PREVIOUS YEAR QUESTIONS

1. The efficiency of a heat energy can never be

(a) 10% (b) 80%

(c) 100% (d) 50%

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Ans. (c) : Heat energy is the result of the movement of tiny particles called atoms, molecules or ions in solids, liquid and gases.

- Heat energy can be transferred from one object to another. Its transfer or flow is done by the difference in temperature between the two bodies.
- According to second law of thermodynamics, it is impossible to get 100% of efficiency because of environmental changes and some other factors. So, the efficiency of a heat energy can never be 100%.

2. The heat generated while transferring 96000 coulomb of charge is one hour through a potential difference of 50 V is

(a) 4.8×10^4 J (b) 1.33×10^3J

(c) 4.8×10^6J (d) 1.33×10^4 J

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Ans. (c) : Given,

V = 50 V

Q = 96000

t = 1 hour = 3600 sec

We know that-

$$H = V\,I\,t = \frac{V \times Q.t}{t} = V \times Q = 50 \times 96000$$

$$\Rightarrow \quad \boxed{H = 4.8 \times 10^6\,J}$$

3. The specific heat capacity of water is

(a) 540 J/kg°C (b) 4186 J/kg°C

(c) 2260 J/kg°C (d) 335 J/kg°C

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Ans. (b) : Specific heat capacity of water = 4186 J/kg°C

4. The thermal coefficient of linear expansion of a material is α. Then the thermal coefficient of its volume expansion will be

(a) $\frac{\alpha}{3}$ (b) 3α

(c) α (d) 2α

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Ans. (b) : First Method- Linear expansion - when the expansion due to heating occurs only along one direction. Then linear expansion,

$$\Delta\ell = \alpha\,\ell.\Delta T$$

where, $\Delta\ell$ = Change in length

ℓ = Length

ΔT = Change in temperature

α = Coefficient of linear expansion

(S.I. Unit C^{-1} or K^{-1})

Volumetric expansion - change in volume (ΔV) is directly proportional to volume (V) and ΔT

So, $\Delta V \propto \Delta T$ and $\Delta V \propto V$

$\Delta V \propto V.\Delta T$

$\Delta V = \gamma V.\Delta T \rightarrow (3)$

Where γ = the coefficient of volume expansion.

When the temperature of a cube of material of side length (ℓ) is increased by $d\ell$ then the volume will be increased by an amount dV is given by,

$$dV = \left(\frac{dV}{d\ell}\right).d\ell$$

Volume of cube (V) = ℓ^3

Put the value of V in equation (3)

$$dV = \frac{d(\ell^3)}{d\ell} \times d\ell = 3\ell^2.d\ell$$

Put the value of $d\ell$

$$dV = 3\ell^2.(\ell\,\alpha dT)$$

$$= 3\ell^3\,\alpha\,dT \qquad \because V = \ell^3$$

$$= 3\,\alpha\,VdT$$

$$dV = \gamma VdT$$

Thus, $\gamma = 3\alpha$

Second Method- We know that

$\alpha : \beta : \gamma = 1 : 2 : 3$

α = Coefficient of linear expansion

γ = Coefficient of volume expansion

β = Coefficient of Areal expansion

So, $\gamma = 3\alpha$

$\beta = 2\alpha$

5. If half litre of a hot water at 90º C is mixed with three and a half liters of cold water at 10º C, find the final equilibrium temperature (in ºC) if no heat is lost.

(a) 50 (b) 20 (c) 40 (d) 30

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Ans : (b) Heat lost = Heat gain

$m_1 c\,\Delta T_1 = m_2 c\,\Delta T_2$

$m_1\,\Delta T_1 = m_2\,\Delta T_2$

$$\frac{1}{2}(90 - T) = \frac{7}{2}(T - 10)$$

$(90 - T) = (7T - 70)$

$8T = 160$

$$T = \frac{160}{8}$$

$\boxed{T = 20^\circ C}$

6. Find the heat capacity of a pan of mass 200 g if its temperature rises by 8º C on receiving 20000 J of heat.

(a) $250JK^{-1}$ (b) $50JkG^{-1}K^{-1}$

(c) $1.25Jkg^{-1}K^{-1}$ (d) $5JK^{-1}$

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Ans : (a) Given, mass (m) = 200 gm

Difference in temperature (ΔT) = 8ºC

and heat (ΔQ) = 2000 J

$$\text{Quantity of heat} = \left(\frac{\text{Heat capacity}}{\text{Temperature increases}}\right)$$

$$= \frac{\Delta Q}{\Delta T} = \frac{2000}{8} = 250\ Jk^{-1}$$

7. Find the specific latent heat of vaporisation of 1.25 g of (in Jg^{-1}), if it releases 250 joules of heat when it condenses at its boiling point of 196º C.

(a) 500 (b) 200
(c) 312.5 (d) 469

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Ans : (b) Latent heat:- Latent heat is the heat required to change the state of unit mass of a substance at a constant temperature is called latent heat of the substance. It is denoted by L.

$Q = mL$

or $L = \frac{Q}{M}$

Given that m = 1.25 gm

$Q = 250$ J

Then, latent heat $(L) = \frac{Q}{M} = \frac{250}{1.25} = 200$

8. Find the specific heat capacity (in $Jg^{-1} K^{-1}$) of a block of metal of mass 500 g, the temperature of which rises by 80º C when it absorbs 10 kJ of heat?

(a) 1.56 (b) 0.25
(c) 0.4 (d) 0.16

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Ans : (b) Given,
Mass of metal (m) = 500 gm
Heat (Q) = 10 kJ = 10,000 J
Increase in temperature $(\Delta T) = 80ºC$
Then $Q = mc\,\Delta T$
Where Q = Heat (or thermal energy)
m = mass
c = specific heat
ΔT = increase in temperature

When $C = \frac{Q}{m \times \Delta T} = \frac{10000}{500 \times 80}$
$= 0.25\ Jg^{-1}k^{-1}$

9. – 100º Celsius = ——— Fahrenheit

(a) -148^o (b) -373^o
(c) 173^o (d) -212^o

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Ans : (a) –Using the formula = $C = \frac{5}{9}(F-32)$

$-100 = \frac{5}{9}(F-32)$

$-\frac{100 \times 9}{5} = F - 32$

$-180 = F - 32$

$F = -180 + 32$

$\boxed{F = -148}$

10. Two litres of superheated water at 190ºC is mixed with six litres of cold water at 20ºC. Find the final equilibrium temperature (in ºC) if no heat is lost.

(a) 47.5 (b) 95
(c) 62.5 (d) 55

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Ans : (c) $T_1 = 190°$
$T_2 = 20°$
$m_1 = 2$ litre
$m_2 = 6$ litre
Here, with no heat loss, let the final equilibrium temperature be T.

Heat loss	=	Heat gain
$m_1C\Delta T_1$	=	$m_2C\Delta T_2$
$m_1\Delta T_1$	=	$m_2\Delta T_2$
$2(190 - T)$	=	$6(T-20)$
$380 - 2T$	=	$6T - 120$
$8T$	=	500

$T = \frac{500}{8}$

$T = 62.5°C$

11. _____ º Celsius = 167ºFahrenheite

(a) 348 (b) 103
(c) 198 (d) 75

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Ans : (d) We know that, $ºC = \frac{5}{9}(F-32)$

$C = \frac{5}{9}(167-32) = \frac{5}{9} \times 135$

$C = 75º$

12. The specific latent heat of fusion of ethyl alcohol is 100 Jg^{-1}. Find the heat absorbed (in J) by 2.25 g of ethyl alcohol when it melts at its melting point of -114ºC.

(a) 311 (b) 45
(c) 225 (d) 100

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Ans: (c) Given,
(M) = 2.25 gm
specific heat (L) = 100 Jg^{-1}
(Q) = ?

$\because$ Specific heat $(L) = \left(\frac{\text{Heat (Q)}}{\text{mass}}\right)$

$100 = \frac{Q}{2.25}$

$Q = 2.25 \times 100$

$Q = 225$ Joule

13. Find the heat capacity of a steel vessel of mass 2.5 kg if its temperature rises by 10 degrees. Specific heat capacity of steel is 500 $Jkg^{-1}K^{-1}$.

(a) $1250JK^{-1}$ (b) 20 $Jkg^{-1}K^{-1}$
(c) $200Jkg^{-1}K^{-1}$ (d) $125JK^{-1}$

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Ans : (a) Given,
mass of steel (m) = 2.5 kg
Increase in its temperature $(\Delta T) = 10°C$
And specific heat (c) = (500 $Jkg^{-1}k^{-1}$)
Heat $Q = mC\Delta T$
$= 2.5 \times 500 \times 10$
$Q = 12500$

Heat capacity $= \left(\frac{\text{amount of heat}}{\text{Increase in temperature}}\right)$

$= \frac{12500}{10} = 1250\ JK^{-1}$

14. Find the mass (in g) of a copper calorimeter if its temperature rises by 45º when it absorbs 3.6kJ of heat. The specific heat capacity of copper is $0.4Jg^{-1}K^{-1}$.

(a) 500 (b) 405
(c) 648 (d) 200

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Ans : (d) Heat absorbed (Q) = 3.6 kJ
Increase in temperature (ΔT) = 45º
Specific heat capacitance (C) = $0.4Jg^{-1}k^{-1}$
mass (m) = ?
$Q = m C\Delta T$
$3.6 = m \times 0.4 \times 45$
$m = \frac{3.6}{18}$
m = 0.2 kg
m = 200 gram

15. Find the heat capacity of a pan of mass 180 g, if its temperature rises by 50 degree on receiving 2400 J of heat.

(a) 48 JK^{-1} (b) 16.67 $Jkg^{-1}K^{-1}$
(c) 13.33 $Jkg^{-1}K^{-1}$ (d) 36 JK^{-1}

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Ans: (a) : mass (m) · 180 gram = 0.18 kg
Q = 2400 Joule C = ?
Temperature (ΔT) = 50 Kelvin
Heat capacity (C)= $\frac{Q}{\Delta T} = \frac{2400}{50} = 48\ J\ K^{-1}$

16. If one and a half litres of hot water at 80°C is mixed with two and a half a litres of colder water at 40°C, find the final equilibrium temperature if no heat is lost.

(a) 50ºC (b) 55ºC
(c) 60ºC (d) 65ºC

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (b) : Let final equivalent temperature = TºC
We know that specific heat of water = $4200\ Jkg^{-1}{}^{o}C^{-1}$
Then,
Heat consumed by hot water = 1.5 × 4200 (80 – T)
Heat obtained by cold water = 2.5 × 4200 (T – 40)
According to the principle of mixing,
Heat loss = Heat gained
1.5 × 4200 (80 – T) = 2.5 × 4200 (T – 40)
120 – 1.5T = 2.5T – 100
4T = 220
T = 55ºC

17. Find the specific heat capacity of a block of metal of mass 300 g, the temperature of which rises by 50 degrees when it absorbs 12 kJ of heat?

(a) 2.5 $Jg^{-1}K^{-1}$ (b) 1.25 $Jg^{-1}K^{-1}$
(c) 0.5 $Jg^{-1}K^{-1}$ (d) 0.8 $Jg^{-1}K^{-1}$

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (d) : Given, m = 300 gm,
$\Delta T = 50°C$,
and Q = 12 KJ = 12000J
Specific heat (s) = ?
$Q = m.s.\Delta T$
$s = \frac{Q}{m.\Delta T} = \frac{12000}{50 \times 300} = \frac{4}{5} = 0.8\ J\ g^{-1}K^{-1}$

18. – 150° Celsius = ____ Fahrenheit

(a) –238º (b) –212º
(c) –418º (d) –373º

RRB ALP & Tech. 08.02.2019 Shift-I

Ans:(a): Formula convert degree Celsius to Fahrenheit:-
$°F = {}^{o}C \times \frac{9}{5} + 32$ or $\left(F = C \times \frac{9}{5} + 32\right)$
Given, C = –150
$F = -150 \times \frac{9}{5} + 32$
F = –270 + 32
F = – 238
So, we can say that – 150°C is equivalent to – 238°F.

19. Find the specific latent heat of vapourisation of 4.5 gm of nitrogen, if it releases 990 joules of heat when it condenses at its boiling point of – 196°C.

(a) 180 J/g (b) 220 J/g
(c) 200 J/g (d) 160 J/g

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Ans : (b) : Given,
mass (m) = 4.5 gram
Heat (Q) = 990 Joule
If the latent heat of the substance is L, then the heat required to change the state of mass of mass (m) of the substance is.
Q = mL
990 = 4.5 × L
$L = \frac{990}{4.5}$
L = 220 Joule/gram

20. Which of the following is equal to 86°F?

(a) $20^{o}C$ (b) $30^{o}C$
(c) $10^{o}C$ (d) $34^{o}C$

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Ans : (b)
$\frac{C}{5} = \frac{F-32}{9}$ [Formula]
$\frac{C}{5} = \frac{86^{o}-32^{o}}{9}$
$\frac{C}{5} = \frac{54^{o}}{9}$
$\frac{C}{5} = 6^{o}$
$C = 30^{o}$

21. The higher the ____ value of a material, the faster it will conduct heat.

(a) Resilence
(b) Melting point
(c) Latent Heat
(d) Thermal conductance

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Ans : (d) The greater the value of the thermal conductivity of material. The more rapidly it will conduct heat.

22. What is the molar specific heat capacity of a substance?

(a) $\left(\frac{1}{\mu}\right)\left(\frac{\Delta Q}{\Delta T}\right)$ (b) $\mu\left(\frac{\Delta Q}{\Delta T}\right)$

(c) $\left(\frac{1}{\mu}\right)\left(\frac{\Delta T}{\Delta Q}\right)$ (d) $(\mu)\left(\frac{\Delta T}{\Delta Q}\right)$

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Ans : (a) Molar specific heat of a substance is the amount of heat required to raise the temperature of 1 mole of a solid or liquid by 1K or 1°C. It is denoted by C_n.

$$C_n = \frac{1}{\mu}\left(\frac{\Delta Q}{\Delta T}\right)$$

23. A brass rod (conductivity 109J/(m-K)) has an area of corss section 0.042 m^2 and length 20 cm. If a temperature difference of 200 J°C is maintained at the two ends of the rod, what will be the rate of heat flow through the rod?

(a) 2.32kJ/s (b) 3.42kJ/s

(c) 4.36kJ/s (d) 5.80kJ/s

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Ans : (c) Rod of conductivity (K) = 109 J (m–k)
Area of transverse cut (A) = 0.04 m^2
length of rod (l) = 0.20 m
Difference of temperature (ΔT) = 200J°C

Rate of heat flow through rod, $Q = K\left(\frac{A}{l}\right)(\Delta T)$

$$= 109\left(\frac{0.04}{0.20}\right)\times 200$$

$$= 109\times\frac{1}{5}\times 200$$

$$= 4360 \text{ J/s} = 4.36 \text{ kJ/s}$$

24. Identify the material which has high coefficient of volume expansion.

(a) Alcohol (b) Glass

(c) Brass (d) Water

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Ans : (a) Coefficient of volume expansion:- It is the measure of the fractional change of size per unit change in the temperature with the surrounding pressure being constant. This coefficient is most applicable to fluids.

Material	**Volume coefficient expansion (/°C)**
Alcohol	– 1490
Glass	– 27.6
Brass	– 57
Water	– 210

out of given option, alcohol has higher coefficient of volume expansion.

25. Identify the material having the highest coefficient of volume expansion.

(a) Iron (b) Brass

(c) Aluminium (d) Mercury

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Ans : (d) Coefficient of volume expansion is most efficient for fluids. Among the given option, the order of the coefficient of volume expansion is given below-

Metal	**Volume expansion of coefficient (/°C)**
Iron	35×10^{-6}
Brass	56 × 10–6
Aluminum	75×10^{-6}
Mercury	180×10^{-6}

26. ____ is a mode of heat transfer by actual motion of matter.

(a) Conduction (b) Radiation

(c) Convection (d) Vaporisation

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Ans : (c) There are the three main methods of transfer or transmission of heat (energy) between substance from one place to another place-
1. Conduction
2. Convection
3. Radiation

Convection is the method of heat transfer from one place to another due to movement of fluid.

27. A 100-g block of lead is heated from 20°C to 50°C. Calculate the amount of heat transferred to the block (specific heat of lead = 127 J kg^{-1} K^{-1})

(a) 321J (b) 381J

(c) 127J (d) 230J

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Ans : (b) Given,
m = 100 gm = 0.1 kg
Difference in temperture ΔT = (50°C – 20°C) = 30°C
Specific heat of lead (c) = 127 $JKg^{-1}.K^{-1}$
ΔQ = ?
$\Delta Q = m.c.\Delta T$
$\Delta Q = 0.1 \times 127 \times 30$
ΔQ = 381 Joule

28. Conduction and convection modes of heat transfer CANNOT operate between bodies separated by.....

(a) ice (b) aluminium

(c) vacuum (d) water

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Ans : (c) Conduction and convection modes of heat transfer cannot operate between bodies separated by vacuum because both are require the presence of material medium to take place.

29. The Fahrenheit and Celsius scales converge at _____.

(a) -50^0 (b) -40^0

(c) -30^0 (d) -20^0

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Ans : (b) Let the Fahrenheit and Celsius scale are oriented one (x).
then,

$$\frac{C}{5} = \frac{F-32}{9}$$

Where, C° = F° = x°

$$\frac{x°}{5} = \frac{x°-32}{9}$$

$9x° = 5x° - 32 \times 5$

$9x° = 5x° - 160$
$4x° = -160$
$x° = -\frac{160}{4}$
So, $x° = -40°$

30. _____ is the unit of thermal conductivity.
(a) $J \cdot s^{-1} \cdot K$ (b) $J \cdot s^{-1} \cdot m^{-1} \cdot K^{-1}$
(c) $J^{-1} \cdot s^{-1} \cdot kg^{-1}$ (d) $J \cdot s \cdot K$

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Ans : (b) In physics, heat conductivity is that property of substance which shows how easily heat can flow through that substance. Silver metal has the highest heat and electrical conductivity among metals. Thermal conductivity is a scalar quantity. Its unit is watt $meter^{-1}$ $kelvin^{-1}$ $(W.m^{-1}.K^{-1})$ or (Joule $second^{-1}$ $meter^{-1}Kelvin^{-1}$)

31. ..... is the heat per unit mass required to change a substance from solid into liquid at the same temperature and pressure.
(a) Sublimation
(b) Vaporisation
(c) Regelation
(d) Latent heat of fusion

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Ans : (d) When a solid substance is heated, its temperature increase and at a specific temperature the solid substance starts melting. This temperature is called the melting points of the solid. At the same melting point, temperature and atmospheric pressure, the amount of heat that can change the unit mass of a solid substance into liquid without changing its temperature is called the latent heat of fusion. Thus, the heat required per unit mass of a substance to change from solid to liquid at the same temperature and pressure is called latent heat of fusion.

32. Identify the conductor having the lowest resistivity.
(a) Silver (b) Aluminium
(c) Iron (d) Copper

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Ans : (a) Silver metal has the highest electrical conductivity and least electrical resistivity among metal. Therefore, out of the above options, silver metal is a good conductor with minimum resistivity. The order of the resistivity of the given metal is as follows-
Irons > Aluminum > copper > silver
Hence the resistivity of silver is minimum.

33. A brick wall having a thickness of 24 cm has an inner surface temperature of 25ºC and an outer surface temperature of 5ºC. The rate of heat loss through per square metre of the wall (thermal conductivity = 0.15 J/(s.m.K) is :
(a) 18.2J/s (b) 20.0J/s
(c) 12.5J/s (d) 23.0J/s

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Ans: (c) Given,
Thickness of wall (d) = 24 cm = 0.24 m
k = 0.15J/s.m.K
Temperature difference ($\Delta\theta$) = 25 – 5 = 20°C
Area of wall = 1 m^2, time = 1 second

$$\theta = \left(\frac{K.A.\Delta\theta.t}{d}\right)$$

$$\theta = \frac{0.15 \times 1 \times 20 \times 1}{0.24}$$

$$\theta = \frac{15 \times 20}{24} = \frac{300}{24} = 12.5 \text{ J/second}$$

34. When 1 kg of water is cooled from 4ºC to 0ºC, its volume _____.
(a) first decreases and then increases
(b) decreses
(c) remains the same
(d) increases

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Ans : (d) The density of water is maximum at 4°C and volume of a given sample of water is minimum at this temperature. But when the water cooled from 4ºC to 0ºC, its volume increases due to **Anomalous expansion** of water.

35. Identify the material having the highest coefficient of volume expansion.
(a) Iron (b) Mercury
(c) Hard rubber (d) Brass

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Ans : (c) : Hard rubber has the highest coefficient of volume expansion. The increase in volume of solid when heated is known as volumetric expansion.
Volume expansion (/ºC) of the other materials is-

Iron	-	3.55×10^{-5}
mercury	-	18.2×10^{-5}
Brass	-	6×10^{-5}
Hard rubber	-	24×10^{-5}

36. Copper expands about ____ times more than glass for the same rise in the temperature.
(a) Three (b) Five
(c) Four (d) Six

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Ans : (b) : Copper expands five times more than glass with the same increase in temperature.

37. A 50g block of copper is heated from 20°C to 60°C. How much heat is transferred to the block (specific heat of copper 386 $Jkg^{-1}K^{-1}$)?
(a) 852 J (b) 572 J
(c) 320 J (d) 772 J

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Ans : (d) : $\Delta T = (60-20) = 40°C$
m = 50 gm = 0.05 kg
specific heat (c) = 386 J Kg^{-1} K^{-1}
Transferred heat $Q = m.c.\Delta T$
$= 0.05 \times 386 \times 40$
$= 772$ J

38. The boiling and freezing points of water are exactly ____ degrees apart on the Fahrenheit scale.
(a) 273 (b) 50
(c) 100 (d) 180

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Ans : (d) : In Fahrenheit scale-
B.P of water = 212 ºF
Freezing point of water = 32 ºF
Body temperature = 98.6 ºF
And the boiling point and freezing point of water exactly 180º apart on the Fahrenheit scale.

39. 95 ºF = _____ ºC

(a) 15 (b) 25
(c) 35 (d) 45

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Ans : (c) : Formula $\left[\frac{C}{5}=\frac{F-32}{9}\right]$

Given F = 95°F

$$\frac{C}{5}=\frac{F-32}{9}$$

$$\frac{C}{5}=\frac{63}{9}\Rightarrow\frac{C}{5}=\frac{7}{1}\Rightarrow \quad C=35°$$

40. 77^0F is equal to :

(a) 25ºC (b) 20ºC
(c) 15ºC (d) 10ºC

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Ans : (a) : Fahrenheit scale was proposed by Daniel Gabriel Fahrenheit in the year 1724 AD.

Formula $\frac{C}{5}=\frac{F-32}{9}$

$$\frac{C}{5}=\frac{77-32}{9}$$

$$\frac{C}{5}=\frac{45}{9}$$

$$\frac{C}{5}=\frac{5}{1}$$

$$\boxed{C=25°C}$$

41. A steel rod with the thermal conductivity of 50.2 W/(m-K) has an area of cross-section 0.02 m^2 and length 15 cm. If the two ends of the rod are maintained at a temperature difference of 300^0C, the rate of heat flow through the rod is : 50.2 W

(a) 4.0 kJ/s (b) 1.0 kJ/s
(c) 3.0 kJ/s (d) 2.0 kJ/s

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Ans: (d) : Thermal conductivity (K) = 50.2 W/(m-K)
Length of rod (l) = 15 cm = 0.15 m
Area of cross-section of rod (A) = 0.02 m^2
Temperature difference betweens $(\theta_1-\theta_2)$ = 300°C

Rate of flow of heat (Q) $\frac{KA(\theta_1-\theta_2)}{l}$

$$=\frac{50.2\times0.02\times300}{0.15}=2008\text{ J/s}$$

= 2 kJ/second

42. How much heat should be transferred to a 100 g block of aluminum (specific heat 900 $Jkg^{-1}K^{-1}$) to increase its temperature by 10^0C ?

(a) 90 J (b) 9 J
(c) 9000 J (d) 900 J

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Ans : (d) : Given,
m = 100g = 0.1 kg
c = 900 $Jkg^{-1}k^{-1}$
$\Delta T = 10^0$C
$Q = m.c.\Delta T \Rightarrow Q = 0.1 \times 900 \times 10$
Q = 900 Joule

43. Identify the substance from the below having highest specific heat capacity :

(a) Kerosene (b) Aluminium
(c) Water (d) Ice

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Ans : (c) : Water has the highest specific capacity strong hydrogen bonding is found between water molecular, due to which the inter molecular force between water molecules is high, which requires more heat to break. Therefore the specific heat water is high. The specific heat of water is given as 4.18 J/g°C.

44. How much heat must be transferred to a block of silver weighing 100g so that its temperature increase by 40°C ? (The Specific heat of silver is 236 $Jkg^{-1}k^{-1}$).

(a) 450J (b) 1270J
(c) 1988J (d) 944J

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (d)

Let the weight (mass) silver (m) = $\frac{100\text{ gram}}{1000\text{gram}}$

= 0.1kg

Temperature $(\Delta T) = 40^oC$

Specific heat of silver = 236 Jkg^{-1}

$Q = MC\Delta T = 0.1\times236\times40 = 944J$

Hence 944J of heat will be transferred to the silver block.

45. 152° Fahrenheit is equal to ————° celsius.

(a) 36.67 (b) 66.67
(c) 86.67 (d) 56.67

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (b) $\frac{C}{5}=\frac{F-32}{9}$

Given F = 152°

$$\frac{C}{5}=\frac{152-32}{9}\qquad\frac{C}{5}=\frac{120}{9}$$

$$9C = 120.5$$

$$C=\left(\frac{120\times5}{5}\right)=\frac{40\times5}{3}$$

$$=\left(\frac{200}{3}\right)$$

= 66.67°C

46. The change from the state of ice to the state of water is due to the ———.

(a) Increase in temperature
(b) Absorption of heat
(c) Emission of heat
(d) Decrease in temperature

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (b) The change of state of ice into water is due to the absorption of heat because when ice (solid state) is converted into water (liquid state), heat is absorbed by ice and the crystalline nature of ice broken and it is available to us as water.

47. When the temperature of a certain quantity of water is increased from 0°C to 4°C, its volume ----------

(a) Decreases
(b) Increases

(c) First increases and then decreases
(d) Remains the same

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (a) When the temperature of a certain amount of water increases from 0°C to 4°C its volume decreases and density increases. This is called abnormal expansion of water. If water is cooled from its boiling point 100°C, then from 100°C to 4°C the volume of water decrease like other liquids, but from 4°C to °C the volume of liquids increases according to their freezing point whereas the volume of water is minimum at a temperature slightly higher than its freezing point.

48. A styrofoam sheet 5 cm thick and 0.25 m in area has a temperature difference of 40°C between its inner and outer saerfaces. What is the rate of heat flow on the sheet ? (Thermal Conductivity is 0.01 J(smk))

(a) 2.0J/s (b) 1.0J/s
(c) 4.0J/s (d) 3.0J/s

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (a) Thickness of Styrofoam sheet (a) = 5cm
And its area (A) = $0.25m^2$
Temperature $\Delta T = 40^oC$
Thermal conductivity k = 0.01 J/smk
The rate of heat flow through the sheet can be calculated as-

$$\frac{Q}{t} = \frac{kA\Delta T}{a}$$

$$\frac{Q}{t} = \frac{0.01 \times 0.25 \times 40}{0.05}$$

$$\frac{Q}{t} = 2.0 \text{ J/sec}$$

Hence, the rate of heat flow is 2.0 J/sec.

49. When to bodies are in thermal contact, heat will flow between them when their ———— are different.

(a) Specific heath (b) Mass
(c) Temperature (d) Density

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (c) When two bodies comes in thermal contact, heat will flow between then when their temperature are different i.e. heat can not flow from an object of lower temperature to an object of Higher temperature unless an external source is used for energy. This is according to the second law of thermodynamics.

50. The boiling and freezing points of water are exactly——degree apart on the fahrenheit seale.

(a) 90 (b) 270
(c) 180 (d) 360

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Ans : (c) The boiling point of water in Celsius is always 100°C. But in Fahrenheit it is 212 F° and the Freezing point is 32F°. that is, in English units, the boiling point of water (212F°) and the freezing point (32F°) will be exactly 180° apart.

51. Specific heat capacity of lead is 125 $Jkg^{-1}K^{-1}$. If the temperature of a block of 250 g of lead rises by 10ºC on absorbing 5 kJ of heat, then find its heat capacity.

(a) 250 $Jkg^{-1}K^{-1}$ (b) 325 $Jkg^{-1}K^{-1}$
(c) 500 JK^{-1} (d) 200 JK^{-1}

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (c) : Given,
Absorbed heat (Q) = 5 KJ

$$Q = 5 \times 1000 \text{ J.} \quad [\because 1 \text{ KJ} = 1000\text{J}].$$

$$Q = 5000 \text{ J}$$

Specific heat capacity (c) = 125 $J\,kg^{-1}, K^{-1}$
mass (m) = 250 gm = 0.25 kg
Rise in temperature (ΔT) = 10^0C
The amount of heat required to raises the temperature of a substance by 1°C. Such quantity of heat is called its heat capacity.

$$\boxed{\text{Heat capacity} = \frac{\text{Amount heat absorbed}}{\text{Raise in temperature}}}$$

$$= \frac{5000}{10} = 500 \text{ JK}^{-1}$$

$$\therefore \quad \boxed{\text{Heat capacity} = 500 \text{ J K}^{-1}}$$

52. If 2.5 *l* of hot water at 85ºC is mixed with 4.5 1 of cold water then the temperature of the cold water rises by 15ºC when equilibrium is reached. Find the initial temperature (in ºC) of the water assuming no heat is lost.

(a) 48 (b) 43
(c) 15 (d) 25

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (b) : mass of Hot water (m) = 2.5 litre
Temperature (T_1) = 85^0C
mass of cold water (m_2) = 4.5 litre
change in temperature of cold water ($T_1 - T_2$) = 15^0C
Final temperature = T^0C
The specific heat capacity is 'C'

Formula $\boxed{Q = mC\Delta T}$

$m_1c_1 (T_1–T) = m_2c_2 (T_1–T_2)$

$\boxed{C_1 = C_2 = C}$

$2.5 (85 – T) = 4.5 (T_1 – T_2)$
$2.5 (85 – T) = 4.5 \times 15$
$212.5 – 2.5T = 67.5$
$2.5 T = 145$

$\boxed{T = 58^0C}$

Hence final temperature of cold water (T) = 58^0C
Change in temperature (T_2) = 15^0C
Thus, the initial temperature of cold water is
= $58^0C – 15^0C$
= 43°C

53. By how many degrees Celsius should an 800 g calorimeter made of aluminium be heated so that it absorbs 43.2 kJ of heat? Specific heat capacity of aluminium is 0.9 $Jkg^{-1}K^{-1}$.

(a) 120 (b) 60
(c) 67.5 (d) 42.5

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (b) : ΔQ = 43.2 KJ
m = 800 gm = 0.8 kg
C = 0.9 $Jkg^{-1}K^{-1}$
ΔT = ?
From ΔQ = m.c. ΔT ,

$$\Delta T = \frac{\Delta Q}{m.c.}$$

$$\Delta T = \frac{43.2}{0.8 \times 0.9}$$

$$\Delta T = \frac{43.2}{0.72} = 60°C$$

54. Watt/steradian is the unit of _____.

(a) electric conductance (b) permittivity
(c) radiant intensity (d) permeability

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (c) : Radiant intensity- The radiant energy that is emitted by a source per unit time per unit solid angle.
Watt/ steradian is the unit of 'radiant intensity.
Electrical conductivity:- Ability of materials to conduct electric current. The measurement is called ' Electrical conductivity' it is denoted by 'σ'.
Permeability :- permeability in the content of electromagnetism is the ability of magnetic lines of force to pass through a medium is called the magnetic permeability of the medium. It is denoted by 'μ'. The SI units of permeability is Henry/meter.
Permittivity:- Electrical permittivity is the content of electricity. It is the property of a substance which helps in general applying an electric field in that substance. But it tells the measure of 'resistance' displayed by that material.

55. Woolen clothes keep the body warm in winter because–

(a) Wool is a bad conductor of heat
(b) Wool is a good conductor of heat
(c) Wool increases body temperature
(d) Wool decreases body temperature

RRB SSE Bilaspur (green) , 21.12.2014

Ans. (a) : Woolen clothes protect the body in winter and keeps warm due to the following reasons.
(i) wool is a bad conductor of heat. Hence the heat is of body does not escape.
(ii) the pores of wool do not allow air to enter. These holes acts as a barrier for air.

56. Which has higher temperature between boiling water or and water vapor?

(a) Boiling of water
(b) Vapour of water
(c) None of these
(d) Depends on heat supply

RRB Asst. Loco Pilot (Patna)-2001

Ans. (c) : Temperature of boiling water and water vapor the temperature is constant (100°C) and heat is given to boiling water is spent in its state change (water to vapour) this heat does not change the temperature. That's why it is called latent heat.

57. Black buffaloes remain lying in ponds in summer the reason for this is -

(a) It is their habit
(b) They feel hot
(c) Their color absorb more heat
(d) They feel more thirsty

Ans. (c) : Since black color absorbs more heat and reflects less. Hence buffaloes feel very hot and they like to sit in the pond.

58. Explain how thin blankets causes less cold than a single thick blanket because -

(a) Thickness increase
(b) Air comes between them
(c) The body gets double the heat
(d) None of these

Ans. (b) : Two thin woolen blankets are warmer than a thick wollen blanket because there is an extra layer of air trapped between thin blankets which act as an insulator and does not allow the body heat to flow out.

59. A bucket of Luke warm water will melt more ice than a cup of boiling water because

(a) The volume of bucket is more
(b) There is more water in the bucket
(c) There is more heat in water in the bucket
(d) The temperature of the water in the bucket is flowing

RRB Asst. Loco Pilot (Mumbai/Bhopal)-2003

Ans. (c) : One bucket of luke warm water will melt more ice than a cup of boiling water because there is more heat in it.

60. It is not cold on the mountains at the time of snowfall but more after. It has a reason.

(a) Ice keeps cooling the air
(b) The temperature of ice starts falling later
(c) cools the surrounding object to melt ice
(d) Jakes heat from the atmosphere to melt ice

RRB Bhopal (Technical), 21.11.1999

Ans. (d) : It is not cold on the mountains at the time of snow fall but it is more cold later because the snow absorbs heat from the atmosphere to melt, due to which the temperature of the atmosphere decreases slightly and we feel cold.

61. The value of mechanical equivalent of heat is.

(a) 4.2×10^7 ergs/cal (b) 4.2 ergs/ cal
(c) 4.2×10^7 Joule/cal (d) 4.2×10^7 joule/kcal

Ans. (a) According to Joule law- work is directly proportional to heat.
$W \propto H$
$W = JH$
Where J is Joules constant.
Which is called mechanical equivalent of heat.
Hence J = 4.2 Joule/calori
or $J = 4.2 \times 10^7$ erg/calori

62. The value of specific heat depends on:-

(a) On the nature of matter
(b) On the amount of external work done due to expansion of the substance due to increase in temperature
(c) Both (a) and (b)
(d) Neither (a) and (b)

Ans. (a) : Specific heat is characteristic property of a substance which depends on the nature of the substance.

63. Which will have the highest specific heat?

(a) Water (b) Copper
(c) Mercury (d) None of these

Ans. (a) : The specific heat of metals is less than that of liquid and the specific heat of liquid is more than of gasses.
Specific heat of water = 1 Calori/ gram°C
Specific heat of mercury = 0.3 calori / gram°C
Specific head of Copper = 0.1 Calori/gram°C

64. The unit of linear expansion coefficient is-

(a) ^0C (b) $m–^0C^{-1}$

(c) $^0C^{-1}$ (d) $m–^0C$

RRB Bhopal (Secunderabad) 2001

Ans:(c)

Linear expansion coefficient $(\alpha)=\left(\frac{\Delta L}{L\times\Delta T}\right)$

Unit of $\alpha=\left(\frac{\text{increase in length}}{\text{per unit length}\times\text{temperature}}\right)$

Unit of $\alpha = {}^0C^{-1}$

65. There is different of 25°C is the temperature of two object, this difference will be on the Fahrenheit scale

(a) 26^0F (b) 45^0F

(c) 52^0F (d) 54^0F

RRB Asst. Loco Pilot (Ranchi)-2005

Ans. (b) : $\frac{\Delta C}{5}=\frac{\Delta F}{9}$

$\therefore \quad \Delta F=\left(\frac{\Delta C}{5}\right)\times 9=\frac{25}{5}\times 9=45^0F$

66. Absolute zero temperature is-

(a) 0^0F (b) $–212^0F$

(c) $–459.40^0F$ (d) None of these

RRB Asst. Loco Pilot (Ranchi)-2005

Ans. (c) : $\frac{K-273}{5}=\frac{F-32}{9}$,

For absolute zero temperature is - $(K=0)$

$$\frac{0-273}{5}=\frac{F-32}{9}$$

$$F=\frac{2297}{5}=-459.4^0F$$

67. The maximum temperature at which human life cannot be possible is

(a) Less than 110°C

(b) Less than 110°K

(c) Less than 110°F

(d) At 110°F

RRB Asst. Loco Pilot (Patna)-2007

Ans. (c) : The normal body temperature of a healthy human being is 98°F (37°C). If human body temperature exceeds 110°F, human life is not possible.

68. The lowest mark in the thermometer is marked at 95°F. This mean-

(a) Can not measure temperature below this

(b) Man can not live below this temperature

(c) To make the calorimeter smaller

(d) Mercury can not fall below this mark

RRB Asst. Loco Pilot (Muzaffarpur)-2009

Ans. (b) : The lowest mark in the thermometer is marked at 95°F i.e. below this temperature man can not live.

69. Specific heat capacity of copper is 0.1 cal/gm. Its value in J/kg^{0}C is :

(a) 0.84×10^3 J/kg^{0}C (b) 0.42×10^3 J/kg^{0}C

(c) 0.24×10^3 J/kg^{0}C (d) 4.2×10^3 J/kg^{0}C

RRB Asst. Loco Pilot (Patna)-2001

Ans.: (b) Specific heat of copper = 0.10 calori/ gram

Specific heat of copper = (Joule/kg – °C)

$= 0.10 \times 4.2\times10^3$

= Joule/kg – °C

$= 0.42 \times 10^3$ Joule/kg –°C

70. Heat is supplied to 50 grams of a solid at the rate of 5 calori/second and the temperature rises by 11°C per minute. The specific of solid substance is calori/ gram°C.

(a) 0.545 (b) 0.90

(c) 0.45 (d) None of these

RRB Kolkata Supervisor (P.Way), 20.02.2000

Ans. (a) :

According to Question $Q = H.t = ms\Delta T$

$\Rightarrow \quad 5 \times (60 \times 1) = 50\times s\times 11$

$300 = 550 \times s$

$s=\frac{300}{550}$

$s = 0.545$ Calori/gram^{0}C

71. The mass of a metal is 500 grams and its specific heat is 0.5 calori/g°C. Its capacity is.

(a) 250 Calori/°C (b) 2500 Calori/°C

(c) 0.25 Calori/°C (d) 25 Calori/°C

RRB Bangalore (Tech.), 22.08.1999

Ans. (a) :

Heat capacity of metal C = mass×specific heat.

$C = 500 \times 0.5$

$C = 250$ Calori/^{0}C

72. The mass of the copper calorimeter is 50 grams and the specific heat of copper is 0.1 calori/gram°C the water equivalent of the calorimeter will be

(a) 5 Calori (b) 5 gram/°C

(c) 50 Calori (d) 50 gram

RRB Kolkata (Tech.), 29.08.1999

Ans. (b) : The water equivalent = m × 5

$= 50\times0.1 = 5$ gram/^{0}C

73. The heat capacities of two objects made of the same metal are in the ratio 3:4. the ratio of their masse will be

(a) 3 : 4 (b) 3 : 7

(c) 4 : 3 (d) 4 : 7

RRB Kolkata Supervisor (P. Way), 20.02.2000

Ans. (a) : Heat capacity, $C = ms$

Then $\frac{C_1}{C_2}=\frac{m_1s_1}{m_2s_2}$

For material made of same metal $s_1 = s_2$

$\boxed{\frac{3}{4}=\frac{m_1}{m_2}}$