

**ESCI 241 – Meteorology**  
**Answers to Selected Exercises for Lesson 2**

1. The specific heat of water at constant pressure is  $1 \text{ cal g}^{-1} \text{ }^{\circ}\text{C}^{-1}$ .

a. What is the heat capacity at constant pressure of 2 kg of water?

**Answer:**  $2000 \text{ cal }^{\circ}\text{C}^{-1}$

b. How much energy must be added to 2 kg of water to increase the temperature by  $3^{\circ}\text{C}$ ?

**Answer:** 6000 cal

2. How much heat is released by the condensation of 3 kg of water vapor? (The latent heat of vaporization is  $600 \text{ cal kg}^{-1}$ .)

**Answer:** 1800 cal

3. A 3 kg block of aluminum has a heat capacity (constant pressure) of  $2691 \text{ J K}^{-1}$ . A 0.5 kg block of beryllium has a heat capacity (constant pressure) of  $912 \text{ J K}^{-1}$ . Which one has a higher specific heat at constant pressure?

**Answer:** beryllium

4. A 1.5-kg parcel of dry air is at a temperature of  $15^{\circ}\text{C}$  and a pressure of 1013 mb.

a. How many moles of air are in the parcel? (The molecular weight of air is  $28.96 \text{ g/mol}$ )

**Answer:** 51.8 mol

b. What is the volume of the parcel?

**Answer:**  $1.22 \text{ m}^3$

c. If 50 KJ of heat are added to the parcel while its volume is held constant, what is the new temperature of the parcel? (The specific heat of air at constant volume is  $717 \text{ J kg}^{-1} \text{ K}^{-1}$ ).

**Answer:**

$$\Delta T = Q/C_v = 50,000\text{J}/1076 \text{ J K}^{-1} = 46.5\text{K}$$

so the new temperature is  $61.5^{\circ}\text{C}$

- d. If 50 KJ of heat are added to the parcel while its pressure is held constant, what is the new temperature of the parcel? (The specific heat of air at constant pressure is  $1005 \text{ J}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$ ).

**Answer:**

$$\Delta T = Q/C_p = 50,000 \text{ J} / 1508 \text{ J} \cdot \text{K}^{-1} = 33 \text{ K}$$

so the new temperature is  $48^\circ\text{C}$