KEY

Worksheet 2.7 – Uniform Accelerated Motion

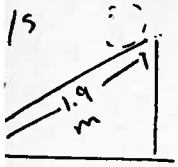
1) Bumblebee jumps straight upwards with a velocity of 14.0 m/s. What is his displacement of after 1.80 s?

$V_f = x$
$V_i = 14.0\ m/s$
$d = ?$
$a = -9.8\ m/s^2$
$t = 1.80\ s$

$d = V_i t + \frac{1}{2}at^2$
$= (14.0)(1.8) + \frac{1}{2}(-9.8)(1.8)^2$
$= \boxed{9.32\ m}$

(9.32 m)

2) A surprisingly spherical decepticon is rolled up a constant slope with an initial velocity of 9.3 m/s. What is the acceleration of the decepticon if its displacement is 1.9 m up the slope after 2.7 s?

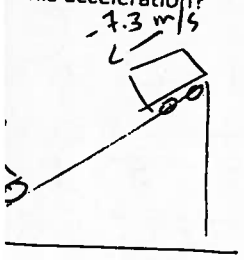


$V_f = x$
$V_i = 9.3\ m/s$
$d = 1.9\ m$
$a = ?$
$t = 2.7\ s$

$d = V_i t + \frac{1}{2}at^2$
$1.9 = 9.3(2.7) + \frac{1}{2}a(2.7)^2$
$1.9 = 25.11 + 3.65(a)$
$\boxed{a = -6.4\ m/s^2}$

(-6.4m/s²)

3) Optimus Prime coasts up a hill initially at 11.0 m/s. After 9.3 s he is rolling back down the slope at 7.3 m/s. What is his acceleration?

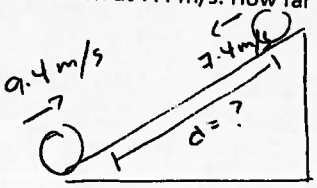


$V_f = -7.3\ m/s$
$V_i = 11.0\ m/s$
$d = x$
$a = ?$
$t = 9.3\ s$

$V_f = V_i + at$
$-7.3 = 11.0 + a(9.3)$
$\boxed{a = -2.0\ m/s^2}$

(-2.0 m/s²)

4) Sonic (you know, the Hedgehog) rolls up a slope at 9.4 m/s. After 3.0 s he is rolling back down at 7.4 m/s. How far up the hill is he at this time?



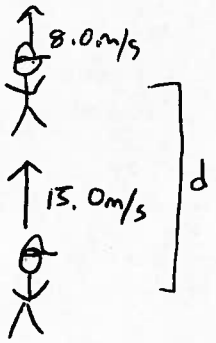
$V_f = -7.4\ m/s$
$V_i = 9.4\ m/s$
$d = ?$
$a =$
$t = 3.0\ s$

$d = \frac{1}{2}(V_i + V_f)t$
$= \frac{1}{2}(-7.4 + 9.4)(3.0)$
$= \boxed{3.0\ m}$

(3.0 m)

5) Luigi jumps straight upwards at 15.0 m/s. How high is he when he is travelling at:

a) 8.0 m/s upwards?

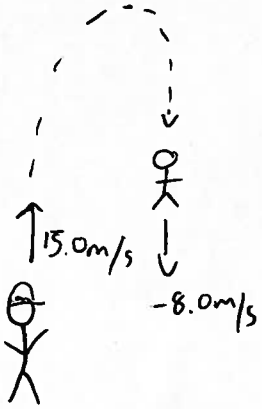


$V_f = 8.0\ m/s$
$V_i = 15.0\ m/s$
$d = ?$
$a = -9.8\ m/s$
$t = x$

$V_f^2 = V_i^2 + 2ad$
$(8.0)^2 = (15.0)^2 + 2(-9.8)d$
$64 = 225 + (-19.6)d$
$-161 = -19.6d$
$\boxed{d = 8.2\ m}$

(8.2 m)

b) 8.0 m/s downwards?



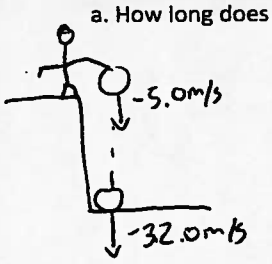
$V_f = -8.0\ m/s$
$V_i = 15.0\ m/s$
$d = ?$
$a = -9.8$
$t = x$

$V_f^2 = V_i^2 + 2ad$
$(-8.0)^2 = (15)^2 + 2(9.8)d$
$\boxed{d = 8.2\ m}$

(8.2 m, weird huh?)

6) Sick of his guff, Optimus decides to throw Megatron down off the top of a building at 5.0 m/s. Megatron hits the ground traveling at 32.0 m/s.

a. How long does it take to hit the ground?



$V_f = -32.0\ m/s$
$V_i = -5.0\ m/s$
$d = x$
$a = -9.8\ m/s^2$
$t = ?$

$V_f = V_i + at$

$-32.0 = -5.0 + -9.8(t)$

$t = 2.8\ s$

(2.8 s)

b. How far does he fall?

$V_f^2 = V_i^2 + 2ad$

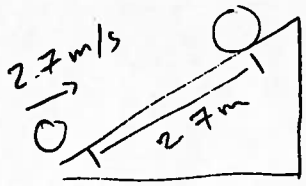
$(-32.0)^2 = (-5.0)^2 + 2(-9.8)d$

$d = 51\ m$

b/c he falls

(-51 m)

7) Mario rolls a coin up a slope at 2.0 m/s. It travels 2.7 m, comes to a stop and rolls back down. What is the coin's entire time of travel?



$V_f = 0$ ← time to stop.
$V_i = 2.0\ m/s$
$d = 2.7\ m$
$a = x$
$t = ?$

$d = \frac{1}{2}(V_i + V_f)t$

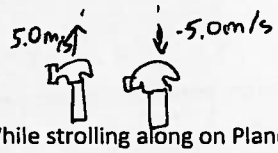
$2.7 = \frac{1}{2}(2.0 + 0)t$

$t = 2.7\ s$

(5.4 s)

this is time to stop

time total $= 2.7 \times 2 = 5.4\ s$



8) While strolling along on Planet X an astronaut decides to throw a hammer and a feather upwards at 5.0 m/s. They both return to the point of release in 3.0 s. What is the acceleration due to gravity on Planet X.

$V_f = -5.0\ m/s$
$V_i = 5.0\ m/s$
$d = x$
$a = ?$
$t = 3.0s$

$V_f = V_i + at$

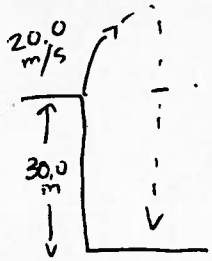
$-5.0\ m/s = 5.0 + a(3.0)$

$a = -3.3\ m/s^2$

(-3.3 m/s²)

9) Princess Toadstool stands on the edge of a 30.0 m high cliff. She throws Bowser upwards at 20.0 m/s. If Bowser falls all the way to the bottom of the cliff, find:

a. his velocity when he hits the ground.



$V_f = ?$
$V_i = -20.0\ m/s$
$d = -30.0\ m$
$a = -9.8\ m/s$
$t = x$

$V_f^2 = V_i^2 + 2ad$

$V_f^2 = (-20.0)^2 + 2(-9.8)(-30)$

$V_f = -31.4\ m/s$

(-31.4 m/s)

b. the time it takes to hit the ground.

$V_f = -31.4\ m/s$
$V_i = 20.0\ m/s$
$d = -30\ m$
$a = -9.8\ m/s^2$
$t = ?$

$V_f = V_i + at$

$-31.4 = 20 + (-9$

$t = 5.24s$

(5.24 s)