

TSOKOS READING ACTIVITY

Section 6-1

1. Essential Idea: A force applied perpendicular to its displacement can result in circular motion.
2. Nature Of Science: Observable universe: Observations and subsequent deductions led to the realization that the force must act radially inwards in all cases of circular motion.
3. International-Mindedness: International collaboration is needed in establishing effective rocket launch sites to benefit space programs.
4. Theory Of Knowledge:
 - a. Foucault's pendulum gives a simple observable proof of the rotation of the earth, which is largely unobservable.
 - b. How can we have knowledge of things that are unobservable?
5. Understandings:
 - a. Period, frequency, angular displacement and angular velocity
 - b. Centripetal force
 - c. Centripetal acceleration
6. Applications And Skills:
 - a. Identifying the forces providing the centripetal forces such as tension, friction, gravitational, electrical, or magnetic
 - b. Solving problems involving centripetal force, centripetal acceleration, period, frequency, angular displacement, linear speed and angular velocity
 - c. Qualitatively and quantitatively describing examples of circular motion including cases of vertical and horizontal circular motion
7. Guidance:
 - a. Banking will be considered qualitatively only
8. Data Booklet Reference:
 - a. $v = \omega t$
 - b. $a = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$
 - c. $F = \frac{mv^2}{r} = m\omega^2 r$
9. Utilization:
 - a. Motion of charged particles in magnetic fields (see Physics sub-topic 5.4)
 - b. Mass spectrometry (see Chemistry sub-topics 2.1 and 11.3)

c. Playground and amusement park rides often use the principles of circular motion in their design

10. Aims:

- a. Aim 6: experiments could include (but are not limited to): mass on a string; observation and quantification of loop-the-loop experiences; friction of a mass on a turntable
- b. Aim 7: technology has allowed for more accurate and precise measurements of circular motion, including data loggers for force measurements and video analysis of objects moving in circular motion

11. Read pg 249-256 in your textbook.

12. Answer the following questions:

a. What is the definition of period (T) with respect to circular motion? _____

b. How does the distance covered in one revolution relate to the circle's radius (R)? _____

c. What is the velocity (v) of a body moving in circular motion? _____

d. What is the angular speed (ω) of a body moving in circular motion in terms of both frequency and period? _____

e. What are the units for angular speed? _____

f. In terms of angular speed, how do you find the frequency of rotation? _____

g. Can the velocity or angular speed ever be constant? _____

h. What is the direction of the velocity in circular motion? _____

i. What is linear speed in relation to angular speed? _____

j. What is the equation for an acceleration vector? _____

k. Acceleration occurs when the velocity's,

1. magnitude changes
2. direction changes
3. both magnitude and direction change
4. all of the above
5. none of the above

l. Centripetal acceleration is the result of a change in what property of the velocity? _____

m. What is the direction of centripetal acceleration in relation to the direction of the velocity? _____

n. What is the equation for centripetal acceleration? _____

o. What is the name for the acceleration that results from a change in the magnitude of the velocity? _____

- p. What is the direction of tangential acceleration in relation to the direction of the velocity? _____

- q. What is the equation for tangential acceleration? _____
- r. What is the equation for centripetal acceleration? _____
- s. How do you compute acceleration when there is change in both direction and magnitude of the velocity? _____

- t. What is the name of the force that produces centripetal acceleration and what is its direction?

- u. What is the equation for centripetal force in terms of linear/tangential velocity? _____
- v. What is the equation for centripetal force in terms of angular speed? _____
- w. Consider a ball of mass m at the end of a string of length r that is being made to move in a circular motion at constant speed v in a vertical plane.
- i. What is the tension in the string at the top and bottom of the circle? _____

 - ii. What is the minimum velocity required to keep the string taut? _____
 - iii. What is the equation for the work done by the centripetal force in this problem? Explain. _____

- x. Compare and contrast *centripetal force* with *centrifugal force*? _____

- y. Nature of Science: What did Newton deduce about the movement of planets from his second law and circular motion? _____

13. Answers may be typed or neatly printed. Drawings may be freehand, but try to make use of the ‘Shapes’ or ‘Insert Clipart’ functions of MS Word. If you submit this assignment electronically, the filename must be in the following format, “LastnameFirstinitialPerXReadActX-X”.