PHYS 2325 - Dr. Honan - Test 4 - A Name _____

Possibly Useful Information: $g = 9.80\text{m/s}^2$ $G = 6.67\times10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2$
For water: $c = 4186\ \frac{\text{J}}{\text{kg}\cdot\text{K}}$, $c_{\text{ice}} = 2100\ \frac{\text{J}}{\text{kg}\cdot\text{K}}$, $L_{\text{f}} = 3.34\times10^{5}\ \frac{\text{J}}{\text{kg}}$, $L_{\text{v}} = 2.26\times10^{6}\ \frac{\text{J}}{\text{kg}}$

Problem 1 Short answer (2 points each)

Which of the following could be used to find the mass of Jupiter? Answer yes or no.

_____ (i) The speed and period of Europa, one of Jupiter's moons.

_____ (ii) The radius and speed of Jupiter's orbit about the sun.

Problem 2 (8 points each)

(a) A simple pendulum has a period of 8s on earth. What is the period of this pendulum on a planet with 5 times the earth's mass and twice its radius?

(b) A particle moves in simple harmonic motion with a frequency of 0.60 Hz and an amplitude of 10 cm. What are the speed and acceleration of the particle when it is at a point 6 cm from the equilibrium position?

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Problem 3

(a) A 200 kg spherical mass is at the origin, an 800 kg spherical mass is at (3m,0) and a 500 kg mass is at (0,2m). What is the magnitude of the net force on the 200 kg mass? (7 points)

(b) If the 800 kg and 500 kg masses in part (a) are fixed in place then what is the smallest speed that the 200 kg mass must be given to escape the gravitational pull of the other two masses? (7 points)

(c) Neptune has a mass that is 17.2 times that of the earth and orbits the sun every 165 years. What is its distance from the sun in AU, where 1 AU is the earth-sun distance?

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Problem 4

(a) When 15-kg of some unknown at 180°C is added to 4-kg of water at 20°C the resulting temperature is 60°C. What is the specific heat of the unknown?
(8 points)

(b) A uniform disk with a 2m radius swings without friction about a nail through a hole 30cm from the rim. What is the period of small oscillations? (8 points)

Problem 5 A piece of space debris of mass m has a speed of v_0 at a height of h above a spherical planet of mass M and radius R. What is its speed when it crashes into the planet? You may not assume that h is small compared to R. Ignore air resistance. (10 points)