PHY2020
Fall 2011, Makeup Exam

I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University.

Name: _____

UF ID: _____

Ignore air friction in all problems.

Please give complete responses to all questions including units and theoretical justification for responses.

You must show ALL of your work to receive full credit!

Useful values and formulas:

$G = 6.7 * 10^{-11}$ N m^2 / kg^2

$M_{Earth} = 5.98 * 10^{24}$ kg
$R_{Earth} = 6378$ km

1 km = 0.62 miles = 3280.8 feet

1 kg = 2.2 lbs

Moment of Inertia
Cylinder of radius r, axis through center: 1/2 m r^2
Sphere of radius r, axis through center: 2/5 m r^2
Rod of length l, axis through center: 1/12 m l^2
Rod of length l, axis through end: 1/3 m l^2

1 kPa = 760 mg Hg

$\rho_{water} = 1$ g/cm^3 = 1000 kg/m^3

1 Cal = 4.18 Joules

$c_{water} = 1.0$ kcal/kg °C

Exam 1 review, slide # 11

1. (10 pts) A 3 kg rock is thrown straight up in the air with an initial speed of 5 m/s from a height of 10 m. What is the maximum height of its motion?

$$y = y_0 + \frac{1}{2}\frac{V_{oy}^2}{g}$$

$$y = 10\,m + \underbrace{\frac{1}{2}\frac{(5.0\,m/s)^2}{9.8\,m/s^2}}_{1.275\,m}$$

$$y = 11.28\,m$$

Lecture 30-32, slide # 5, Test 3 Review ch 18, 19, slide # 1, 2

2. (5 pts) A 200 mA current is traveling through a wire. How much charge is passing any point along the wire at each second?

$$I = \frac{nq}{t}$$

$$200\,mA = \frac{n \cdot (1.6 \times 10^{-19} C)}{1\,sec}$$

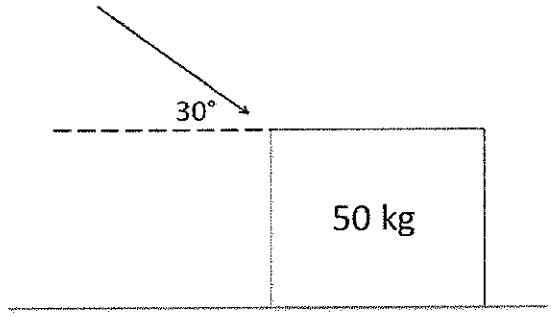
$$200 \times 10^{-3} A = (1.6 \times 10^{-19} C) \cdot n$$

$$n = \frac{200 \times 10^{-3} A}{1.6 \times 10^{-19} C}$$

$$n = 1.25 \times 10^{18} \text{ electrons / units of charge}$$

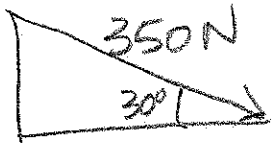
slide slide
Lecture 6 # 1, Exam 1 review # 4

3. (10 pts) A 50 kg box is pushed across the floor with a constant force of 350 N, as shown in the image. What is the acceleration of the box?



$\vec{F} = m \cdot \vec{a}$

Must use F in $\underline{x}$ direction



$F_x = 350\,N \cdot \cos 30°$

$$\vec{a} = \frac{\vec{F}_x}{m} = \frac{350\,N \cdot \cos 30°}{50\,kg}$$

$$\vec{a} = 6.06\ m/s^2$$

Slide

Test 3 Review, # 24, 25

4. (15 pts) A 43 lb object is submerged in a tank of water where it's weight is measured to be 43 N. What is the buoyant force acting on the weight?

$F_{grav\ in\ air} = F_{object\ submerged} + F_{buoyant}$

43 lbs needs to be in kg

$43\,lb \cdot \left(\frac{1\,kg}{2.2\,lb}\right) = 19.55\,kg$

$(19.55\,kg)(9.8\,m/s^2) = 43N + F_{buoyant}$

$191.54\,N - 43N = F_{buoyant}$

$F_{buoyant} = 148.54\,N$

Similar to Test 2 Review, #3, also exam 2 slide

5. (15 pts) A ball is located on a ledge 50 km above the surface of the Earth. The ball is fired ~~downward~~ straight down with an initial velocity of 10 m/s. What is the speed of the ball when it reaches the ground?

$E_i = E_f$ conservation of E

$E_i = \frac{1}{2}mv_i^2 + mgh$

$E_f = \frac{1}{2}mv_f^2$

$\frac{1}{2}m v_i^2 + mgh = \frac{1}{2}m v_f^2$

m's cancel in all terms

$\frac{1}{2}(10\ m/s)^2 + (9.8\ m/s^2)\left(50\ km \cdot \frac{1000\ m}{1\ km}\right) = \frac{1}{2}v_f^2$

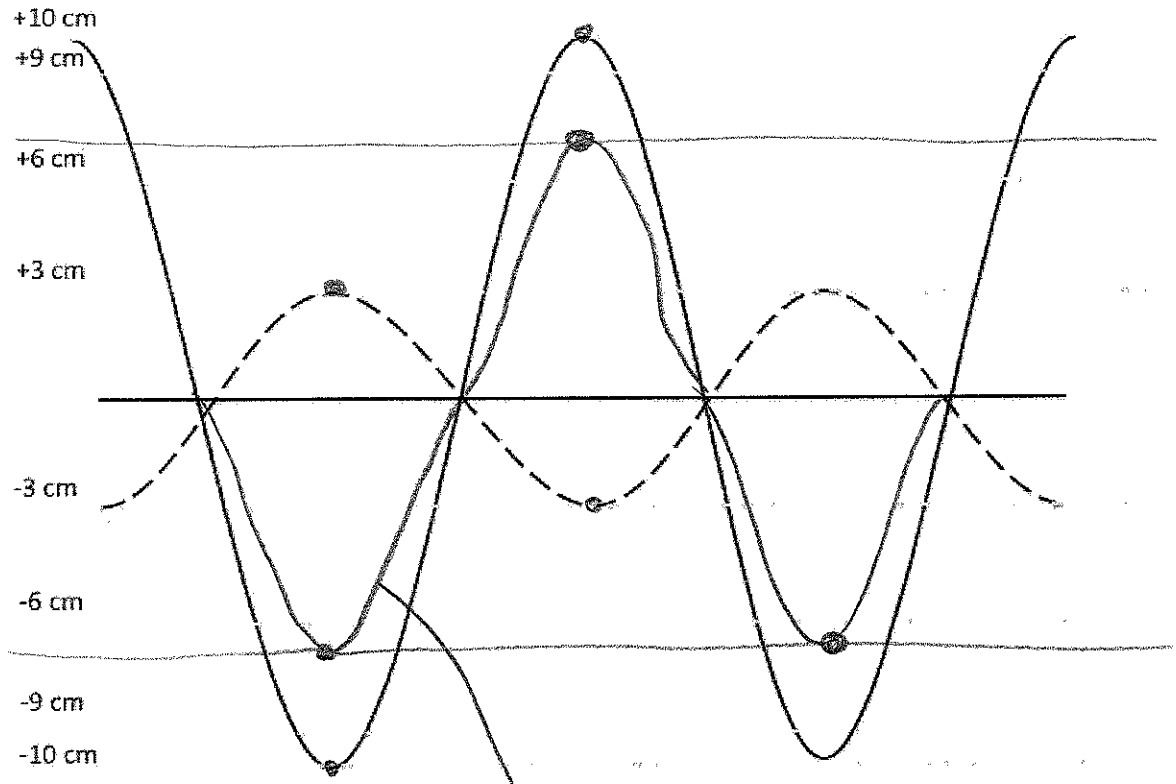
$50\ m^2/s^2 + 490{,}000\ \frac{m^2}{s^2} = \frac{1}{2}v_f^2$

$980{,}100\ m^2/s^2 = v_f^2$

$v_f = 990\ m/s$

Done in class

6. (10 pts) The image shows two waves that are moving through the same region of space at the same time. What is the resulting wave that is observed? You must include values and all information possible on your sketch.



$+3 + {}^{-}10 = -7$

$+10 + {}^{-}3 = +7$

final wave has amplitude of ±7cm now

1 wave with amplitude ±10cm

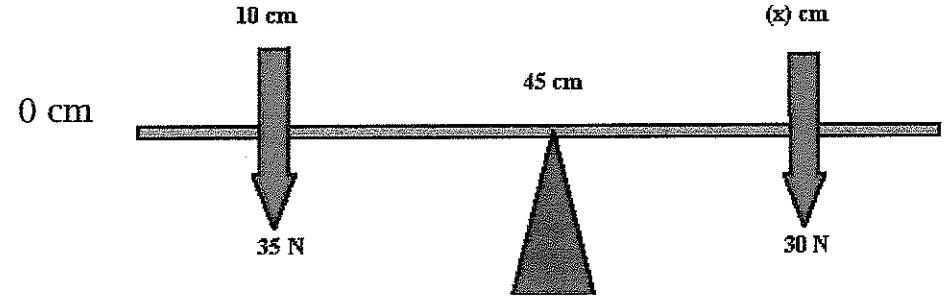
1 wave with amplitude ± 3 cm

they are out of phase → one peaks positive when the next peaks negative

destructive interference

Lecture 17, slide #2

7. (10 pts) Determine the absolute location of the 30 N force in the image below:



System is in equilibrium so Torques = same on both sides and F = same

$\tau = F \cdot \underline{l} \cdot \sin\theta$ $\quad \theta = 90°, \sin\theta = 1$

$\underline{l}$ → distance from Force to pivot point

$\tau_{left} = 35\,N \cdot (45\,cm - 10\,cm) = 1225\ N \cdot cm$

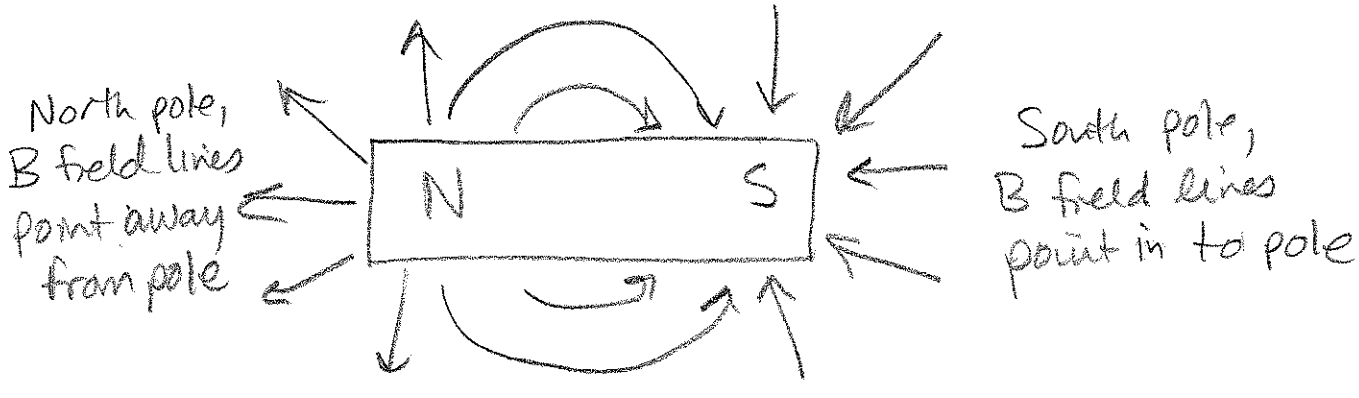
$\tau_{right} = 30\,N \cdot (X\,cm - 45\,cm) = 30N \cdot X\,cm - 1350\ N \cdot cm$

$2575\ N \cdot cm = 30N \cdot X\,cm$

$X = 85.83\ cm$

No clicker Qns @ end.

8. (5 pts) Sketch the magnetic field lines found around a magnet. Include the direction of the field lines. Clearly label all parts of the diagram.



Lecture 14 #2

9. (10 pts) A 2.3 kg ball moving at 2 m/s collides with a 10 kg ball that is at rest. The balls stick together. What is the final momentum of the system?

Conservation of momentum

$P_i = P_f$

$(mv)_{ball1} + (mv)_{ball2} = (mv)_{balls\ 1+2}$

$(2.3\,kg \cdot 2\,m/s) + (10\,kg \cdot 0\,m/s) = (2.3\,kg + 10\,kg)\, V_{1+2}$

$4.6\ kg\frac{m}{s} = 12.3\ kg \cdot V_{1+2}$

$V_f = 0.37\ m/s$

Lecture 9 #8 → See #12

10. (10 pts) What is the force of gravity between the Earth and a 10 lb cat located on the surface of the planet?

$F_{grav} = \frac{G m_1 m_2}{d^2}$

but on surface of earth you can use

$\vec{F}_{grav} = m \cdot \vec{a} = m \cdot g$

$\vec{F} = 10\,lbs\left(\frac{1\,kg}{2.2\,lbs}\right) \cdot 9.8\ m/s^2 = 44.55\ N$