{o} C, 323 K

11. On a new scale of temperature (which is linear) called the W scale, freezing and boiling points of water are respectively 39^{o} W and 239^{o} W. What will be the temperature on the new scale corresponding to a temperature of 39^{o} C on the celcius scale? **[1]**

a) 139^{o} W

b) 200^{o} W

c) 117^{o} W

d) 78^{o} W

12. A constant pressure air thermometer gave a reading of 47.5 units of volume, when immersed in ice-cold water, and 67 units in a boiling liquid. The boiling point of the liquid is **[1]**

a) 125^{o}C

b) 112^{o}C

c) 100^{o}C

d) 135^{o}C

13. A Centigrade and Fahrenheit thermometers are dipped in boiling water. The water temperature is lowered, until the Fahrenheit thermometer registers 140°. What is the fall in temperature registered by the centigrade thermometer? **[1]**

a) 40^{o}

b) 60^{o}

c) 30^{o}

d) 80^{o}

14. At which temperature, the centigrade and Fahrenheit scales are equal? **[1]**

a) -40^{o}

b) 37^{o}

c) -80^{o}

d) 40^{o}

15. On a hilly region, water boils at 95°C. The temperature expressed in Fahrenheit is **[1]**

a) 150°F

b) 20.3°F

c) 203°F

d) 100°F

16. The triple points of carbon dioxide are 216.55 K. Express this temperature on the Celsius and Fahrenheit scales: **[1]**

a) $-66.60\ ^{o}C = -99.88\ ^{o}F$

b) $-86.60\ ^{o}C = -150.88\ ^{o}F$

c) $-56.60\ ^{o}C = -69.88\ ^{o}F$

d) $-76.60\ ^{o}C = -120.88\ ^{o}F$

17. According to kinetic theory of gases, at absolute zero of temperature **[1]**

a) molecular motion stops

b) liquid helium freezes

c) liquid hydrogen freezes

d) water freezes

18. We plot a graph, having temperature in °C on x-axis and in °F on y-axis. If the graph is straight line, then it **[1]**

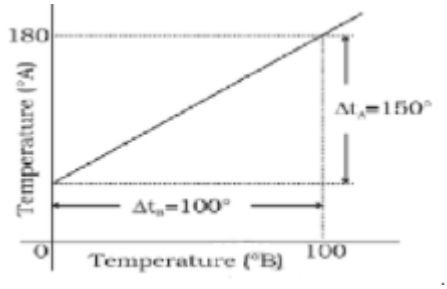
a) intercepts the negative axis of both x- and y-axes

b) passes through origin

c) intercepts the positive y-axis

d) intercepts the positive x-axis

19. The graph between two temperature scales A and B is shown in Fig. Between upper fixed point and lower fixed point there are 150 equal division on scale A and 100 on scale B. The relationship for conversion between the two scales **[1]**



a) $\frac{t_B-40}{100} = \frac{t_A}{180}$

b) $\frac{t_A-30}{150} = \frac{t_B}{100}$

c) $\frac{t_A-180}{100} = \frac{t_B}{150}$

d) $\frac{t_B-180}{150} = \frac{t_A}{100}$

20. The correct equation for conversion between Fahrenheit temperature t_F and Celsius temperature t_C is: **[1]**

a) $\frac{t_F-32}{180} = \frac{t_C}{120}$

b) $\frac{t_F-32}{160} = \frac{t_C}{100}$

c) $\frac{t_p-32}{180} = \frac{t_C}{100}$

d) $\frac{t_F+32}{180} = \frac{t_C}{100}$

21. Which of the following is true of the Celsius and Kelvin temperature scales? **[1]**

a) Both the Celsius and Kelvin temperature scales have negative values.

b) A Kelvin degree and a Celsius degree are equivalent in size.

c) A Kelvin degree is larger in size than a Celsius degree.

d) A Kelvin degree is smaller in size than a Celsius degree.

22. At what temperature is the Fahrenheit scale reading equal to half of the Celsius scale reading? **[1]**

23. What is the minimum possible temperature? Is there also a maximum possible temperature? **[1]**

24. A faulty thermometer has its fixed points marked as 5° and 95°. Temperature of a body as measured by the faulty thermometer is 59°. Find the correct temperature of the body on the Celsius scale. **[1]**

25. A mercury thermometer is transferred from melting ice to a hot liquid. The mercury rises 0.9 of the distance between lower and upper fixed points. What is the temperature of the liquid in °C? What in °F? **[1]**

26. A constant-volume gas thermometer using helium records a pressure of 20.0 kPa at the triple-point of water, and pressure of 14.3 kPa at the temperature of **dry ice** (solid CO_2). What is the temperature of **dry ice**? **[1]**

27. What is the normal temperature of a human body? **[1]**

28. A geyser heats water flowing at the rate of 3 kg per minute from 27°C to 77°C. If the geyser operates on a gas burner, what is its rate of consumption of fuel if the heat of combustion is 4×10^4 J/g? Given specific heat of water is 4.20×10^3 J/kg/K. **[1]**

29. There were two fixed points in the original Celsius scale as mentioned above which were assigned the number 0 °C and 100 °C respectively. On the absolute scale, one of the fixed points is the triple-point of water, which on the Kelvin absolute scale is assigned the number 273.16 K. What is the other fixed point on this (Kelvin) scale? **[1]**

30. What is thermometry? **[1]**

31. At what temperature, do the readings of Celcius and Fahrenheit scales coincide? **[1]**

32. A piece of wire gauze is placed over the Bunsen burner. If the gas is turned on below the gauge, will the flame go above the gauge? **[1]**

33. Two thermometers are constructed in the same way except that one has a spherical bulb and the other an elongated cylindrical bulb. Which of the two will respond quickly to temperature changes? **[1]**

34. Taking absolute zero as the basis of the scale of temperature, what are the values of melting point and boiling point of water? **[1]**

35. Mercury boils at 357^o C. How can then a mercury thermometer be used to measure temperature upto 500^o C? **[1]**

36. A faulty thermometer reads 5°C in melting ice and 99°C in steam. Find the correct temperature in °F when the faulty thermometer reads 52°C. **[1]**

37. What is pyrometry? **[1]**

Section B

38. **Fill in the blanks:** **[2]**

    (a) The temperature scale which starts with -273.15°C as its zero is called _____. **[1]**

    (b) Mercury is used as thermometric liquid because its coefficient of real expansion is _____ and _____. **[1]**

39. Suggest suitable methods for measuring the temperature of **[2]**

    i. surface of the sun,

    ii. surface of the earth,

    iii. an insect, and

    iv. liquid helium.

40. Name the suitable thermometers to measure the following temperatures **[2]**

    a. -100°C

    b. 80°C

    c. 780°C

    d. 2000°C

41. The triple points of neon and carbon dioxide are 24.57 K and 216.55 K, respectively. Express these temperatures on the Celsius and Fahrenheit scales. **[2]**

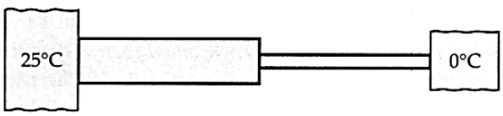
42. Water is boiled in a rectangular steel tank of thickness 2 cm by a constant temperature furnace. Due to vaporisation, water level falls at a steady rate of 1 cm in 9 minutes. Calculate the temperature of the furnace. **[2]**

    Given K for steel = 0.2 $cals^{-1}m^{-1o}C^{-1}$.

43. Calculate the temperature which has same numeral value on celsius and Fahrenheit scale. **[2]**

44. Write the advantages and disadvantages of platinum resistance thermometer. **[2]**

45. In the figure, two bars of the same metal are connected. The length of the first bar is half of that of the second, but the cross-sectional area is double. What is the temperature of the junction of the bars? **[2]**



46. 100 g of water is super cooled to –10°C. At this point, due to some disturbance mechanized or otherwise some of it suddenly freezes to ice. What will be the temperature of the resultant mixture and how much mass would freeze? **[2]**

    [$S_w = 1cal/g/^\circ C$ and $L^W_{fusion} = 80cal/g$]

47. Describe the working principle of a platinum resistance thermometer. **[2]**

48. A Celsius and Fahrenheit thermometer are put in a hot bath. The reading of Fahrenheit thermometer is 3/2 times the reading of Celsius thermometer. What is the temperature of the bath on Celsius, Fahrenheit and kelvin's scales? **[2]**

49. Why is mercury used in a thermometer? **[2]**

50. Give four reasons why is mercury used in thermometers. **[2]**

51. Find out the temperature which has same numerical value on Celsius and fahrenheit scale. **[2]**

52. The temperature of a body is increased from 27^oC to 127^oC. By what factor would the radiation emitted by it increase? **[2]**

53. Give some merits of gas thermometers over those of mercury thermometers. **[2]**

54. A thermometer has wrong calibration. It reads the melting point of ice as - 10^0C. It reads 60^0C in place of 50^0C. What is the temperature of boiling point of water on the scale? **[2]**

55. Gas thermometers are more sensitive than mercury thermometers. Why? **[2]**

56. What is a liquid thermometer? Briefly describe its working principle. **[2]**

57. What is the temperature of the triple-point of water on an absolute scale whose unit interval size is equal to that of the Fahrenheit scale? **[2]**

58. Find the temperature of 149°F on Kelvin scale. **[2]**

59. In what ways are the gas thermometers superior to mercury thermometers? **[2]**

60. How much pressure will a man of mass 80 kg exert on the ground when (1) he is lying and (2) he is standing on his feet. Given area of the body of the man is 0.6 m^2 and that of one of his feet is 80 cm^2.(Given, g = 9.8 m/s^2) **[2]**

61. A constant volume thermometer using helium gas records a pressure of 1.75×10^4 Pa at the normal freezing point of water, and a pressure of 239×10^4 Pa at the normal boiling point of water. Obtain from these observations the temperature of absolute zero on the Celsius scale. **[2]**

62. Name the suitable thermometers to measure the following temperatures: - 80° C, 60° C, 250° C, 780° C, 2000° C. **[2]**

63. Give reasons why water is considered unsuitable for use in thermometers. **[2]**

64. Give reasons why is a platinum wire used in a resistance thermometer. **[2]**

Section C

65. Starting from Charle's law, develop the concept of absolute zero and absolute scale of temperature. **[3]**

66. Calculate the maximum amount of heat that may be lost per second by radiation by a sphere 14 cm in diameter at a temperature of 227° C, when placed in an enclosure at 27° C. **[3]**

    Given Stefan's constant = 5.7×10^{-8} Wm^{-2} K^{-4}.

67. A thermometer has the wrong calibration. It reads the melting point of ice -10 °C. It reads 60° C in place of 50°. Calculate the temperature of the boiling point of water on this scale. **[3]**

Section D

68. Draw a P-T diagram for CO_2. Explain its behavior, when both pressure and temperature are above and below the triple point. Give the importance of the triple point. **[5]**

Section E

69. **State True or False:** **[6]**

    (a) The Celsius and Fahrenheit scales do not agree at any temperature. **[1]**

    (b) Mercury boils at 357° C Even then we can use a mercury thermometer to measure temperature upto **[1]**

500°C.

(c) A clinical thermometer can be sterilized with boiling water. **[1]**

(d) Gas thermometers are more sensitive than mercury thermometers. **[1]**

(e) Thermometers with spherical bulbs are more sensitive than thermometers with cylindrical bulbs. **[1]**

(f) The constant volume gas thermometer is based on Boyle's law. **[1]**