Here are solutions for the problems assigned on Weekly Handouts #6, #7, #8, #10 and #11. (Note that there was no “week #9” homework, as that was Spring Break week.)

**Homework for Week #6**

1. Chapter 7, *Thought Question* #12 (all 5 parts): Which of the following transformations is (are) fusion and which is (are) fission? (See Appendix 13 for a list of the elements.)

   *Solution:* Since fusion is the building up of heavier atomic nuclei from lighter ones, and fission is the breakup of heavy atomic nuclei into two or more light ones, we just have to determine whether the ‘before’ nucleus is lighter (i.e., has fewer protons, as indicated by its atomic number) than the ‘after’ nucleus. If the ‘before’ nucleus is lighter than the ‘after’ nucleus, then the transformation represents fusion; otherwise, it’s fission. OK, here we go:

   (a) helium to carbon: Since He has 2 protons and C has 6, this transformation represents fusion.
   (b) carbon to iron: Since C has 6 protons and Fe has 26, this transformation represents fusion.
   (c) uranium to lead: Since U has 96 protons and Pb has 82, this transformation represents fission.
   (d) boron to carbon: Since B has 5 protons and C has 6, this transformation represents fusion.
   (e) oxygen to neon: Since O has 8 protons and Ne has 10, this transformation represents fusion.

**Homework for Week #7**

Please answer the following question in the form of a short essay. Take the approach in your response that you are *explaining* this to another student who has not had the benefit of Astronomy 301 (or 101!).

1. Explain in your own words and with as much detail as possible the role that Einstein’s famous equation $E = mc^2$ plays in our present understanding of how the Sun generates the energy by which it shines.

   *Solution:* Please see the sample student response(s) on reserve at the book reserve desk at the library (should be available by Tuesday, April 4).

**Homework for Week #8**

Please answer the following question in the form of a (typed) essay. Take the approach in your response that you are *explaining* this to another student who has not had the benefit of Astronomy 301.

1. Explain in your own words and with as much detail as possible why a massive star (initial main-sequence mass $\gtrsim 8 M_\odot$) will end its life by experiencing the gravitational collapse of its iron core. Feel free to use diagrams to help illustrate your point(s), if you wish.

   *Solution:* Please see the sample student response(s) on reserve at the book reserve desk at the library (should be available by Tuesday, April 4).

**Homework for Week #10**

1. During Spring Break a friend stumbles over to you on the beach and says: “I know you’re taking this cool class on gravitation, so I thought I’d ask you: I’ve heard that gravity bends light. Is this true?” How do you respond to your friend? Write your response in the form of a (typed) essay, *without* the aid of diagrams (you were on the beach, after all!).

   *Solution:* Please see the sample student response(s) on reserve at the book reserve desk at the library (should be available by Tuesday, April 4).
Two contrasting views on beauty, art, and science were presented in class on Tuesday: The first from a poem by Walt Whitman, and the second from interview with the physicist Richard Feynman. Here they are again:

When I Heard the Learned Astronomer  
by Walt Whitman

When I heard the learned astronomer  
When the proofs, the figures, were ranged in columns before me,  
When I was shown the charts and diagrams, to add, divide, and measure them,  
When I sitting heard the astronomer where he lectured with much applause in the lecture-room,  
How soon unaccountable I became tired and sick,  
Till rising and gliding out I wandered off by myself,  
In the mystical moist night-air, and from time to time,  
Looked up in perfect silence at the stars.

Excerpt from an Interview with Richard Feynman

I have a friend who’s an artist, and he sometimes takes a view which I don’t agree with very well. He’ll hold up a flower and say, “Look how beautiful it is,” and I’ll agree. But then he’ll say, “I, as an artist, can see how beautiful a flower is. But you, a scientist, take it apart and it becomes a dull thing.” I think he’s kind of nutty.

First of all, the beauty that he sees is available to other people - and to me, too, I believe. Although I might not be quite as refined aesthetically as he is, I can appreciate the beauty of a flower. But at the same time, I see much more in the flower than he sees. I can imagine the cells inside, which also have a beauty. There’s beauty not just at the dimension of one centimeter; there’s also beauty at a smaller dimension.

There are the complicated actions of the cells, and other processes. The fact that the colors in the flower have evolved in order to attract insects to pollinate it is interesting; it means insects can see colors. That adds a question: does this aesthetic sense we have also exist in lower forms of life? There are all kinds of interesting questions that come from a knowledge of science, which only adds to the excitement and mystery and awe of a flower. It only adds. I don’t understand how it subtracts.

With this as background, please answer the following in the form of a typed essay:

1. Of the two viewpoints presented, which one do you find yourself most closely philosophically aligned with? Do you believe that knowledge of science takes away from the artistic appreciation of beauty?

   Solution: Please see the sample student response(s) on reserve at the book reserve desk at the library (should be available by Tuesday, April 4).