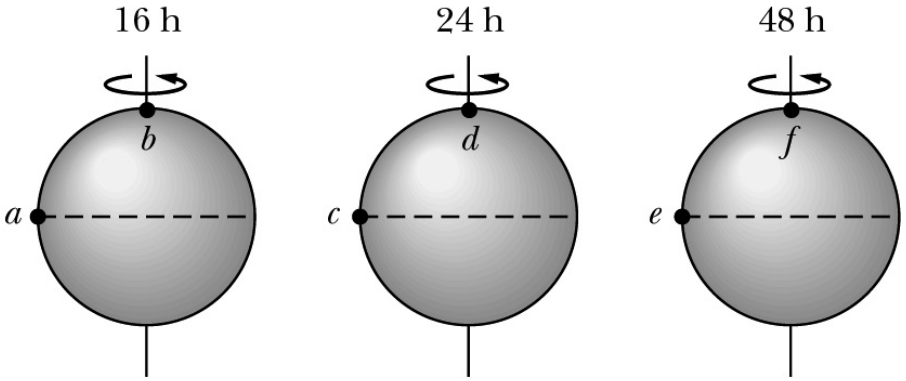
Physics 407 **Concept Quiz 11 (Dec 4, 2001)**

Name:_____ **SS#:_____**

1) Gravitation on a planet



The figure shows three uniform *spherical* planets that have the same mass and size. The period of rotation is indicated at the axis of each planet. The free fall acceleration *g* is measured in six locations on the planets that are indicated by letters. Rank the locations according to the free fall acceleration (highest first) in the boxes below from left to right. Use the same box for equal values.

2.5 Points

Hints:

Note that the locations in question are either at the pole or at the equator.
Which additional acceleration is relevant at the equator?
Does it increase or decrease the free fall acceleration?
How does the additional acceleration scale with the rotation rate?

For a realistic planet, the assumption of a spherical shape is incorrect. How would the planets be deformed?

_____ **2.5 Points**

Hints:
Recall what you feel in your arms when you turn around fast with your arms extended?
How does this effect deform a planet?

2) Interstellar Exploration

The crew of the Enterprise has arrived in a new star system with one inhabitable planet. The star has a mass M that is 2 times the mass of the sun. The planet is at 2 times the distance of the earth from the sun.

Is the gravitational force of the star on the planet

a) weaker than **b)** stronger than **c)** the same as

the gravitational force of the sun on the Earth? **2.5 Points**

Hints:

How does the gravitational force scale with mass and with distance?

How long is one "planet year" on that new planet in terms of Earth years?

a) 1 year
b) 1/2 year
c) 2 years
d) 4 years
e) 8 years

2.5 Points

Hint: Use Kepler's 3rd Law $\quad \text{Distance}^3/\text{Period}^2 = \text{Constant}*\text{Mass(Star)}$

Hints:

Make use of the fact that Kepler's Law as stated above contains

Period in years
Distance in AU (distance of the Earth from the sun)
Mass in solar masses

when compared with the planets in the solar system.