NAME_____

Projectile Motion Assignment 1

1. A basketballer passes the ball to a teammate, giving the ball an initial speed of $20ms^{-1}$ and an angle of 20° above the horizontal, from a height of 2m.
Calculate, assuming that the ball is caught at a height of 2m:

a) The time of flight of the ball /3
b) The distance between the players /2
c) The velocity of the ball when it is caught /4

2. An Extreme Boules player must lob the steel "boule" so that it lands as close as possible to the "jack", a small white ball which lies 10m away. However the player must clear a large bush with his throw, so he gives it an angle of 70° above the horizontal. His throw is made from ground level (assume it will land at ground level).

(a) Show that the time of flight $t = \dfrac{2v_0 \sin 70°}{g}$

Note: use $a_V = -g$ /3

(b) Hence show that the final horizontal component of velocity $v_H = \dfrac{s_H\ g}{2v_0 \sin 70°}$ /2

(c) Hence calculate the initial velocity required for the boule to land directly on the jack. /3
Hint: the initial and final horizontal components of velocity are the same.

3. An invading soldier is trying to sneak close to a castle and is currently lying on the ground 10m away horizontally from the castle wall. A castle defender throws a small rock horizontally from a castle turret 10m above the ground, with a speed of $7.0ms^{-1}$.

a) Calculate the range of the rock and hence state whether the invading soldier is likely to be clobbered. /4
b) Calculate the speed the rock is going at the end of its flight. /3

4. Calculate the maximum height of a student fired out of a cannon with an initial speed of $50ms^{-1}$ at an angle of 70° above the horizontal. The cannon is placed on top of a 10m tall tower.

/3

5. Two physicists are performing an experiment with a Vortex (those balls that whistle as they fly). They connect a microphone to a computer and measure that the Vortex whistles for 5.62 seconds. The Vortex is thrown and caught at a height of 1.59m.
Calculate the maximum height the Vortex reached during its flight.

/3

Total marks: /30