Shedding Light on Motion Episode 5: Graphing Free Fall **Name: ______________________________**

Part A

Velocity and Displacement Data for a Falling Object (ignoring air resistance)		
Time (s)	**Velocity (m/s)**	**Displacement (metres)**
0	**0**	**0**
1	**9.8**	**4.9**
2	**19.6**	**19.6**
3	**29.4**	**44.1**
4	**39.2**	**78.4**
5		
6		
7		

1. Answer/Complete each of the following questions in order.
(a) Fill in the missing data in the Velocity column.
(b) Draw up the velocity vs time graph using the data.
(c) Calculate the displacement of the object at the 5s mark, the 6s mark, and the 7s mark by calculating the corresponding area under the v-t graph. (or by following the pattern. Notice that 4.9 = 1/2 x 1 x 9.8 and 19.6 = ½ x 2 x 19.6 etc.)
(d) Draw up the displacement vs time graph.

Use your two graphs to answer the following questions.
2. A ball is dropped from a tall building and it takes 3.5 seconds to hit the ground below.
(a) At what height was the ball dropped from?

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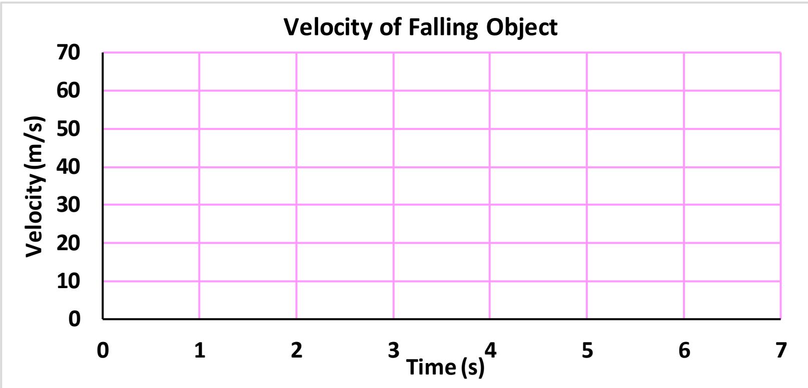
(b) At what speed will it hit the ground?

____



3. A ball is dropped from a cliff which is 200 metres high.
(a) how much time will it take to hit the ground below?

____

(b) At what speed will it hit the ground?

____

4. A skydiver jumps out of a plane.
(a) How much time will it take to reach a speed of 100 km/hr? (100km/hr = _____________m/s)

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(b) How far will the skydiver have fallen before reaching 100 km/hr?

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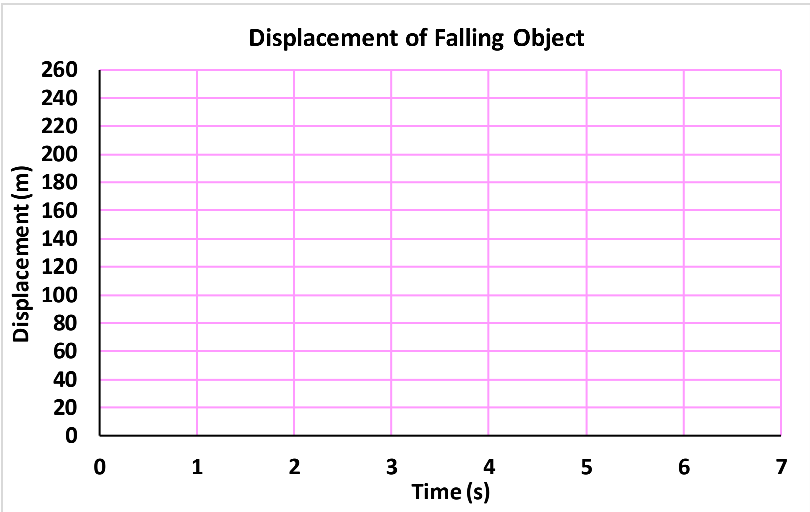
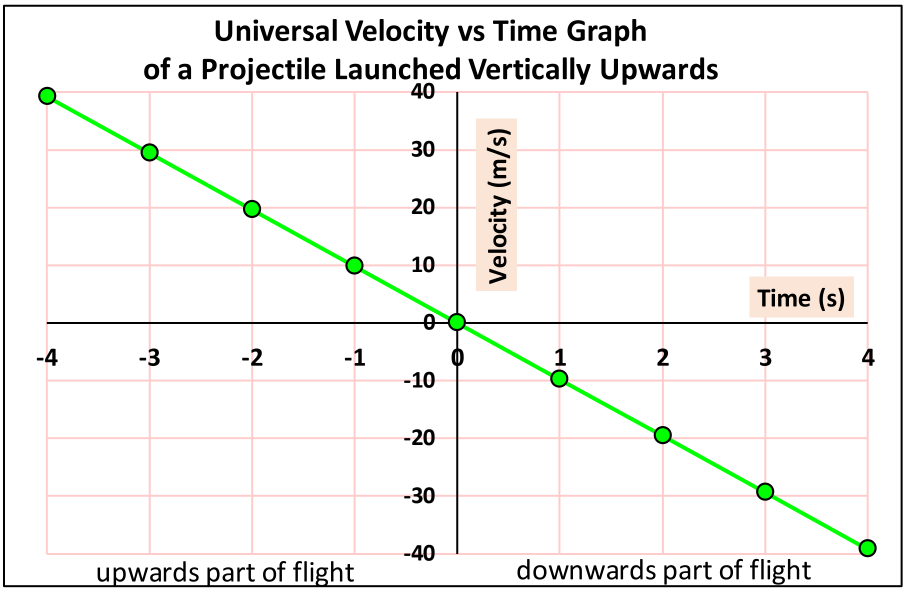
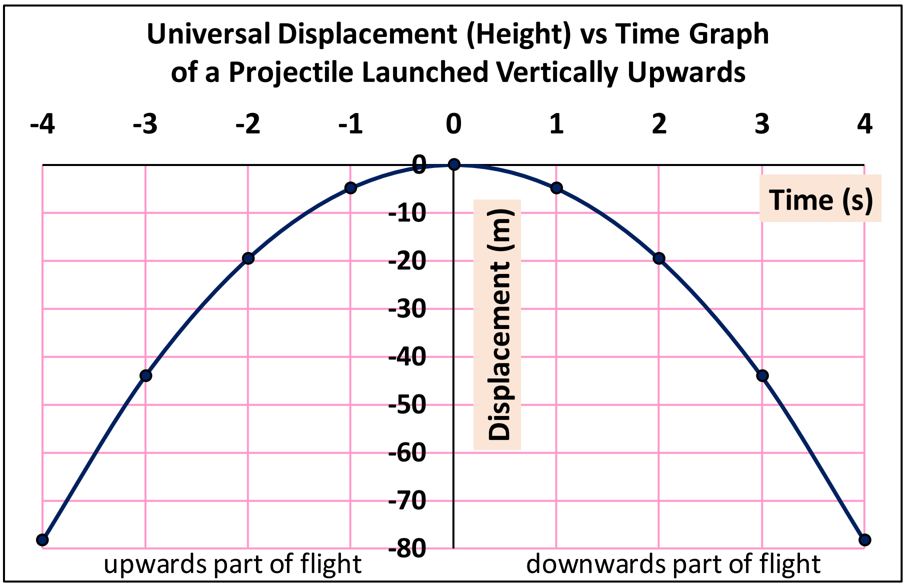


5. The table next to Question 1 shows that if you drop an object from a tall cliff, then…
After 1 second, it will fall _______ metres.
After 2 seconds, it will fall _______ metres which is _______ times further than the 1-second distance.
After 3 seconds, it will fall _______ metres which is _______ times further than the 1-second distance.
After 4 seconds, it will fall _______ metres which is _______ times further than the 1-second distance.
After 5 seconds, it will fall _______ metres which is _______ times further than the 1-second distance.
Therefore, following the same logic, the formula for calculating the displacement of an object that falls for "t" seconds is…

Displacement = 4.9 × _____

Part B





6. A ball is thrown upwards with an initial velocity of **32 m/s**.

(a) By reading off the v-t graph (at the 32 m/s mark), find the time that it takes to reach the top of its flight.

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(b) Therefore, how much time did it take to drop back down from its maximum height to the level from which it was thrown?

____

(c) What was the total time that it was in the air?

____

(d) By using the Displacement vs Time Graph, work out the height that the ball reached. (You will need to use your answer to 6a.)

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7. Using a catapult, a student launches a ball upwards and, using video footage, calculates that the ball was in the air for a total of 7.8 seconds.

(a) How much time did the ball take to reach the top of its flight?

____

(b) Use the Displacement vs Time graph (and your answer to Question 7a) to work out the height that it reached. ______________________________

(c) Use the Velocity vs Time graph (and your answer to Question 7a) to work out the ball's initial velocity when it was launched. ______________________________

(d) What was its final velocity when it returned to the height from which it was launched?

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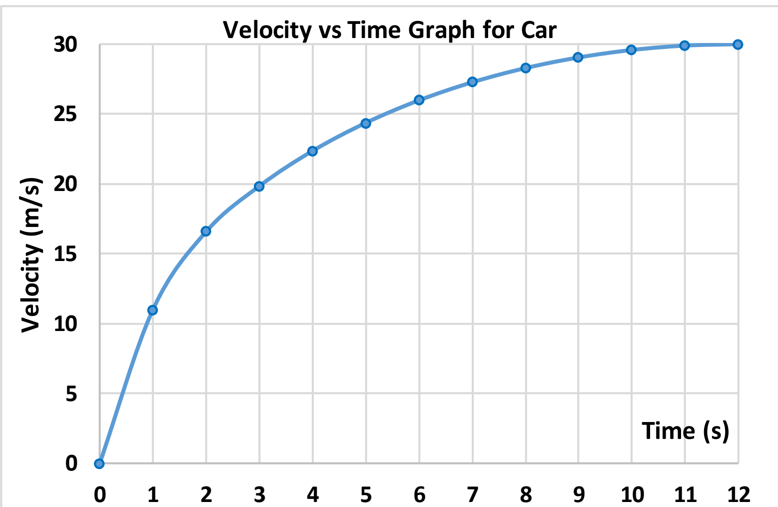
Part C



8. A car accelerates from rest and the v-t graph on the left is obtained. What is the car's velocity at

(a) the 2-second mark? ______________

(b) the 5-second mark? ______________

9. By using tangents, calculate the acceleration of the car at

(a) the 2-second mark? ______________

(b) the 5-second mark? ______________