FORMULA BANK THERMODYNAMICS

1. Relation between different scales of temperature

$$\frac{T_C - 0}{100} = \frac{T_F - 32}{180} = \frac{T_R - 0}{80} = \frac{T_K - 273{\cdot}15}{100}$$

2. $T_C = \frac{5}{9}(T_F - 32)$

3. $T_F = \frac{9}{5}T_C + 32$

4. – 40°C has same value on Celcius and Fahrenheit scales.

5. Triple point of water on absolute scale of temperature is 273·16 *k*.

6. Faulty Thermometer.

$$\frac{\text{False reading} - \text{lower point}}{\text{range}} = \frac{\text{True reading} - \text{lower point}}{\text{range}}$$

7. Co-efficient of linear expansion

$$\alpha = \frac{\Delta l}{l\Delta T}$$

$$l' = l(1 + \alpha\Delta T)$$

8. Coefficient of superficial expansion

$$\beta = \frac{\Delta S}{S\Delta T}$$

$S' = S(1 + \beta\Delta T)$.

9. Coefficient of cubic expansion

$$\gamma = \frac{\Delta V}{V\Delta T}$$

$V' = V(1 + \gamma\Delta T)$.

10. Relation between α, β and γ

$6\alpha = 3\beta = 2\gamma$

or $\alpha = \frac{\beta}{2} = \frac{\gamma}{3}$

11. Heat supplied to a solid of mass *m* for increasing temperature ΔT is $Q = mC\Delta T$.

12. Heat supplied to change its state at constant temperature $Q = mL$

13. Gases possess infinite values of specific heat but we consider only two specific heats C_P and C_v.

14. Mayer's formula $C_P - C_v = R$.

15. For monoatomic gas, $f = 3$

$$C_v = \frac{3}{2}R \text{ and } C_P = \frac{5}{2}R \text{ and } \gamma = \frac{5}{3} = 1{\cdot}67$$

16. For diatomic gas $f = 5$ at room temperature

$$C_v = \frac{5}{2}R \text{ and } C_P = \frac{7}{2}R \text{ and } \gamma = \frac{7}{5} = 1{\cdot}4$$

17. For triatomic gas $f = 6$

$$Cv = 3R, C_P = 4R \text{ and } \gamma = \frac{4}{3} = 1{\cdot}33$$

18. Joules mechanical equivalent of heat

$$J = \frac{W}{Q} = 4{\cdot}186 \text{ J cal}^{-1}.$$

19. Rise in temperature of body when it falls throu height *h*

$$\Delta T = \frac{gh}{CJ}.$$

20. The height from which a block of ice be dropped that it melts completely on reaching ground.

$$h = \frac{JL}{g}$$

21. The velocity with whcih a ball of ice be thro against a wall so that it melts completely,

$$v = \sqrt{2JL}$$

22. Equation of isothermal process

$PV = \text{Const.}$

23. Equation of adiabatic process

(*i*) $PV^{\gamma} = \text{Const.}$

(*ii*) $TP^{\gamma - 1} = \text{Const.}$

(*iii*) $\frac{T^{\gamma}}{P^{\gamma - 1}} = \text{Const.}$

24. Work done during isothermal process

$$W = 2{\cdot}303\, RT \log_{10}\frac{V_2}{V_1}$$

$$W = 2{\cdot}303\, RT \log_{10}\frac{P_2}{P_1}$$

25. Work done during adiabatic process

$$W = \frac{R}{\gamma - 1}(T_1 - T_2)$$

$$W = \frac{R}{\gamma - 1}(P_1V_1 - P_2V_2)$$

$W = C_v(T_1 - T_2)$

26. Slope of adiabatic graph is γ-times more than sl of isothermal process.

27. First law of thermodynamics

$$dQ = dU + dW$$

28. Efficiency of heat engine

$$\eta = 1 - \frac{Q_2}{Q_1}$$

$$\eta = 1 - \frac{T_2}{T_1}$$

29. Efficiency of heat engine can never be 100%.

30. Coefficient of performance of refrigerator.

$$\beta = \frac{T_2}{T_1 - T_2} = \frac{Q_2}{Q_1 - Q_2}.$$

31. There are two dead centres per cycle for a st engine.