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Abstract: We use the first and second laws of thermodynamics to analyze the behavior of an ideal jet engine. Simple analytical expressions for the thermal efficiency, the overall efficiency, and the reduced thrust are derived. We show that the thermal efficiency depends only on the compression ratio r and on the velocity of the aircraft. The other two performance measures depend also on the ratio of the temperature at the turbine to the inlet temperature in the engine, T-3/T-i. An analysis of these expressions shows that it is not possible to choose an optimal set of values of r and T-3/T-i that maximize both the overall efficiency and thrust. We study how irreversibilities in the compressor and the turbine decrease the overall efficiency of jet engines and show that this effect is more pronounced for smaller T-3/T-i. (C) 2010 American Association of Physics Teachers. [DOI: 10.1119/1.3373924]

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