PHYSICS 12 **FREEE FALL AND PROJECTILE MOTION**

Quantity	Free Fall	Projectile Motion
Initial velocity		
Acceleration		
Horizontal motion		
Vertical motion		
Velocity at maximum height		
Propulsion		
Air resistance		

Kinematics equations

- Slope on a position-time graph is _____
- Slope on a velocity-time graph is _____
- Area below the curve of the velocity-time graph is _____

1. a)Consider an object A thrown vertically with velocity 40m/s [up] and an object B that is thrown 1.03 seconds after object A. At what velocity [up] must be the object B thrown in order to reach its maximum height at the same instant as the object A?

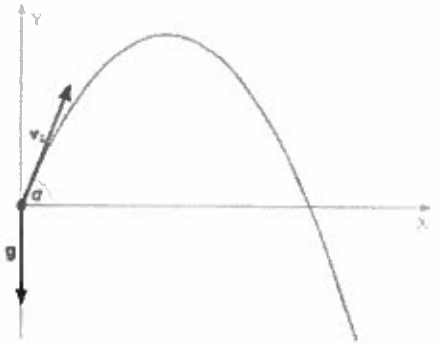
b) How does the maximum height of object A compare to the maximum height of object B?

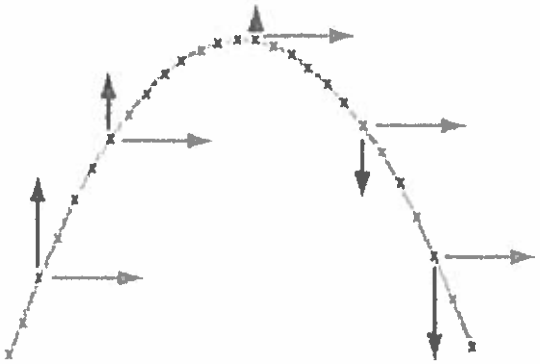
c) How would your answer from a) change if the object B was thrown at an angle above the horizontal?

2. Consider two objects that are thrown with the same speed of 30m/s. If one object is thrown vertically upwards at what velocity must be the other object thrown, so both objects reach their maximum height at the same instant even though they were thrown 8.5×10^{-2} seconds apart?

Answer the following questions: p 47 #13-16 and p 52 #1,3, 6, 10, 13,19,22,24 and p53 #13 **Support your answers.**

Projectile Motion:





1. List all given information. **Recall: acceleration is only in the vertical direction. Horizontal motion is at constant velocity.**

2. Sketch a labelled diagram that shows the path of the projectile.

3. Sketch a separate diagram of the initial velocity vector. Label the horizontal and vertical vector components of the initial velocity vector. Label the given angle.

4. Find the horizontal and vertical component of the initial velocity.

5. When looking for maximum height and time needed the maximum height use the vertical component of the initial velocity.

6. When looking for the range use the horizontal component of the initial velocity and total time in the air.

7. Total time in the air is twice the time needed to reach the maximum height if and only if the projectile lands at the same level it was launched from.

8. Total time in the air for any other scenario is **time needed to reach the maximum height + time to free fall from the maximum height to the landing level.**

9. Practice and ask questions.

10. In the space below list the formulae you frequently use:

Example1: An object is thrown from the ground with initial velocity of 80m/s [40° above horizontal]. Find its maximum height and its range.

Given:

Diagram:

Vector diagram of v_i:

Vector components of v_i:

Time to reach maximum height:

Maximum height:

Time in the air:

Range:

Example 2: In your notebook solve the above problem with a projectile launched 200 m above the ground level. Assume that the projectile lands on the ground. Compare your results with ex. 1.