Unit 1 Review

Name: Answer Key Period: _____ Date: _____

Identify the following characteristics as either QUALITATIVE or QUANTITATIVE.

B 1. Amount of water in a pool - Can be measured in gallons

B 2. Length of hair on a person's head

A 3. Color of hair

B 4. The time an astronaut spends in space

A 5. The type of fabric used to reupholster a couch

A 6. The softness of a tissue

A. Qualitative
B. Quantitative

For each of the scenarios identify the variables as either INDEPENDENT or DEPENDENT.

Karen constantly talked on the phone and texted way more than the average person. It seemed she was constantly grounded at the end of the month because her father was upset with the wireless bill.

B 7. Her father's mood - Depends on how much she talks / size of bill

A 8. The time she spent on the phone

B 9. The size of the bill - Depends on how much she talks

A. Independent
B. Dependent

Greg was having a difficult time getting his drives to go more than 80 yards. His friends would give him several tips to improve the length of his drive, but nothing seemed to work. He changed the spacing of his feet, the speed of his swing, and type of ball. He finally broke down and started to take lessons where his instructor showed him how to properly set up his backswing. Finally he started to see results.

A 10. Type of ball

A 11. Spacing of his feet

B 12. Distance of his drive

A 13. His backswing

A. Independent
B. Dependent

Read the following scenario and answer questions 14 - 20.

a. Charles was walking by a construction zone and noticed a cinder block (a big brick) and an empty lunch pail fall
b. from the second story. He thought it was strange that they fell side by side the entire way to the ground. He
c. thought that since the block had more mass it would fall faster. This made him wonder if mass had
d. anything to do with how fast something fell. He thought about it for a while and figured out a way to get an
e. answer. He went home and got an empty container, metal pellets, a stop watch, a letter scale, and a tape
f. measure. He marked a distance of two meters on the wall and added a few pellets to the container. After he
g. determined the mass of the container and recorded it using the postage scale, he held the container up to the
h. mark and dropped it at the same time that he started the stop watch. When the container hit the ground he
i. stopped the timer and recorded the time in a table. He felt that he needed additional trials because his
j. measurement wasn't extremely precise so he repeated the same test two more times. Then he added several
k. more pellets, recorded its mass and repeated the test three more times for the new mass. He changed the mass
l. and repeated the test a total of 10 times. Looking at the numbers he still had a difficult time determining if
m. there was a relationship. He decided to graph the data he collected. After he graphed the data he felt confident
n. he knew the answer and he went and shared his ideas with his physics teacher because PHYSICS ROCKS! He
o. explained what he was thinking and how he acquired the data. He also shared the graphs he was able to make
p. using the data. His physics teacher looked over his results and explained that his answer was correct. Charles
q. then exclaimed, "This is the most rewarding experience ever! This even beats the time I ran 90 yards to return a
r. kickoff for the touchdown in the state championship."

D 14. Which of the sections best showed Charles stated his conclusion?

B 15. Which of the sections best showed Charles formulated and objectively tested a hypothesis?

C 16. Which of the sections best showed Charles interpreted his results?

A 17. Which of the sections best showed Charles made observations that lead to a question?

A. Lines a-d
B. Lines e-l
C. Lines l-n
D. Lines n-p
E. Lines p-r

Use the passage above to answer the following questions

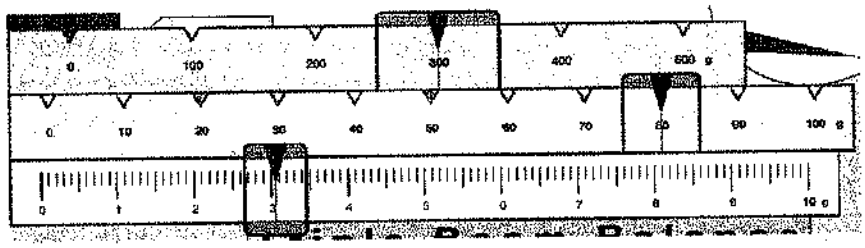
18. Which of the following variables was Charles' independent variable?
    a. Time
    b. Height
    (c.) Mass
    d. Type of pellets

19. Which of the following variables was Charles' dependent variable?
    (a.) Time
    b. Height
    c. Mass
    d. Type of pellets

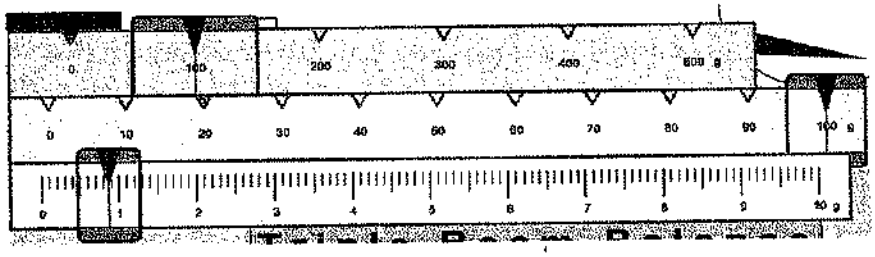
20. Which of the following is NOT a quantitative variable?
    a. Time
    b. Height
    c. Mass
    (d.) Type of pellets

Determine the measurement represented in each diagram with proper significant figures.

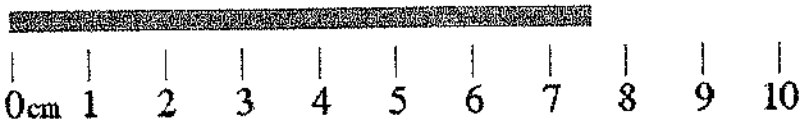
21. 383.05 g



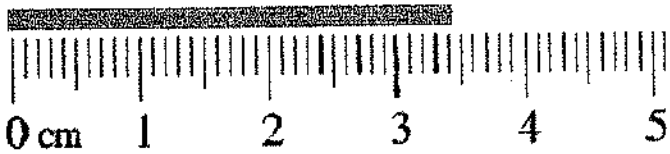
22. 200.88 g



23. 7.6 cm



24. 3.41 cm



In each of the following groups of numbers circle the number that is the most precise.

25. Group 1

32456
2134.2
123.21
5294
0.001

26. Group 2

3.04
23.45
19.320
1001.1
22.4

27. Determine the accuracy of 23.14 when compared to the accepted value of 21.92 by finding the percent error.

SHOW ALL WORK!!

$$\frac{\text{observed} - \text{expected}}{\text{expected}} \times 100$$

$$\frac{23.14 - 21.92}{21.92} \times 100$$

5.57 %

Write the following numbers in scientific notation. Record each value with THREE SIGNIFICANT FIGURES.

28. 0.00000344 kg = 3.44×10^{-6} kg

29. 32539.01 m = 3.25×10^{4} m

Take the following numbers out of scientific notation.

30. 2.31×10^{-4} g = 0.000231 g

31. 1.456×10^{6} nm = 1456000 nm

Complete the following math problems using proper significant figures. Explain the reasoning behind your answer.

32. $\frac{9.34}{0.25}$ = 37.36 (37) Division sig. figs. depend on the # of sig. figs.

33. 14.25 + 132.2 = 146.45 (146.5) Addition sig. figs. depend on the precision of the factors

Perform the following conversions and SHOW ALL WORK including the KHDBDCM work if used. Leave all answers in THREE SIGNIFICANT FIGURES

34. 24.5 cm = 1.52×10^{-4} miles

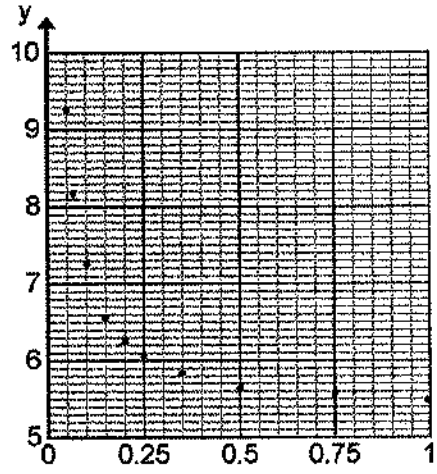
$$24.5\,\text{cm} \times \frac{1\ \text{m}}{100\ \text{cm}} \times \frac{1\ \text{km}}{1000\ \text{m}} \times \frac{1\ \text{mi}}{1.609\ \text{km}} = 1.52 \times 10^{-4}\ \text{mi}$$

35. 7.25×10^{17} nm = 7.25×10^{5} km

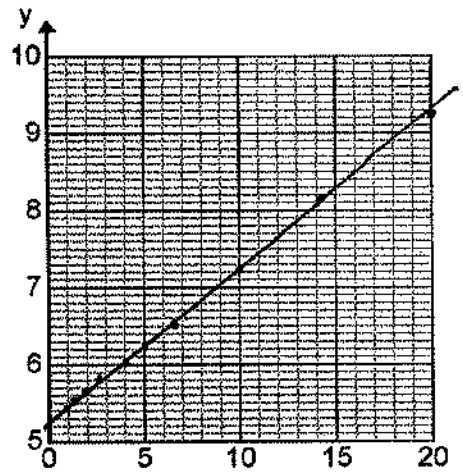
$$7.25 \times 10^{17}\,\text{nm} \times \frac{1\ \text{m}}{1 \times 10^{9}\ \text{nm}} \times \frac{1\ \text{km}}{1000\ \text{m}} = 7.25 \times 10^{5}\ \text{km}$$

Title and label the graph below. Plot the following data and determine the equation. Answer the remaining questions based on the data.

Time (s)	Position (m)
0.05	9.25
0.07	8.11
0.10	7.25
0.15	6.58
0.20	6.25
0.25	6.05
0.35	5.82
0.50	5.65
0.75	5.52
1.00	5.45



$\frac{1}{x}$	y
20	9.25
14.3	8.11
10	7.25
6.67	6.58
5	6.25
4	6.05
2.86	5.82
2	5.65
1.33	5.52
1	5.45



36. Slope: 0.2

37. Y-Intercept: 5.25

38. Mathematical Expression: $y = 0.2\left(\frac{1}{x}\right) + 5.25$

$m = \frac{\Delta y}{\Delta x} = \frac{y_f - y_i}{x_f - x_i} = \frac{9.25 - 5.45}{20 - 1}$

$m = 0.2$

$y = m\frac{1}{x} + b$

$y = 0.2\left(\frac{1}{x}\right) + b$

$6.05 = 0.2\left(\frac{1}{.25}\right) + b$

$6.05 = 0.8 + b$

$-.8 \quad -.8$

$5.25 = b$

39. At what time would the object be at 15 m?

0.021 s

40. Where would the object be at 2 seconds?

5.35 m

$y = 0.2\left(\frac{1}{x}\right) + 5.25$

$15 = 0.2\left(\frac{1}{x}\right) + 5.25$

$15 - 5.25 = 0.2\left(\frac{1}{x}\right)$

$\frac{9.75}{0.2} = \frac{0.2\left(\frac{1}{x}\right)}{0.2}$

$48.75 = \frac{1}{x}$

$x = 0.021$ s

$y = 0.2\left(\frac{1}{x}\right) + 5.25$

$y = 0.2\left(\frac{1}{2}\right) + 5.25$

$y = 5.35$ m

41. Complete the following table

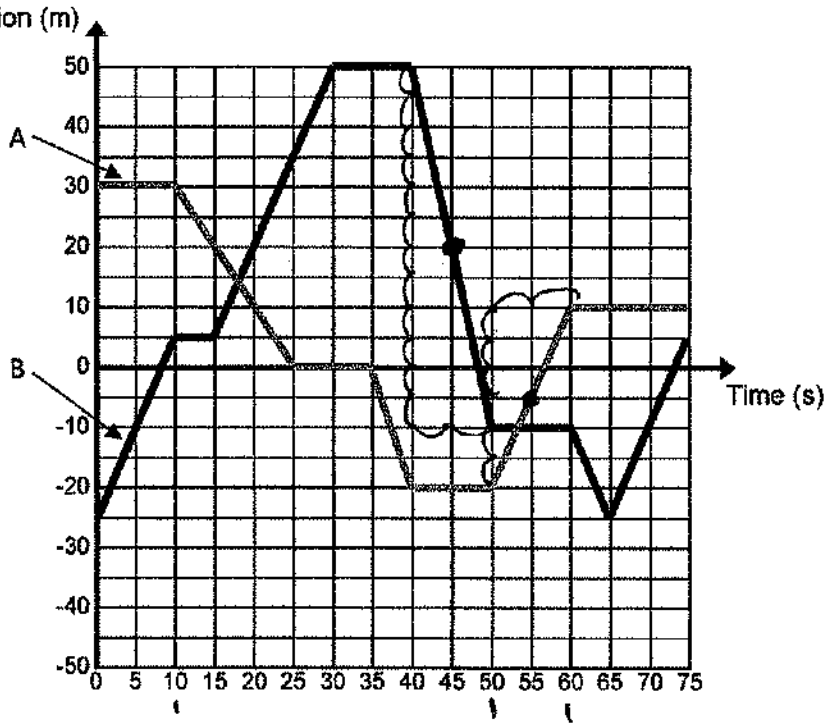
Time (s)	Position (m)
0.06	8.58
0.17	6.43
0.24	6.10
0.01	20.21

Review Unit II: One Dimensional Motion

Name: KEY Period: _____ Date: _____

Define the following terms.

1. Distance
   The total ground covered by an object
2. Displacement
   The change of an object's position.
3. Speed
   The distance an object travels over a period of time.
4. Velocity
   The change of an object's position over a period of time.



Use the graph above to answer questions 5-15. Pay attention to the scale of the x and y axis. Show all work! Leave all calculated answers in 3 significant figures.

5. What is the initial position of object A and B?

   A: 30m

   B: -25m

6. What is the total distance traveled by object A between 0 and 75 seconds?

   left 30 m
   left 20 m
   right 30m

   80.0m

7. What is the total distance traveled by object B between 0 and 75 seconds?

   r 30m L 15m
   r 45m r 30m
   L 60m

   180m

8. What is the displacement of object B between 0 and 50 seconds?

   $\Delta x = x_f - x_i$

   $-10m - (-25m)$

   $-10m + 25m$

   15.0m

9. What is the displacement of object A between 10 and 60 seconds?

   $\Delta x = x_f - x_i$

   $\Delta x = 10m - 30m$

   $\Delta x = -20.0m$

10. What is the average velocity of object A between 10 and 50 seconds?

    $\bar{v} = \frac{\Delta x}{t} = \frac{x_f - x_i}{t} = \frac{-20m - 30m}{40s}$

    $\bar{v} = \frac{-50m}{40s} = -1.25\ m/s$

11. What is the average velocity of object B between 10 and 75 seconds?

    $\bar{v} = \frac{\Delta x}{t} = \frac{x_f - x_i}{t} = \frac{5m - 5m}{65s} = 0\ m/s$

12. What is the average speed of object B between 0 and 50 seconds?

    $S = \frac{\text{distance}}{\text{time}} = \frac{135m}{50s} = 2.70\ m/s$

13. What is the average speed of object A between 35 and 60 seconds?

$S = \frac{\text{distance}}{\text{time}} = \frac{50\text{ m}}{25\text{ s}} = 2.00\text{ m/s}$

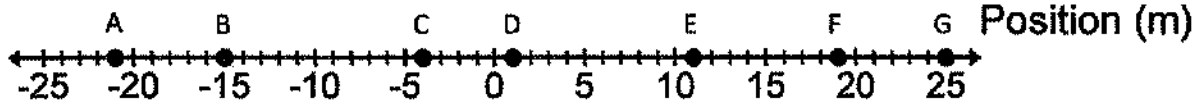
14. What is the instantaneous velocity of object B at 45 seconds?

$V = \frac{\text{rise}}{\text{run}} = \frac{-60\text{ m}}{10\text{ s}} = -6.00\text{ m/s}$

15. What is the instantaneous velocity of object A at 55 seconds?

$V = \frac{\text{rise}}{\text{run}} = \frac{30\text{ m}}{10\text{ s}} = 3.00\text{ m/s}$

Use the number line below to answer questions 16-21. Show all work! Leave all calculated values in 3 sig. figures.



16. What is the total displacement on an object that travels from G to B to E to D?

$\Delta x = x_f - x_i$ (x_i = G, x_f = D?)

$\Delta x = 1\text{ m} - 25\text{ m}$

$\Delta x = -24.0\text{ m}$

17. What is the total distance of an object that travels from B to F to E?

B ⇒ F = 34m

F ⇒ E = 8m

Total = 42.0 m

18. What is the average velocity of an object if it travels from C to G to A in 15 seconds?

$\bar{v} = \frac{\Delta x}{t} = \frac{x_f - x_i}{t} = \frac{-21\text{m} - (-4\text{m})}{15\text{s}}$ (x_i = C, x_f = A)

$\bar{v} = \frac{-21\text{m} + 4\text{m}}{15\text{ s}} = \frac{-17\text{m}}{15\text{s}} = -1.13\text{ m/s}$

19. What is the average velocity of an object if it travels from D to C to E in 5 seconds?

$\bar{v} = \frac{\Delta x}{t} = \frac{x_f - x_i}{t} = \frac{11\text{m} - 1\text{m}}{5\text{s}} = \frac{10\text{ m}}{5\text{s}}$ (x_i = D, x_f = E)

$\bar{v} = 2.00\text{ m/s}$

20. What is the average speed of an object if it travels from A to C to B in 4 seconds?

$S = \frac{\text{distance}}{\text{time}} = \frac{28\text{ m}}{4\text{s}} = 7.00\text{ m/s}$

A ⇒ C = 17m

C ⇒ B = 11m

21. What is the average speed of an object if it travels from F to D to G in 10 seconds?

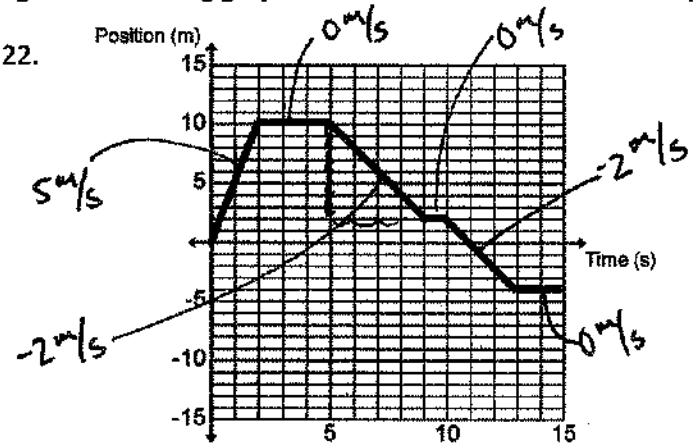
$S = \frac{\text{distance}}{\text{time}} = \frac{42\text{ m}}{10\text{ s}} = 4.20\text{ m/s}$

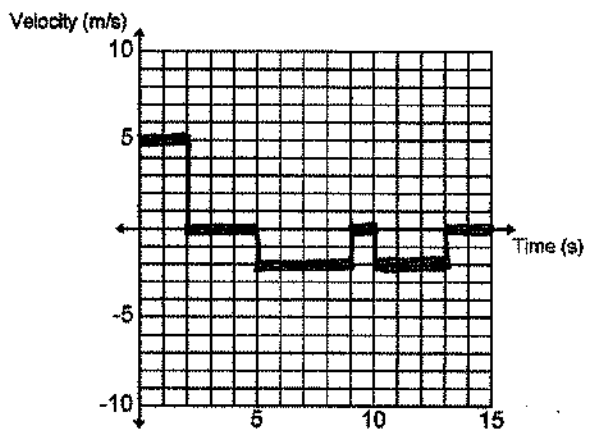
F → D = 18 m

D ⇒ G = 24m

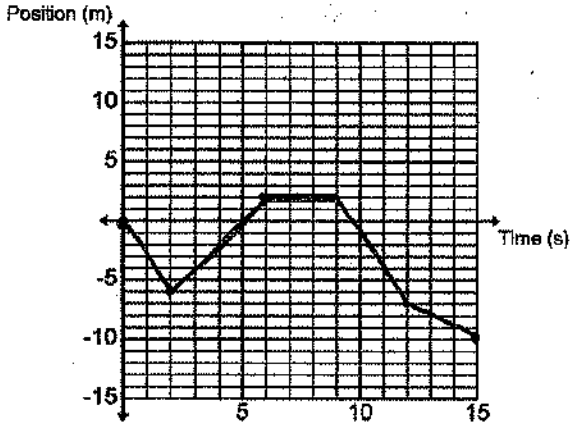
Change the following graphs from one form into the other. (i.e. Position vs. Time to Velocity vs. Time and vice versa.)

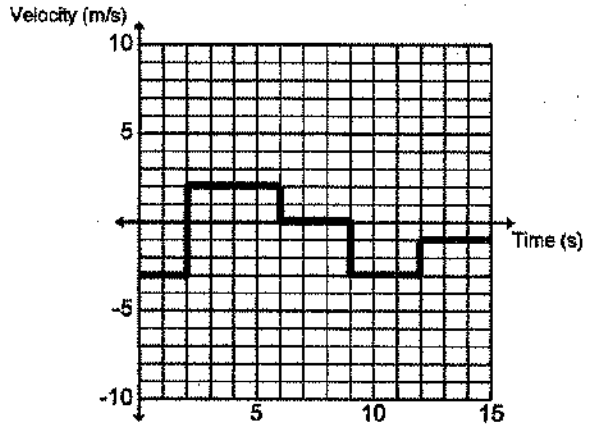
22.



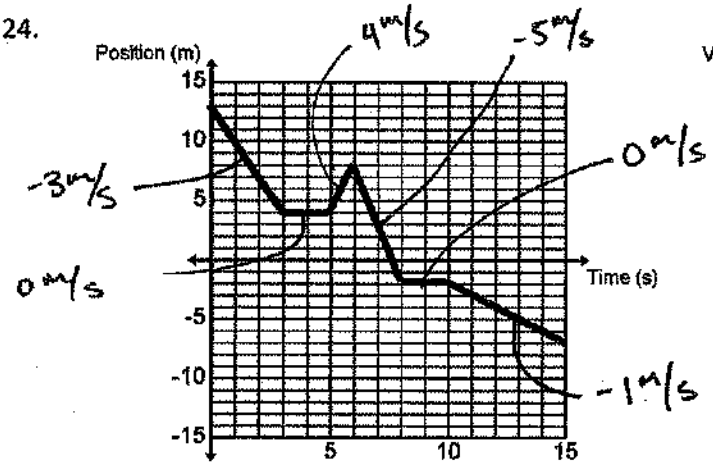


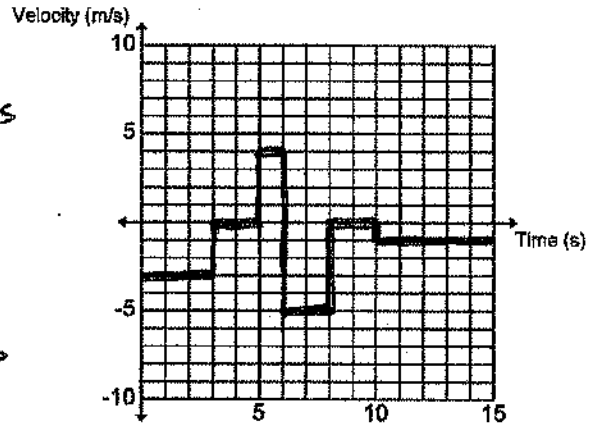
23.



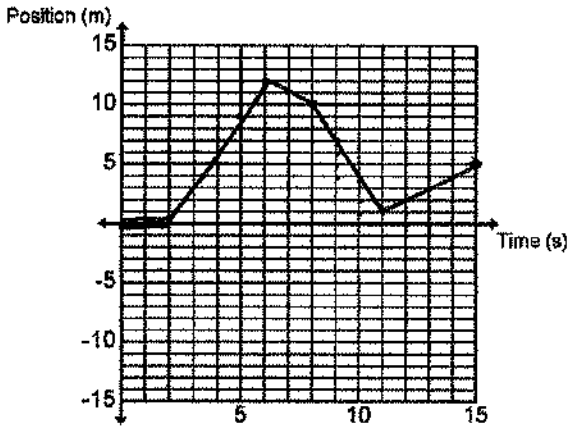


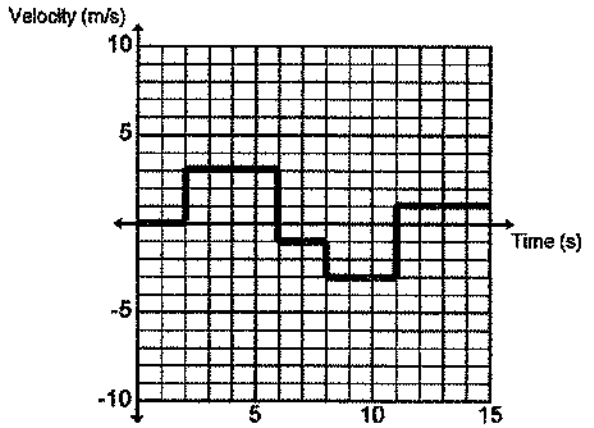
24.





25.





Use the velocity equation to solve the following questions. Leave all answers in 3 significant figures.

26. The late bell is about to ring in 5 seconds and Stanley needs to get to homeroom on time or he will end up with TOC. He travels at a velocity of 2.34 m/s to the LEFT and makes it to his homeroom right as the bell rings. If the homeroom is considered the origin, what was Stanley's initial position?

$t = 5s$
$v = -2.34\ m/s$
$x_f = 0\ m$
$x_i = ?$

$\Delta x = vt$
$x_f - x_i = vt$
$-x_f \quad -x_f$
$\frac{-x_i}{-1} = \frac{vt - x_f}{-1}$

$x_i = -vt + x_f$
$x_i = -(-2.34\ m/s)(5s) + 0m$
$x_i = 11.7\ m$

27. How much time would it take for an object to go from a position of -5.13 m to a position of 14.2 m if it is traveling at a velocity of 3.12 m/s?

$\Delta x = vt$
$\frac{x_f - x_i}{v} = \frac{vt}{v}$

Double neg. ↗

$t = \frac{x_f - x_i}{v} = \frac{14.2m - (-5.13m)}{3.12\ m/s} = 6.1955\ s$

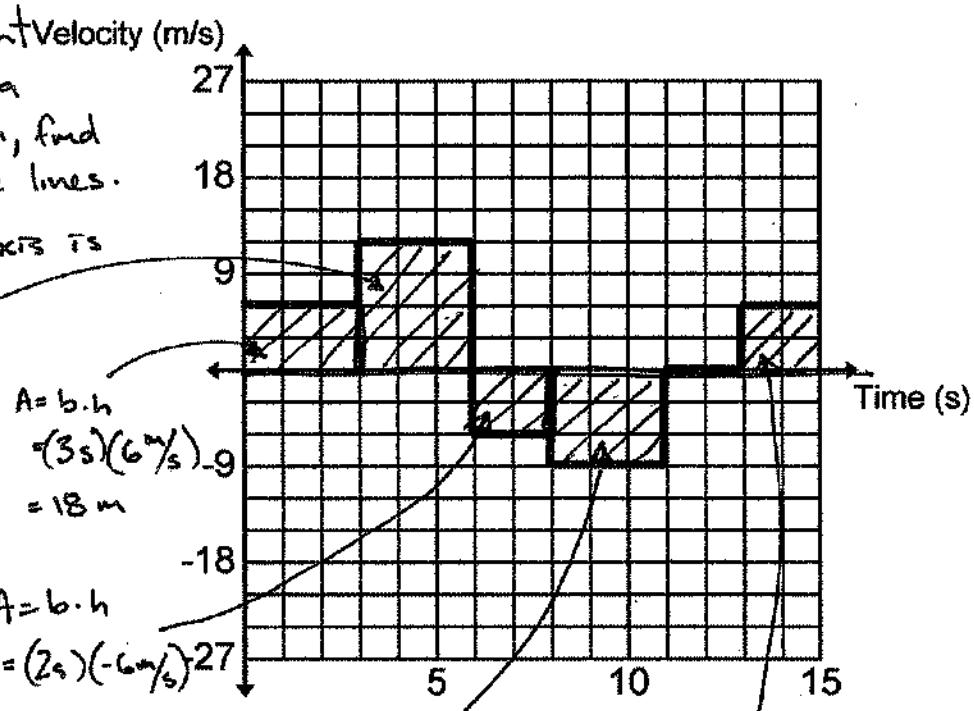
$x_i = -5.13m$
$x_f = 14.2m$
$v = 3.12\ m/s$

6.20s

28. What is the displacement of the object below between 0 and 15 seconds? Pay attention to the scale of the axis.

To find the displacement of an object using a velocity vs. time graph, find the area under the lines.

The scale of the y-axis is 3:1!



$A = b \cdot h$
$A = (3s)(12\ m/s)$
$= 36\ m$

$A = b \cdot h$
$= (3s)(6\ m/s)$
$= 18\ m$

$A = b \cdot h$
$= (2s)(-6\ m/s)$
$= -12\ m$

$A = b \cdot h$
$A = (3s)(9\ m/s)$
$= 27\ m$

$A = b \cdot h$
$= (2s)(6\ m/s)$
$= 12\ m/s$

Total Area

36m
+ 18m
+ 12m
− 12m
− 27m

27m

$\Delta x = 27m$

Unit III Review

Name: KEY Period: _____ Date: _____

1. Define acceleration.

   CHANGE OF VELOCITY OVER TIME

2. A small sandbag is dropped from rest from a hovering hot-air balloon. After 2.0 s, how far below the balloon is the sand bag?

   $v_i = 0$ (0)
   $t = 2\,s$
   $\Delta y = ?$
   $a = -9.81\,m/s^2$

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

   $\Delta y = \frac{1}{2}(-9.81\,m/s^2)(2s)^2$

   $\Delta y = -19.62\,m$

3. A gumdrop is released from rest at the top of the Empire State Building, which is 381 m tall. Disregarding air resistance, calculate the displacement of the gumdrop after 1.00, 2.00, and 3.00 s.

   $v_i = 0$
   $a = -9.81\,m/s^2$
   $t = 1, 2, 3\,s$

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

   $\Delta y = \frac{1}{2}at^2$

1s	2s	3s
$\Delta y = \frac{1}{2}(-9.81)(1)^2$	$\Delta y = \frac{1}{2}(-9.81)(2)^2$	$\Delta y = \frac{1}{2}(-9.81)(3)^2$
$= -4.91\,m$	$= -19.62\,m$	$\Delta y = -44.1\,m$

4. The flight speed of a small bottle rocket can vary greatly, depending on how well its powder burns. Suppose a rocket is launched from rest so that it travels 12.4 m upward in 2.0 s. What is the rocket's net acceleration?

   $v_i = 0\,m/s$
   $\Delta y = 12.4\,m$
   $t = 2\,s$
   $a = ?$

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

   $2 \cdot \Delta y - v_i t = \frac{1}{2}at^2 \cdot 2$

   $\frac{2(\Delta y - v_i t)}{t^2} = \frac{at^2}{t^2}$

   $a = \frac{2(\Delta y - v_i t)}{t^2}$

   $a = \frac{2(12.4 - 0)}{2^2}$

   $a = 6.20\,m/s^2$

5. A ship with an initial speed of 6.23 m/s approaches a dock that is 255 m away. If the ship accelerates uniformly and comes to rest in 82 s, what is its acceleration?

   $v_i = 6.23\,m/s$
   $\Delta x = 255\,m$
   $t = 82\,s$
   $v_f = 0$
   $a = ?$

   $v_f = v_i + at$

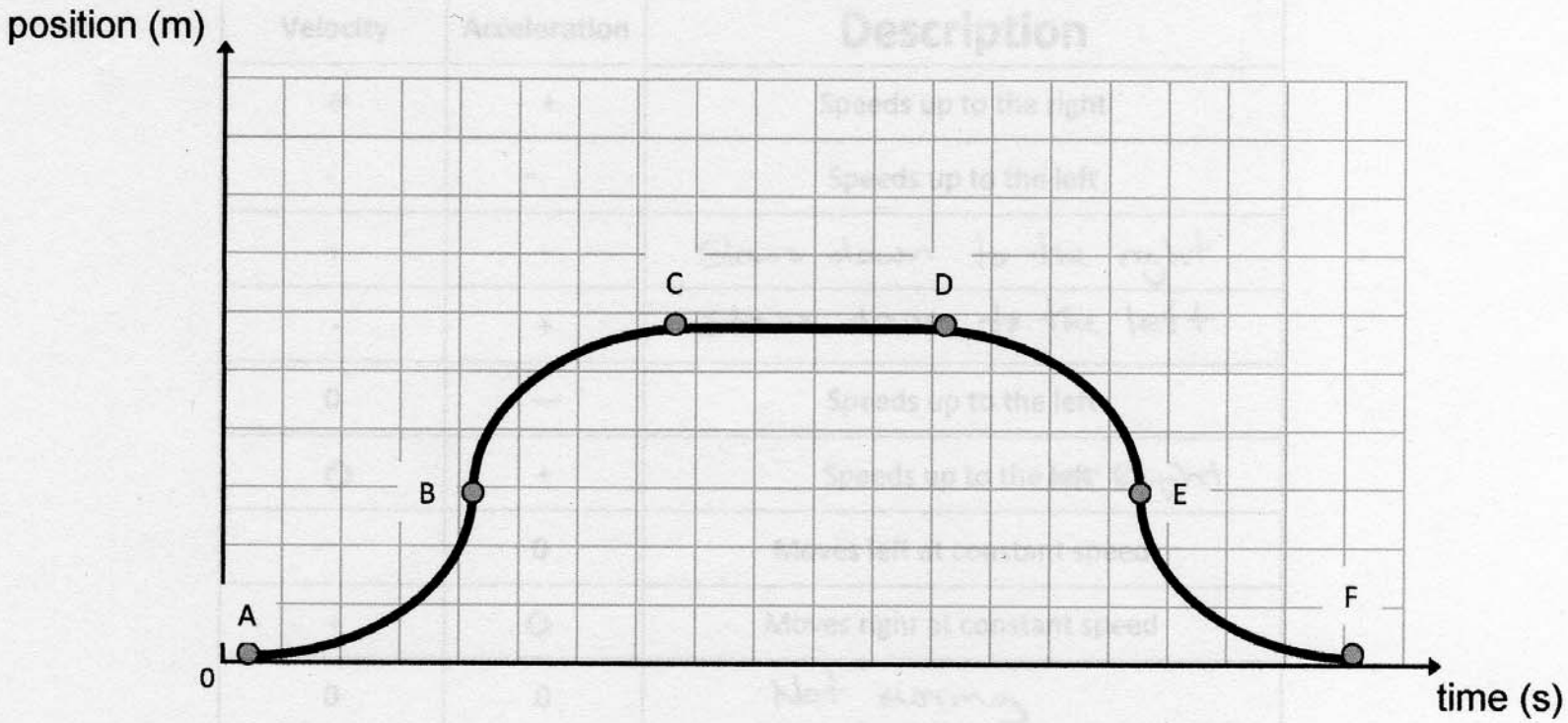
   $\frac{v_f - v_i}{t} = \frac{at}{t}$

   $a = \frac{v_f - v_i}{t}$

   $a = \frac{0 - 6.23}{82}$

   $a = -0.0760\,m/s^2$

Use the graph below to answer questions 6 to 10.



6. What is the object doing between points A and B?

Speeding up going right

7. What is the object doing between points B and C?

Slowing down going right

8. What is the object doing between points C and D?

Not Moving

9. What is the object doing between points D and E?

Speeding up going left

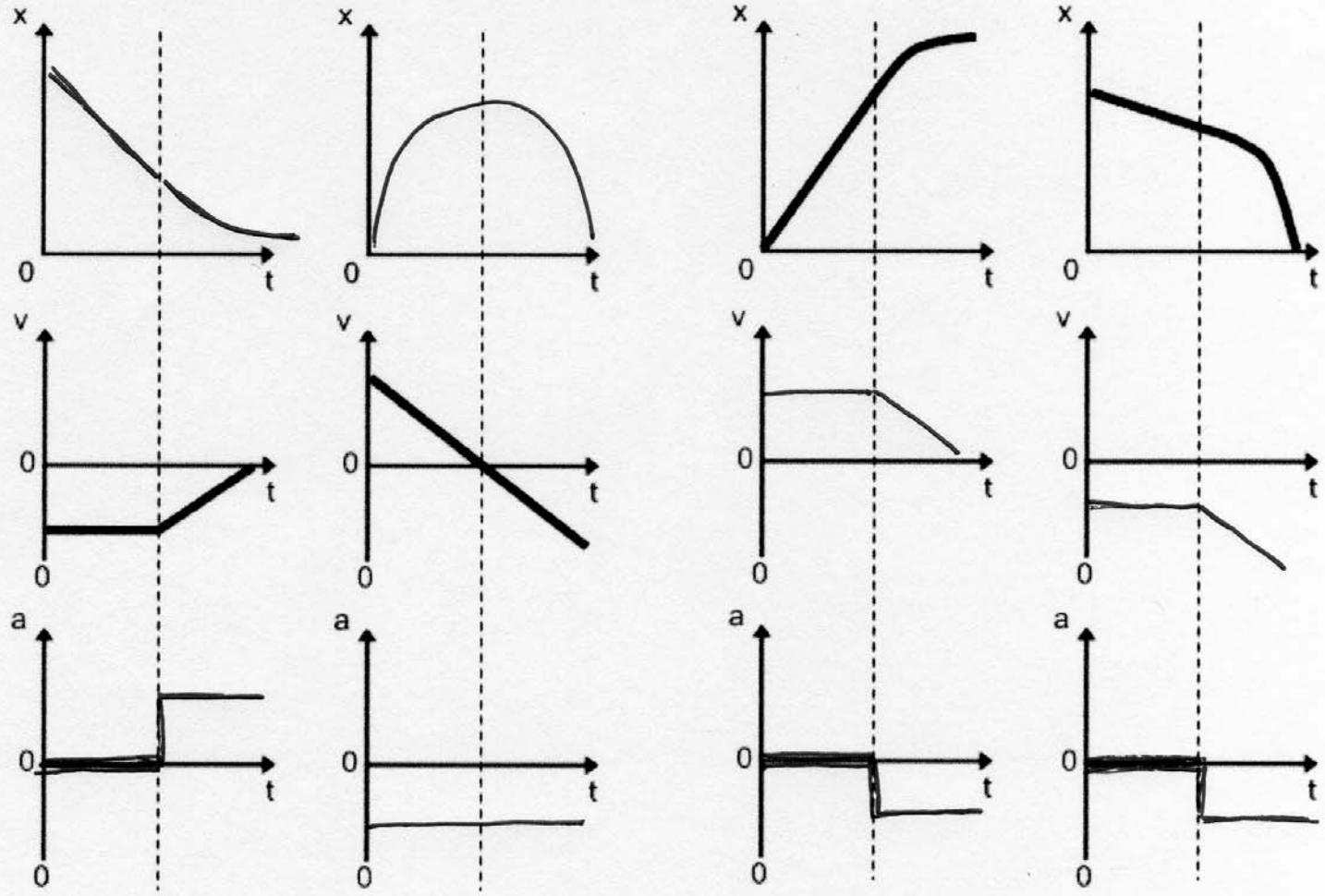
10. What is the object doing between points E and F?

Slowing down going left

11. Fill in the chart below.

Velocity	Acceleration	Description
+	+	Speeds up to the right
-	-	Speeds up to the left
+	-	Slows down to the right
-	+	Slows down to the left
0	—	Speeds up to the left
0	+	Speeds up to the ~~left~~ Right
-	0	Moves left at constant speed
+	0	Moves right at constant speed
0	0	Not moving

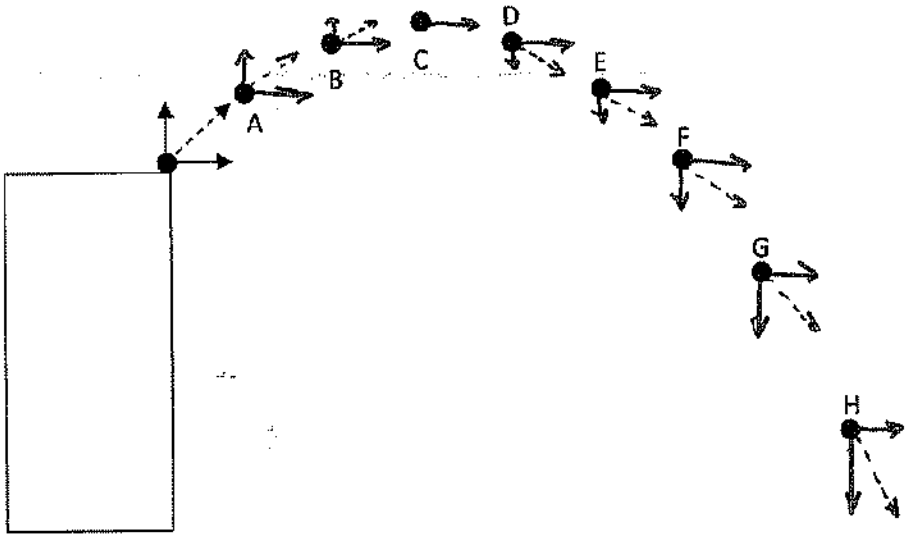
12. Fill in the blank graphs



Unit IV Review

Name: _____ Period: _____ Date: _____

Use the diagram below to answer questions 1-5.



1. Draw the x and y component of velocity on each point in the diagram above. In addition draw the resultant on each point as well. The first point is done for you as an example.

2. Based on the completed diagram, where is the ball's vertical velocity the smallest?

a. A	(c.) C	e. E	g. G
b. B	d. D	f. F	h. H

3. Based on the completed diagram, where is the ball's resultant velocity the greatest?

a. A	c. C	e. E	g. G
b. B	d. D	f. F	(h.) H

4. Based on the completed diagram, where is the ball's resultant velocity the smallest?

a. A	(c.) C	e. E	g. G
b. B	d. D	f. F	h. H

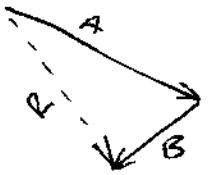
5. What happens to the horizontal velocity as time elapses?
   a. It increases
   b. It decreases
   (c.) It remains constant

Unit IV Review

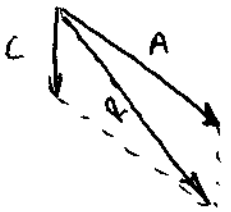
Name: _____ Period: _____ Date: _____

Use vectors A, B and C to perform the following functions.

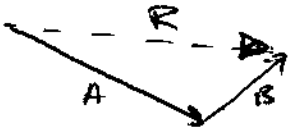
1. A + B using the Head to tail method.



2. A + C using the parallelogram method.



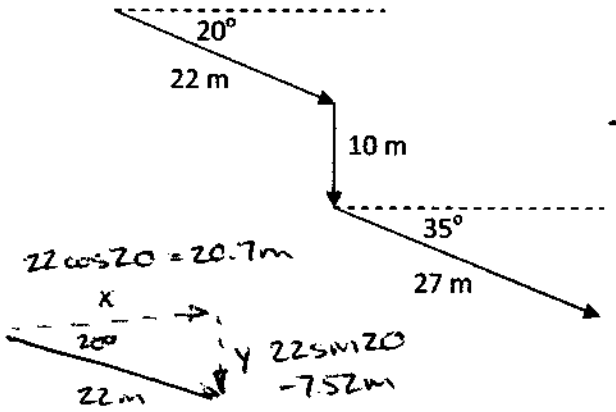
3. A - B



4. A - B - C

Complete the following questions and SHOW ALL WORK.

5. What is the magnitude and direction (angle and description) of the resultant?

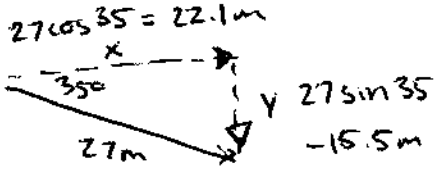


X	Y
20.7m	-7.52
22.1m	-10.00
42.8m	-15.5
	-33.0m

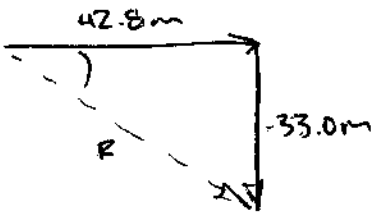
$22\cos 20 = 20.7\text{m}$

$22\sin 20$
-7.52m

$27\cos 35 = 22.1\text{m}$



$27\sin 35$
-15.5m



$a^2+b^2=c^2$

$c=\sqrt{a^2+b^2}$

$c=\sqrt{42.8^2+(-33.0)^2}$

$c=54.0\text{m}$

$\tan\theta=\frac{O}{A}$

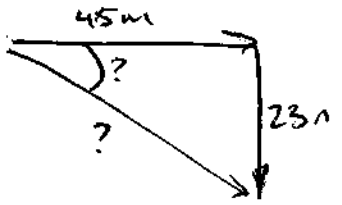
$\theta=\tan^{-1}\left(\frac{O}{A}\right)$

$\theta=\tan^{-1}\left(\frac{33.0}{42.8}\right)$

$\theta=37.6°$

54.0m @ 37.6° S of E

6. A bird flies 45 m directly east and then 23 m directly south. What is the magnitude and direction (angle and description) of the resultant?



$a^2+b^2=c^2$

$c=\sqrt{a^2+b^2}$

$c=\sqrt{45^2+23^2}$

$c=50.5\text{m}$

$\tan\theta=\frac{O}{A}$

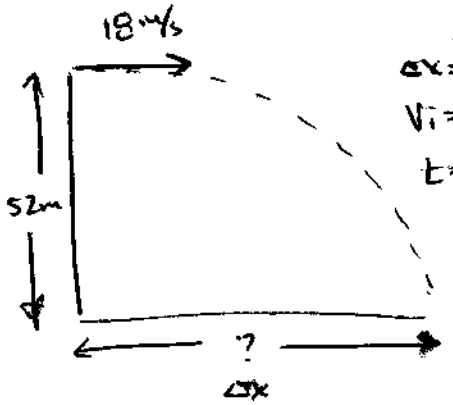
$\theta=\tan^{-1}\left(\frac{O}{A}\right)$

$\theta=\tan^{-1}\left(\frac{23}{45}\right)$

$\theta=27.1^\circ$

$50.5\text{m}\ @\ 27.1^\circ\ \text{S of E}$

7. A person standing at the edge of a seaside cliff kicks a stone horizontally over the edge with a speed of 18 m/s. The cliff is 52 m above the water's surface. How long does it take for the stone to fall to the water? What is the horizontal displacement of the stone?



X	Y
$\Delta x=$	$\Delta y=-52\text{m}$
$V_i=18\text{m/s}$	$a=-9.81\text{m/s}^2$
$t=$	$t=$
	$V_i=0\text{m/s}$
	$V_f=$

$\Delta y=V_i t+\frac{1}{2}at^2$ (0)

$\Delta y=\frac{1}{2}at^2$

$t=\sqrt{\frac{2\Delta y}{g}}$

$t=\sqrt{\frac{2(-52)}{-9.81}}$

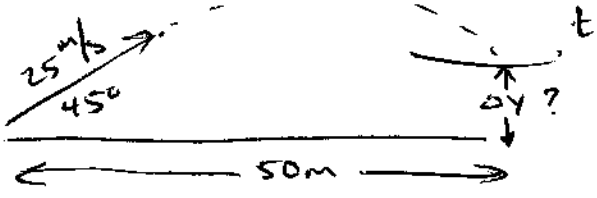
$t=3.26\text{s}$

$\Delta x=V_i t$

$\Delta x=(18)(3.26\text{s})$

$\Delta x=58.7\text{m}$

8. A human cannonball is shot out of a cannon at 45.0° to the horizontal with an initial speed of 25.0 m/s. A net is positioned at a horizontal distance of 50.0 m from the cannon. At what height above the cannon should the net be placed in order to catch the human cannonball? Show all work.



X	Y
$\Delta x=50\text{m}$	$\Delta y=?$
$V_i=17.7\text{m/s}$	$a=-9.81\text{m/s}^2$
$t=$	$t=$
	$V_i=17.7\text{m/s}$
	$V_f=$

$\Delta y=V_i t+\frac{1}{2}at^2$

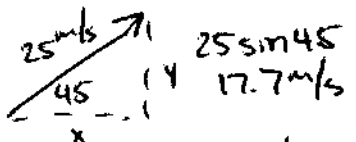
$\Delta y=(17.7)(2.82)+\frac{1}{2}(-9.81)(2.82)^2$

$\Delta y=10.9\text{m}$

$\Delta x=V_i t$

$t=\frac{\Delta x}{V_i}$

$t=\frac{50}{17.7}=2.82\text{s}$



Unit V Review

Name: _____ Period: _____ Date: _____

1. What is the definition of mass?

   The amount of matter in an object

2. What is the standard unit for mass?

   kg

3. What is the difference between mass and weight?

   Weight is a Force
   Mass is a measurement of the amount of matter

4. What is the difference between weight and force of gravity?

   They are the same thing.

5. What is the equation for the force of gravity?

   $F_g = mg$

6. Name three types of non-contact forces.
   a. Gravity
   b. Magnetism
   c. Electrostatic

7. What is inertia?

   The resistance to acceleration

8. How do you measure inertia?

   Mass

9. If an object is in equilibrium, what does that mean?

   All Forces add to zero.

10. What are Newton's three laws?
    a. An object @ rest tends to stay @ rest an object in motion tends to stay @ motion
    b. Force → directly prop to acceleration. Mass is inversely prop. to accel.
    c. For every force there is an equal & opposite force

11. What is the equation associated with Newton's second law?

    $a = \frac{\Sigma F}{m}$

12. What are the action-reaction pairs of forces in the following situations?
    a. A person jumping off the ground.
       Foot on ground
       ground on Foot
    b. A person closing a door by pushing on the door handle.
       Force of hand on handle
       Force of handle on hand
    c. A person falling to the ground.
       Earth pulling on man
       man pulling on earth

13. What is the normal force and in which direction does it point?

    Force applied by surface.
    Always perp. to the surface.

14. What is the force of friction and which way does it point?

    Force of friction opposes motion & points opposite of the direction of motion.

15. What are the two types of friction and define them.

a. Static friction - Friction of objects at rest

b. Kinetic friction Friction of objects in motion

16. Which of the following are examples of acceleration? (Circle all that apply)

(a.) An object speeds up.

(b.) An object slows down.

(c.) An object changes direction.

17. Is the coefficient of friction a scalar or vector quantity?

Scalar (No direction)

18. Do free-body diagrams include the forces acting on an object or forces caused by the object?

The forces acting on an object

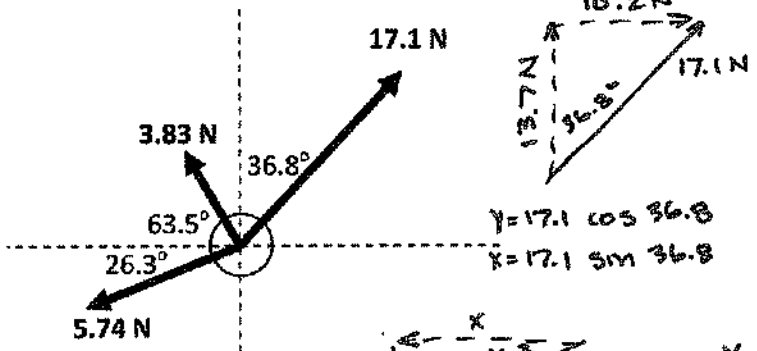
19. When does an object accelerate?

a. When it has a zero net force acting on it.

(b.) When it has a non-zero net force acting on it.

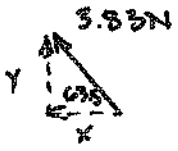
---

20. What is the net force acting on the object below? What is its acceleration if its mass is 35 kg?



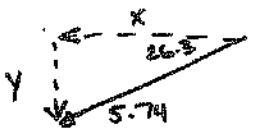
$y = 17.1 \cos 36.8$

$x = 17.1 \sin 36.8$



$x = 3.83 \cos 63.5 = 1.71\ N$

$y = 3.83 \sin 63.5 = 3.43\ N$



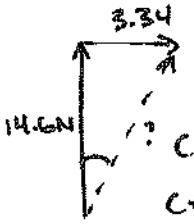
$x = 5.74 \cos 26.3 = -5.15\ N$

$y = 5.74 \sin 26.3 = -2.54\ N$

x	y
10.2	13.7
-1.71	3.43
-5.15	-2.54
3.84 N	14.6N

NET FORCE

15.0N @ 12.9° E of N



$a^2 + b^2 = c^2$

$c = \sqrt{a^2 + b^2}$

$c = \sqrt{14.6^2 + 3.34^2}$

$c = 15.0\ N$

$\tan\theta = \frac{O}{A}$

$\theta = \tan^{-1}\left(\frac{3.34}{14.6}\right)$

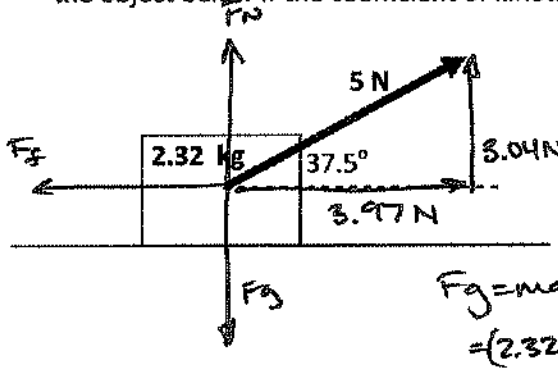
$\theta = 12.9°$

$a = \frac{\Sigma F}{m}$

$a = \frac{15.0\ N}{35\ kg}$

$a = 0.429\ m/s^2$ @ 12.9° E of N

21. Draw the remainder of the forces acting on the object. What is the normal force and force of friction acting on the object below if the coefficient of kinetic friction is 0.023?



$5 \sin 37.5 = 3.04\ N$

$5 \cos 37.5 = 3.97\ N$

$F_g = mag$

$= (2.32)(-9.81)$

$= -22.8\ N$

Normal force

$\Sigma F_y = 0$

$F_g + F_N + F_{Ay} = 0$

$F_N = -F_g - F_{Ay}$

$= -(-22.8) - (3.04)$

$= 19.8\ N$

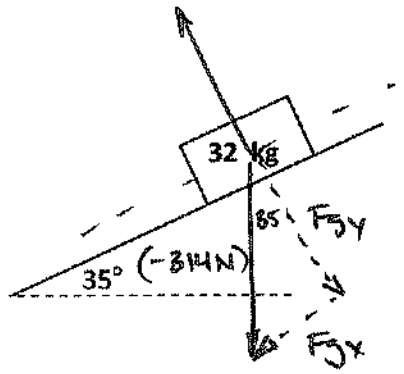
Friction

$F_f = \mu N$

$F_f = (0.023)(19.8)$

$= -0.455\ N$

22. What is the acceleration and normal force acting on the object below? (Ignore friction)



$F_g = mg$

$= 32(-9.81)$

$= -313.92$

$(-314\ N)$

$F_{gx} = 314 \sin 35$

$= -180\ N$

$F_{gy} = 314 \cos 35$

$= -257\ N$

Normal Force

$\Sigma F_y = 0$

$F_g + F_N = 0$

$F_N = -F_{gy}$

$F_N = -(-257)$

$= 257N$

Acceleration

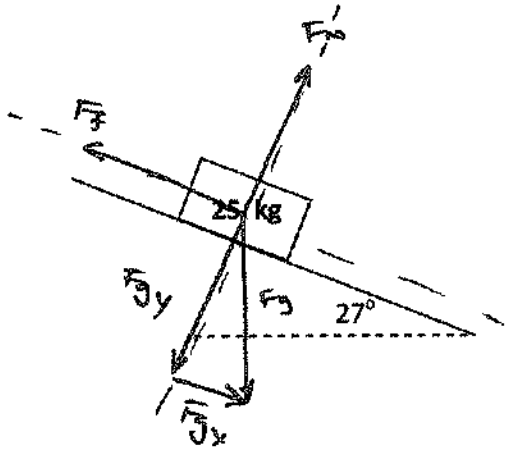
$a = \frac{\Sigma F_x}{m}$

$= \frac{F_{gx}}{32}$

$= \frac{-180N}{32}$

$= -5.63\ m/s^2$

23. What is the force of friction acting on the object below if the acceleration is 3.21 m/s^2?



$F_g = mg$

$= (25)(9.81)$

$= -245\ N$

$F_{gx} = 245 \sin 27$

$= 111\ N$

$F_{gy} = 245 \cos 27$

$= -218\ N$

$a = \frac{\Sigma F_x}{m}$

$m \cdot a = \frac{F_{gx} + F_f}{m} \cdot m$

$F_{gx} + F_f = m \cdot a$

$F_f = m \cdot a - F_{gx}$

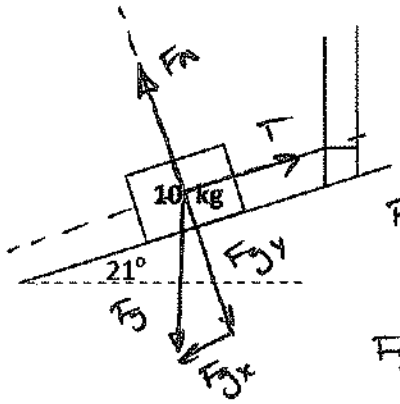
$= (25)(3.21) - 111$

$= -30.8\ N$

24. If the object below is in equilibrium, what is the tension in the string? (Ignore Friction)

$\Sigma F_x = 0$

$\Sigma F_y = 0$



$F_g = mag$

$= 10(-9.81)$

$= -98.1\ N$

$F_{gx} = 98.1 \sin 21$

$= -35.2\ N$

$F_{gy} = 98.1 \cos 21$

$= -91.6\ N$

$\Sigma F_x = 0$

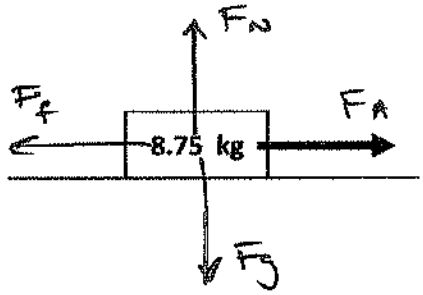
$T + F_{gx} = 0$

$T = -F_{gx}$

$= -(-35.2N)$

$T = 35.2\ N$

25. What is the coefficient of static friction if it requires 23 N to move the object below?



$\mu = \frac{F_A}{F_N} = \frac{23\ N}{85.8\ N} = 0.268$

$F_g = mag$

$= (8.75)(-9.81)$

$= -85.8\ N$

Normal Force

$\Sigma F_y = 0$

$F_g + F_N = 0$

$F_N = -F_g$

$= -(-85.8)$

$F_N = 85.8N$

Unit 6 Review

Name: KEY Period: _____ Date: _____

Answer the following questions and show all work whenever work is needed.

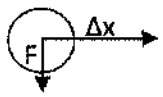
1. Give an example of a situation where the everyday meaning of work is being used.

   Studying for a test.

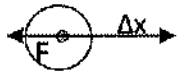
2. Give an example of a situation where the scientific meaning of work is being used.

   Pushing a crate across the floor

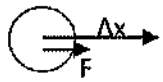
3. Is the work in the following situations positive, negative, or zero?

   a. 

   (0)

   b. 

   (−)

   c. 

   (+)

4. Is work done in the following scenarios? Explain why.
   a. Greg holds a box of stones above his head for 2 minutes.
      No - there is no displacement
   b. A person reads a sign.
      No - there is no force or displacement
   c. Charles pushes on a car but it never moves.
      No - There is no displacement
   d. James pulls on a wagon as he pulls it down the road.
      Yes - There is a force & displacement in the same dimension.

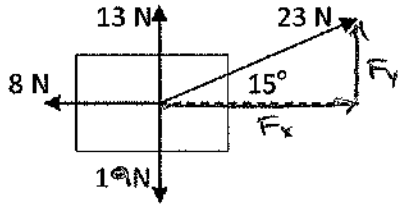
5. Define kinetic energy.

   The energy associated with an object's motion.

6. Define potential energy.

   Stored energy.

7. What is the net work done on the object below if it is pulled directly east for 2.5 m?



$F_x = 23 \cos 15 = 22.2\,N$

$F_y = 23 \sin 15 = 5.95\,N$

$W_{net} = F_{net} \cdot d$

$F_{net} = (-8N) + (22.2N)$

$= 14.2\,N$

$W = F \cdot d$

$= (14.2\,N)(2.5\,m)$

$= 35.5\,J$

8. List 5 different types of potential energy.

a. Gravitational
b. Elastic
c. Chemical
d. Nuclear
e. Elastic

9. If object A is 9 kg and object B is 27 kg, what is the ratio of their kinetic energy?

Ratio of Masses

$\frac{9}{27} = \frac{1}{3}$

Ratio of Energy

$\frac{1}{3}$

10. If object A is moving with a velocity of 9 m/s and object B is moving at 3 m/s, what is the ratio of their kinetic energy?

Ratio of Vel

$\frac{9}{3} = \frac{3}{1} \rightarrow \frac{x^2\ Rel}{\left(\frac{3}{1}\right)^2}$

Ratio of Energy

$\frac{9}{1}$

11. What is the gravitational potential energy of a 34.3 kg object that is 2.13 cm above the ground?

$PE = mgh$

$2.13\,cm = 0.0213\,m$

$= (34.3\,kg)(9.81\,m/s^2)(0.0213\,m)$

$= 7.17\,J$

12. What is mechanical energy?

The sum of all kinetic energy and elastic and gravitational potential energy.

13. Why is mechanical energy not conserved when friction is present?

Friction changes mechanical energy into non-mechanical energy.

14. When catching a baseball, a catcher's glove moves by 10 cm along the line of motion of the ball. If the baseball exerts a force of 475 N on the glove, how much work is done **by the ball**?

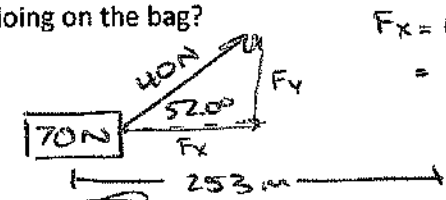
10 cm = 0.10 m

$W = F \cdot d$

$= (475\ N)(0.10\ m)$

$= 47.5\ J$

15. A flight attendant pulls her 70.0 N flight bag a distance of 253 m along a level airport floor at a constant velocity. The force she exerts is 40.0 N at an angle of 52.0° above the horizontal. How much work is the flight attendant doing on the bag?



$F_x = 40\cos 52$

$= 24.6\ N$

$W = F \cdot d$

$(24.6\ N)(253\ m)$

$= 6230\ J$

16. What speed would a fly with a mass of 0.55 g need in order to have 7.6×10^4 J of kinetic energy?

$0.55\ g = 0.00055\ kg$

$2 \cdot KE = \frac{1}{2} m v^2 \cdot 2$

$\frac{2KE}{m} = \frac{mv^2}{m}$

$\sqrt{\frac{2KE}{m}} = \sqrt{v^2}$

$v = \pm\sqrt{\frac{2KE}{m}}$

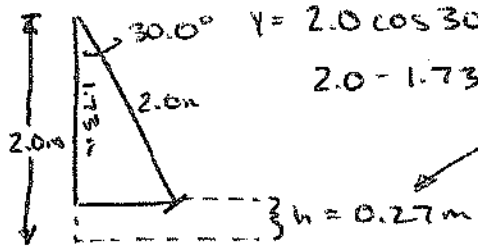
$v = \pm\sqrt{\frac{2(7.6 \times 10^4)}{0.00055}}$

$v = \pm 1.66 \times 10^4\ m/s$

$1.66 \times 10^4\ m/s$

17. A 25 kg child on a 2.0 m long swing is released from rest when the swing makes an angle of 30.0° with the vertical.

a. What is the maximum potential energy associated with the child?



$Y = 2.0\cos 30° = 1.73\ m$

$2.0 - 1.73\ m = 0.27\ m$

$PE = mgh$

$= (25)(9.81)(0.27)$

$= 66.2\ J$

b. Ignoring friction, find the child's speed at the lowest position. (Conservation of Energy)

$ME_i = ME_f$

$KE_i + PE_i = KE_f + PE_f$

$(2)\ mgh_i = \frac{1}{2} m v_f^2\ (2)$

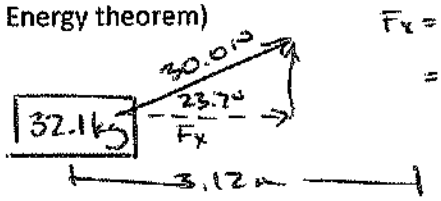
$\pm\sqrt{2gh_i} = \sqrt{v_f^2}$

$v_f = \pm\sqrt{2gh_i}$

$v_f = \pm\sqrt{2(9.81)(0.27)}$

$v_f = 2.30\ m/s$

18. Starting at rest, John pulls on a 32.1 kg crate with a force of 30.0 N at an angle of 23.7° above the horizontal. If friction is ignored, how fast is the crate going after he pulls the cart directly east for 3.12 m? (Work-Kinetic Energy theorem)



$F_x = 30.0\cos 23.7$

$= 27.5\ N$

$W = \Delta KE$

$F \cdot d = KE_f - KE_i$ → 0

$2 \cdot F \cdot d = \frac{1}{2} m v_f^2 \cdot 2$

$\frac{2Fd}{m} = \frac{mv_f^2}{m}$

$\sqrt{v_f^2} = \sqrt{\frac{2Fd}{m}}$

$v_f = \pm\sqrt{\frac{2Fd}{m}}$

$v_f = \pm\sqrt{\frac{2(27.5)(3.12)}{32.1}}$

$v_f = 2.31\ m/s$

Unit 7 Review

Name: KEY Period: _____ Date: _____

Momentum

1. What two factors impact an object's momentum?
   a. Mass
   b. Velocity
2. Object A is travelling 3 times faster than object B, but they have the same momentum. How can this be true?

   Object B must have 3 times the mass.

3. In 1987,Marisa Canofoglia, of Italy, roller-skated at a record-setting speed of 40.3 km/h. If the magnitude of Canofoglia's momentum was 6.60 x 10^2 kgm/s, what was her mass?

$$40.3\ \frac{km}{h} \times \frac{1000\ m}{1\ km} \times \frac{1\ h}{3600\ s} = 11.2\ m/s$$

$$p = mv \qquad m = \frac{p}{v}$$

$$m = \frac{6.60 \times 10^2\ \frac{kg\,m}{s}}{11.2\ m/s} = 59.1\ kg$$

4. The first human-made satellite, *Sputnik I*, had a mass of 83.6 kg and a momentum with a magnitude of 6.63 x 10^5 kgm/s. What was the satellite's speed?

$$\frac{p}{m} = \frac{mv}{m}$$

$$v = \frac{p}{m}$$

$$v = \frac{6.63 \times 10^5\ \frac{kg\,m}{s}}{83.6\ kg}$$

They are asking for speed so direction is not needed.

v= 7930 m/s

Impulse

5. What is the definition of Impulse?

- A change in an object's momentum
- The product of the force and the time over which the force acts on an object.

6. How can a small force have a large impulse?

It acts over a long period of time.

7. How can a large force have a small impulse?

It acts for only a short time.

8. What are the three equations associated with impulse?

a. $I = \Delta p$

b. $I = Fat$

c. $\Delta p = Fat$

9. In 1992, Dan Bozich of the United States drove a gasoline-powered go-cart at a speed of 34.9 m/s. Suppose Bozich applies the brakes upon reaching this speed. If the combined mass of the go-cart and driver is 200 kg, the decelerating force is 3.60×10^2 N opposite the cart's motion and the time during which the deceleration takes place is 10.0 s. What is the final speed of Bozich and the go-cart? (must have opp. sign)

$m = 200\text{ kg}$

$V_i = 34.9\text{ m/s}$

$F = -3.60 \times 10^2\text{ N}$

$t = 10\text{ s}$

F ← ○ → V

$\Delta p = Fat$

$P_f - P_i = Fat$

$MV_f - MV_i = Fat$

$+MV_i \quad +MV_i$

$MV_f = Fat + MV_i$

$\frac{MV_f}{M} = \frac{Fat + MV_i}{m}$

$V_f = \frac{Fat + MV_i}{m}$

$V_f = \frac{(-3.60 \times 10^2)(10) + (200)(34.9)}{200}$

$V_f = 16.9\text{ m/s}$

10. With upward speeds of 12.5 m/s, the elevators in the Yokohama Landmark Tower in Yokohama, Japan, are among the fastest elevators in the world. Suppose a passenger with a mass of 70.0 kg enters one of these elevators. The elevator then goes up, reaching full speed in 4.00 s. Calculate the net force that is applied to the passenger during the elevator's acceleration.

$V = 12.5\text{ m/s}$

$M = 70.0\text{ kg}$

$t = 4.00\text{ s}$

$F = ?$

up (+)

$\Delta p = Fat$

$\frac{MV_f - MV_i}{\Delta t} = \frac{Fat}{\Delta t}$

$V_i = 0$ (starts @ rest)

$F = \frac{MV_f - MV_i}{\Delta t}$

$F = \frac{(70.0\text{ kg})(12.5\text{ m/s})}{4.00\text{ s}}$

$= 219\text{ N upward}$

Conservation of Momentum

11. Two skaters initially at rest push off of each other and both move in opposite directions. Skater A has two times more mass than skater B. (Ignore Friction)

    a. What is the total momentum of the system before they push off of each other?

    0 $\frac{kgm}{s}$

    b. Do the individual skaters have momentum after they push off of each other? How do you know?

    Yes, they are both moving.

    c. Based on your answers from parts A and B, how is momentum conserved?

    They are moving in opposite directions. Therefore one has (+) mom. & the other (-).

    d. When comparing the **magnitude** (ignore direction) of the two skater's momentum after they push off of each other, which of the following statements is true?

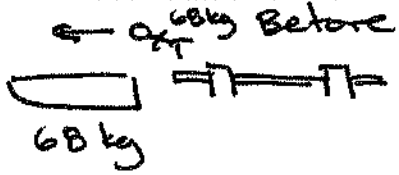
    i. Skater A has more momentum than skater B.

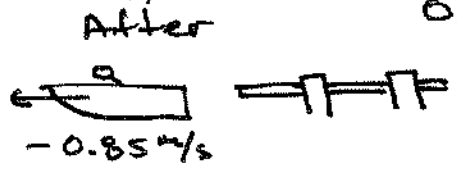
    ii. Skater B has more momentum than skater A.

    iii. They have the same momentum.

    WHY? Their momentums must cancel out. Therefore their momentums must be equal and opposite.

12. A student stumbles backward off a dock and lands in a small boat. The student isn't hurt, but the boat drifts away from the dock with a velocity of 0.85 m/s to the west. If the boat and student each have a mass of 68 kg, what is the student's initial horizontal velocity?





Boat is object #1

Person is object #2

1.7 m/s west

$P_i = P_f$

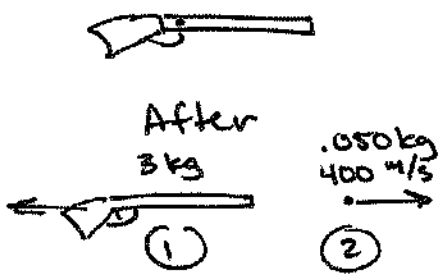
$0 = m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$

$\frac{m_2 v_{2i}}{m_2} = \frac{(m_1 + m_2) v_f}{m_2}$

$v_{2i} = \frac{(68+68)(-0.85\ m/s)}{68}$

$v_{2i} = -1.7\ m/s$

13. A 50.0 g shell fired from a 3.00 kg rifle has a speed of 400.0 m/s. With what speed does the rifle recoil in the opposite direction?



$P_i = P_f$

$0 = (m_1 + m_2) v_i = m_1 v_{1f} + m_2 v_{2f}$

$0 = m_1 v_{1f} + m_2 v_{2f}$

$-m_2 v_{2f} \quad -m_2 v_{2f}$

$\frac{-m_2 v_{2f}}{m_1} = \frac{m_1 v_{1f}}{m_1}$

no direction needed in answer.

$v_{1f} = \frac{-m_2 v_{2f}}{m_1}$

$= \frac{-(.050)(400)}{3}$

$= -6.67\ m/s$

6.67 m/s

Kinetic Energy and Conservation of Momentum

14. What are the tree different types of collisions and explain what happens for each one.

a. Elastic - objects bounce off - no deformation

b. Inelastic - objects bounce off - deform (change shape)

c. Perfectly inelastic - objects stick together

15. In which of the collisions is momentum conserved?

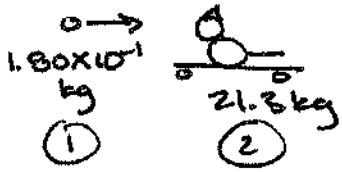
All of them

16. In which of the collisions is kinetic energy conserved?

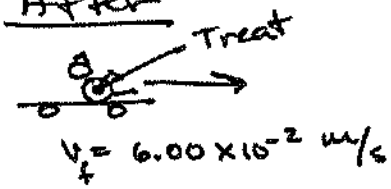
Elastic only

17. There was a domestic cat in Australia with a mass of 21.3 kg. Suppose this cat is sitting on a skateboard that is not moving. A 1.80×10^{-1} kg treat is thrown to the cat. When the cat catches the treat, the cat and skateboard move with a speed of 6.00×10^{-2} m/s. How much kinetic energy is dissipated in the process? Assume one-dimensional motion.

Before



After



$P_i = P_f \rightarrow 0$

$m_1 v_{1i} + m_2 v_2 = (m_1 + m_2) v_f$

$\frac{m_1 v_{1i}}{m_1} = \frac{(m_1 + m_2) v_f}{m_1}$

$v_{1i} = \frac{(1.80 \times 10^{-1} + 21.3)(6.00 \times 10^{-2})}{1.80 \times 10^{-1}}$

$v_{1i} = 7.16$ m/s Right

$\Delta KE = KE_f - KE_i$ ← only the treat has energy in the beginning

$= \left[\frac{1}{2}(m_1 + m_2) v_f^2\right] - \left[\frac{1}{2} m_1 v_{1i}^2\right]$

$= \left[\frac{1}{2}(.180 + 21.3)(.0600)^2\right] - \left[\frac{1}{2}(.180)(7.16)^2\right]$

$= 0.0387\ J - 4.61\ J$

$= -4.58\ J$

Unit 8 Review Part A

Name: KEY Period: _____ Date: _____

1. A 985 kg car is driving on a circular track with a constant speed of 25.0 m/s. The circumference of the track is 2.75 km.

   a. Why does a passenger in the car feel pulled toward the outside of the circular path?

   The passenger wants to travel in a straight line because of their inertia.

   b. Describe the force that keeps the car moving in a circle, identify what causes the force and explain which direction it points.

   The force pulling the car around in a circle is called the centripetal force. Friction is causing this force and it points toward the center.

   c. Find the centripetal acceleration of the car. Which way does this acceleration point?

   $C = 2\pi r \quad r = \frac{C}{2\pi} = \frac{2750\ m}{2\pi} = 438\ m$

   $a_c = \frac{V_t^2}{r} = \frac{(25.0\ m/s)^2}{438} = 1.43\ m/s^2$ toward the center

   d. Find the centripetal force on the car.

   $F_c = \frac{mV_t^2}{r} = \frac{(985)(25)^2}{438} = 1405.5 \rightarrow$ Correct Sig. Figs $\rightarrow$ 1410 N toward the center

   e. Why does the front passenger get pushed into the door?

   Same as part (a) Inertia.

2. Determine the change in gravitational force under the following changes.

   a. If one of the masses is doubled the force is Doubled 2x
   b. If both masses are doubled the force is Quadrupled 4x

   } Directly Proportional

   c. If the distance between masses is doubled the force is 1/4
   d. If the distance between masses is halved the force is Quadrupled
   e. If the distance between masses is tripled the force is 1/9

   } Inverse square law

3. Manipulate the following equation for mass.

$$\frac{T}{2\pi} = \frac{2\pi\sqrt{\frac{r^3}{Gm}}}{2\pi}$$

$$\left(\frac{I}{2\pi}\right)^2 = \left(\sqrt{\frac{r3}{Gm}}\right)^2$$

$$m \cdot \left(\frac{I}{2\pi}\right)^2 = \frac{r3}{Gm} \cdot m$$

$$M \cdot \left(\frac{T}{2\pi}\right)^2 = \frac{r3}{G}$$

$$M = \frac{\frac{r^3}{G}}{\left(\frac{T}{2\pi}\right)^2}$$

$$M = \frac{r^3}{G} \cdot \left(\frac{2\pi}{T}\right)^2$$

4. Manipulate the following equation for radius.

$$\frac{T}{2\pi} = \frac{2\pi\sqrt{\frac{r^3}{Gm}}}{2\pi}$$

$$\left(\frac{I}{2\pi}\right)^2 = \left(\sqrt{\frac{r3}{Gm}}\right)^2$$

$$Gm\left(\frac{I}{2\pi}\right)^2 = \frac{r3}{Gm} \cdot Gm$$

$$\sqrt[3]{r^3} = \sqrt[3]{Gm\left(\frac{I}{2\pi}\right)^2}$$

$$r = \sqrt[3]{Gm\left(\frac{I}{2\pi}\right)^2}$$

5. Manipulate the following equation for mass.

$$\left(v_t\right)^2 = \left(\sqrt{G\frac{m}{r}}\right)^2$$

$$r \cdot v_t^2 = G\frac{M}{r} \cdot r$$

$$\frac{v_t^2 r}{G} = \frac{GM}{G}$$

$$M = \frac{v_t^2 r}{G}$$

6. Manipulate the following equation for radius.

$$v_t^2 = \left(\sqrt{G\frac{m}{r}}\right)^2$$

$$r \cdot v_t^2 = G\frac{M}{r} \cdot r$$

$$\frac{r \cdot v_t^2}{v_t^2} = \frac{GM}{v_t^2}$$

$$r = \frac{GM}{v_t^2}$$

7. As an elevator begins to descend, you feel momentarily lighter. As the elevator begins to stop, you feel momentarily heavier. Explain the sensations you feel.

As the elevator descends there is a smaller normal force and the feeling of heavy or light is based on the normal force. As the elevator begins to stop the normal force is larger.

8. A 45.0 kg satellite is in a circular orbit around Earth with an orbital radius of 4.23×10^7 m. Earth's mass is 5.97×10^{24} kg. Calculate the following:

a. the magnitude of the gravitational force on the satellite 10.0N toward the center

b. the period of the satellite's orbit 8.66×10^4 s

c. the orbital speed of the satellite 3.07×10^3 m/s

d. When measuring the radius what points do you use? Center to Center

a) $F_g = G\frac{M_1 M_2}{r^2}$

$F_g = 6.67\times10^{-11}\frac{Nm^2}{kg^2}\frac{(45kg)(5.97\times10^{24}kg)}{(4.23\times10^7 m)^2}$

$F_g = 10.0\ N$

b) $T = 2\pi\sqrt{\frac{r^3}{Gm}}$

$T = 2\pi\sqrt{\frac{(4.23\times10^7)^3}{(6.67\times10^{-11})(5.97\times10^{24})}}$

$T = 8.66\times10^4\ s$

c) $V_t = \sqrt{G\frac{M}{r}}$

$V_t = \sqrt{6.67\times10^{-11}\frac{5.97\times10^{24}}{4.23\times10^7}}$

$V_t = 3.07\times10^3\ m/s$

9. What does the mass represent in the previous manipulations? Mass of the central object.

10. Pluto's moon, Charon, has an orbital period of 153 hours. How far is Charon from Pluto? ($m_{pluto} = 1.30\times10^{22}$ kg)

$153\ hrs \times \frac{60\ min}{1\ hr} \times \frac{60\ s}{1\ min} = 5.51\times10^5\ s$

$T = 5.51\times10^5\ s$

$M_p = 1.30\times10^{22}\ kg$

$\frac{T}{2\pi} = \frac{2\pi\sqrt{\frac{r^3}{GM}}}{2\pi}$

$\left(\frac{T}{2\pi}\right)^2 = \left(\sqrt{\frac{r^3}{GM}}\right)^2$

$GM_c\left(\frac{T}{2\pi}\right)^2 = r^3$

$r = \sqrt[3]{GM_c\left(\frac{T}{2\pi}\right)^2}$

$r = \sqrt[3]{(6.67\times10^{-11})(1.30\times10^{22})\left(\frac{5.51\times10^5}{2\pi}\right)^2}$

$r = 1.88\times10^7\ m$

$GM\cdot\left(\frac{T}{2\pi}\right)^2 = \frac{r^3}{GM}\cdot GM$

11. What are Kepler's three laws?

a. Planets follow elliptical paths

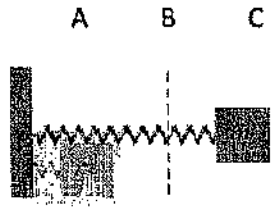
b. A line drawn from the planet to the sun will sweep out equal areas in equal amounts of time.

c. The square of a planet's period is proportional to the cube of the radius. $\frac{T_1^2}{T_2^2} = \frac{r_1^3}{r_2^3}$

Chapter 11 Review

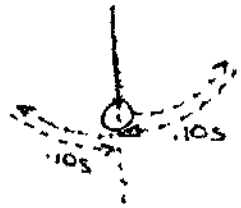
Name: _____ Period: _____ Date: _____

1. At what point does the spring mass system, shown at the right, have the following?



   a. Minimum Velocity
      A, C
   b. Maximum Force
      A, C
   c. Minimum Acceleration
      B
   d. Maximum Velocity
      B
   e. Maximum Acceleration
      A, C
   f. Minimum Force
      B

2. A pendulum with a mass of 0.100 kg was released. The bob of the pendulum returns to its lowest point every 0.10 s.



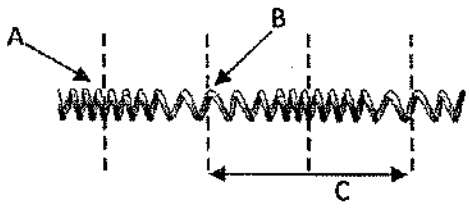
   a. What is its period?
      $T = .20\ s$
   b. What is its frequency?
      $f = \frac{1}{T} = \frac{1}{.20} = 5\ Hz$

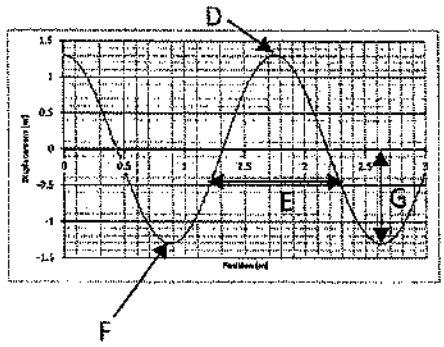
3. The frequency of a pressure wave is 1.00×10^2 Hz. Its wavelength is 3.00 m. What is the speed of the wave?

$$v = f\lambda = (1.00 \times 10^2\ Hz)(3.00\ m) = 300\ m/s$$

4. What is a transverse wave? Give an example.
   A wave whose particles move perpendicular to the motion of the wave. Ex: Ocean Wave.
5. What is a longitudinal wave? Give an example.
   A wave whose particles move parallel to the direction of the wave. Ex: Sound wave.
6. How is period related to frequency?
   Period is the reciprocal of frequency

7. Identify the following parts of the diagrams on the right.





a. Compression
b. Rarefaction
c. wavelength (λ)
d. Crest
e. NOTHING
f. Trough
g. Amplitude

8. Define the following terms.
   a. Frequency
      # of cycles per second
   b. Wavelength
      The distance btw two identical consecutive points.
   c. Period
      The time for one cycle
   d. Amplitude.
      Any displacement from equilibrium

9. What are three tests for simple harmonic motion?
   a. periodic motion
   b. Restoring force
   c. Restoring force is proportional to displacement

10. Find the length of a pendulum that oscillates with a frequency of 0.16 Hz. $f \Rightarrow T = \frac{1}{f} = T = (6.25\text{ s})$

$$\frac{T}{2\pi} = \frac{2\pi\sqrt{\frac{L}{g}}}{2\pi} \quad g\cdot\left(\frac{T}{2\pi}\right)^2 = \frac{L}{g}\cdot g \quad L = g\left(\frac{T}{2\pi}\right)^2 = 9.81\,\text{m/s}^2\left(\frac{6.25\text{ s}}{2\pi}\right)^2 = 9.72\text{ m}$$

11. What is the spring constant for a spring that stretches 0.25 m to the right with a 15 N force?

$\Delta x \longrightarrow (+)$

Force of spring $\longleftarrow (-)$

$F = -kx$

$k = \frac{F}{-x}$

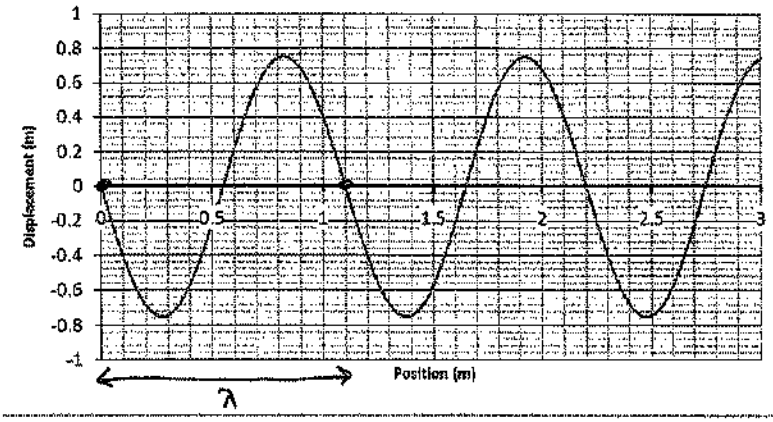
$k = \frac{-15\text{ N}}{-(0.25\text{ m})} = 60\text{ N/m}$

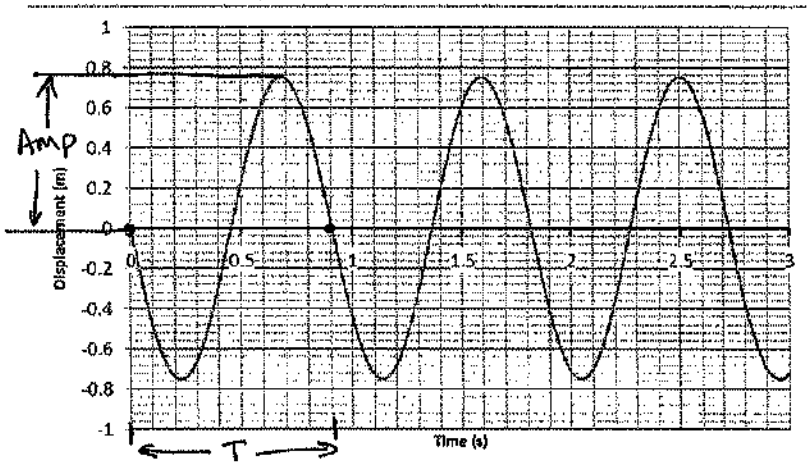
12. What is the wavelength of a wave travelling at 246 m/s with a frequency of 210 Hz?

$v = f\lambda$

$\lambda = \frac{v}{f}$

$\lambda = \frac{246\text{ m/s}}{210\text{ Hz}} = 1.17\text{ m}$





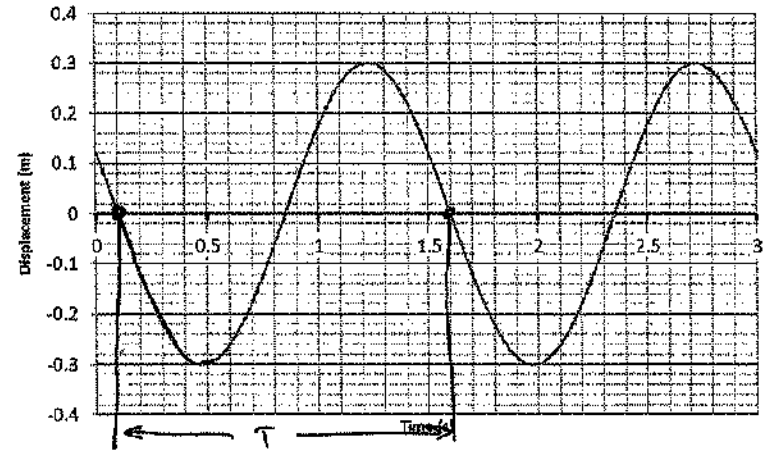
Use the waveforms on the left to identify the values for the following.

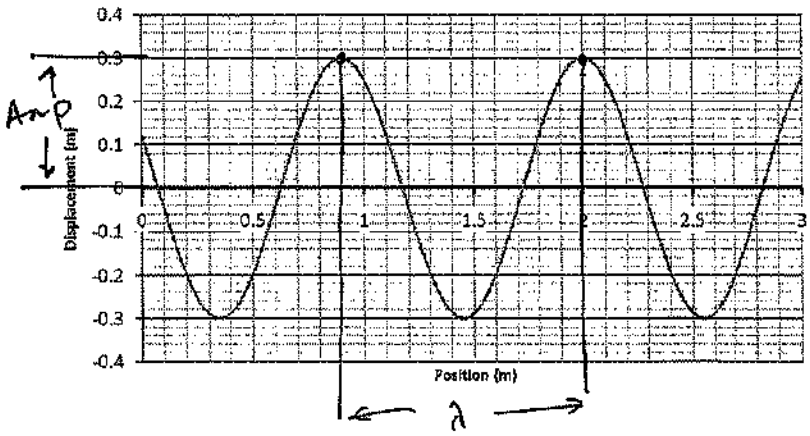
Period: 0.90 s

Wavelength: 1.10 m

Frequency: $\frac{1}{T}$ = 1.11 Hz

Amplitude: 0.760 m





Use the waveforms on the left to identify the values for the following.

Period: 1.50s

Wavelength: 1.10 m

Frequency: $\frac{1}{T}$ = 0.667 Hz

Amplitude: 0.30 m