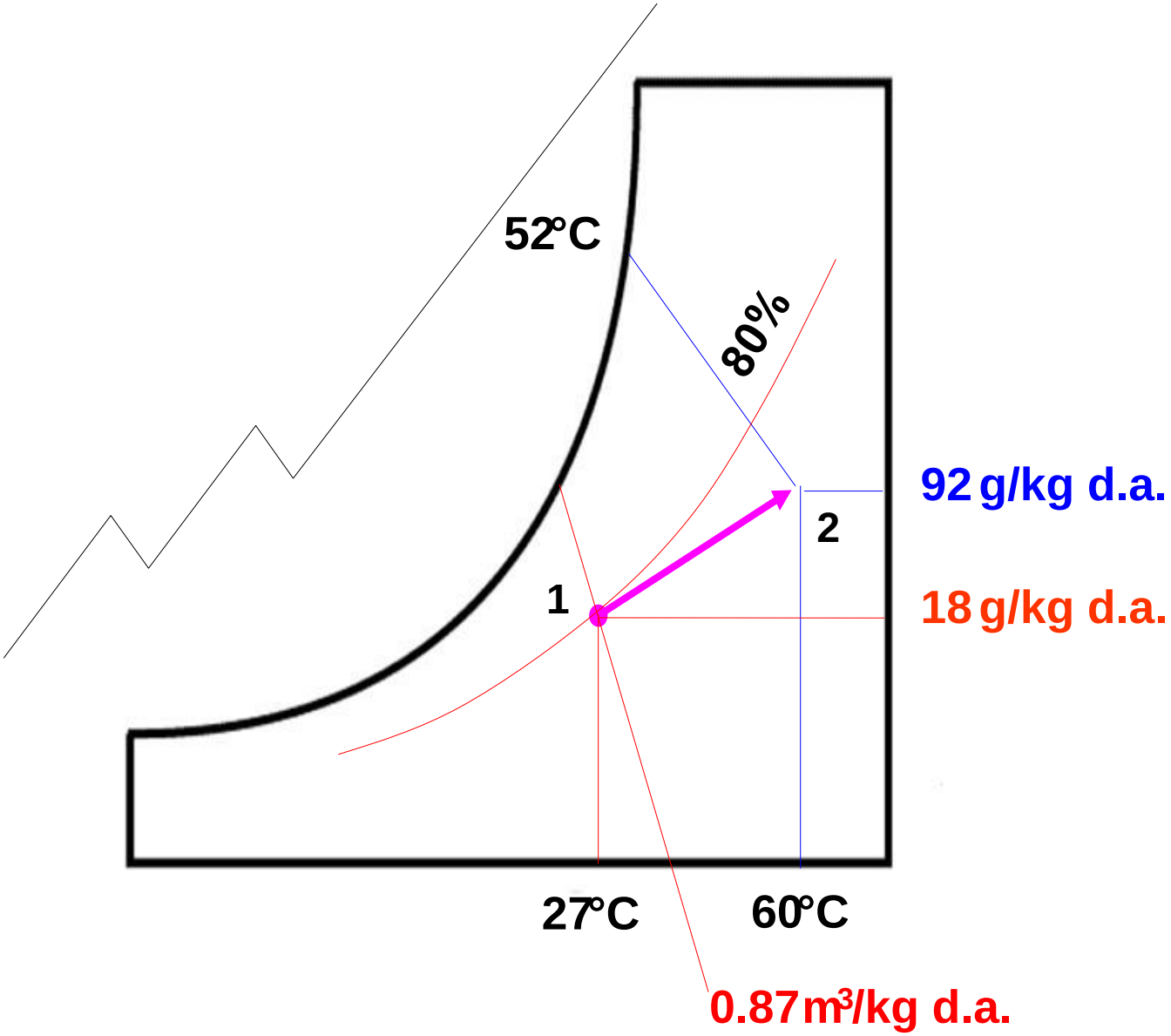
Heating and humidifying: Example

Q.No.1 Two and a half cubic meters of lumber is being dried at 60°C dry bulb temperature and 52°C wet bulb temperature. The drying rate of the lumber is 12.5 kg of water per hour. If outside air is at 27°C dry bulb temperature and 80% relative humidity, how much outside air is needed per minute to carry away the evaporated moisture?



ΔHR = (92.0 – 18.0) g/kg dry air = 74.0 g/kg dry air

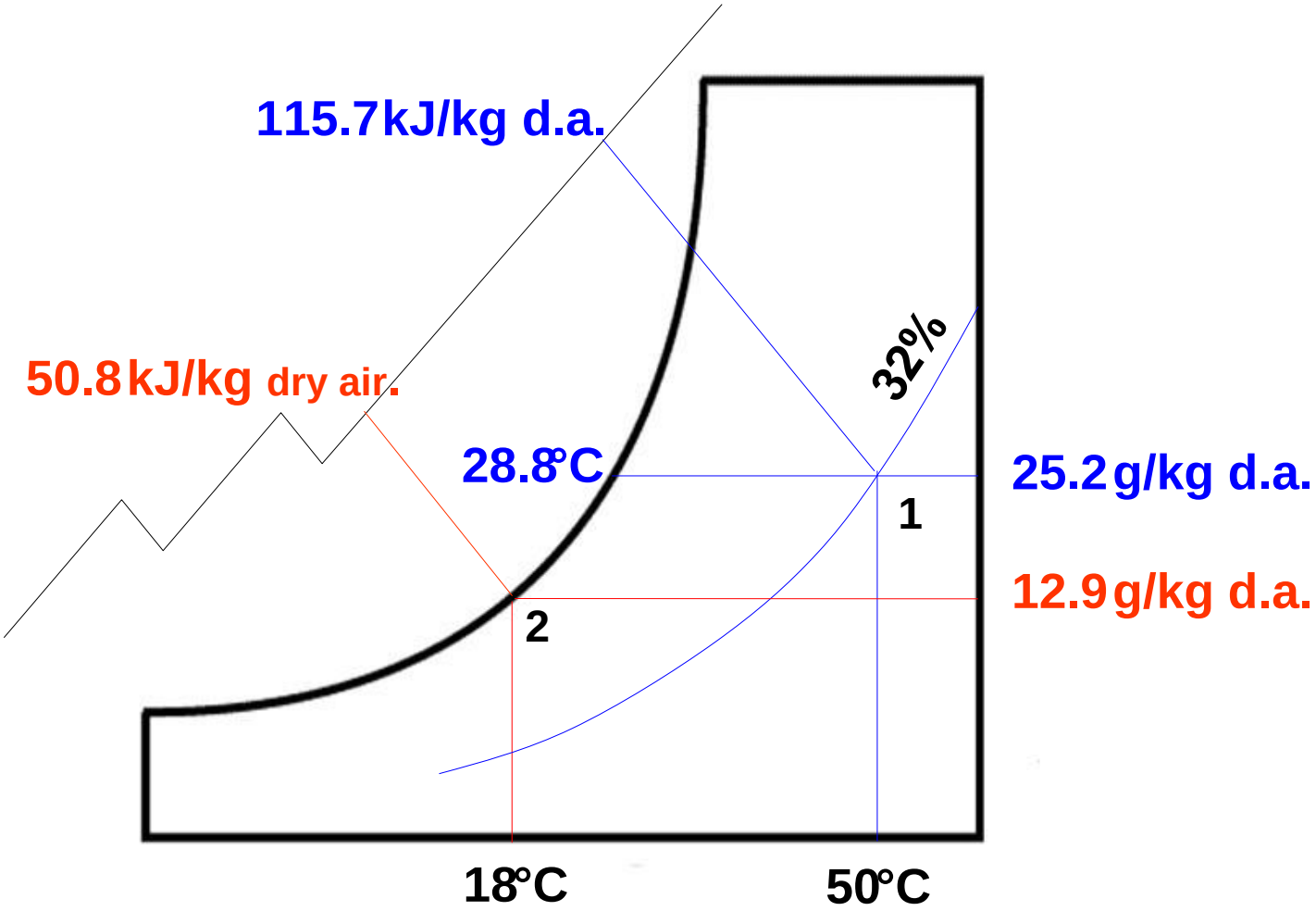
Mass flow rate = drying rate/ΔHR = (12.5 kg/hour)/(0.074 kg/kg dry air) = 168.9 kg dry air/hour

Rate of flow =(mass flow rate)(v1) =(168.9 kg dry air/hour)(0.87 m^3/kg dry air) = 147 m^3/hour

= 2.45 m^3/minute

Cooling and dehumidifying: Example

Q.No.2 Moist air at 50°C dry bulb temperature and 32% relative humidity enters the cooling coil of a dehumidification kiln heat pump system and is cooled to a temperature of 18°C. If the drying rate of 6 m^3 of red oak lumber is 4 kg/hour, determine the kW of refrigeration required.



Δ HR = (25.2 –12.9) g water/kg dry air = 12.3 g water/kg dry air

Mass flow rate w_a = drying rate/Δ HR = 4 / 0.0123 = 325 kg of dry air / hour

Δh = = (115.7 –50.8) kJ/kg dry air = 64.9 kJ/kg dry air

Power of refrigeration = q = (Δh) w_a = 64.9 x 325.2 = 21105.7 k J/hr = 5.9 kW