

Name: _____

Class: _____

Date: _____

ID: A

Physics Unit 4 Exam Prep

Be prepared to answer any
10 - questions (12a, 12b, 12c count as
One question)

Short Answer

1. Is there an outward force in circular motion?
2. A ball is whirled in a horizontal circular path on the end of a string. Predict the path of the ball when the string breaks, and explain your answer.
3. What is the main difference between mass and moment of inertia?

Problem

4. A 61 kg student sits at a desk 1.25 m away from a 70.0 kg student. What is the magnitude of the gravitational force between the two students?
($G = 6.673 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$)

Essay

5. Define torque. When all the torques on an object are balanced, the object is in rotational equilibrium. Apply this statement to two people sitting on either side of a seesaw. Give another example.
6. Which has more rotational inertia, a solid sphere of mass 100 kg and radius 50 cm or a solid cylinder of the same mass and radius? What is the rotational inertia of the sphere?
Most satellites and planets have elliptical orbits. Explain what an elliptical orbit is. Where are the foci located? How can you draw an ellipse?
8. Distinguish between the first and second laws of thermodynamics in terms of whether or not exceptions occur.
9. How does the second law of thermodynamics relate to the direction of heat flow?
10. What does it mean to say that energy becomes less organized when it transforms from one form to another?

11) Given that $KE = \frac{1}{2}m_0v^2$ and $U = -Gm_0mr^{-1}$ derive the equation for escape velocity. Start with $KE + U = 0$. Solve problems if given G , m , r , or v .

12a) given that $F_c = m_0v^2r^{-1}$ and $F_g = Gm_0mr^{-2}$ derive the equation for a satellite to maintain circular orbit. Solve problems if given G , m , r , or v .

12b) given that $v = 2\pi r/T$, where T is orbital period, determine an equation that expresses T in terms of r and m .

12c) given that $r_e = 6.4 \times 10^6$ m, a satellite is 400 km above the Earth's surface, and that it circles the Earth once every 93 minutes, determine the mass of the Earth in kilograms.

13) Given

Name	Discovery Date	Discoverer	Distance from Jupiter ($\times 10^3$ km)	Orbital Period (days)	Mass (1020 kg)	Radius (km)
Io (JI)	1610	Galileo Galilei	421.6	1.769138	893.2	1821.6
Europa (JII)	1610	Galileo Galilei	670.9	3.551181	480	1560.8
Ganymede (JIII)	1610	Galileo Galilei	1070.4	7.154553	1481.9	2631.2
Callisto (JIV)	1610	Galileo Galilei	1882.7	16.689018	1075.9	2410.3

a) Determine the mass of Jupiter.

14) Given an ellipse, determine the eccentricity, Major-axis, the distance between the foci.

15) Starting with Newton's Law of Universal Gravitation, derive the Schwarzschild Radius equation. Explain the role of the Event Horizon. Compare and contrast Newton's and Einstein's version of Gravity.