

Meteorology 3510
Example Problems: Adiabatic Parcel

1. A parcel has properties T , p , and RH. Calculate e , e_s , w , and T_d .

Solution: Use the definitions of these quantities given in the *Notes on Thermodynamics*. The procedure is described in problems 5 and 6 in *Example Problems: Thermodynamic Processes*.

2. A parcel rises adiabatically from p_1 to p_2 . Calculate RH, e , e_s , w , w_s , T , T_d , and θ at p_2 .

Solution:

- (a) Because the process is adiabatic,

$$\theta(p_2) = \theta(p_1) \text{ and } w(p_2) = w(p_1).$$

- (b) Obtain $T(p_2)$ using

$$T(p_2) = \theta \left(\frac{p_2}{p_0} \right)^{R/c_p}.$$

- (c) Because we know w and p , we can use the definition of w to obtain e :

$$w \approx \epsilon \frac{e}{p}.$$

- (d) Calculate $e_s(T)$ from the formula given in the *Notes*. Check your value against that from the graphs on the next page.

- (e) Calculate $w_s(T, p)$ from the formula given in the *Notes*.

- (f) RH: $r = e/e_s = w/w_s$.

- (g) Calculate T_d from the formula given in the *Notes*.

