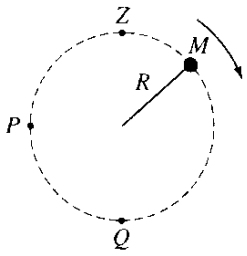
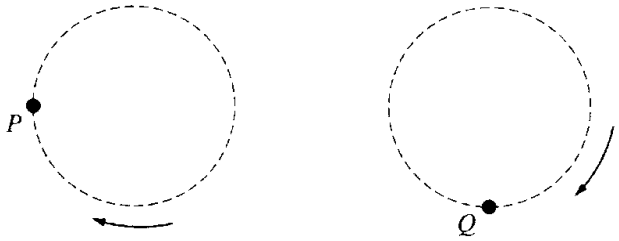
Name _____ Date _____ Period _____



Side View

2. A ball of mass M is attached to a string of length R and negligible mass. The ball moves clockwise in a vertical circle, as shown above. When the ball is at point P, the string is horizontal. Point Q is at the bottom of the circle and point Z is at the top of the circle. Air resistance is negligible. Express all algebraic answers in terms of the given quantities and fundamental constants.

a. On the figures below, draw and label all the forces exerted on the ball when it is at points P and Q, respectively.



b. Derive an expression for v_{min} the minimum speed the ball can have at point Z without leaving the circular path.

c. The maximum tension the string can have without breaking is T_{max} Derive an expression for v_{max}, the maximum speed the ball can have at point Q without breaking the string.

d. Suppose that the string breaks at the instant the ball is at point P. Describe the motion of the ball immediately after the string breaks.