PHYS-1800 **Homework 4** **Due: Fri 12 Feb, 2010**

Name:_____ **(show all workings, use g = 9.8 m/s^2)**

1. To explain the retrograde motion of the planets Ptolemy introduced the concept of _____. (1 point)

2. Suppose one's hand exerts a force of 12 N upwards on a book weighing 10 N. The reaction to the force of the hand on the book is a force: (1 point)

   A. 12 N exerted by the earth on the book
   B. 10 N exerted by the book on the earth
   C. 12 N exerted by the book on the hand
   D. 10 N exerted by the book on the hand.

3. If a person sits on a bathroom scale while riding on a Ferris wheel, the reading on the scales will be highest while passing through the _____ point (indicate a point in the path). (1 point)

4. According to Newton's Law of Gravitation, if the distance between two bodies is doubled the attractive force between them is: (1 point)

   A. Increased by a factor of 2.
   B. Decreased by a factor of 1/2.
   C. Increased by a factor of 4.
   D. Decreased by a factor of 1/4.
   E. Unchanged.

5. A car travels around two curves. It travels with a speed V around the first curve which has a radius r. It travels with twice that speed, 2V, around the second curve which has radius of 2r, twice that of the first curve. The centripetal acceleration will be: (1 point)

   A. Zero on both curves
   B. The same on both curves
   C. Greater on the first curve
   D. Greater on the second curve

6. Sketch the geometry of the Sun, Moon and Earth for a solar eclipse. Indicate the phase of the Moon. (2 points)

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7. (a) List in order of increasing orbital radius the four satellites (called the Galilean satellites) of Jupiter that Galileo discovered in the 16th century using a telescope. (2 points)

(b) Comment on the relationship between their orbital velocities:

8. A man weighs 600 N while on the surface of the Earth. If he is transported to the planet Mythos, which has the same mass as the Earth but a radius that is twice as large as Earth's, his weight would be: (2 points)

A. 1200 N B. 600 N C. 300 N D. 150 N E. 100 N

9. Given the orbital period of the Earth is 365.25 days and its average distance from the Sun is 1.5 x 10^8 km determine (a) the average orbital distance of Venus from the Sun, and (b) the orbital velocity of Venus. Use orbital period of Venus = 224.70 days. (4 points)

10. Due to the Earth's rotation the surface value of g changes by about 0.5% as one moves from the pole to the equator. Using appropriate Newton's laws calculate the value of g at the pole and at the equator. Assume Earth is perfectly spherical. Use mass of the Earth = 5.98 x 10^{24} kg, radius of the Earth = 6370 km, and G = 6.67 x 10^{-11} N.m2/kg^2. Compare your results. (5 points)

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Additional (optional) questions worth up to a total of 10 points:

A. Determine (i) the altitude above the Earth's surface and (ii) the necessary orbital injection speed for a geostationary satellite of Mass 200 kg (i.e. for an orbital period of 24 hours). Use mass of the Earth = 5.98 x 10^{24} kg, radius of the Earth = 6370 km, and G = 6.67 x 10^{-11} N.m2/kg^2. (iii) name two important uses of geostationary satellites. (5 points)

B. Using Sun's mass = 1.99 x 10^{30} kg, mass of the Earth = 5.98 x 10^{24} kg, and mass of the Moon = 7.36 x 10^{22} kg, the average distance between the Sun and the Earth = 1.50 x 10^{11} m, and the average distance between the Moon and the Earth = 3.82 x 10^{8} m determine: (i) The average force exerted by the Earth on the Sun

(ii) The average force exerted by the Earth on the Moon.

(iii) The average force exerted by the Sun on the Moon (assuming the distance from the Sun to the Moon is same as distance of the Earth to the Sun).

(iv) The ratio of the forces exerted by the Earth on the Moon and the Sun on the Moon

(iv) What can you conclude about the impact of the Sun on the orbit of the Moon about the Earth? (5 points)