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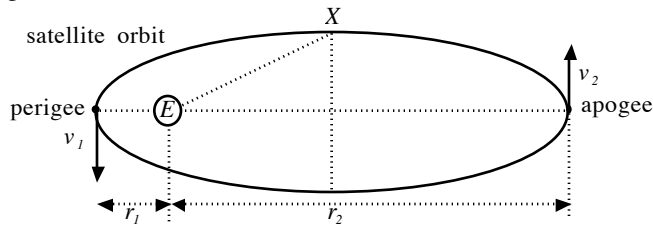
Date: \_\_\_\_\_

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**AP Physics C  
Gravity HO24**

- 1.) If the distance between two point particles is doubled, what happens to the gravitational force between them.
- 2.) At the surface of the earth, an object of mass  $m$  has weight  $w$ . Find its new mass and weight if this object is transported to an altitude that twice the radius of the earth.
- 3.) A moon of mass  $m$  orbits a planet of mass  $100m$ . Let the strength of the gravitational force exerted by the planet on the moon be denoted by  $F_1$ , and let the strength of the gravitational force exerted by the moon on the planet be  $F_2$ . What is the relationship between these two forces?
- 4.) The planet Pluto has  $1/500$  the mass and  $1/15$  the radius of the Earth. What is the value of  $g$  on the surface of Pluto?
- 5.) A satellite is currently orbiting Earth in a circular orbit of radius  $R$ , its kinetic energy is  $K_1$ . If the satellite is moved and enters a new circular orbit of radius  $2R$ , what will be its kinetic energy?
- 6.) A moon of Jupiter has a nearly circular orbit of radius  $R$  and an orbit period of  $T$ . Find an expression for the mass of Jupiter.
- 7.) The mean distance from the Saturn to the Sun is 9 times greater than the mean distance from Earth to the Sun. How long is a Saturn year in terms of Earth years?
- 8.) Two uniform spheres, each of mass  $M$  and radius  $R$ , touch each other. What is the magnitude of their gravitational force of attraction? (UP 12-2)
- 9.) The Moon has a mass  $M$  and radius  $R$ . A small object is dropped from a distance of  $3R$  from the Moon's center. What is the object's impact speed when it strikes the surface of the Moon?
- 10.) A newly discovered planet "Cosmo", has a mass that is 6 times the mass of the Earth. The radius of Earth is  $R_E$ . Find the radius of Cosmo ( in terms of  $R_E$ ) so that the gravitational field strength at the surface of Cosmo is equal to that at the surface of the Earth.

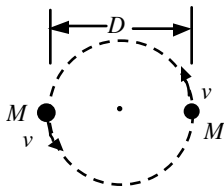
11.) A satellite of mass  $m$  is in the elliptical orbit shown below around Earth (radius  $r_E$ , mass  $M$ ). Assume that  $m \ll M$ .



- Determine  $v_1$ , the speed of the satellite at perigee (the point of the orbit closest to Earth). Write your answer in terms of  $r_1$ ,  $r_2$ ,  $M$ , and  $G$ .
- Determine  $v_2$ , the speed of the satellite at apogee (the point of the orbit farthest from Earth). Write your answer in terms of  $r_1$ ,  $r_2$ ,  $M$ , and  $G$ .
- Express the ratio  $v_1/v_2$  in simplest terms.
- What is the satellite's angular momentum (with respect to Earth's center) when it is at apogee?
- Determine the speed of the satellite when it is at the point marked X in the figure.
- Determine the period of the satellite's orbit. Write your answer in terms of  $r_1$ ,  $r_2$ ,  $M$ , and fundamental constants.
- What is the eccentricity of the satellite's orbit? Express your answer in terms of  $r_1$  and  $r_2$ .

12.) The radius of the Earth is approximately 6000 km. What is the acceleration of an astronaut in a perfectly circular orbit 300 km above the surface of the Earth?

13.) Two identical stars, a fixed distance  $D$  apart, revolve in a circle about their mutual center of mass. Each star has a mass  $M$  and speed  $v$ .  $G$  is the universal gravitational constant. Determine an expression for  $v$  in terms of the other quantities.



14.) The mass of Planet X is one-sixth that of the Earth, and its diameter is one-third that of the Earth. Find the acceleration due to gravity at the surface of Planet X.