Co-efficent of performance → : It is dimession-less quantities and has no unit.

COP (cofficient of performance) = $\frac{\text{Useful heat transfer (output)}}{\text{work input (W)}}$

The COP is difined as the ratio of the useful heat transfered to the work input required.

The cofficient of performance (cop) is a measure of the efficienty of a refrigerator, air condition or, heat pump. Unlike the thermal efficiency of a heat engine (which is always less than 1), the cop is typically grater than 1.

COP for a Refrigerator / Air condition →

For refrigerator/Air conditioner, the objective is to extract heat (Q_2 or. Q_c) from a cold reservoir (eg. the food compartment) and reject it to a hot reservoir (eg, the surrounding room or outside air) The useful output is the heat removed from the cold space.

→ formula for it

$$COP_{colling} (K_R) = \frac{Q_2}{W}$$

Where Q_L is the heat removed from the cold reservoir, and W is the work input.

→ For a reversible (carnot) refrigerator, the heat ratio rat)
can be replaced by absolute temperature (T_1 for hot, T_2 for cold)

$$\boxed{K_{R\,carnot} = \frac{T_2}{T_1 - T_2}}$$

COP (co-efficient of performance) for a heat pump →:
For a heat pump, the object is ~~not~~ to supply heat (Q_1 or Q_h) to a warm resarviar (eg, a room for heating) by enacting it from a calder one (eg. the out side air or ground) The useful output is the heat delivered to the hot space.
formula is,

$$COP_{heating} (K_H) = \frac{Q_1}{W}$$

Where Q_1 is the heat delivered to the hot reservoir, and W is the work input.

→ For a reversible (carnot) heat pump —

$$\boxed{KH_{carnot} = \frac{T_1}{T_1 - T_2}}$$

⇒ Relationship between cooling and heating COP →

→ A System can ~~often~~ often be run in reverse (as a refrigerator or a heat pump). The Two COPs are related

$$\boxed{COP_{heating} = COP_{cooling} + 1}$$