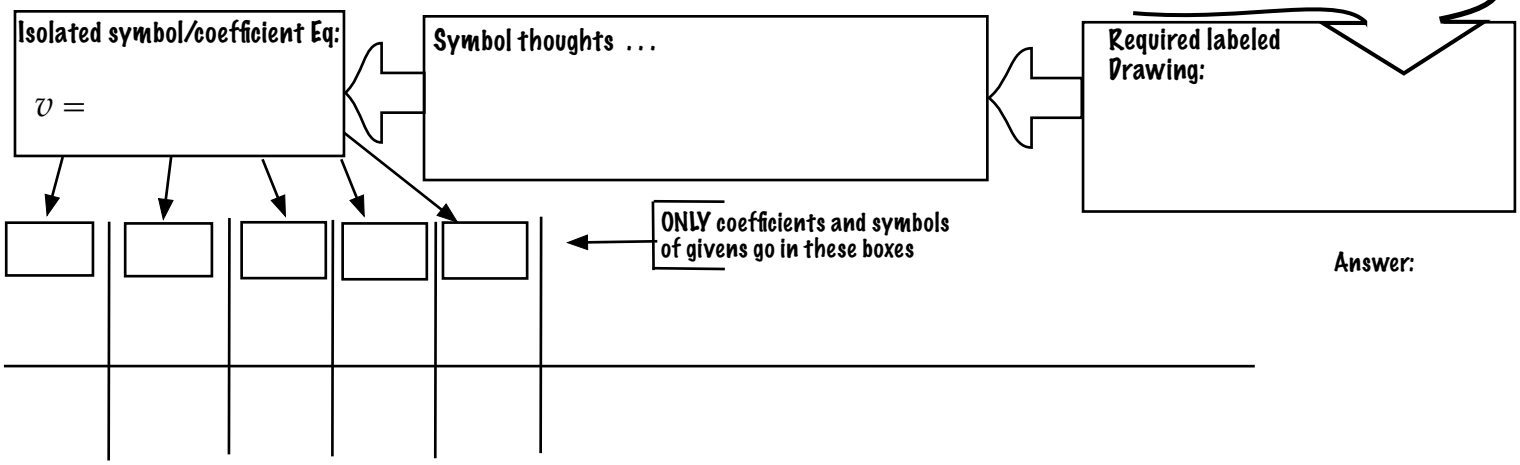
Physics name _____ hr ____

GSUA PART 4 -- FINAL CHAPTER?? Stamp Dates -- Front: _____ Back: _____ sheet # ____

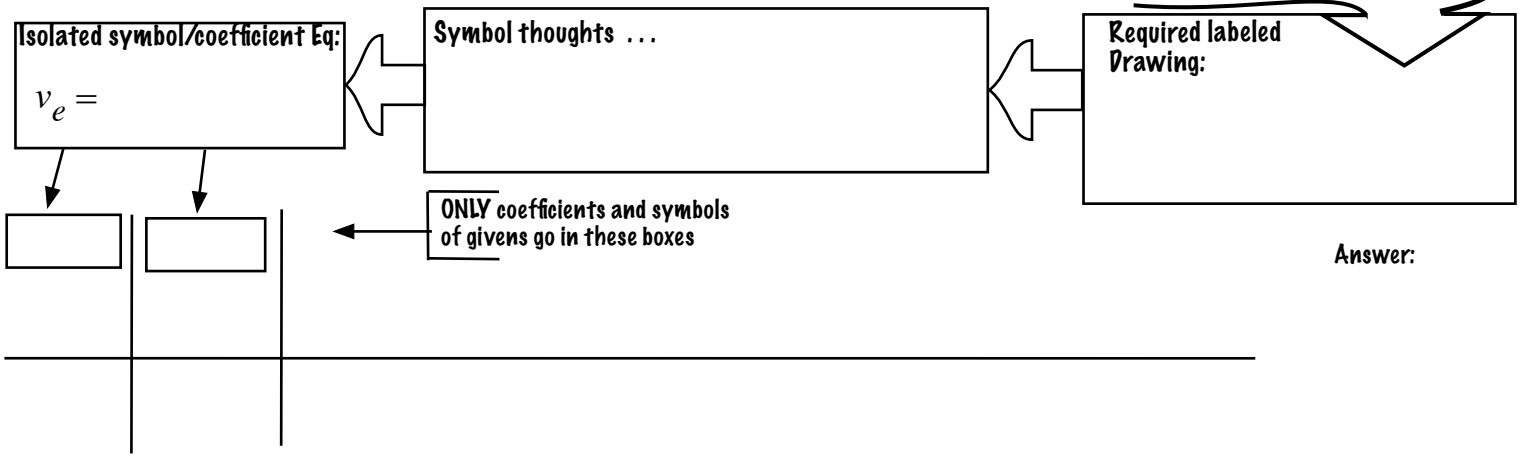
CONS: 0.305m = 1ft; 5280ft = 1mi; 12 in. = 1ft; 3ft = 1yd; 1knot = 1.15mph; 1N = kg·m/s^2; 1 Joule= N·m

1.) Here is the equation for air drag (R_a) at high velocities through a thin medium: $R_a(v) = \frac{1}{2} D\rho A v^2$

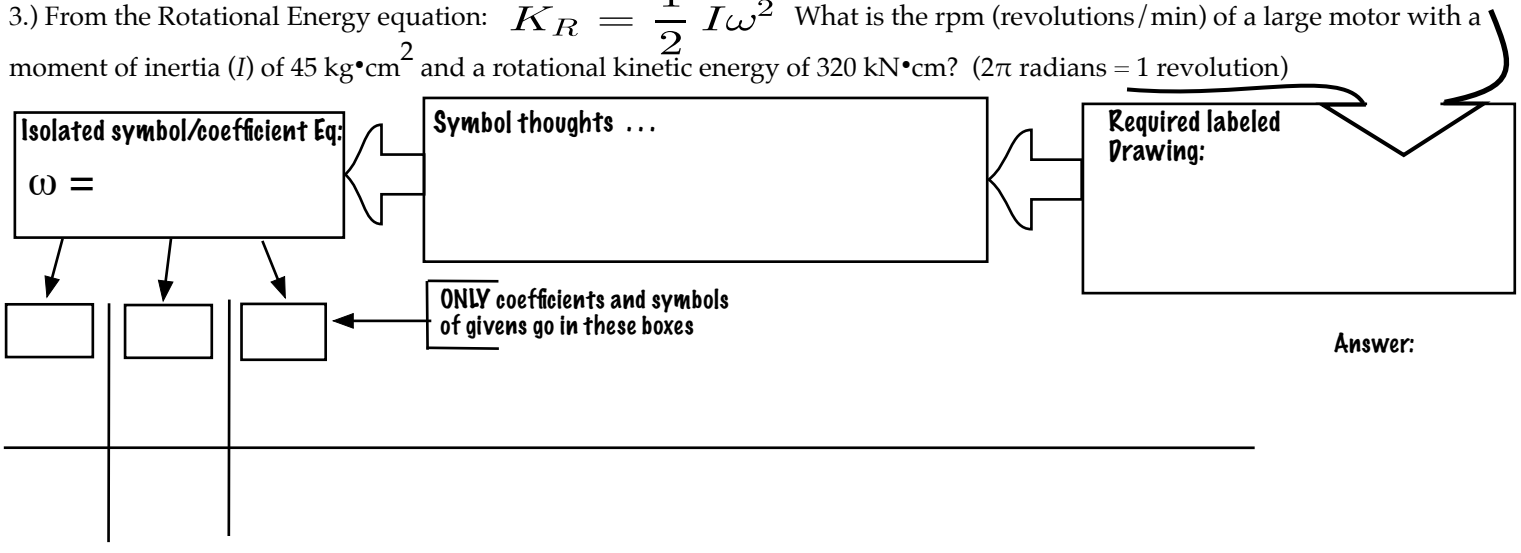
Where D is the Drag Coefficient, rho (ρ) is the density of the medium (usually air), A is the profile area of the object in the direction of motion and v is the velocity of the object. Here's the question: How many knots is an airplane moving if the drag coefficient is 0.20, the density of air is 0.0012 g/cc, the profile area is 520 square inches, and the force of air drag is 750N.



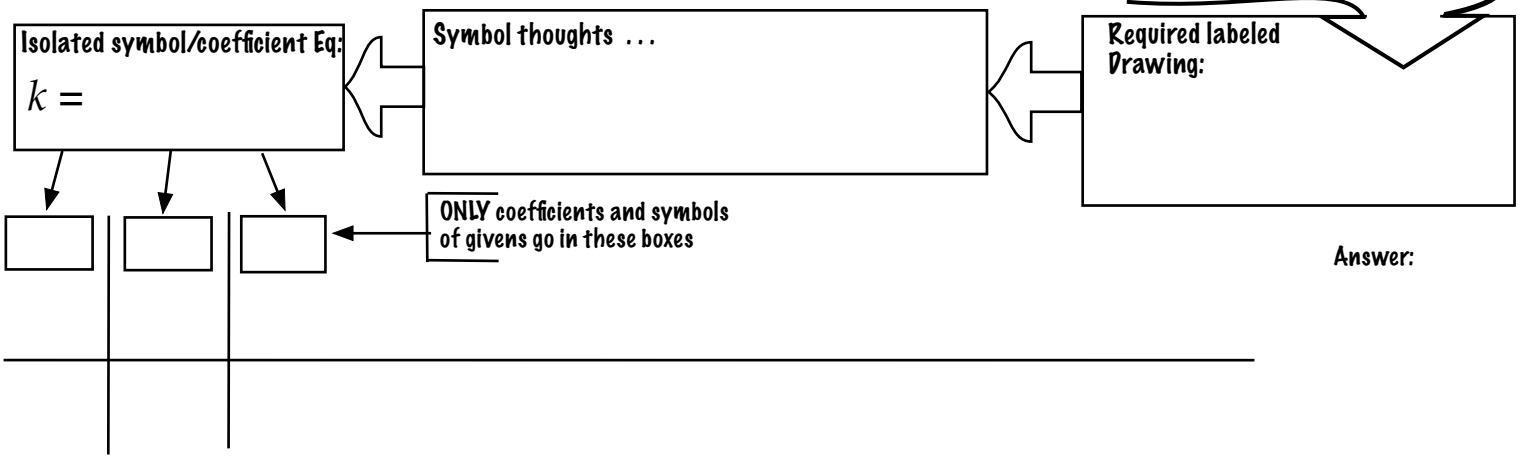
2.) A rocket has a thrust force of 120 MN. The rate of gas mass loss of the rocket is 500mg/ns, Use the Thrust Equation for Rockets ($\mathbf{F_T = \dot{m}\, v_e}$) to determine the mph of this escaping gas from the exhaust of the rocket.



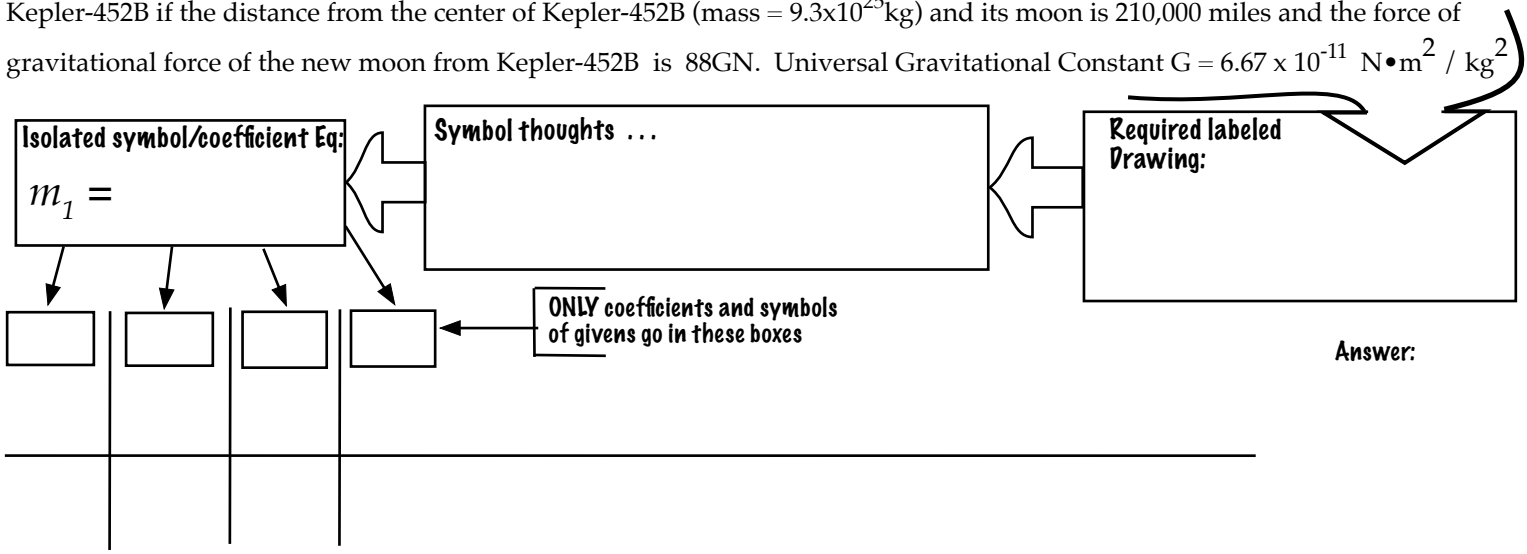
3.) From the Rotational Energy equation: $K_R = \frac{1}{2} I\omega^2$ What is the rpm (revolutions/min) of a large motor with a moment of inertia (*I*) of 45 kg•cm^2 and a rotational kinetic energy of 320 kN•cm? (2π radians = 1 revolution)



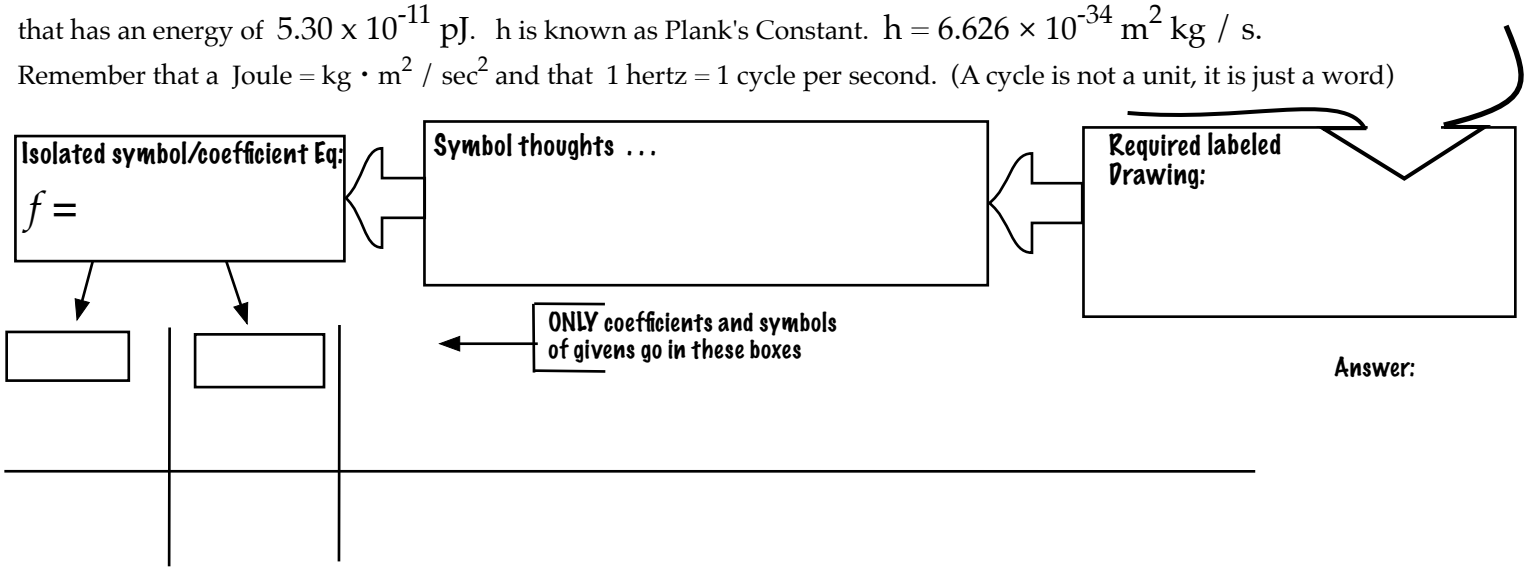
4.) From Elastic Potential Energy: $U_s = \frac{1}{2} kx^2$ A spring with an elastic potential energy of 2500kJ is compressed 18mm from it's equilibrium position. What is the spring constant (k) in terms of MN/cm?



5.) From Universal Gravitation: $F_g = G \frac{m_1 m_2}{d^2}$ What must be the mass in Tg of a newly discovered moon of exoplanet Kepler-452B if the distance from the center of Kepler-452B (mass = 9.3×10^{25}kg) and its moon is 210,000 miles and the force of gravitational force of the new moon from Kepler-452B is 88GN. Universal Gravitational Constant G = 6.67×10^{-11} N•m^2 / kg^2



6.) Using the equation relating frequency to energy (E = hf) determine the frequency in GHz of an electromagnetic wave that has an energy of 5.30×10^{-11} pJ. h is known as Plank's Constant. h = 6.626×10^{-34} m^2 kg / s.
Remember that a Joule = kg • m^2 / sec^2 and that 1 hertz = 1 cycle per second. (A cycle is not a unit, it is just a word)



answers: 1.) 265 knots 2.) 537 mph 3.) 683,000 rpm 4.) 154 MN/cm 5.) 1622 Tg 6.) 800. GHz