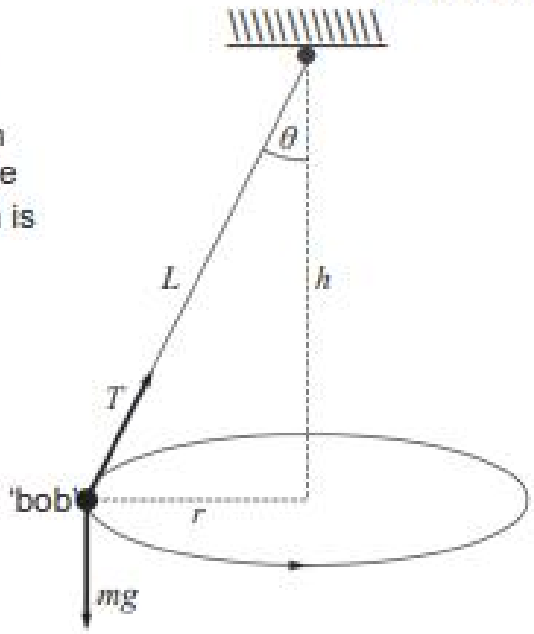
Question 17 **(16 marks)**

The diagram to the right shows the two forces acting on a conical pendulum as it spins at a set frequency. The vector addition of these two forces provides the centripetal force on the 'bob'. The mass of the 'bob' is 255 g and the length of the pendulum string L is 1.20 m. When the frequency of rotation is 0.490 Hz, the angle $\theta = 30.0°$.



(a) Calculate the tension in the string when $\theta = 30.0°$. (4 marks)

Answer: _____ N

(b) Calculate the radius of the circular path the 'bob' is moving in when the angle is 30.0°. (2 marks)

Answer: _____ m

(c) Calculate the new angle between the pendulum string and the vertical if the frequency of rotation is doubled. (6 marks)

Answer: _____ °

(d) Explain why θ can never equal 90.0°, regardless of how great the frequency of the pendulum becomes. You may use mathematical relationships in your answer. (4 marks)

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