Exam II — Fall 2008

**Short Answers:**
1. Both are right, if the 1st person uses the top of the table as a reference height and the other uses the ground.
2. Initially, momentum equals zero. If air shoots out in one direction, it has some momentum; the rest of the balloon must have an equal and opposite momentum so the total momentum is conserved. This is exactly how a rocket works; yes, it would also happen in the vacuum of space.
3. $1.94 \times 10^4$ m/s
4. Normal and $\cos 30$ component of gravity do no work since perpendicular to displacement. Friction is opposite to direction of motion, so work is negative. $\sin 30$ component of gravity is parallel to motion, so does positive work. Since it doesn’t stop, friction is smaller than gravity so gravity does the most work.

**Problem 1:**
(a) $T_{HST} = 5784$ s, $T_{ISS} = 5479$ s  
(b) The ISS is 250 km lower than the HST.  
(c) The ISS is 140 m/s faster than the HST.

**Problem 2:**
(a) $+795$ J  
(b) 37.1 m/s  
(c) Would not change.

**Problem 3:**
(a) $m_s \vec{v}_{s,i} = 3300 \text{kg} \cdot \text{m/s}$

(b) $\vec{v}_{s,i} = 43.3$ m/s due East, $\vec{v}_{s,f} = 30.0$ m/s 60.9° North of East

(c) Inelastic (134 kJ vs 75 kJ)

**Problem 4:**
(a) 12.5 m/s  
(b) 1.6 m