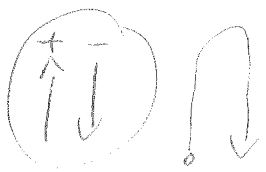
KEY

Physics 11 Worksheet - Kinematics

$v_f = at + v_i$

1. 



(a) $v_i = 15.0\ m/s$ ∴ $t = \frac{v_f - v_i}{a}$

$a = -9.8\ m/s^2$

at highest point $v_f = 0\ m/s$

$t = ?$

$t = \frac{0 - 15.0\ m/s}{-9.8\ m/s^2}$

$\therefore \boxed{t = 1.5\ s}$

(b) at E speed = 15.0 m/s

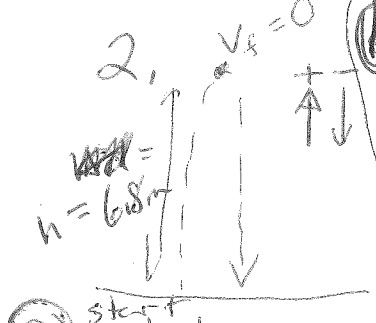
at C speed = 0.0 m/s

at F speed = 15.0 m/s ($\vec{v} = -15.0\ m/s$ ← velocity)

(c) Area A = Area B because the distance the ball flew upward (area A) = the distance the ball fell to the ground (area B)

(d) At C the ball is at the top of its trajectory.

2.



(a) $v_i = 0$

$a = -9.8\ m/s^2$

$\Delta d = -6.8\ m$

$t = ?$

(b) $v_i = ?$

$a = -9.8\ m/s^2$

$v_f = 0\ m/s$

$\Delta d = 6.8\ m$

$v_f^2 = 2a\Delta d + v_i^2$

$\therefore v_i = \sqrt{v_f^2 - 2a\Delta d}$

$= \sqrt{0 - 2(-9.8)(6.8)}$

$v_i = +11.54\ m/s$

$\therefore \boxed{v_i = 12\ m/s\ [up]}$

$\Delta d = \frac{1}{2}at^2 + v_i t$

$\therefore t = \sqrt{\frac{2\Delta d}{a}}$

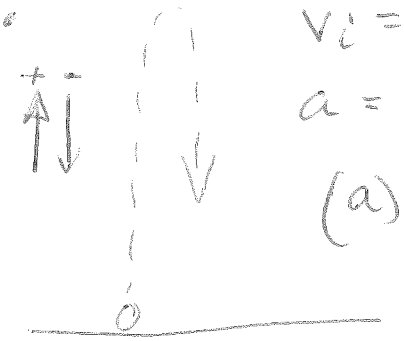
$t = \sqrt{\frac{2(-6.8)}{-9.8}} = 1.178$

total time $= 2t = \boxed{2.4\ s}$

(c) $v_f = -12\ m/s$

$\boxed{v_f = 12\ m/s\ [down]}$

3.



$v_i = 12.0\ m/s$

$a = -9.8\ m/s^2$

(a) $t = 1.0\ s$

$\Delta d = ?$

$\Delta d = \frac{1}{2}at^2 + v_i t$

$= \frac{1}{2}(-9.8)(1.0_s)^2 + (12)(1)$

$\boxed{\Delta d = 7.1\ m}$

(b) $t = 2.0\ s$

$\Delta d = \frac{1}{2}at^2 + v_i t$

$= \frac{1}{2}(-9.8)(2)^2 + (12)(2)$

$\boxed{\Delta d = 4.4\ m}$

(c) $v_f = 0\ m/s$

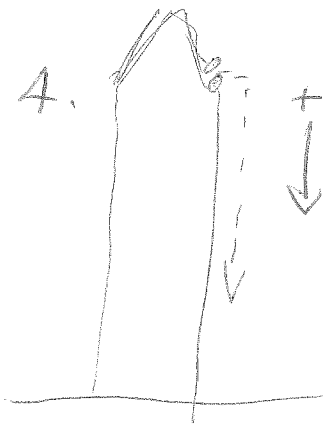
$\Delta d = ?$

$v_f^2 = 2a\Delta d + v_i^2$

$\Delta d = \frac{v_f^2 - v_i^2}{2a} = \frac{0 - (12)^2}{2(-9.8)}$

$\boxed{\Delta d = 7.3\ m}$

4.



$v_i = 0$

$a = 9.8\ m/s^2$

$\Delta d = 449\ m$

$t = ?$

$v_f = ?$

(a) $\Delta d = \frac{1}{2}at^2 + \cancel{v_i t}$

$t = \sqrt{\frac{2\Delta d}{a}} = \sqrt{\frac{(2)(449)}{9.8}}$

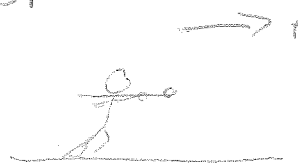
$\boxed{t = 9.6\ s}$

(b) $v_f^2 = 2a\Delta d + v_i^2$

$v_f = \sqrt{2(9.8)(449) + 0^2}$

$\boxed{v_f = 94\ m/s\ [down]}$

5.



$v_i = 6.0\ m/s$

$a = 250\ m/s^2$

$t = 0.10\ s$

$v_f = ?$

$v_f = at + v_i$

$= (250)(0.1) + 6$

$\boxed{v_f = 31\ m/s}$

6.

$v_i = 0$

$v_f = 18.0\ m/s$

$t = 20.0\ s$

$a = ?$

$\Delta d = ?$

(a) $a = \frac{v_f - v_i}{\Delta t} = \frac{18 - 0}{20} = \boxed{0.90\ m/s^2}$

(b) ~~$\Delta d = \frac{v_f^2 - v_i^2}{2a} = \frac{(18)^2 - 0}{2a}$~~

(b) $\Delta d = \frac{1}{2}(v_i + v_f)\Delta t = \frac{1}{2}(0 + 18)(20)$

$\boxed{\Delta d = 1.8 \times 10^2\ m}$

7.

$v_i = 3.50\ m/s$

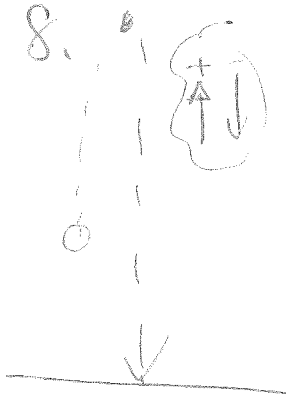
$v_f = 11.40\ m/s$

$t = 4.2\ s$

$\Delta d = \frac{1}{2}(v_i + v_f)\Delta t$

$= \frac{1}{2}(3.5 + 11.4)(4.2)$

$\boxed{\Delta d = 31\ m}$

8. 

$V_i = 8.0 m/s$

$a = -9.8 m/s^2$

$V_f = 0$

$\Delta d = ?$

$V_f^2 = 2a\Delta d + V_i^2$

$\Delta d = \frac{V_f^2 - V_i^2}{2a}$

$= \frac{0 - 8^2}{2(-9.8)} = 3.265 m$

height above the ground $= 3.265m + 1.0m$

$\boxed{h = 4.3m}$

9. 

$V_i = \frac{100 km/h}{3.6} = 27.778$

$V_f = 0 m/s$

$a = -5.0 m/s^2$

$\Delta d = ?$

$\Delta d = \frac{V_f^2 - V_i^2}{2a}$

$= \frac{0 - (27.778)^2}{2(-8)}$

$\boxed{\Delta d = 48m}$

10. (a) (graph on next pg)

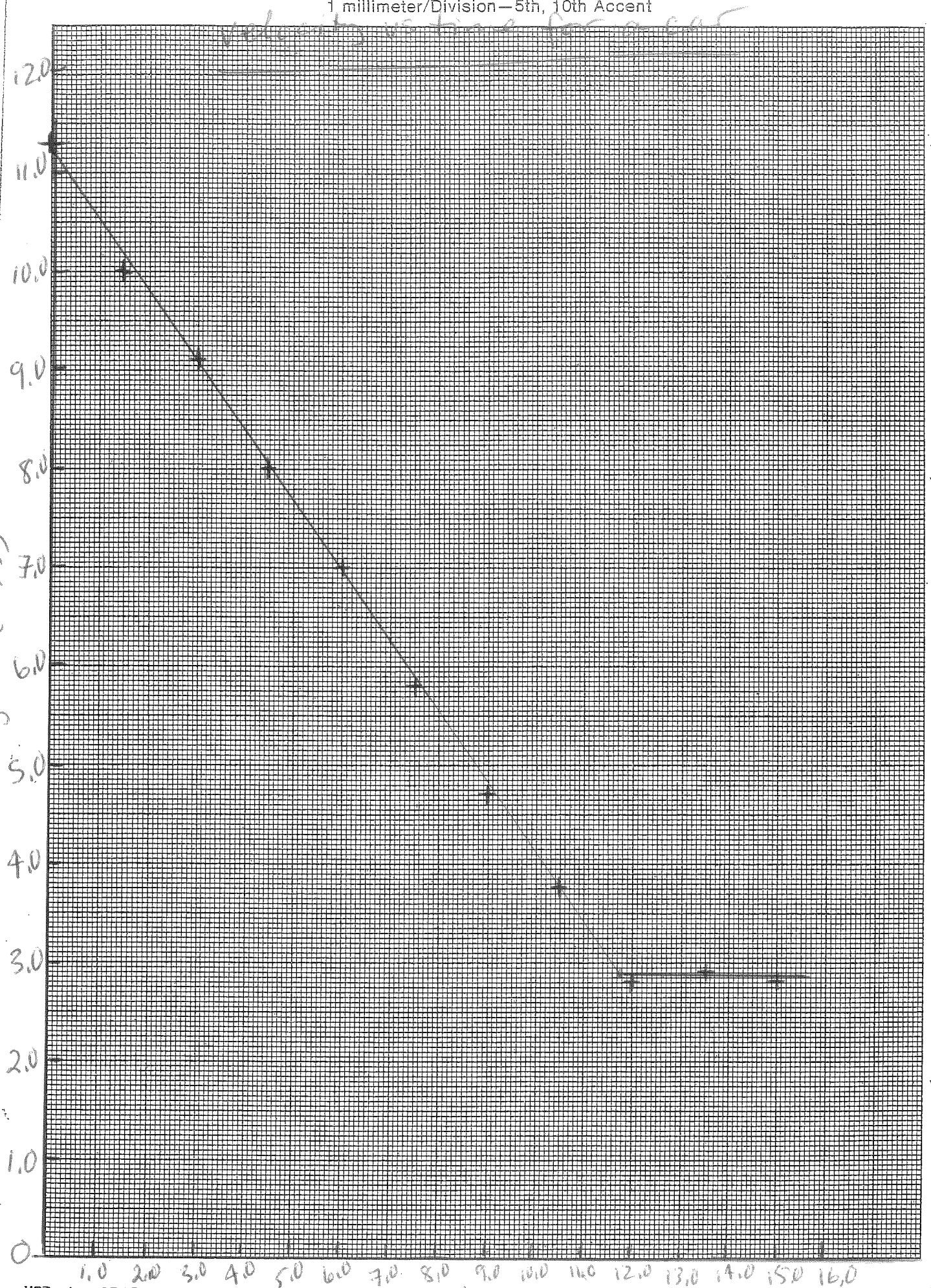
(b) The car reduced speed at a constant rate from 0s to 11.6s, then continued moving at a constant speed of about 2.85 m/s.

(c) $\text{slope} = \frac{v_2 - v_1}{t_2 - t_1} = \frac{2.9 m/s - 11.2 m/s}{11.75 - 0s} = \boxed{-0.71 m/s^2}$

(d) $y = mx + b$

$\boxed{v = (-0.71 m/s^2)t + 11.2 m/s}$

1 millimeter/Division—5th, 10th Accent

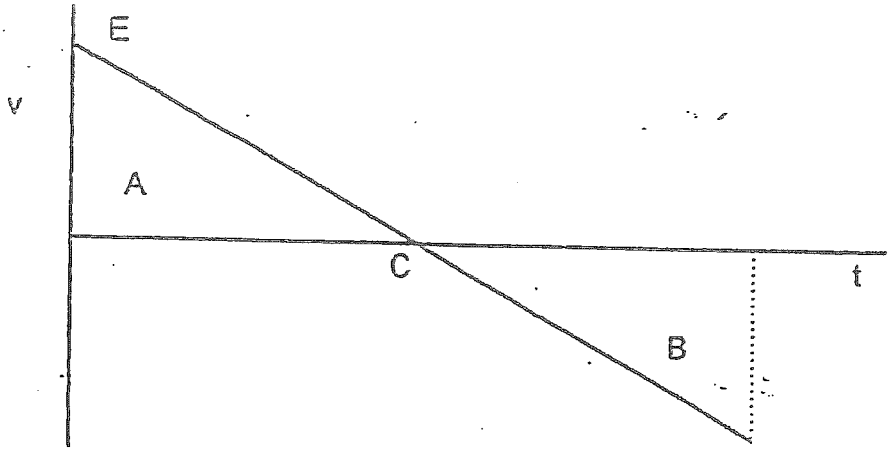


[A] (1)

Physics 11 Worksheet - Kinematics

recall: acceleration due to gravity is 9.8 m/s^2

1. A stone is thrown up vertically with a speed of 15.0 m/s. A sketch of the velocity-time graph for the motion is shown below.



(a) How long does it take to get to its highest point?
(b) What is the speed at each of the points E, C and F?
(c) Why is area A equal to area B?
(d) At what stage of its flight is the stone when it is at C?

2. "Darryl-the-wonder-dog" was a very talented pup. One of his skills was throwing and catching his tennis ball. On one throw, the ball went vertically into the air to a height of 6.8m.
(a) How long did he have to wait to catch the ball on its way down?
(b) What was the ball's initial velocity?
(c) What was its final velocity?

3. A ball is thrown vertically upwards with a velocity of 12.0 m/s.
(a) At what height is the ball 1.0s later?
(b) At what height is the ball 2.0s after being thrown?
(c) What is the maximum height the ball reaches?

4. The Empire State building in New York city is 449 m high.
(a) How long would it take a 1500 kg elephant dropped from the top of the building to reach the ground?
(b) What would its final velocity be?

B

(2)

(5) A javelin thrower carrying a spear while running at 6.0 m/s thrusts the spear ahead with an acceleration of 250m/s^2 for 0.10s. What is the speed with which the javelin leaves the throwers hand?

(6) (a) If an Olympic cyclist reaches 18.0 m/s from a standing start in 20.0 s, what is his average acceleration?

(b) What distance does he travel in that time?

(7) If a skier accelerates steadily down a hill from 3.50 m/s to 11.40 m/s in 4.20 s, what distance does she travel?

(8) A frustrated physics student threw his textbook into the air with a speed of 8.0 m/s from a height of 1.0m. If the acceleration of the book was 9.8 m/s^2 (towards the earth), how high did the book fly before falling down?

(9) In a panic stop a cars brakes can produce an acceleration of - 8.0 m/s^2. If you are driving at 100km/h, what is your minimum stopping distance?

(10) The data table below shows the velocity of a car.

(a) On the graph paper provided, draw a graph of the points on the data table. Include all required elements in the graph.

velocity (m/s)	11.3	10.0	9.1	8.0	7.0	5.8	4.7	3.75	2.8	2.9	2.8
time (s)	0.0	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12	13.5	15

(b) In words, describe the motion of the car.

(c) Calculate the slope of the line of best fit for the portion of the graph between t = 0.0 s and t = 11.0 s.

(d) What is the equation of the line of best fit for the portion of the graph between t = 0.0 s and t = 11.0 s?