Astronomy 110

HOMEWORK #13

Use a calculator whenever necessary.

For full credit, always show your work and explain how you got your answer.
Be careful about units!

Please CIRCLE or put a box around your final answer if it is numerical.

If you wish, you may discuss the questions with friends, but please turn in your own hand-written solutions, with questions answered in your own way.

1) Speed, Velocity and Acceleration

a) If Mike drives 25 miles to school every morning and it takes 35 minutes, what is his average speed?

b) What is Mike’s average velocity?

c) If Mike accelerates from 20 m.p.h. to 60 m.p.h. in 8 seconds, what is the average acceleration during this 8 second interval?

d) If Mike drives the 25 miles from school back home in 40 minutes, what is his average velocity?

e) How is it possible for Mike to be accelerating while his speed remains constant?

2) Forced and Natural motion

a) According to Aristotle, what is an example of natural motion?

b) According to Aristotle, what is an example of forced motion?

c) What is Galileo’s term for natural motion? Give an example of it.
d) According to Galileo, what is a good example of forced motion?

e) For the following statements, write a G for Galileo if you attribute it to him or an A for Aristotle if you attribute it to him.

1) An object in free-fall exhibits natural motion.

2) An object in free-fall exhibits forced motion.

3) An object in horizontal flight exhibits natural motion.

4) An object in horizontal flight exhibits forced motion.

3) Describe how Galileo’s telescopic observations of Venus going through phases lends support to a heliocentric cosmos.

4) Newton’s Laws

a) State how Newton’s 1st law of motion proves there is a force acting on the moon.

b) Use Newton’s 2nd law to explain why when one throws a basketball and a baseball as hard as they can the baseball goes farther.

c) Use Newton’s 3rd law to explain what happens when one runs into a wall.

d) An airplane slows itself down by reversing its jets after touching down on the landing strip. Could a plane slow itself down if it were flying in outer space? Why?
5) Universal Law of Gravitation

   a) How would the gravitational force between the earth and moon compare to the current
      force if the moon was suddenly moved 6 times as far away as it is now?

   b) How would the gravitational force between the earth and moon compare to the current
      force if the moon’s mass was suddenly increased 6 times?

   c) Jupiter is 320 times as massive as the earth and about 5 A.U.’s from the Sun. How
      much greater is Jupiter’s gravitational force toward the sun than the Earth’s?

6) Using the concepts of inertia, centripetal force and gravity, explain why the Moon orbits
   the Earth.

7) State and explain the proofs for why the Earth rotates.
8) State and explain the proofs for why the Earth revolves.

9) Seasons
   a) With the help of a diagram, explain why the Earth has seasons.

   b) The earth’s axis is tilted with respect to what?

   c) Should the earth’s tilt cause the height of the two high tides in a given 24 hour period to be different?