PHYSICS 113 (KALDON)
WMU - APRIL 1912
FINAL EXAM (SAMPLE) - 200,000 POINTS

NAME _____

☐ YOU MUST GO THROUGH "CHECK-OUT" WITH DR. PHIL

SECTION: 10A A TO C | 10B D TO F | 10C G TO K | 10D L TO N | 10E O TO R | 10F S TO Z

STATE ANY ASSUMPTIONS YOU NEED TO MAKE – SHOW ALL WORK – CIRCLE ANY FINAL ANSWERS
USE YOUR TIME WISELY – WORK ON WHAT YOU CAN – BE SURE TO WRITE DOWN EQUATIONS
MOST PARTS ARE NOT NEARLY AS HARD AS YOU THINK – FEEL FREE TO ASK ANY QUESTIONS

TITANIC – DENSITY AND WATER (50,000 POINTS) --- FINAL EXTRA VERSION ---

$\rho_{\text{sea water}} = 1030 \text{ kg/m}^3$

1.) If the mass of *Titanic* was 60,000,000 kg (that would correspond to a displacement of about 66,000 tons), then find (a) the weight of the ship…

… and (b) the mass of the water displaced by the ship.

(c) *RMS Titanic* was about 800 feet long (245 meters) and according to the numbers painted on the bow of the ship, she was drafting about 37 feet (11.3 meters) – that means that 11.3 meters of the ship was below the water. Assume that the part of the ship under the water is a rectangular box with these dimensions – what is the width of this box – and hence the width of the ship?

The wreck of the *Titanic* lies 3821 meters below the surface of the Atlantic Ocean – about two and a half miles. The Мир Один (Mir One) submersible that visited the wreck keeps the air pressure inside the sub at 101,300 Pa (the same as at the surface) for the people inside. Find (d) the gauge pressure of the water down there and …

… (e) the speed that water would pour into the submersible if one of the nine inch thick glass windows were to develop a crack.

TITANIC – KINEMATICS, ENERGY AND MOTION (50,000 POINTS)

knot – A unit of speed, one nautical mile per hour, approximately 1.85 kilometers (1.15 statute miles) per hour

2.) *RMS Titanic* was going at approximately 23 knots (42,55 km/hour = 11.82 m/s) when it hit the iceberg. (a) How long would it take for the length of the ship to pass a stationary iceberg – if it kept at a constant speed?

(b) What is the kinetic energy of the *Titanic* at 23 knots (42,55 km/hour = 11.82 m/s)?

The next two parts may require more than one step, so don't assume it's just one plug-in! If it took four minutes to bring the *Titanic* to a complete stop, find (c) the force being applied to the ship to slow it down and …

… (d) the power required to bring the ship to a complete stop.

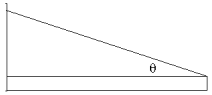
(e) The *Titanic* was steaming due west 23 knots (42,55 km/hour = 11.82 m/s) – that's to the left. The iceberg is 30.0 seconds ahead. To miss the iceberg, it has to add an additional velocity component to the south, such that it will move 60.0 m in the 30.0 seconds. Find the total vector velocity, $\vec{v}$, in standard form.

TITANIC – BALLISTICS AND STATICS (50,000 POINTS)

3.) White phosphorus flare rockets are fired straight up into the air, as *Titanic* slowly sinks. They reach their maximum height in 6.00 seconds. Assuming that they almost instantly reach their maximum velocity, v_0, then their entire flight would be a *ballistic* problem that we can solve with the kinematic equations (or other equations developed in this course). Find the initial *vector* velocity, $\vec{v}_o$, of the rocket, giving in standard form (a) the magnitude and (b) the direction of the vector. *Don't tell me that the initial velocity is zero – we are assuming that the rocket has finished firing and the rocket is now moving at its maximum speed at time zero.*

(c) How high does the rocket travel? *Note: this can be solved with or without the answer to part (a).*

A rod 5.00 m long and mass 25.0 kg is held to the wall without moving by a force F_1, where the rod is attached to the wall and by a cable, where $\theta = 17°$. Set up *but do not solve* the equations from the relevant (d) Free Body and (e) Free Rotation Diagram.



TITANIC – HEAT & PHYSICAL ATTRACTION (50,000 POINTS)

4.) (a) If the reservoir temperatures of the engines corresponds to 373 K and 773 K, then identify and calculate one of the three efficiencies we studied.

(b) Ignoring drag forces, if the Second Law Efficiency is 86% (0.86), how much energy is wasted to bring the ship up to speed from rest? *You need the answer to (2b) to find the Work needed.*

(c) Rose DeWitt DuBukater (m = 58 kg) and Jack Dawson (m = 64 kg) are one foot apart (r = 0.305 meters). So find the force of the gravitational attraction between them. $G = 6.67 \times 10^{-11}\ N{\cdot}m^2/kg^2$.

(e) If the *Titanic* was 245.000 meters long at 68°F (20°C, 293 K), then what was the length of the ship at time of its sinking, assuming that the temperature was the freezing point of water?

$\alpha_{iron} = 12 \times 10^{-6}\ °C^{-1}$

THIS WAS AN ACTUAL FINAL EXAM FOR PHYS-107 WITH 4 PARTS FROM A PHYS-205 TITANIC EXAM. WHITE SPACE HAS BEEN COMPRESSED TO 4 PAGES.