



LPR Cup

10.s01.e05



Psycho...
– Hedgehog in the fog

The fog

In the air conditioner, the radiator cools the air to 5°C , while in the radiator moist air and condensate are formed, which is removed from the room through the drainage system. Cool air is blown out of the air conditioner by a fan. Air enters the room and isobarically gradually mixed with the air of the room, moving deeper into the room. At some humidity, fog forms in the room during the mixing of cool and warm air, and then it dissipates.

1. (*7 pts*) Find at what humidity φ_0 in the room with a temperature of 30°C fog will form. Building a model, neglect the thermal conductivity of air, consider air and steam as the ideal gas with the same molar heat capacity.
2. (*3 pts*) Estimate graphically the maximum fog density (mg/m^3) at humidity $(1 + \varphi_0)/2$.

Consider that in this process, the air from the air conditioner cools that part of the air with which it has interacted and then this new part with the new temperature interacts with another portion of the warm air and so long.

The change in air temperature in the room due to the fact that the air conditioner *continues* working can be neglected. In other words, the process of mixing of the air is quite fast compared to cooling the air in the whole room.

All tabular values associated with the temperature dependence of saturated vapor pressure are considered to be known.

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First hint — 25.05.2020 14:00 (Moscow time)

Second hint — 27.05.2020 14:00 (Moscow time)

Final of the fifth round — 29.05.2020 22:00 (Moscow time)