Reminders 02-02-10:

-2nd Quiz Due NOW

-2nd POW due Thursday by 5PM

-Quiz 3 Chapters 3 and 4 Thursday in Lecture

-Exam 1 Tuesday February 9.

-All graded items are placed in a basket outside my office.

-Drop off any papers under my door (S-107A)

-1st Lab Due This Week. Include Coversheet. DO NOT Use Pencil on Any Portion of the Report!

-Lab check rules; (1) lab must be completed, it must be checked at least one day before it is due;(3) only one per lab; and (4) you must be present.

Objectives:

-Uniform and Non-Uniform Circular Motion

-Brief Discussion of Reference Frames

-Newton's Laws

Physics 4A Honors

Highly motivated students have the opportunity to receive honors credit by completing an Honors Contract. The elements of the Honors Contract include a special problem-centered project that involves some or all of the following: reading, writing, critical thinking, problem solving, research, and technical skills. It is designed to give the highly motivated student experience beyond the classroom. Generally, it will add an additional 20 percent (about 4-6 hours/week) to the course workload.

The Honors project is NOT FOR extra-credit, and WILL NOT factor into the course grade . Upon completing the honors requirements, the student's transcript will reflect a completed honors level course.

What should I do if I'm interested in Honors credit in my course?

1. Discuss your intention in receiving Honors credit with your professor.
2. Decide on a project in conjunction with your professor.
3. Fill out an Honors Contract from your instructor.
4. Submit the completed contract for review and approval by 3PM, Thursday Feb 11.

Requirement for Honors credit for Physics 4A

1. Student must receive a B or higher in the course.
2. Submit all Honors contract work by a stated deadline (about a week before the final exam).

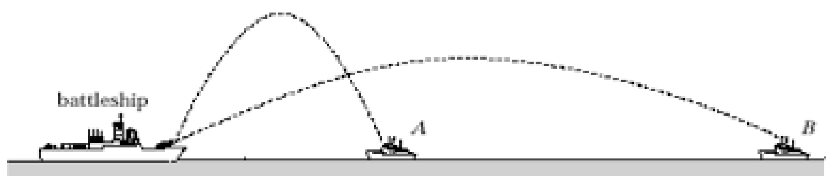
A battleship simultaneously fires two shells (same initial speed) at enemy ships. If the shells follow the parabolic trajectories shown, which ship gets hit first? Assume the initial velocities of the shells are the same.

A. *A*

B. both at the same time

C. B

D. need more information



$\theta_A > \theta_B$

$V_{yA} = V_i \sin\theta_A$

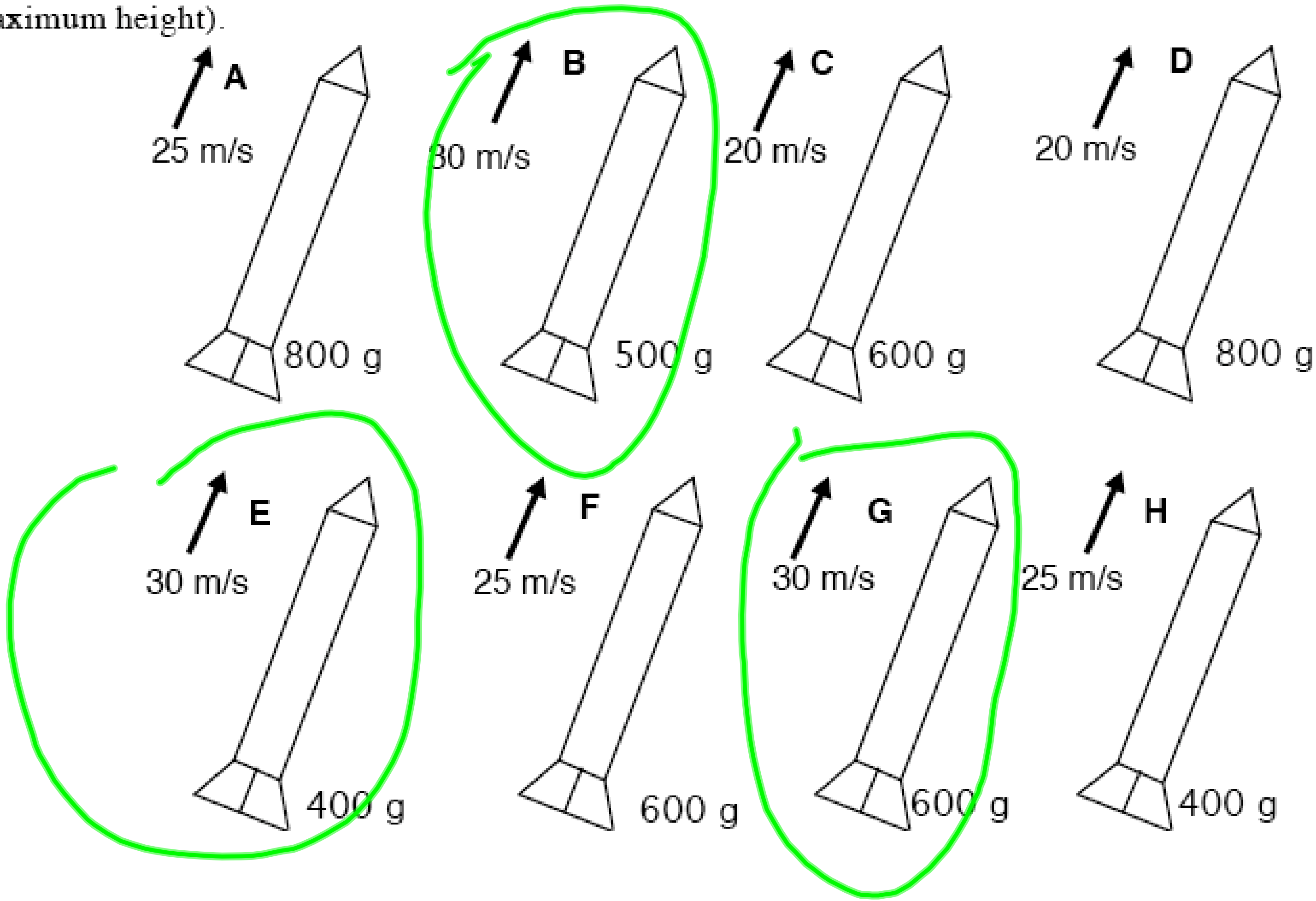
$V_{yB} = V_i \sin\theta_B$ } $V_{yA} > V_{yB}$

$V_y = V_{y0} + a_y t$

$t = \frac{-V_{y0}}{a_y}$ $\quad t_A > t_B$

The eight figures below depict eight model rockets that have just had their engines turned off. All of the rockets are aimed upward at the same angle, but their speeds differ. All of the rockets are the same size and shape, but they carry different loads, so their masses differ. The specific mass and speed for each rocket is given in each figure. (In this situation we are going to ignore any effect air resistance may have on the rockets.) At the instant when the engines are turned off, the rockets are all at the same height.

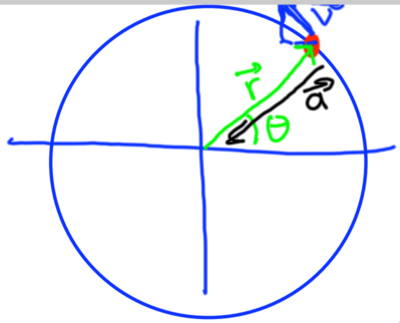
Rank these model rockets from greatest to least on the basis of the horizontal speed at the top (at the maximum height).



$$a_c = \frac{V^2}{R} \quad \text{if } V \text{ constant}$$

$$V = \frac{2\pi R}{T} \qquad a_c = \frac{\left(\frac{2\pi R}{T}\right)^2}{R}$$

$$a_c = \frac{4\pi^2 R}{T^2} = \left(\frac{2\pi}{T}\right)^2 R = \omega^2 R$$



$$\vec{r} = x\hat{i} + y\hat{j}$$

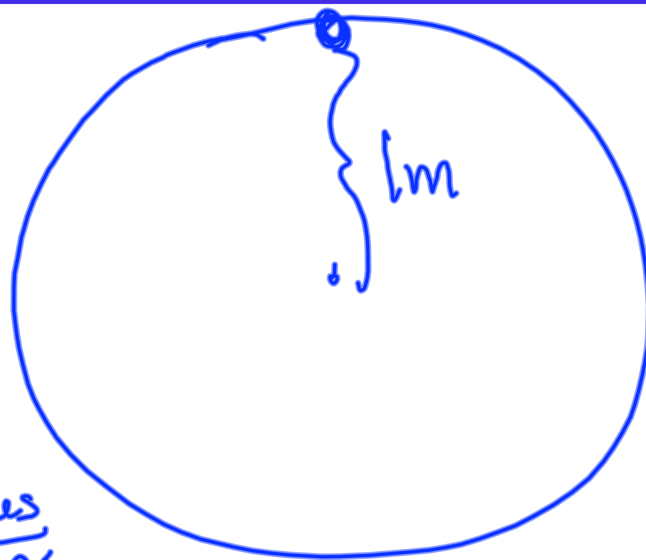
$$\vec{r} = R\cos\theta\,\hat{i} + R\sin\theta\,\hat{j}$$
$$= R(\cos\theta\,\hat{i} + \sin\theta\,\hat{j})$$
$$= R\underbrace{(\cos\omega t\,\hat{i} + \sin\omega t\,\hat{j})} = R\hat{r}$$

$$\vec{V} = \frac{d\vec{r}}{dt} = R\left[-\omega\sin\omega t\,\hat{i} + \omega\cos\omega t\,\hat{j}\right)$$
$$= R\omega\left[-\sin\omega t\,\hat{i} + \cos\omega t\,\hat{j}\right]$$

$$\vec{a} = \frac{d\vec{V}}{dt} = R\omega\left[-\omega\cos\omega t\,\hat{i} - \omega\sin\omega t\,\hat{j}\right]$$
$$= -R\omega^2\left[\cos\omega t\,\hat{i} + \sin\omega t\,\hat{j}\right]$$
$$= -R\left(\frac{2\pi}{T}\right)^2\left[\cos\omega t\,\hat{i} + \sin\omega t\,\hat{j}\right]$$
$$= -\frac{V^2}{R}\underbrace{\left[\cos\omega t\,\hat{i} + \sin\omega t\,\hat{j}\right]}$$
$$= -\frac{V^2}{R}\hat{r}$$

A merry-go-round 2 m in diameter rotates
10 rpm. What is the acceleration of a child
is riding on the perimeter?

$f = 10\,rpm$



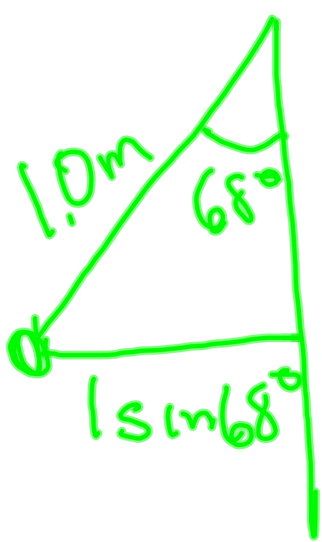
$T = 6\,s$

$$f = \frac{10\,rpm}{60\,s/m} = \frac{1}{6}\,\frac{cycles}{sec}$$

$$a_c = \frac{V^2}{R} = \frac{\left(\frac{2\pi R}{T}\right)^2}{R} = \frac{4\pi^2 R}{T^2}$$

$$= \frac{4\pi (1m)}{(6s)^2} = \underline{1.10\,m/s^2}$$

A conical pendulum has a string of length 1.0 and when the pendulum is rotating with a per of 2 s the string makes an angle with the verti of 68°. What is the acceleration of the pendul bob?

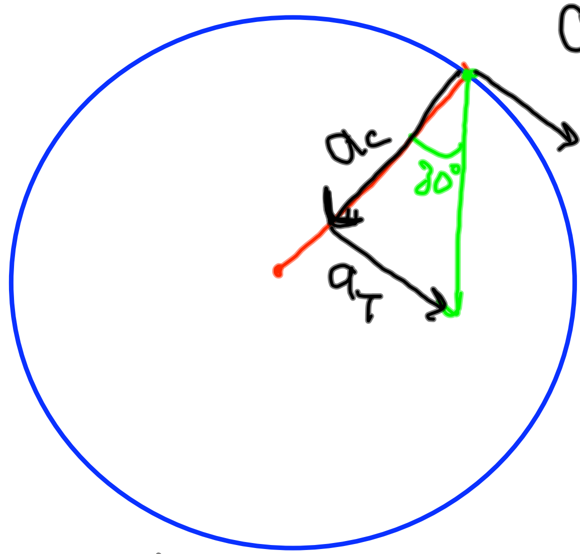


$$a_c = \frac{v^2}{R} = \frac{\left(\frac{2\pi R}{T}\right)^2}{R}$$

$$= \frac{4\pi^2 R}{T^2} = \frac{4\pi^2 1\sin 68^\circ}{2^2}$$

$$= 9.15\,m/s^2$$

Problem 4-31: (See figure in book) At an instant in time, an object traveling in a circular path of radius 2.5 m has an acceleration of 15 m/s² at an angle of 30° with respect to a line drawn radially to the object. At this instant of time, what is the speed of the particle and its tangential acceleration?



$a_c = 15\cos 30^\circ$

$a_T = 15\sin 30$

$a_c = 13\ m/s^2$

$a_t = 7.5\ m/s^2$

$$a_c = \frac{V_T^2}{R}$$

$$V_T = \sqrt{R a_c}$$

$$= \sqrt{(2.5\ m)(13\ \tfrac{m}{s^2})}$$

$$V_T = 5.7\ m/s$$

Galilean transformation implies

ABSOLUTE MOTION CANNOT BE DETECTED

This idea is called the

PRINCIPLE OF NEWTONIAN RELATIVITY

Einstein extended this idea to all fields of Physics

However, the Galilean transformation is approximately true because it assumes that the time interval between two events is the same in all reference frames.

When v≈c Einstein's Theory of Relativity shows…..

Time interval between two events is frame dependent

ABSOLUTE SIMULTANEITY NOT POSSIBLE