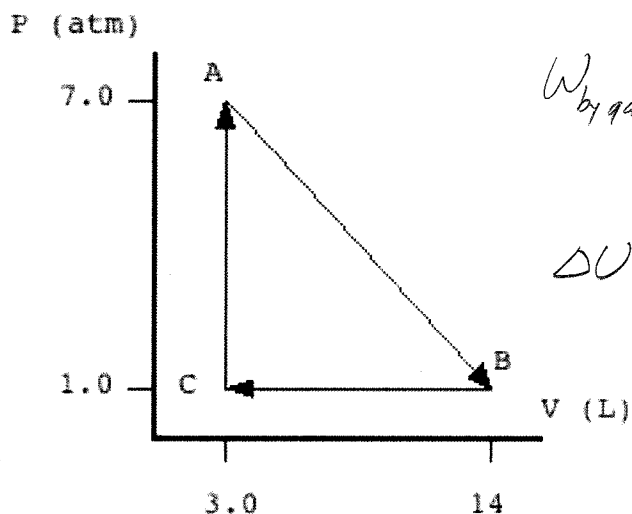


Physics 10154 - Exam #11A

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. The PV diagram below represents three different states for a gas. The internal energy of the gas in state A is 1200 J. The internal energy of the gas in state B is 2400 J.

- a) How much heat is added to the gas as it changes from A \rightarrow B?
 b) How much heat is added to the gas from B \rightarrow C \rightarrow A?



$$W_{\text{by gas}}(A \rightarrow B) = (4 \times 10^5)(11 \times 10^{-3})$$

$$= 4400 \text{ J}$$

$$\Delta U = 2400 - 1200$$

$$1200 = -4400 + Q$$

$$Q = 5600 \text{ J}$$

$$W_{\text{by gas}}(B \rightarrow C) = (1 \times 10^5)(-11 \times 10^{-3}) = -1100 \text{ J}$$

$$W_{\text{by gas}}(C \rightarrow A) = 0$$

$$\text{Cycle: } \Delta U_{\text{TOT}} = 0 = -W_{\text{by gas}} + Q$$

$$= -3300 + Q$$

$$Q_{\text{TOT}} = 3300 = Q_{AB} + Q_{BCA}$$

$$Q_{BCA} = 2300 \text{ J}$$

2. A 12 gram bullet is moving with an initial speed of 320 m/s. It is fired into a 1.20 kg block attached to a spring with a spring constant of 1400 N/m. The bullet is embedded in the block after the collision.

a) The bullet/block system compresses the spring by a maximum amount of ... how much?

b) How much mechanical energy is lost in the collision?

$$\text{Collision: } m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$(.012)(320) + 0 = (1.212) v_f$$

$$v_f = 3.17 \text{ m/s}$$

= v_0 for compressing spring

$$W_{\text{spr}} = \Delta K$$

$$-\frac{1}{2} k x^2 = -\frac{1}{2} m v_0^2$$

$$x^2 = \frac{m v_0^2}{k} = \frac{(1.212)(3.17)^2}{1400}$$

$$x = .093 \text{ m}$$

$$b) \frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2 = 614.4 \text{ J}$$

$$\frac{1}{2} (m_1 + m_2) v_f^2 = 6.1 \text{ J}$$

$$\Delta K = 610 \text{ J}$$