Date _____ Period _____ Name _____

CHAPTER 3

Study Guide

Accelerated Motion

Vocabulary Review

Write the term that correctly completes the statement. Use each term once.

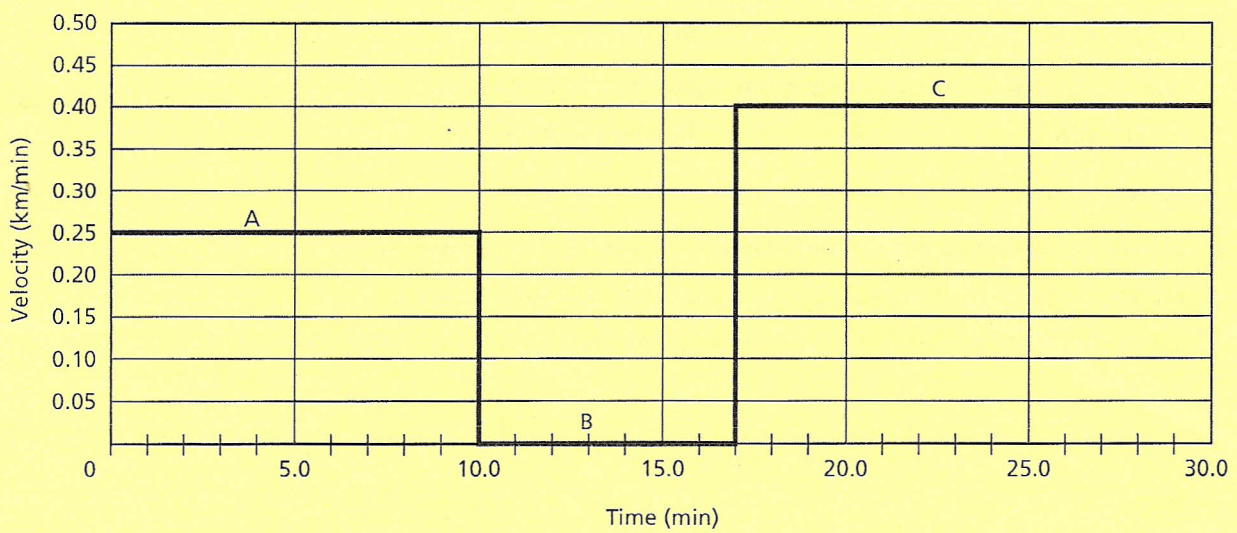
acceleration	average acceleration	instantaneous acceleration
acceleration due to gravity	free fall	velocity-time graph

1. velocity-time — A ____ shows how velocity is related to time.
2. instantaneous acceleration — The change in velocity of an object at an instant of time is its ____.
3. Acceleration — The rate at which an object's velocity changes is its ____.
4. free fall — The motion of falling objects when air resistance is negligible is called ____.
5. Average acceleration — The ____ of an object is the change in velocity during some measurable time interval divided by that time interval.
6. acceleration due to gravity — The acceleration of an object in free fall that results from the influence of Earth's gravity is ____.

Section 3.1 Acceleration

In your textbook, read about changing velocity and velocity-time graphs on pages 58–59.

1. Refer to this velocity-time graph of a jogger to complete the two tables on the next page.



Name _____

3 Study Guide

continued

Segment	*V*	Δt	Δd
A			
B			
C			

Δt	**Distance Run**	**Displacement**	**Average Velocity**

In your textbook, read about acceleration on pages 59–64.

Circle the letter of the choice that best completes the statement or answers the question.

2. The slope of a tangent line on a velocity-time graph is the _____.

a. displacement
c. average acceleration
b. velocity
d. acceleration due to gravity

3. When acceleration and velocity vectors are pointing in opposite directions, the object is _____.

a. speeding up
c. moving at constant speed
b. slowing down
d. not moving

4. If a runner accelerates from 2 m/s to 3 m/s in 4 s, her average acceleration is _____.

a. 4.0 m/s^2
c. 0.40 m/s^2
b. 2.5 m/s^2
d. 0.25 m/s^2

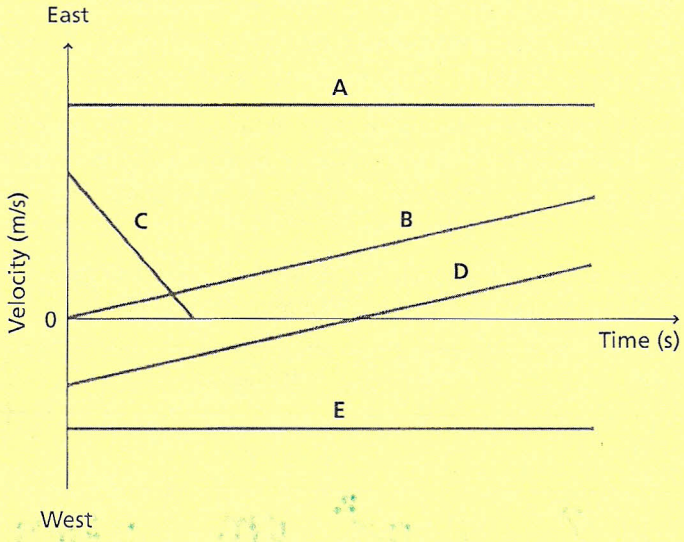
5. The area under a velocity-time graph is equal to the object's _____.

a. stop time
c. displacement
b. acceleration
d. average speed

6. The area under an acceleration-time graph is equal to the object's _____.

a. velocity
c. change in acceleration
b. weight
d. displacement

The graph below shows the motion of five objects. Refer to the graph to answer questions 7–11.



7. Which has the greater acceleration, Object A or B? How do you know?

_____

_____

8. Which of these objects has the least value of acceleration? How do you know?

_____

_____

9. Which of these objects started its motion from rest? Which object comes to a complete stop? Explain your answers.

_____

_____

10. Object D crosses the axis while maintaining a constant positive acceleration. What does this indicate?

_____

_____

_____

11. Object A and Object E both have a constant velocity and acceleration of zero. What is different between these two?

_____

_____

_____

Section 3.2 Motion with Constant Acceleration

In your textbook, read about velocity with average acceleration, position with constant acceleration, and an alternative expression for position, velocity, and time on pages 65–68.

Complete the tables below. Fill in the values for the initial conditions and the variables. Write a question mark for the unknown variable in each table. If a variable or initial condition is not needed to answer the problem, write X. *Write the equation you would use to answer each question. Then solve the problem and show your calculations.*

1. A ball rolls past a mark on an incline at 0.40 m/s. If the ball has an average acceleration of 0.20 m/s^2, what is its velocity 3.0 s after it passes the mark?

Initial Conditions			Variables			Equation
Δt	d_f	v_f	$\bar{a}$	d_i	v_i	$v_f = v_i + a \cdot t$
3 s		?	0.2 m/s^2	0 m	0.4 m/s	$v_f = 0.4\ m/s + 0.2\ m/s^2 \cdot 3\ s$

$v_f = 0.4\ m/s + 0.6\ m/s = 1\ m/s$ $\boxed{v_f = 1\ m/s}$

2. A car initially traveling at 15 m/s accelerates at a constant rate of 4.5 m/s^2 over a distance of 45 m. How long does it take the car to cover this distance?

Initial Conditions			Variables			Equation
t_f	d_f	v_f	$\bar{a}$	d_i	v_i	$d_f = v_i t + \frac{1}{2} a t^2$
?	45 m	?	4.5 m/s^2	0 m	15 m/s	

$v_f^2 = v_i^2 + 2 \cdot a \cdot d \Rightarrow v_f = \sqrt{v_i^2 + 2a \cdot d} = \sqrt{225\ (m/s)^2 + 2 \cdot 4.5 \cdot 45\ (m/s)^2}$

$v_f = \sqrt{630}\ m/s = 25.09\ m/s \quad t = \frac{v_f - v_i}{a} = \frac{25.09\ m/s - 15\ m/s}{4.5\ m/s^2} = 2.24\ s$

3. A car accelerates from 10.0 m/s to 15.0 m/s in 3.0 s. How far does the car travel?

Initial Conditions			Variables			Equation
t_f	d_f	v_f	$\bar{a}$	d_i	v_i	$\bar{a} = \frac{v_f - v_i}{t} = \frac{5\ m/s}{3\ s} = 1.67\ m/s^2$
3 s	?	15 m/s	?	0 m	10 m/s	$v_f^2 = v_i^2 + 2a \cdot d$

$2ad = v_f^2 - v_i^2$

$d = \frac{v_f^2 - v_i^2}{2a} = \frac{225\ m^2/s^2 - 100\ m^2/s^2}{2 \cdot 1.67\ m/s^2} = \frac{125\ m^2/s^2}{3.34\ m/s^2}$

$\boxed{d = 37.425\ m}$

4. A race car accelerates at 4.5 m/s^2 from rest. What is the car's velocity after it has traveled 35.0 m?

Initial Conditions			Variables			Equation
Δt	d_f	v_f	$\bar{a}$	d_i	v_i	$v_f^2 = v_i^2 + 2a \cdot d$
	35 m	?	$4.5 m/s^2$	0	0 m/s	$v_f = \sqrt{2a \cdot d}$

$v_f = \sqrt{2 \cdot 4.5 m/s^2 \cdot 35 m} = 17.75 m/s$

$v_f = 17.75 m/s$

Section 3.3 Free Fall

In your textbook, read about acceleration due to gravity on pages 72–75.

For each statement below, write true ***or rewrite the italicized part to make the statement true.***

1. _____ A feather does not fall in the same way as a pebble because of *gravity.*

2. _____ *Freefall* is the motion of a falling object when the air resistance is negligible.

3. _____ Galileo concluded that objects in free fall have *different* accelerations.

4. _____ Acceleration due to gravity is *the same* for objects of different sizes.

5. _____ Acceleration due to gravity is always *downward.*

6. _____ If you drop a rock, its velocity after 3 s will be *19.6 m/s.*

7. _____ The decision to treat acceleration due to gravity as positive or negative depends on the *coordinate system* you use.

8. _____ If you toss a ball up, it reaches its maximum height when its velocity is *zero.*

9. _____ If you toss a ball up, its acceleration at its maximum height is *zero.*

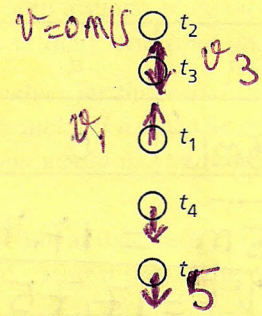
10. _____ If a tossed ball had no velocity or acceleration, it would *have no motion at all.*

Name _____

3 Study Guide

continued

The diagram below shows the positions of a ball that was thrown upward at time t_1. Refer to the diagram to answer questions 11–14.



11. Assume that the downward direction is positive. For each time shown on the diagram, determine whether the direction of the velocity is positive, negative, or zero, and whether the direction of the acceleration is positive, negative, or zero. Record your answers in the table using the symbols +, −, and *0*.

	Time				
Variable	t_1	t_2	t_3	t_4	t_5
v	−	0m/s	+	+	+
a	+	+	+	+	+

↓ + direction

12. Still assuming that the downward direction is positive, rank the magnitudes of the velocities v_1, v_2, v_3, v_4, v_5 in decreasing order.

v_5, v_4, v_1, v_3, v_2

13. Now assume that the downward direction is negative. For each time shown on the diagram, determine whether the direction of the velocity is positive, negative, or zero, and whether the direction of the acceleration is positive, negative, or zero. Record your answers in the table using the symbols +, −, and *0*.

	Time				
Variable	t_1	t_2	t_3	t_4	t_5
v	+	0m/s	−	−	−
a	−	−	−	−	−

↓ − direction

14. Still assuming that the downward direction is negative, rank the magnitudes of the velocities v_1, v_2, v_3, v_4, v_5 in decreasing order.

v_2, v_3, v_1, v_4, v_5