

## Homework Problem Set 8 – Due THURSDay, 11/10

### **Problem 66, p. 179**

### **Problem 96, p. 180**

(Be as quantitative as possible!)

### **Problem 3**

Could Earth's orbit around the sun stay the same if Earth's mass were only 1/10 of its true value, but everything else being equal?

### **Problem 4 3 pts**

Where does the energy fueling a supernova explosion come from? (In a supernova, a big fraction of a dying star collapses to a very small volume, either a neutron star or a black hole). Be precise: What kind of initial energy gets converted into the energy of the explosion? Explain why that energy becomes more negative (i.e., decreases) during the collapse, and how overall conservation of energy leads to the production of heat.

### **Problem 5**

Whenever a planet reaches its closest distance from the sun on its orbit, it is moving with higher speed than at the point where it has its maximum distance. Which conservation laws we have studied so far explains this observation? Extra credit if you can find TWO DIFFERENT conservation laws that both explain it. (But you have to give details!)

### **Problem 6**

You are on an airplane going at constant velocity and height and are supposed to drop a pallet with supplies to the ground. If we can ignore air resistance, what does the shape of the trajectory of that pallet look like

- a) to someone on the ground, standing off to the side
- b) to you?
- c) How would your answer to b) change if air resistance can **not** be ignored?

### **Problem 7**

Revisiting Problem 6, but this time quantitatively (again, ignore air resistance):

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Assume you observe the pallet hitting the ground exactly 4 s after you let it go. Also, your airplane is going at 120 m/s (horizontal direction).

- a) At what altitude is the airplane flying?
- b) How far horizontally from the point where you released it does the pallet hit the ground, relative to an observer on the ground? I.e., assuming you release the pallet right above the head of the observer, how far will she have to walk to retrieve it?