U02L04 Assignment

Chapter Review Questions

1. What is the difference between average speed and instantaneous speed?

2. What is the difference between velocity and speed?

3. What is the definition of acceleration?

4. Under what condition can acceleration be calculated simply by dividing change in speed by change in time?

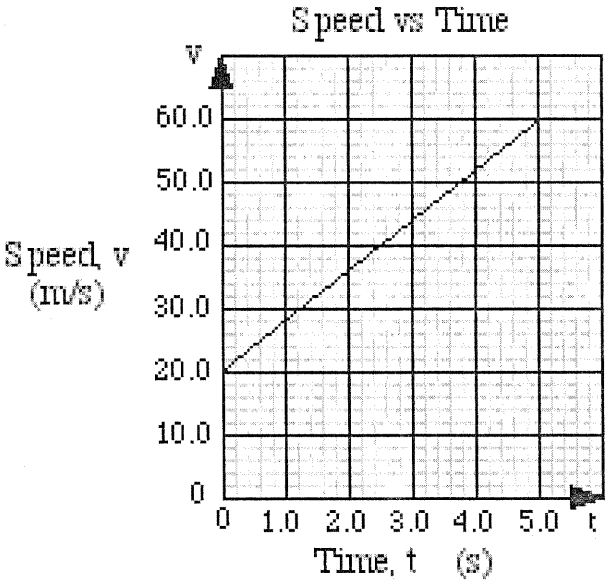


Figure 2.15

5. **Figure 2.15** is a speed-time graph for a vehicle.

   (a) What was the acceleration of the vehicle?
   (b) What was the average speed of the vehicle during its 5.00 s trip?
   (c) What distance did the vehicle travel during the 5.00 s?
   (d) Write a specific equation for this graph.

6. A high-powered racing car accelerates from rest at a rate of 7.0 m/s^2. How fast will it be moving after 10.0 s? Convert this speed to km/h.

7. **Figure 2.16** is a speed-time graph for a vehicle.

   (a) What was the acceleration of the vehicle?
   (b) Write a specific equation for this graph.
   (c) What was the average speed of the vehicle during its 5.00 s trip?
   (d) What distance did the vehicle travel during the 5.00 s trip?
   (e) Calculate the *area* of the triangle formed by the line and the axes of the graph, using the units and dimensions on the axes. Why does this area equal the distance travelled by the vehicle?

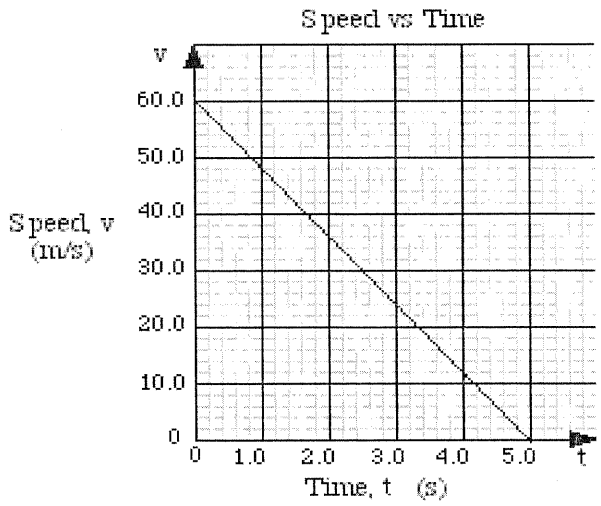


Figure 2.16

8. A child on a toboggan slides down a snowy hill, accelerating uniformly at 2.8 m/s^2. When the toboggan passes the first observer, it is travelling with a speed of 1.4 m/s. How fast will it be moving when it passes a second observer, who is 2.5 m downhill from the first observer?
9. A space vehicle is orbiting the earth at a speed of 7.58 x 10^3 m/s. In preparation for a return to earth, it fires retro-rockets, which provide a negative acceleration of 78.4 m/s^2. Ignoring any change in altitude that might occur, how long will it take the vehicle to slow down to 1.52 x 10^3 m/s?
10. A truck is moving along at 80.0 km/h when it hits a gravel patch, which causes it to accelerate at -5.0 km/h/s. How far will the truck travel before it slows to 20.0 km/h?
11. A very frustrated physics student drops a physics textbook off the top of the CN tower. If the tower is 5.3 x 10^2 m high, how long will the book take to reach the ground, assuming there is negligible air resistance? (g = 9.8 m/s^2)
12. If an electron inside a TV tube accelerates in a space of 5.0 cm from rest to 1/10 c, (where c is the speed of light, which is 3.0 x 10^8 m/s), what is its acceleration?
13. Snoopy is taking off in his WW I biplane. He coasts down the runway at a speed of 40.0 m/s, then accelerates for 5.2 s at a rate of 1/2 g, where g is the acceleration due to gravity (9.81 m/s^2). How fast is the plane moving after the 5.2 s?
14. A woman biker (leader of the local chapter of *Heck's Angels*) is driving along the highway at 80.0 km/h, in a 60.0 km/h speed zone. She sees a police car ahead, so she brakes so that her bike accelerates at -8.0 km/h/s. How far along the road will she travel before she is at the legal speed limit?
15. Spiderman is crawling up a building at the rate of 0.50 m/s. Seeing Spiderwoman 56 m ahead of him, he accelerates at the rate of 2.3 m/s^2.
    (a) How fast will he be moving when he reaches Spiderwoman?
    (b) How much time will it take to reach Spiderwoman?
    (c) When he reaches Spiderwoman, Spiderman discovers that she is a Black Widow and, as you know, Black Widows eat their mates! He is 200.00 m from the road below. How long will it take him to fall to the safety of the road, if he drops with an acceleration of

$g = 9.81$ m/s^2?

(d) ***Riddle!*** Why will Spiderman not be killed by the fall?***

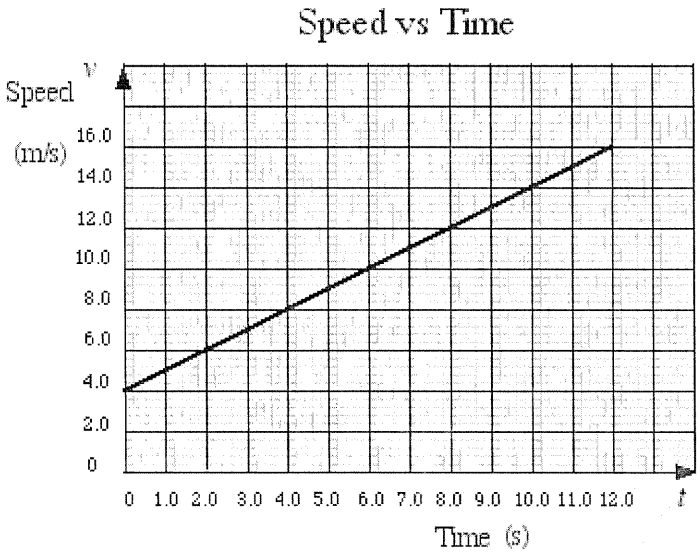
16. A stone is dropped from the top of a tall building. It accelerates at a rate of 9.81 m/s^2. How long will the stone take to pass a window that is 2.0 m high, if the top of the window is 20.0 m below the point from which the stone was dropped?
17. A glider on an air track is made to accelerate uniformly by tilting the track at a slight angle. The distance travelled by the glider was measured at the end of each 0.10 s interval, and the following data was gathered:

DISTANCE d (cm)	0	0.025	0.100	0.225	0.400	0.625
TIME t (s)	0	0.100	0.200	0.300	0.400	0.500

(a) Plot a graph with distance d on the Y-axis and time t on the X-axis.
(b) Plot a second graph with distance d on the Y-axis and t^2 on the X-axis.
(c) Use the slope of your second graph to figure out the acceleration of the glider on the air
track. ***HINT!*** *Think about the third equation for uniform acceleration.*

*** Because a spider, no matter how far he falls, always has eight feet left to go!

Test Yourself!



1. (a) What is the **y-intercept** of the above graph? (Include **units**.)
   (b) What is the **slope** of the above graph? (Include **units**.)
   (c) What is the **equation** for the above graph? (Use **symbols** v, t, in the equation.)

2. An aircraft, preparing for take-off, accelerates uniformly from 0 m/s to 20.0 m/s, in a time of 5.00 s.

(a) What is the acceleration of the aircraft?
(b) How long will the plane take to reach its take-off speed of 36.0 m/s?

3. At an air show, a jet car accelerates from rest at a rate of $3g$, where g is 9.80 m/s^2. How far does the jet car travel down the runway in a time of 4.0 s?

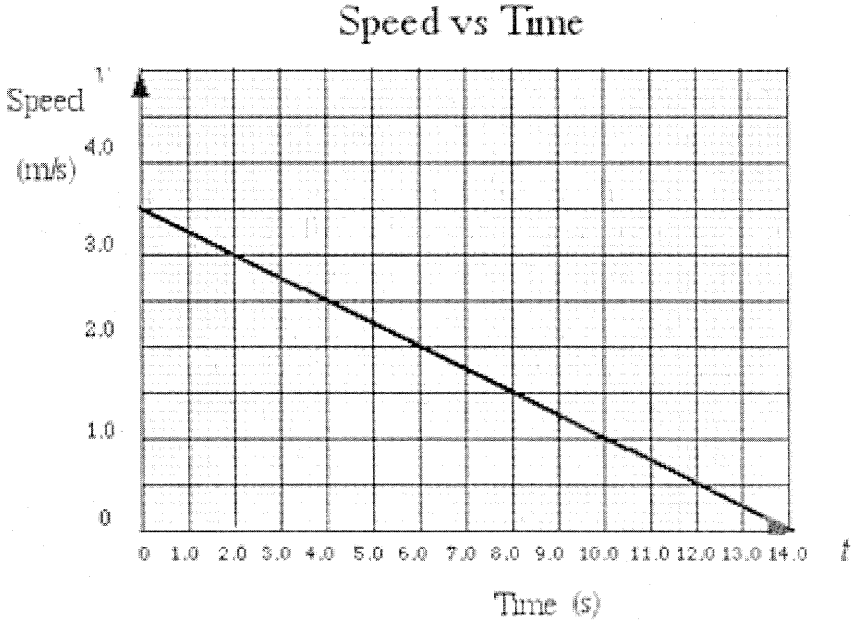
4. The CN Tower in Toronto is about 530 m high. If air friction did not slow it down, how long would it take a penny to fall from the top of the tower to the ground below? (g = 9.80 m/s^2)

5. A motocross rider is coasting at a speed of 2.00 m/s. He then decides to accelerate his bike at a rate of 3.00 m/s^2 for a distance of 100.0 m.

   (a) How fast is the bike moving, in m/s, at the end of the 100.0 m stretch?
   (b) Convert your answer to (a) from m/s to km/h.

6. A mountain bike rider, after coming down a steep hill, loses control of her bike while moving with a speed of 5.00 m/s. Fortunately, she collides with a haystack, which brings her to rest in a distance of 0.625 m. What was the acceleration of the bike and rider *while colliding with the haystack?*

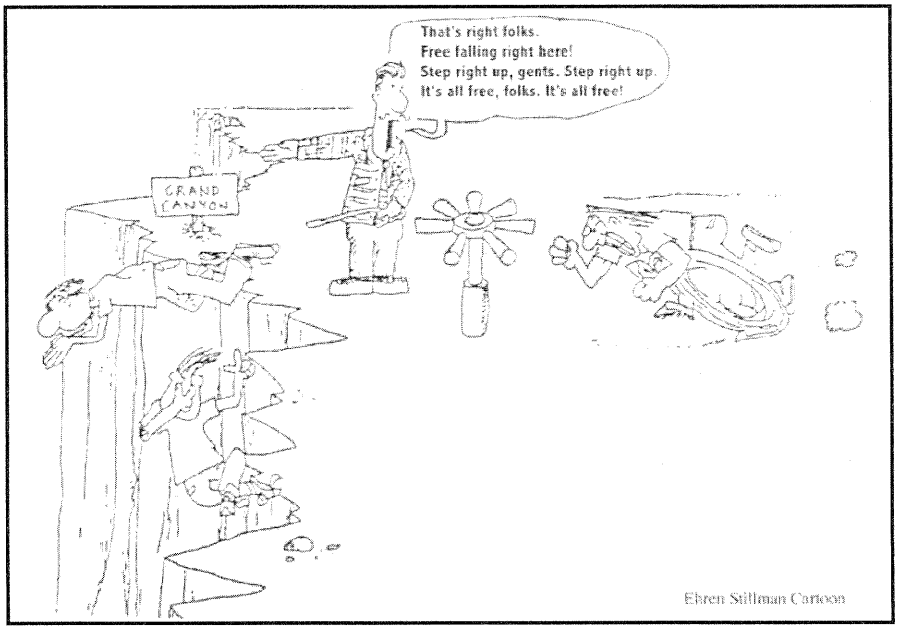
7. A policeman on a mountain bike is cruising at a speed of 4.00 m/s, when he sees a wanted
criminal standing on a corner, 100.0 m ahead of him. If the policeman accelerates at a rate of 2.00 m/s^2, how much time will he take to reach the corner?



8. The graph shows how the speed of an aging physics teacher varies with time, as he tries to run up a hill.

(a) What was the **starting speed** of the runner?
(b) What was the **acceleration** of the runner?
(c) What **distance** did the runner travel?

(d) What is the *specific* **equation** for the above graph?



ANS.

Chapter Review Questions

1. Instantaneous speed is a speed at a certain point. Average speed is the average speed between two points.
2. Speed is how fast you are going (scalar), Velocity is your speed in a certain direction.
3. Acceleration is the rate of change of velocity. It is a vector quantity.
4. When no change in direction occurs.
5. (a) $a = \dfrac{60.0 \text{ m/s} - 20.0 \text{ m/s}}{5.0 \text{ s} - 0} = 8.00 \text{ m/s}^2$

   (b) $\bar{v} = \dfrac{20.0 \text{ m/s} + 60.0 \text{ m/s}}{2} = 40.0 \text{ m/s}$

   (c) $d = \bar{v}\, t = (40.0 \text{ m/s})(5.00 \text{ s}) = 2.00 \times 10^2 \text{ m}$

   (d) $v_f = 20.0 \text{ m/s} + (8.0 \text{ m/s}^2)t$
6. $v_f = 0 + (7.0 \text{ m/s}^2)(10.0 \text{ s}) = 70. \text{ m/s}$

   $70. \text{ m/s} = \dfrac{0.070 \text{ km}}{\text{s}} \times \dfrac{3600 \text{ s}}{\text{h}} = 2.5 \times 10^2 \text{ km/h}$
7. (a) $a = \dfrac{0 - 60.0 \text{ m/s}}{5.0 \text{ s} - 0} = -12.0 \text{ m/s}^2$

   (b) $v_f = 60.0 \text{ m/s} - (12.0 \text{ m/s}^2)t$

   (c) $\bar{v} = \dfrac{60.0 \text{ m/s} + 0}{2} = 30.0 \text{ m/s}$

   (d) $d = \bar{v}\, t = (30.0 \text{ m/s})(5.0 \text{ s}) = 1.5 \times 10^2 \text{ m}$

   (e) Area = ½ height x base

$= \frac{1}{2}(60.0 \text{ m/s})(5.0 \text{ s}) = 1.5 \times 10^2 \text{ m}$

Note! ½ height x base = average speed x time (Same as (d)!)

8. $v_f^2 = v_o^2 + 2ad$

$= (1.4 \text{ m/s})(1.4 \text{ m/s}) + 2(2.8 \text{ m/s}^2)(2.5 \text{ m})$

$v_f^2 = 16 \text{ m}^2/\text{s}^2$.

$v_f = \sqrt{16 \text{ m}^2/\text{s}^2} = 4.0 \text{ m/s}$

9. $v_f = v_o + at$

$1.52 \times 10^3 \text{ m/s} = 7.58 \times 10^3 \text{ m/s} + (-78.4 \text{ m/s}^2)t$ $t = -\dfrac{7.58 \times 10^3 \text{ m/s} + 1.52 \times 10^3 \text{ m/s}}{-78.4 \text{ m/s}^2} = 77.3 \text{ s}$

10. The truck decelerates from 80.0 km/h to 20.0 km/h, so $\Delta v = 60.0$ km/h. It would take a time of $t = 12$ s if the acceleration is -5.0 km/h/s.

$$d = \bar{v}\, t = \frac{80.0 \text{ km/h} + 20.0 \text{ km/h}}{2} \times 12 \text{ s}$$

$$d = 50.0 \frac{\text{km}}{\text{h}} \times \frac{12 \text{ s}}{3600 \frac{\text{s}}{\text{h}}} = 0.167 \text{ km}$$

$d \cong 167$ m or 1.7×10^2 m

11. $d = \frac{1}{2}at^2$, so $t^2 = 2d/g$

$t^2 = 2 \times 5.3 \times 10^2 \text{ m}/9.8 \text{ m/s}^2 = 108 \text{ s}^2$

$t = \sqrt{108 \text{ s}^2} = 1.0 \times 10^1 \text{ s}$

12. $v_f^2 = 2ad$

$$a = \frac{v_f^2}{2d} = \frac{(3.00 \times 10^7 \frac{\text{m}}{\text{s}})(3.00 \times 10^7 \frac{\text{m}}{\text{s}})}{2 \times 5.0 \times 10^{-2} \text{ m}}$$

$$= 9.0 \times 10^{15} \text{ m/s}^2$$

13. $v_f = v_o + at$

$v_f = 40.0 \text{ m/s} + \frac{1}{2}(9.81 \text{ m/s}^2)(5.2 \text{ s}) = 66 \text{ m/s}$

14. $\Delta t = \dfrac{\Delta v}{a} = \dfrac{(60 \text{ km/h} - 80 \text{ km/h})}{-8.0 \text{ km/h/s}} = 2.5 \text{ s}$

$$\Delta d = \bar{v}\, \Delta t = \frac{(60 \text{ km/h} + 80 \text{ km/h})}{2} \times \frac{2.5 \text{ s}}{3600 \text{ s/h}}$$

$\Delta d = 49$ m

15. (a) $v_f^2 = v_o^2 + 2ad$

$v_f^2 = (0.50 \text{ m/s})^2 + 2(2.3 \text{ m/s}^2)(56 \text{ m})$

$v_f^2 = 258.25 \text{ m}^2/\text{s}^2$

$v_f = 16$ m/s

(b) $t = \dfrac{v_f - v_o}{a} = \dfrac{16 \text{ m/s} - 0.50 \text{ m/s}}{2.3 \text{ m/s}^2}$

$t = 6.7$ s

(c) $t^2 = 2d/g = 400 \text{ m}/9.81 \text{ m/s}^2 = 40.8 \text{ s}^2$

$t = \sqrt{40.8 \text{ s}^2} = 6.4$ s

16. $d_1 = 20.0$ m

$$t_1 = \sqrt{\frac{2d_1}{g}} = \sqrt{\frac{2 \times 20.0 \text{ m}}{9.81 \text{ m/s}^2}} = 2.02 \text{ s}$$

$d_2 = 22.0$ m

$$t_2 = \sqrt{\frac{2d_2}{g}} = \sqrt{\frac{2 \times 22.0 \text{ m}}{9.81 \text{ m/s}^2}} = 2.12 \text{ s}$$

$\Delta t = t_2 - t_1 = 0.10$ s to pass the window.

17. (a) Graph of d *vs* t is a parabola.
    (b) Graph of d *vs* t^2 is a straight line, with a slope of k = 2.5 cm/s^2. So $d = kt^2$.
    Since $d = \frac{1}{2}at^2$, the slope k must equal $\frac{1}{2}a$.
    Therefore, $a = 2k = 5.0$ cm/s^2.

Test Yourself

Chapter 2

1. (a) 4.0 cm/s
   (b) 1.0 cm/s^2
   (c) $v = 4.0$ cm/s + (1.0 cm/s^2)t
2. (a) 4.00 m/s^2
   (b) 9.0 s
3. 2.4 x 10^2 m
4. 10.4 s
5. (a) 24.6 m/s
   (b) 88.5 km/h
6. -20.0 m/s^2
7. 8.2 s
8. (a) 3.50 m/s
   (b) -0.25 m/s^2
   (c) 24.5 m
   (d) $v = 3.5$ m/s - (0.25 m/s^2)t

Physics 11 OKM

Name: _____ Date: _____

Block: ____

Projectile Motion

Objects Launched Horizontally

1. A stone is thrown horizontally at a speed of +5.0 m/s from the top of a cliff 78.4 m high.
   a. How long does it take the stone to reach the bottom of the cliff?

   b. How far from the base of the cliff does the stone strike the ground?

   c. What are the horizontal and vertical components of the velocity of the stone just before it hits the ground?
      i. Horizontal

      ii. Vertical

   d. What is the magnitude and direction of the velocity of the projectile upon impact with the ground? (Draw a diagram)

2. A steel ball rolls with constant velocity across a tabletop 0.950 m high. It rolls off and hits theground +0.352 m horizontally from the edge of the table. How fast was the ball rolling?

3. An auto, moving too fast on a horizontal stretch of mountain road, slides off the road, falling into deep snow 43.9 m below the road and 87.7 m beyond the edge of the road.
   a. How long did the auto take to fall?

   b. How fast was it going when it left the road? (in m/s and km/h)

   c. What was it's acceleration 10 m below the edge of the road?

Physics 11 OKM

Name: _____ Date: _____

Block: ____

Projectile Motion

Objects Launched Horizontally

1. A stone is thrown horizontally at a speed of +5.0 m/s from the top of a cliff 78.4 m high.
   a. How long does it take the stone to reach the bottom of the cliff?

$d_y = \frac{1}{2} g t^2 \Rightarrow t = \sqrt{\frac{2d_y}{g}}$

$t = \sqrt{\frac{2(-78.4\,m)}{-9.80\,m/s^2}} = \boxed{4.0\,s}$

   b. How far from the base of the cliff does the stone strike the ground?

$d_x = v_{ox} t$

$= (5\,m/s)(4.0\,s) = \boxed{20\,m}$

   c. What are the horizontal and vertical components of the velocity of the stone just before it hits the ground?
      i. Horizontal $+5.0\,m/s$
      ii. Vertical

$v_y = gt = (-9.80\,m/s^2)(4.0\,s) = \boxed{-39\,m/s}$

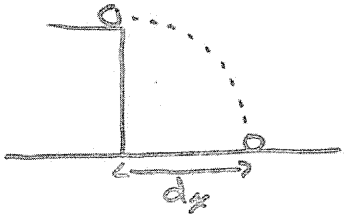
   d. What is the magnitude and direction of the velocity of the projectile upon impact with the ground? (Draw a diagram)

$v = \sqrt{v_{ox}^2 + v_{oy}^2} = \sqrt{(5.0\,m/s)^2 + (-39\,m/s)^2}$

$v = 39.3\,m/s = \boxed{39\,m/s}$

$\tan\theta = \frac{v_{ox}}{v_y} \rightarrow \theta = \tan^{-1}\left(\frac{5\,m/s}{39.3\,m/s}\right) = \boxed{7.3^\circ \text{ from vertical}}$

2. A steel ball rolls with constant velocity across a tabletop 0.950 m high. It rolls off and hits theground +0.352 m horizontally from the edge of the table. How fast was the ball rolling?



$d_y = \frac{1}{2} g t^2 \rightarrow t = \sqrt{\frac{2d_y}{g}}$

$t = \sqrt{\frac{2(-0.95\,m)}{-9.80\,m/s^2}} = \boxed{0.44\,s}$

$v_{ox} = \frac{d_x}{t} = \frac{0.352\,m}{0.44\,s} = \boxed{0.800\,m/s}$

Lachapelle From: Merril: Physics – Principles and Problems

3. An auto, moving too fast on a horizontal stretch of mountain road, slides off the road, falling into deep snow 43.9 m below the road and 87.7 m beyond the edge of the road.

   a. How long did the auto take to fall?

$$d_y = \frac{1}{2} g t^2 \rightarrow t = \sqrt{\frac{2 d_y}{g}} = \sqrt{\frac{2(-43.9\,m)}{-9.80\,m/s^2}} =$$

$$\boxed{t = 2.99\,s}$$

   b. How fast was it going when it left the road? (in m/s and km/h)

$$d_x = v_{ox} t \rightarrow v_{ox} = \frac{d_x}{t}$$

$$v_{ox} = \frac{87.7\,m}{2.99\,s} = \boxed{29.3\,m/s}$$

$$29.3\,\frac{m}{s}\left(\frac{1\,km}{1000\,m}\right)\left(\frac{3600\,s}{1\,h}\right) = \boxed{106\,km/h}$$

   c. What was it's acceleration 10 m below the edge of the road?

$$\boxed{g = -9.80\,m/s^2}$$

Lachapelle From: Merril: Physics – Principles and Problems

PHYSICS 11 KINEMATICS WORKSHEET 3

Read over your notes kinematics formulas, and refer to pp 54-56, 63-68 of the text to answer the following questions. Assume $g = 9.8\ m/s^2$.

1. A flower pot falls from a third storey window, 17.0 m above a sidewalk.
   a) With what speed does the pot hit the path?
   b) How long does it take for the pot to hit the path?

2. A penknife drops out of a sailor's hand while she is at the top of a mast. She times the knife's drop to the deck and measures 1.3 s.
   a) How high was she up the mast?
   b) With what speed did the knife hit the deck?
   c) What was the knife's average speed?

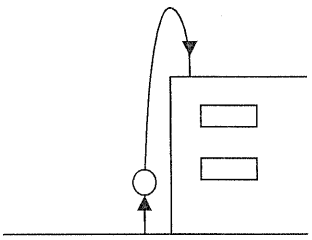
3. Our hero, Phreddie Physics, visits Vancouver so he can drop a small iron bolt from Lion's Gate bridge to the water 65 m below.
   a) With what speed will the bolt hit the water?
   b) What should be the bolt's average velocity while dropping?
   c) How long will the drop take?

4. Dirk Doofus belly-flops straight down from a 3.0-metre diving board into the water.
   a) How long is he airborne?
   b) With what speed does Dirk hit the ground?
   c) Will this landing be painful?

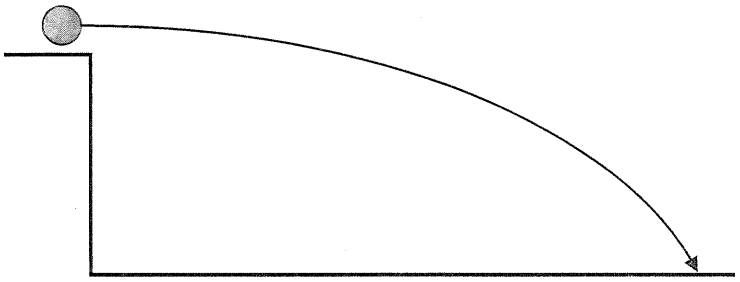
5. A cowboy fires a bullet straight up from ground level at a speed of 182 m/s.
   a) How high does the bullet go?
   b) How long does it take for the bullet to stop?
   c) When is the bullet's acceleration equal to zero?
   d) What is the bullet's total time in the air?

6. A car moving at 30 m/s makes a head-on collision with a stone wall. From what height would the car have to fall in order to make an equally hard collision with the ground (i.e., hit at the same speed)?

7. A baseball is tossed from street level by a student straight up at a speed of 25.3 m/s. After reaching maximum height, it is caught by another student on the roof of a building, 17.4 m above the street (see side picture). How long does this take?



8. An object is fired horizontally from the top of a cliff, and lands on the ground at some distance away from the base of the cliff.



a) List all the horizontal information that is known about the object.
b) List all vertical information known about this object.

9. Homer Simpson attempts to cross a 27 m-deep canyon on Bart's skateboard. He takes off horizontally from one side at 12.3 m/s but ends up falling to the canyon floor.
a) How long is he airborne?
b) How far from the cliff does he land?

10. A student throws a baseball horizontally from the balcony of the school. If the balcony is 5.6 m above the ground, and the ball lands on the ground 25 m from the base of the school, with what initial speed did the student throw the baseball?

1. a) 19 m/s b) 1.9 s 2. a) 8.3 m b) 12 m/s c) 6.0 m/s 3. a) 35 m/s b) 18 m/s c) 3.6 s
4. a) 0.78 s b) 7.6 m/s c) u-betcha 5. a) 1.69 x 10^3 m b) 18.6 s c) never! (explain) d) 37.2 s 6. 47 m 7. 4.34 s
8. a) a = 0, $v_i = v_f = v_{av}$ = constant b) $v_i = 0$, a = 9.8 m/s^2 down 9. a) 2.4 s b) 29 m 10. 23 m/s

Projectile Motion Worksheet Name _____ Due _____

You are required to show ALL working when doing these problems, Circle all you answers for calculations, assume gravity = $9.8ms^{-2}$

1. What assumption must be made before we can do Projectile Motion calculations at this level?

2. A bottle rocket is fired straight up at $9ms^{-1}$,
   (a) Explain why it slows as it rises
   (b) What is its velocity at the top of motion?
   (c) Explain why it increases it velocity as it falls
   (d) Theoretically, what is its velocity when it hits the ground?
   (f) explain why the horizontal velocity is constant during the flight

3. A Holden commodore full of hooligans is driven off a 22m cliff into the sea at 80km/h
   (a) How long did the occupants have to wait before they hit the sea?
   (b) how far into the sea did the car go?
   (c) What is the vertical and horizontal velocity at which they hit?

4. An artillery gun is being tested for effective range, it fires a 1.5kg shell at 120m/s. Find the max range it can go at the following heights:
   (a) 30m (b) 40 m (c) 50 m (d) 60 m
   (e) At what velocity must it be fired at, if we want to attack (although we should never attack thy enemy, always love thy enemy) at a range of 4000m.

5. A golfer makes a hit, if the tee box is elevated to 15m and he's trying to get a hole-in-one on a par 3 that's 238m long…
   (a) How hard does he have to hit the ball?
   (b) How long was the ball in flight?
   (c) If he strikes it at 4.5m/s does he get an ace?

Review

Forces and Newton's Laws

For all calculation questions:

- **identify the formula you are using**
- **show your work**
- **place your answer with correct units in a box**

1. State Newton's three laws of motion and give an example from your life of each.

2. Find the force of gravity at the earth's surface on a 5.7 kg mass.

3. What is the mass of an object which weighs 79 N on the Earth's surface?

4. What is the gravitational field strength ('g) on Venus if its mass is 4.88×10^{24} kg and its radius is 6.073×10^{6} m.

5. If the force of gravity on an object at the earths surface is 3200 N, what is the force of gravity when the object is 1.5 earth radii into space?

6. What is the gravitational attraction between a man with a mass of 110 kg and his wife (mass of 55 kg) when they are just 15 cm apart?

7. How much force is required to pull a 75 kg crate along a floor if the coefficient of friction is 0.26?

8. What is the coefficient of friction if a 7 N force is required to pull a 2.3 kg object along a floor at a constant velocity?

9. A 30N force applied to a rubber band causes a stretch of 5.4 cm. What is the spring constant?

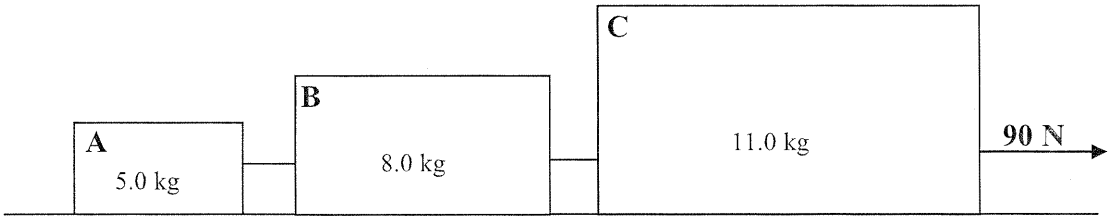
10. How much will a fishing line stretch when a 65 N force is applied to a 1 m length? $\left(k=14.2\frac{N}{m}\right)$

11. A 2.1 kg toy is pulled by a force of 4 N. If the coefficient of friction is 0.135 and the toy starts from rest, how far will it travel in the first 3 seconds?

12. A 2200kg car traveling 75 km/h on an icy, level road approaches an intersection. The brakes lock and the car skids to a stop. If the coefficient of friction between the road and tires is 0.078, what is the minimum distance in which the car will stop? (answer in meters)

13. Two boys pull on a 60 kg sled. One pulls with 700 N to the right while the other pulls with 640 No to the left. What will be the acceleration of the sled?

14. Blocks A, B, and C are joined by ropes. A force of 90 N is applied to C. The coefficient of friction is 0.355.



a) What is the net force on the boxes?

b) What is the acceleration of the boxes?

c) What is the tension in the rope joining box B to A?

15. A block with a mass of 7.4 kg is sliding along a frictionless surface at 9 m/s. If it encounters a rough surface which exerts a force of friction of 7 N, how long will it take to come to a stop?

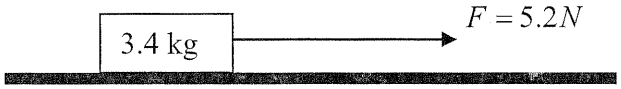
16. Calculate the unbalanced force acting on a 12.7 kg object that accelerates from 5 m/s to 18 m/s in 7.3 sec.

17. A fully loaded rocket has a mass of 2.63×10^{6} kg. Its engines have a thrust of 2.81×10^{7} N.
    a) Calculate the force of gravity on the rocket.

    b) What is the acceleration of the rocket as it blasts off?

18. A 625 N student (as weighed in a physics lab) wants to see how his weight is affected by his riding in an elevator. Suppose this student is standing on a scale that reads in Newtons and is travelling up but accelerating at -1.4 m/s^2. What value will the scale read ?

19. A 3.4 kg object is pulled along a horizontal surfaces as shown in the diagram by a horizontal force of 5.2 N. If the object is accelerating at a rate of 1.1 m/s^2 to the right, what is the force of friction acting on the object?



20. Jeff (mass 87 kg) and Kevin (mass 92 kg) are standing on the same surface $(\mu = 0.23)$. Jeff pushes Kevin with a force of 1000 N. Determine the acceleration Jeff and Kevin will experience after the push.

Worksheet 5.3 - Force of Friction

1) A 7.6 kg object is resting on a horizontal surface. What is the normal force on the object?

2) A 7.6 kg object is pulled along a horizontal surface. If the coefficient of friction is 0.20, what is the force of friction?

4) A 9.6 kg object is pulled along a horizontal surface. If the coefficient of friction is 0.11 what is the force of friction?

5) A 20.0 N object is pulled along a horizontal surface at a constant velocity by a 3.0 N force, what is the coefficient of friction?

6) A 16.2 kg object is pulled along a frictionless surface by an applied force of 10.2 N, what is the normal force acting on it?

7) A 6.2 kg object is pulled along a horizontal surface by a force of 22.0 N. If its acceleration is 1.1 m/s^2, what is the coefficient of friction between the two surfaces?

8) A 1250 kg car traveling at 60.0 km/h comes to a sudden stop in 35 m. What is the coefficient of friction acting on the brakes?

9) A 950 kg car traveling at a constant velocity of 28 m/s, has a coefficient of friction of 0.125 acting on its axle. How much force is required by the engine to maintain its speed?

10) A 1425 kg dragster exerts 13900 N of force and accelerates from 0 to 100.0 km/h in 3.25 s. What is the coefficient of friction acting on the car?

1) 74 N 2) 15 N 3) 137 N 4) 10. N 5) 0.15 6) 159 N 7) 0.25 8) 0.40 9) 1200 N 10) 0.123

Physics 11 **Tension Problems** Name_____

Draw FBDs for all problems!

1. A 550 kg elevator is at rest and is being held by a cable. Determine the tension forces in the cable.

2. A 25 kg sign hangs outside a restaurant and is being held by two cables. Determine the tension forces in each cable. (hint: the weight is distributed evenly between the two cables!)

3. A 12.0 kg bucket is lifted upwards with constant velocity by a rope. What is the tension in the rope?

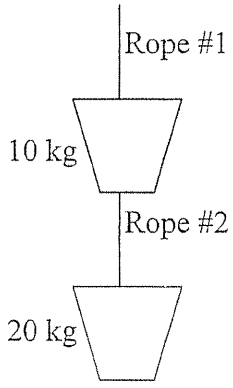
4. A 12.0 kg bucket is accelerated upwards at 0.60 m/s^2 by pulling a rope. What is the tension in the rope?

5. A 12.0 kg bucket held by a rope is accelerated downwards at 0.80 m/s^2. What is the tension in the rope?

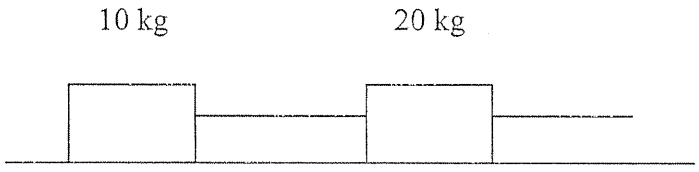
6. A 30.0 kg block is pulled along a table surface by a rope. If the table surface has a μ = 0.18, what applied force (the tension force) in the rope necessary to accelerate the block at 1.5 m/s^2?

7. A 20.0 kg block is pulled along a table surface by a rope. If the table surface has a μ = 0.10, what applied force (the tension force) in the rope necessary to accelerate the block at 2.5 m/s^2?

8. Two buckets are at rest as arranged in the diagram below. Determine the tension in each rope.



9. What is the tension in the rope that joins the two blocks that are pulled by a constant force of 500 N in the diagram below:



$\mu = 0.12$

10. Safety engineers estimate that an elevator can hold 15 persons of 80 kg average mass. The elevator itself has a mass of 500 kg. Tensile strengths show that the cable supporting the elevator can withstand a maximum force of 2.85×10^4 N. What is the greatest acceleration that the elevator can attain without breaking the cable?

Universal Gravitation and Gravitational Fields

Refer to Table 8-1 for some of the questions below.

1) What is the force of gravity on the following masses at the earth's surface, use Universal Gravitation.

a) 75 kg b) 500 g

2) The force of gravity on a mass is known to be 12 000 N at earth's surface. What is the force of gravity at the following distances:

a) 2.5 radii b) 3 radii c) 4 radii

3) Find the mass of a person who experiences a force of gravity of 281N on the surface of Mars.

4) Show by calculation the gravitational field strength at:

a) the earth's surface b) five radii c) the surface of the sun

5) A spaceship experiences a gravitational field toward the earth of 2.0 N/kg, what would the same field strength be when the ship is half that distance from the earth?

6) 1 pound is about 4.5 N, how much would a 10 kg cat weigh on Mars, Earth, and Jupiter?

Ans. 1) 735N,4.9N 2)1920N, 1333N, 750N 3) 75kg 4) 9.8 N/kg, 0.392 N/kg, 274 N/kg 5)8 N/kg 6) 8.3lbs, 22 lbs, 57.8 lbs

Name: _____ Date: _____

Block: _____

Worksheet

Hooke's Law

(1)

1. When a 5.00 kg mass is hung on the end of a certain spring, it stretches 0.260 m. What is the force constant of the spring (in N/m)?

   Given Information: Equations Used

   Answer: _____

2. A spring of force constant 45 N/m is used to pull a block along a level surface at constant speed. The spring is observed to stretch 12.0 cm while supplying this force. How much force is applied?

   F = _____

3. How much does a 55 kg girl compress the spring in a pogo stick when she stands on it? You are given that the spring constant is 78 N/cm.

   x = _____

4. How much force must be applied to a spring (k = 1400 N/m) in order to extend it by 0.10 m?

   F = _____

Physics 11 OKM

Name: _____ Date: _____

Block: ____

Chapter 4

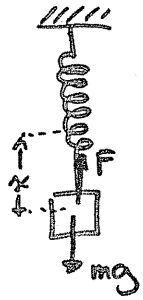
Hooke's Law

(Elastic Force)

1. When a 5.00 kg mass is hung on the end of a certain spring, it stretches 0.260 m. What is the force constant of the spring (in N/m)?

(3.00 marks)

Given Information: Equations Used



$F = kx$ $\quad \Sigma F = ma$ where $a = 0$

$F - mg = 0 \rightarrow F = mg$

$kx = mg \rightarrow k = \frac{mg}{x}$

$k = \frac{(5.00\,kg)(9.80\,m/s^2)}{0.260\,m} = 188\,N/m$

Answer 188 N/m (3)

2. A spring of force constant 45 N/m is used to pull a block along a level surface at constant speed. The spring is observed to stretch 12.0 cm while supplying this force. How much force is applied? $k = 45\,N/m$ $\quad x = 0.120\,m$

(3.00 marks)

$\Sigma F = ma$ where $a = 0$

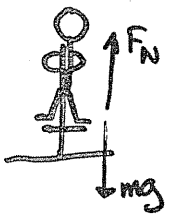
$F_A - F = 0 \rightarrow F_A = F$

$F_A = kx = (45\,N/m)(0.120\,m) = 5.4\,N$

F = 5.4 N (3 marks)

3. How much does a 55 kg girl compress the spring in a pogo stick when she stands on it? You are given that the spring constant is 78 N/cm. (3.00 marks)

$m = 55\,kg$ $\quad k = 78\,N/cm$



$\Sigma F = ma$ where $a = 0$

$F_N - mg = 0 \rightarrow F_N = mg$ $\quad F_N$ supplied by spring

$F_N = kx = mg \rightarrow x = \frac{mg}{k} = \frac{(55\,kg)(9.80\,m/s^2)}{78\,N/cm} = 6.9\,cm$

x = 6.9 cm (3 marks)

4. How much force must be applied to a spring (k = 1400 N/m) in order to extend it by 0.10 m? (3.00 marks)

$F = kx = (1400\,N/m)(0.10\,m) = 140\,N$

$= 1.4 \times 10^2\,N$