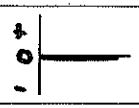
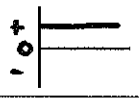
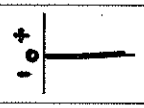
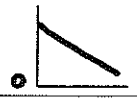
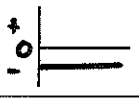
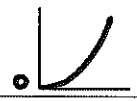
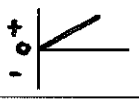
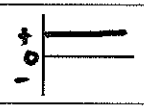
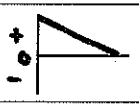
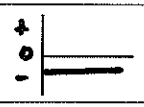
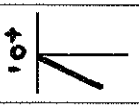
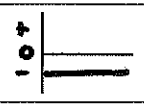
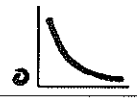
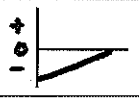
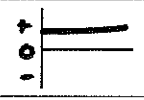
Academic Physics
Unit 5 Review Sheet – Motion in 1D

Name KEY
Date

1. Draw the position, velocity and acceleration vs. time graphs for the 7 scenarios of motion discussed in class.

Motion Description	Sign for v & a	Position vs. Time Graph	Velocity vs. Time Graph	Acceleration vs. Time Graph
At Rest	Sign of v: N/A Sign of a: N/A			
Constant Velocity Away	Sign of v: ⊕ Sign of a: N/A			
Constant Velocity Toward	Sign of v: ⊖ Sign of a: N/A			
Speeding Up Away	Sign of v: ⊕ Sign of a: ⊕			
Slowing Down Away	Sign of v: ⊕ Sign of a: ⊖			
Speeding Up Toward	Sign of v: ⊖ Sign of a: ⊖			
Slowing Down Toward	Sign of v: ⊖ Sign of a: ⊕			

2. A motorcycle starts from rest and has a constant acceleration. In a certain time interval, its displacement triples. In the same time interval, by what factor does its velocity increase?

$v_f^2 = v_i^2 + 2a\Delta x$ (Assume starts at rest)

Try Random ... picked a value for a ... picked a value for Δx

$v_f = \sqrt{2 \cdot 2 \cdot 2} = 2.83\ m/s$

$v_f = \sqrt{2 \cdot 2 \cdot 6} = 4.90\ m/s$ ← triple Δx

1.73 x bigger

3. A car is traveling along a straight road and is decelerating. Does the car's acceleration *a* necessarily have a negative value?

↓ means slowing down

→ → →
if v is ⊕, then a is ⊖

← ← ←
if v is ⊖, then a is ⊕ ... A does not have to be negative. Its a direction. Thats opposite to velocity

4. A football game customarily begins with a coin toss to determine who kicks off. The referee tosses the coin up with an initial velocity of 5.0 m/s. In the absence of air resistance, how high does the coin go above its point of release?

v_i = 5.0 m/s, $\Delta x = ?$

v_f @ top = 0 m/s, $a = \ominus 9.8\ m/s^2$

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

$\Delta x = \oplus 1.28\ m$

5. A car has uniformly accelerated motion and starting from rest has a velocity of +37 m/s after traveling 175 m. Find the car's acceleration.

$v_i = 0$ m/s, $v_f =$, Δx, $a = ?$

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

$a = \oplus 3.91\ m/s^2$

6. A train running at +26.8 m/s is stopped uniform acceleration (deceleration) in 44 seconds by the application of the brakes.
   a. What is the acceleration?
   b. What is the distance traveled before coming to rest?

v_i, $v_f = 0$, $a = ?$, t

$v_f = v_i + at$

$a = \ominus 0.61\ m/s^2$

$\Delta x = ?$

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

$\Delta x = \oplus 589.6\ m$

7. A book is dropped 2.5 m from a second floor balcony. A 1.65-m tall person that was 3.0 m away when the book was dropped is able to catch the book at waist level (1.0 m above the ground). How ~~fast was the person walking~~ long to fall?

$\Delta x = 2.5 - 1.00 = \ominus 1.50$ m

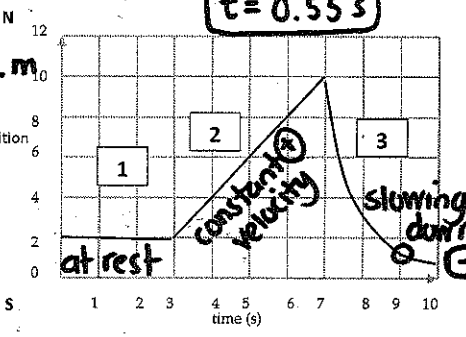
$t = ?$

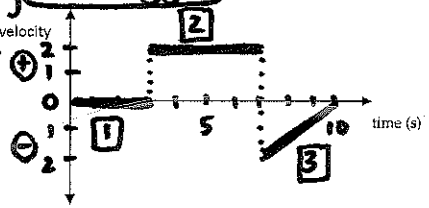
$v_i = 0$ m/s, $a = \ominus 9.8\ m/s^2$

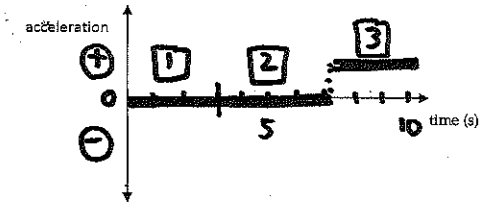
$\Delta x = v_i t + \frac{1}{2}at^2$

$t = 0.55$ s

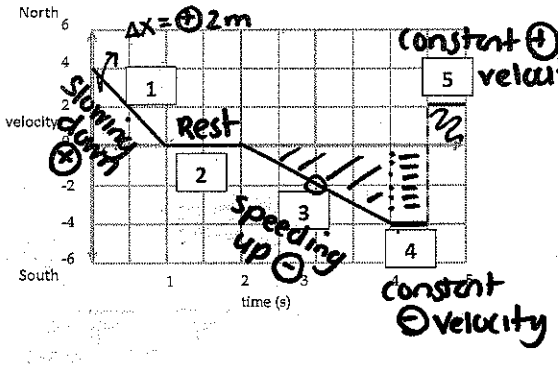
8. Use the position vs. time graph below to answer the questions that follow.
   a. What is the position at 9 seconds? About 1 m
   b. Describe the motion of the object during each segment. See graph
   c. What is the velocity of the object from 0 s to 3 s? 0 m/s
   d. What is the velocity of the object from 3 s to 7 s? $+8\ m/4\ s = \oplus 2\ m/s$
   e. Draw the velocity vs. time and acceleration vs. time graphs that correspond with the above graph.







9. Use the velocity vs. time graph below to answer the questions that follow.



a. What is the instantaneous velocity at 3 seconds? ⊖ 2 m/s

b. Describe the motion of the object during each interval.

see graph

Slope c. What is the acceleration of the object from 0 s to 1 s?

$-4/1 = \ominus 4\ m/s^2$

Area d. What is the displacement of the object from 2 s to 4.5 s?

$\left[\frac{1}{2}(-4)(2.0)\right] + \left[(0.5)(-4)\right] = \ominus 6\ m$

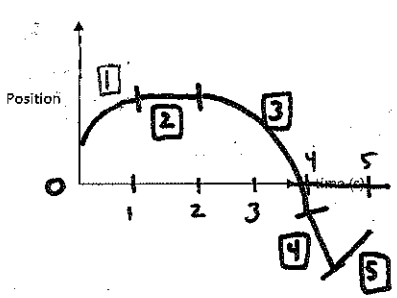
Slope e. What is the acceleration of the object from 4 to 4.5 s?

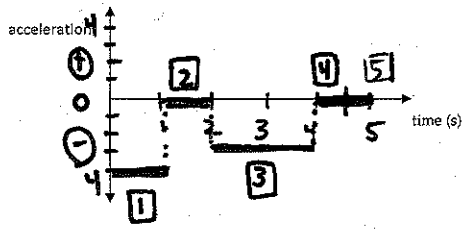
$0\ m/s^2$

Area f. How far has the object traveled between 4.5 and 5 s?

$(0.5)(+2) = \oplus 1\ m$

g. Draw the position vs. time and acceleration vs. time graphs that corresponds to this velocity vs. time graph.





Unit V – Motion in 1D STUDY GUIDE

Vocabulary & Concepts

- Scalar
- Vector
- Time
- Distance
- Speed
- Position
- Displacement
- Velocity
  constant + velocity graphs
  constant – velocity graphs
  speeding up + graphs
  speeding up – graphs
- Acceleration
  constant + acceleration graphs
  constant – acceleration graphs
- Free Fall
  acceleration on the way up?
  acceleration at the top?
  acceleration on the way down

Equations

$s = d/t$ $\quad v = \Delta x/t$

$v_f = v_i + at$ $\quad \Delta x = \frac{1}{2}(v_i + v_f)t$ $\quad v_f^2 = v_i^2 + 2a\Delta x$ $\quad \Delta x = v_i t + \frac{1}{2} at^2$

Core Concepts

- Students will understand and interpret graphs of position, velocity, and acceleration vs. time for 7 scenarios of motion.
- Given a graph of position vs. time, calculate velocity and describe the motion of the object.
- Given a graph of velocity vs. time, calculate acceleration and describe the motion of the object.
- Students will be able to use the equations of constant acceleration to analyze motion.
- Students will be able to identify the velocity and acceleration of an object in free fall in all segments of motion: going up, coming down, and at the to