Chapters 12, 13 & 14: **Universal Gravitation**

Text:

Chapter 12
Think and Explain:
Think and Solve:

Chapter 13
Think and Explain:
Think and Solve:

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Vocabulary:
mass, Newton's law of universal gravitation, gravitational constant, inverse square law, gravitational field, acceleration due to gravity, satellite, period, ellipse

Equations:

$$F_g = \frac{Gm_1m_2}{d^2} \qquad v = \frac{2\pi r}{T} \qquad a_c = \frac{v^2}{r} \qquad F_c = \frac{mv^2}{r}$$

Constants: $G = 6.67 \times 10^{-11}\ Nm^2/kg^2$ $m_{earth} = 6 \times 10^{24}\ kg$ $r_{earth} = 6.4 \times 10^{6}\ m$

Key Objectives:
Concepts

- What does it mean to say that gravity is universal?
- Why don't you feel the gravitational forces between you and other objects around you?
- Find by what factor the force increases or decreases based on increasing or decreasing the masses or distance.
- Apply Newton's 3rd law to the concept of the forces between two masses.
- Relate the motion of a falling apple to the motion of the moon in orbit around the earth.
- Understand the concept of the gravitational field and how it relates to the acceleration due to gravity.
- Are objects in orbit around the earth truly weightless?
- [What causes ocean tides?]
- [What is a black hole?]

Problem Solving

- Calculate the force between two masses using Newton's law of universal gravitation.
- Solve for the missing variable when given all but one value.
- When given three masses in a row, find the net force on one of the masses due to the other two.
- Use universal gravitation to find the acceleration due to gravity on any planet when given the mass of the planet and the distance from the center of the planet.
- Apply the concepts of universal gravitation and circular motion to orbiting bodies.