

Physics 102 Rec
Quiz # 3
Chapter 19

Date: 17 March 2002

Name:

Id:

Sect:

1. What mass of steam initially at 130 °C is needed to warm 200 g of water in a 100-g glass container from 20 °C to 50 °C. (For water: $c = 4186 \text{ J/kg}^\circ\text{C}$; $L_f = 333 \times 10^3 \text{ J/kg}$; $L_v = 2260 \times 10^3 \text{ J/kg}$; For glass: $c = 837 \text{ J/kg}^\circ\text{C}$)

$$Q_{\text{steam}} + Q_{\text{glass}} + Q_{\text{water}} = 0$$

$$\begin{aligned} Q_{\text{steam}} &= m c \Delta T - m L_v + m c \Delta T \\ &= m [4186 \times (100 - 130) - 2260 \times 10^3 + 4186 \times (50 - 100)] \\ &= -2594880 m \quad \text{Joules} \end{aligned}$$

$$Q_{\text{glass}} = m c \Delta T = 0.1 \times 837 \times (50 - 20) = 2511 \text{ Joules}$$

$$Q_{\text{water}} = m c \Delta T = 4186 \times 0.2 \times (30) = 25116 \text{ Joules}$$

$$\Rightarrow 27627 - 2594880 m = 0 \Rightarrow m = 0.0106 \text{ Kg}$$
$$\Rightarrow \boxed{m = 10.6 \text{ g}}$$

2. An ideal gas undergo an isobaric expansion at 2.5 kPa. If the volume increases from 1 m³ to 3 m³ and 12 kJ of heat is transferred to the gas, find the change in internal energy of the gas.

$$\Delta E_{\text{int}} = Q - W$$

$$Q = 12 \times 10^3 \text{ J}$$

$$W = P \Delta V = 2.5 \times 10^3 (3 - 1) = 5 \times 10^3 \text{ J}$$

$$\Delta E_{\text{int}} = 12 \times 10^3 - 5 \times 10^3 = \boxed{7 \times 10^3 \text{ J}}$$