Physics 3204

Unit 1: Motion

STSE : Physics of Juggling

Student Name:_____

PART A: MULTIPLE CHOICE:

Instruction : Place the correct answer on the provided Scantron sheet.

1.   Which of the following would best describe juggling?

   (A)   Projectile motion
   (B)   Free Fall
   (C)   Uniform Circular Motion
   (D)   Uniform Motion

2.   How would you describe the path of an object thrown in juggling

   (A)   Linear
   (B)   Parabolic
   (C)   Circular
   (D)   Rectangular

3.   Which of the following is true for the term "juggling"?

   (A)   Comes from the latin word "joculare" meaning "to jest"
   (B)   Comes from the english word "joculare" meaning "to jest"
   (C)   Comes from the latin word "jacto" meaning "to throw"
   (D)   Comes from the english word "jacto" meaning "to throw"

4.   What happens when a juggler throws a ball high?

   I)   Allows for extra time
   II)   Increases the risk of error
   III)   Allows for more objects to be juggled

   (A)   I only
   (B)   I and II
   (C)   II and III
   (D)   I, II and III

5.   What name is given to the following juggling patter?

   (A)   One ball fountain
   (B)   three ball cascade
   (C)   Three ball shower
   (D)   Four ball Fountain

6. Which of the following describes "dwell ratio"?

   (A) The initial velocity of the ball thrown from the hand
   (B) The height the object was thrown
   (C) The fraction of time that a hand holds on to a ball between two catches
   (D) The angle of the object thrown from the juggler's had

7. What does a small dwell ratio mean?

   (A) The balls have a longer time in the air, which allows the juggler time to make corrections to hand repositioning.
   (B) The balls have a longer time in the air, which does not allow the juggler time to make corrections to hand repositioning.
   (C) The balls have a smaller time in the air, which allows the juggler time to make corrections to hand repositioning.
   (D) The balls have a longer time in the air, which does not allow the juggler time to make corrections to hand repositioning.

8. Which of the following is true for a novice juggler?

   I)   Have large dwell ratio
   II) They cradle the ball for a longer period of time
   III) They spend less time to accurately throw the ball.

   (A) I only
   (B) I and II
   (C) II and III
   (D) I, II and III

9. What are the horizontal and vertical components of a ball that leave a juggler's hand at 1.5 m /s at an angle of 50°?

	Horizontal Component	**Vertical Component**
(A)	0.96	1.1
(B)	1.1	0.96
(C)	0.96	1.8
(D)	1.8	1.1

10. Which of the following formulae would be used to calculate the distance between the juggler's hands?

   (A) $d = vt$
   (B) $v_2 = v_2 + at$
   (C) $v_2^2 = v_1^2 + 2ad$
   (D) $v_2 = v_1 + 2ad$

11. What is the value of the ball's velocity at the top of its trajectory?

   (A) 0
   (B) v_{1x}
   (C) v_{1y}
   (D) v_{2y}

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12. The picture below represents the parabolic path of a juggled object. Which of the following represents the vertical component of the velocity at points X, Y and Z for this object?
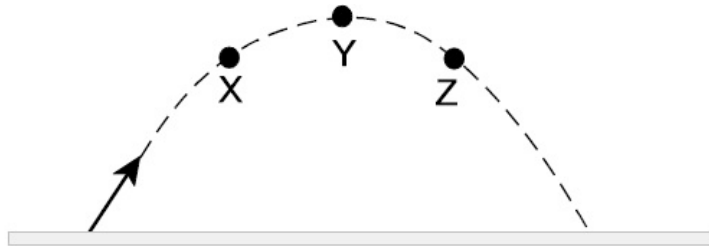
	x	y	z
(A)	downward	downward	downward
(B)	downward	zero	0
(C)	upward	upward	upward
(D)	upward	zero	downward

13. Which represents the velocity components of a projectile that is juggled ?
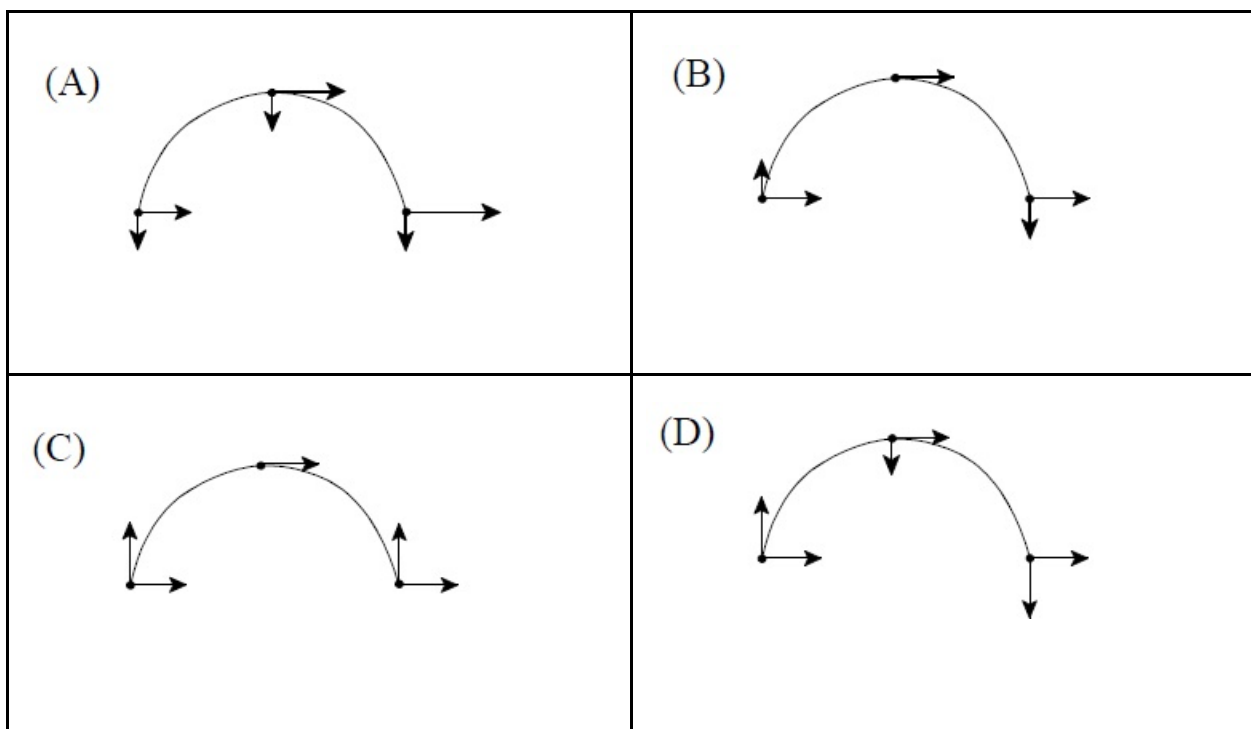
14. A ball is launched from a juggler's hand with an initial velocity of 28.0 m/s at 40.0^0 above the horizontal. How long does it take for the ball to reach its maximum height?

(A) 1.68 s
(B) 1.84 s
(C) 2.19 s
(D) 2.86 s

15. What is the best advice for a juggler?

(A) Throw the projectiles fast
(B) Don't keep your eyes on the projectiles
(C) Throw lots of projectiles
(D) Start with juggling chainsaws

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16.   What is the acceleration of the projectile at each point in the diagram below?
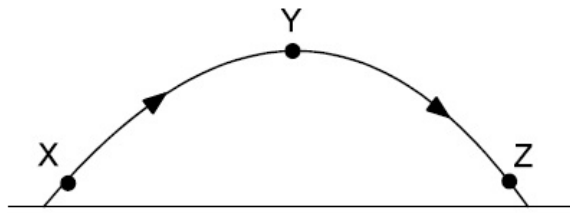
	x (m/s²)	y (m/s²)	z (m/s²)
(A)	-9.8	-9.8	-9.8
(B)	-9.8	0	-9.8
(C)	9.8	9.8	-9.8
(D)	9.8	0	-9.8

PART B: CONSTRUCTED RESPONSE.

Instructions: *Place your answers and solutions in the spaces provided. Show all workings!*

1.   A ball is thrown at an initial velocity of 3.0 m/s upward at an angle of 80° to the horizontal.

   A)   How high will the ball rise?

   B)   How far apart should the juggler hold his/her hands?

2.   A juggler throws a ball at an angle of 70° to the horizontal. If the ball took 0.20 s to reach its maximum height, at what initial velocity was it thrown?

3.   A juggler throws a ball upward at an angle of 65° to the horizontal, with an initial speed of 3.2 m/s. What is the time of flight for the ball if it land at the same level from which it was thrown?

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4.   How is knowledge of projectile motion principles useful to a juggler?

5.   Explain why beginning jugglers prefer large dwell ratios, while professional jugglers prefer smaller dwell ratios. AUGUST 2007