April 29 - Professional Learning Day (Friday)

May 5 - NBTA Meetings (Thursday)

May 6 - NBTA Council Day (Friday)

May 23 - Victoria Day (Monday)

May 27 - Professional Learning Day (Friday)

Physics 112

Friday, April 22/16

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*Library Books

Explain That Stuff - April 22/16

1. Return Midterms

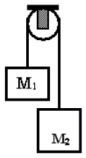
2. Check -> Worksheet: Text: Page 163, PP #1-3
   Text - Page 168 #4-7

3. Atwood's Machine Problems - Example #1 (see next page)
   Example #2 - HW

4. Textbook: Page 485, #19-21 (C10)

5. Worksheet: C4 and C5 Force Problems

Atwood's Machine

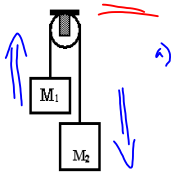


Assume the pulley is frictionless and there is no air resistance.

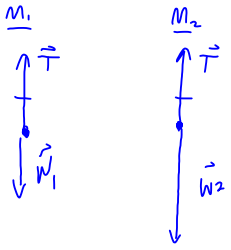
* Bodies are not freely falling.

Examples

1. Two masses are attached to a lightweight cord that passes over a frictionless pulley as shown in the diagram below. The mass of M_1 is 3.0 kg and the mass of M_2 is 4.0 kg.
   a) Draw an FBD for each mass.
   b) What is the magnitude and direction of the acceleration of the smaller mass? 1.4 m/s², up
   c) What is the magnitude of the tension in the cord? 34 N



a)



* $a_1 = a_2 = a$
* $T_1 = T_2 = T$

b) acc. of M_1 ($\vec{a}$)

$\vec{F}_{net} = m\vec{a}$

$+T - W_1 = M_1(+a)$

$T - M_1 g = M_1 a$

$T = M_1 g + M_1 a$

$\vec{F}_{net} = m\vec{a}$

$+T - W_2 = M_2(-a)$

$T - M_2 g = -M_2 a$

$T = M_2 g - M_2 a$

$M_1 g + M_1 a = M_2 g - M_2 a$

$M_1 a + M_2 a = M_2 g - M_1 g$

$a(M_1 + M_2) = M_2 g - M_1 g$

$$a = \frac{M_2 g - M_1 g}{M_1 + M_2}$$

$$a = \frac{(4.0)(9.8) - (3.0)(9.8)}{3.0 + 4.0}$$

$a = 1.4\ m/s^2$ ← magnitude

$\vec{a}_1 = 1.4\ m/s^2$, up

The acceleration of M_1 is 1.4 m/s², up

* $\vec{a}_2 = 1.4\ m/s^2$, down

c) $T = M_1 g + M_1 a$

$T = (3.0)(9.8) + (3.0)(1.4)$

$T = 34\ N$

The magnitude of the tension is 34 N.

* Kinematic possibilities.

$M_1 \rightarrow t = ?$

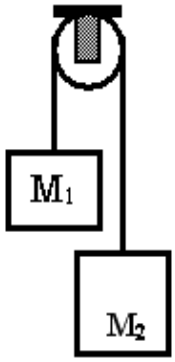
$\vec{v}_f = ?$

$\vec{\ } \ ?$

(Examples)

2. Two masses are attached to a lightweight cord that passes over a frictionless pulley as shown in the diagram below. The mass of M_1 is 5.0 kg and the mass of M_2 is 8.0 kg.

a) Draw an FBD for each mass.
b) What is the magnitude and direction of the acceleration of the larger mass?
c) What is the magnitude of the tension in the cord?



b) 2.3 m/s^2, down

c) 60 N

Science 122

Friday, April 22/16

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Midterm - April 28/16 (Thursday)

1. Questions? Worksheet: Pressure and Depth in a Static Fluid
2. Pascal's Principle
3. Archimedes' Principle - To Be Continued

4. Apparent Weight
5. Worksheet: Archimedes' Principle

Science 122 - Midterm Topics

1. Complex Circuit. * R's given

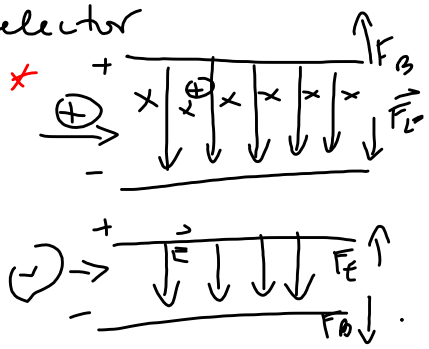
2. Magnetism
   - → Find B (3 cases)
   - → $F = IlB\sin\theta$
   - * → $F = qvB\sin\theta$
   - → * $r = \frac{mv}{qB}$ ← speed

→ velocity selector

$v = \frac{E}{B}$ *

$F_E = E$

$F_B = B$

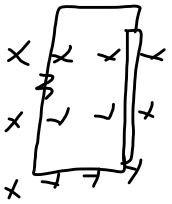


→ $\left[\frac{q}{m} = \frac{2V}{r^2B^2}\right]$ *

→ $V = EMF = BLv$ *

$V = IR$

$F = IlB\sin\theta$



→ Transformers → not on midt.

→ Optics

→ double lens. [Concave II divery. *

→ mirror (spherical). *

concave) converging.

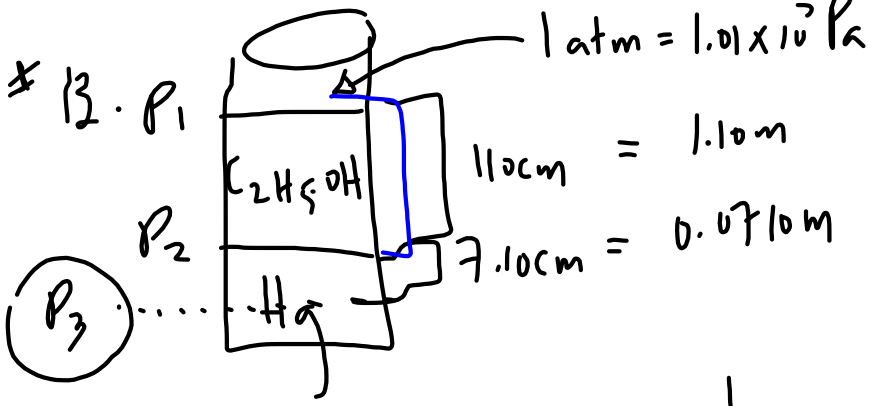
→ Fluid Mechanics

hydrostatics → pressure ① *

→ hydrostatic eq^n.

$P_2 = P_1 + \rho g h$ *

S122 - Worksheet - Pressure + Hydrostatics.



$$P_2 = P_1 + \rho_{C_2H_5OH} g h_{C_2H_5OH}$$

$$P_2 = 1.01 \times 10^5 + (806)(9.80)(1.10)$$

$$P_2 = 1.0969 \times 10^5 \text{ Pa}$$

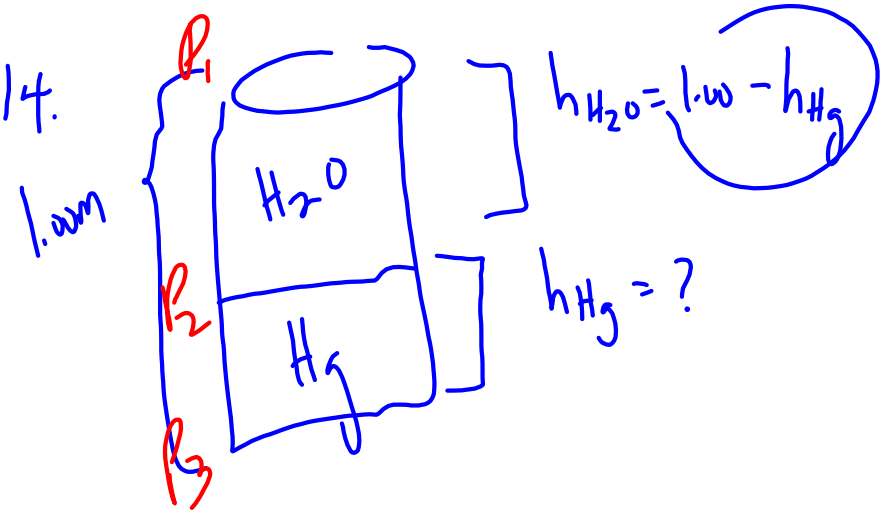
absolute pressure

$$P_3 = P_2 + \rho_{Hg} g h_{Hg}$$

$$P_3 = 1.0969 \times 10^5 + (13600)(9.80)(0.0710)$$

$$P_3 = 1.19 \times 10^5 \text{ Pa}$$

14.



Science 10

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Friday, April 22/16

Assignment: Word Problems - Monday, April 25/16

1. Check -> Worksheet: Position vs Time Graph
2. Worksheet: Position vs Time Graph - HW
3. Velocity vs Time Graphs

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4. Worksheet: Velocity-Time Graphs
5. If Time -> Roller Coasters

Physics 122

Friday, April 22/16

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Explain That Stuff - April 22/16

Midterm - Tuesday - April 26

1. Experiment 10.2 - Torques (Page 67)
   Experiment 9.1 - Conservation of Momentum (Page 55)
   April 28/16

2. Kepler's Three Laws of Planetary Motion - To Be Continued

3. Worksheet: Kepler's Laws

4. Assignment: Experiment 8.1 - Kepler's Laws - Page 49
   - Due - April 28/16

Midterm Prob.

Opt. 1. push/pull or incline plane

2. Static torque

3. 2D collision/explosion

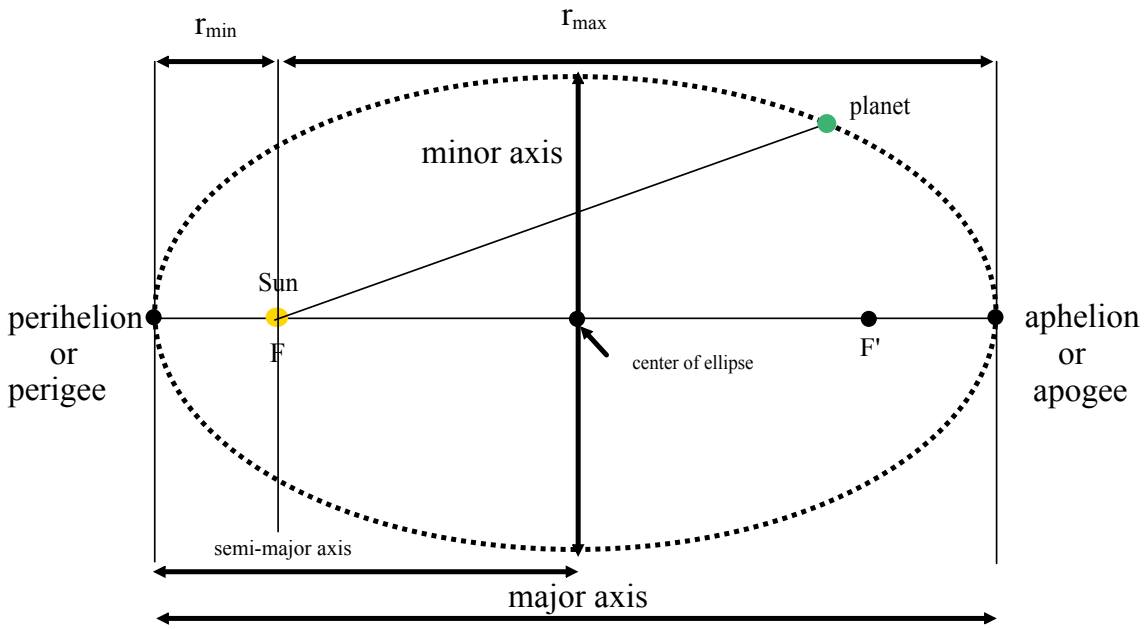
4. projectile → horizontal

5. projectile → angle

6. Circular motion, banked/unbanked

Kepler's Three Laws of Planetary Motion

1. Law of Orbits - The paths of the planets are ellipses with the center of the Sun at one focus.



eccentricity - a quantity indicating how non-circular an ellipse is
- based on a scale from 0 to 1 where a value nearer 1 implies a higher degree of non-circularity

2. Law of Areas - An imaginary line from the sun to a planet sweeps out equal areas in equal time intervals. Therefore, planets move faster when closest to the sun and slowest when farthest away.

3. Law of Periods - The ratio of the square of the periods of any two planets revolving about the sun is equal to the ratio of the cubes of their average distances from the sun.

$$\frac{T_A^2}{T_B^2} = \frac{r_A^3}{r_B^3}$$

$\left(\frac{T_A}{T_B}\right)^2 = \left(\frac{r_A}{r_B}\right)^3$

T_A -> period of object A (s, min, h, etc)
T_B -> period of object B (s, min, h, etc)
r_A -> mean orbital radius (m, km, etc)
r_B -> mean orbital radius (m, km, etc)

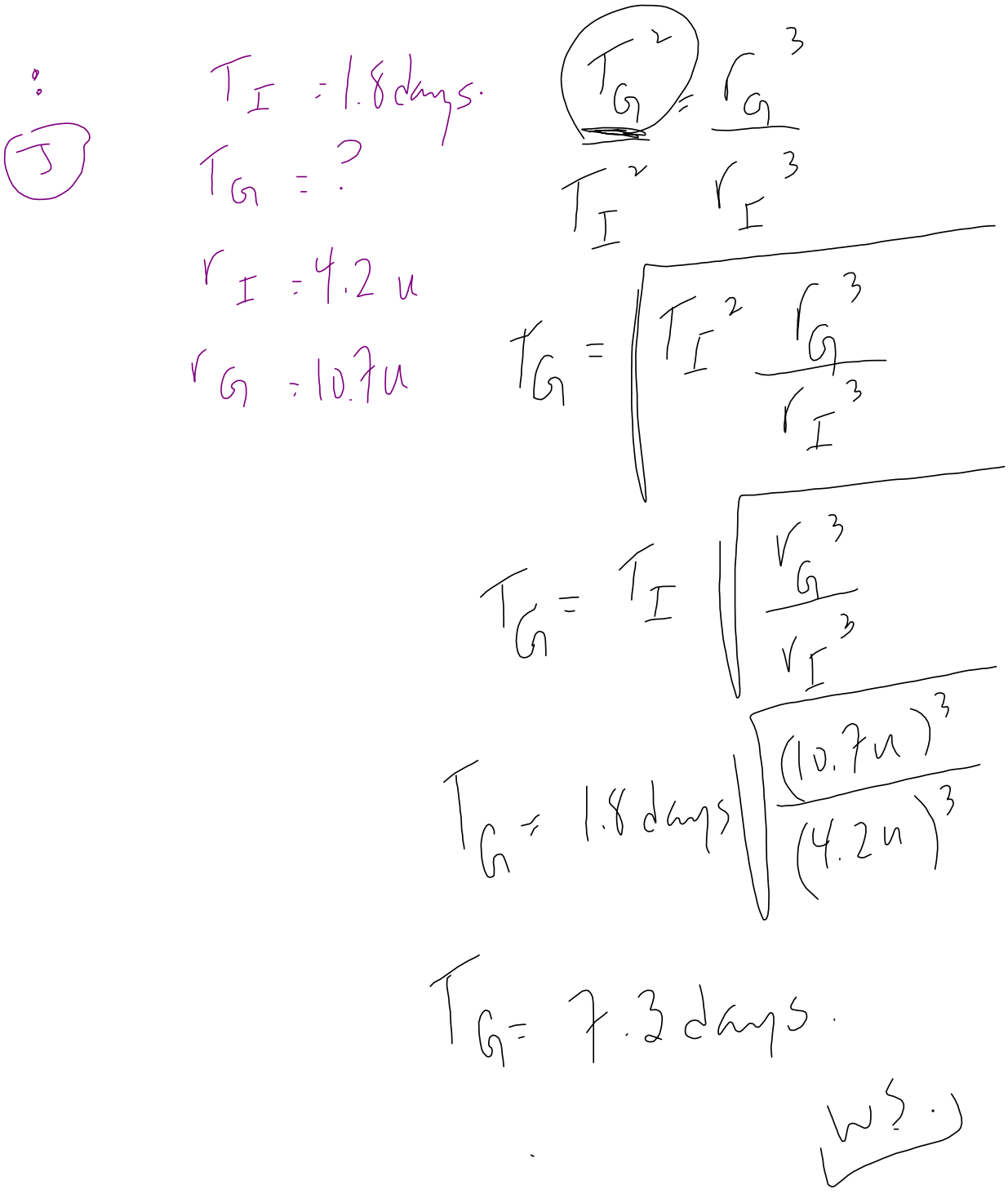
NOTE: The first two laws apply to each planet, satellite or moon. The third relates to the motion of two objects which are orbiting the same central body. The central body does not have to be the sun.

NOTE: One astronomical unit (AU) is the average distance from Earth to the Sun.

$$1 \text{ AU} = 1.496 \times 10^{11} \text{m}$$

NOTE: Physical data can be found on Page 573 and 955.

Example:
Galileo discovered four moons of Jupiter. Io, which he measured to be 4.2 units from the center of Jupiter, has a period of 1.8 days. He measured the radius of Ganymede's orbit as 10.7 units. Use Kepler's third law to find the period of Ganymede. (7.3 days)



Example:
Uranus requires 84 years to circle the sun. Find Uranus' orbital radius as a multiple of Earth's orbital radius. ($19r_E$)

$T_u = 84\text{ y}$ or 84 a

Sun central body

$T_E = 1.0\text{ y}$

$r_u = ?$

$r_E = r_E$

$$\frac{r_u^3}{r_E^3} = \frac{T_u^2}{T_E^2}$$

$$r_u^3 = \frac{r_E^3 T_u^2}{T_E^2}$$

$$r_u = r_E \sqrt[3]{\frac{T_u^2}{T_E^2}}$$

$$r_u = r_E \sqrt[3]{\frac{(84)^2}{(1.0)^2}}$$

$$r_u = \boxed{19\, r_E}$$

(WS)