**PROJECTILE MOTION QUESTIONS – WORKSHEET 1**

In all the following questions ignore the effects of air resistance. Take the acceleration due to gravity close to the surface of the Earth as 9.8 ms-2.

1. A tennis ball is thrown vertically upward with an initial speed of 24.5 ms-1.

	1. Calculate the greatest height it will attain. (30.6 m)
	2. How long does it take to reach its maximum height? (2.5 s)
	3. What is its speed when it returns to its starting point? (24.5 ms-1)
	4. What is its total time of flight? (5.0 s)
2. A child hits a cricket ball with a velocity of 8.0 ms-1 at an angle of 60° with the horizontal. Calculate:

	1. Its horizontal and vertical displacements after 0.5 s has elapsed;
	(2.0 m & 2.2 m)
	2. The time taken to return to the level from which it was hit; (1.4 s)
	3. The horizontal distance travelled during its flight; (5.6 m) and
	4. At what angle to the horizontal should the child have hit the ball to achieve maximum range for the shot? (45°)
3. A projectile is launched at 100 m/s East at an angle of 60o to the horizontal. Calculate:

	1. The horizontal component of its initial velocity. (50m/s East)
	2. The vertical component of its initial velocity. (86.6m/s vertically up)
	3. The total time of flight. (17.7s)
	4. The maximum height reached. (382.6m)
	5. The range of the projectile. (885m)
4. A stone is thrown horizontally at a speed of 20 m/s from a height of 2 metres. Determine:

	1. The time taken for the stone to hit the ground. (0.64s)
	2. The vertical component of the velocity as the stone hits the ground.
	(- 6.27m/s or 6.27m/s down)
	3. How far the stone travels horizontally. (12.8m)
5. A projectile is fired at 50m/s at an angle of 30o to the horizontal. Determine:

	1. The horizontal component of its initial velocity. (43.3m/s horizontally)
	2. The vertical component of its initial velocity. (25m/s vertically up)
	3. The total time of flight. (5.1s)
	4. The maximum height reached. (31.9m)
	5. The range of the projectile. (220.8m)
	6. The velocity of the projectile 4.5 seconds after launch. (At t = 4.5s: vx = 43.3m/s, vy = - 19.1m/s and the total velocity v = 47.3m/s at an angle of 23.8o below the horizontal.)
	7. The displacement of the projectile from its launch position 4.5 seconds after launch. (At t = 4.5s: sx = 194.9m, sy = 13.3m and the total displacement s = 195.4m at an angle of 3.9o above the horizontal.)
6. In the annals of golf history, astronaut Alan Shepard's shots on the lunar surface may be the most famous swings ever taken. Shepard, commander of Apollo 14, hit two golf balls on the moon, just for fun. [His best shot](https://astronomy.com/news/2021/02/alan-shepard-smacked-golf-balls-on-the-moon--and-now-we-know-where-they-landed) only went a meagre 40 m or so due to the difficulty of playing the shots while dressed in his bulky EVA suit.

Let’s suppose when humans next visit the moon, the space suits will be much more streamlined and suitable for physical activity. Assume an astronaut is able to hit a golf ball with an initial velocity of 20.0 ms-1 at an angle to the horizontal of 45°. Given that the acceleration due to gravity on the moon is 1.6 ms-2, calculate both the maximum height and range achieved by this shot.

(62.5 m & 249 m)