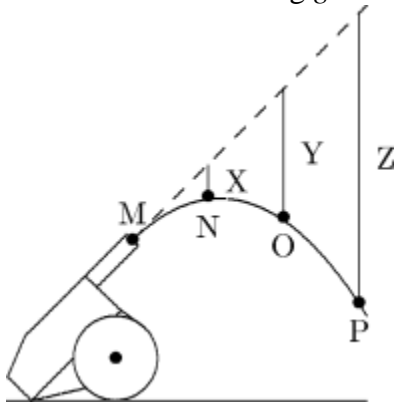


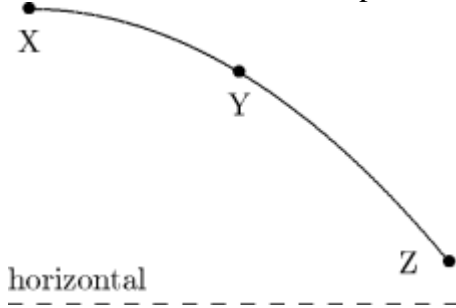
Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. A boy on the edge of a vertical cliff 20 m high throws a stone horizontally outward with a speed of 20 m/s. It strikes the ground at what horizontal distance from the foot of the cliff? Use  $g = 10 \text{ m/s}^2$ .  
A) 10 m  
B) 40 m  
C) 50 m  
D)  $50\sqrt{5}$  m  
E) none of these
2. A cannon fires a projectile as shown. The dashed line shows the trajectory in the absence of gravity; points MNOP correspond to the positions of the particle at one second intervals. Using  $g = 10 \text{ N/kg}$ , the lengths X,Y,Z are:



- A) 5 m, 10 m, 15 m
- B) 5 m, 20 m, 45 m
- C) 10 m, 40 m, 90 m
- D) 10 m, 20 m, 30 m
- E) 0.2 m, 0.8 m, 1.8 m

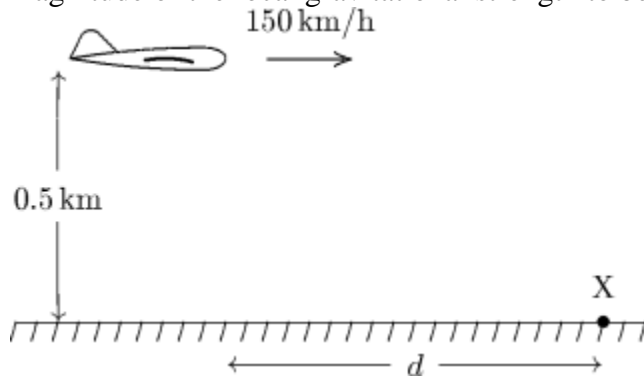
3. A stone is thrown horizontally and follows the path XYZ shown. The direction of the acceleration of the stone at point Y is:



- A) ↓  
B) →  
C) ↘  
D) ↙  
E) ↗
4. A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are:  
A) both tangent to the circular path  
B) both perpendicular to the circular path  
C) perpendicular to each other  
D) opposite to each other  
E) none of the above
5. A stone thrown from the top of a tall building follows a path that is:  
A) circular  
B) made of two straight line segments  
C) hyperbolic  
D) parabolic  
E) a straight line
6. An object is shot from the back of a railroad flatcar moving at 40 km/h on a straight horizontal road. The launcher is aimed upward, perpendicular to the bed of the flatcar. The object falls:  
A) in front of the flatcar  
B) behind the flatcar  
C) on the flatcar  
D) either behind or in front of the flatcar, depending on the initial speed of the object  
E) to the side of the flatcar

7. A stone is thrown outward from the top of a 59.4-m high cliff with an upward velocity component of 19.5 m/s. How long is the stone in the air?
- A) 4 s
  - B) 5 s
  - C) 6 s
  - D) 7 s
  - E) 8 s
8. A car rounds a 20-m radius curve at 10 m/s. The magnitude of its acceleration in is:
- A) 0
  - B)  $0.20 \text{ m/s}^2$
  - C)  $5.0 \text{ m/s}^2$
  - D)  $40 \text{ m/s}^2$
  - E)  $400 \text{ m/s}^2$
9. A bullet shot horizontally from a gun:
- A) strikes the ground much later than one dropped vertically from the same point at the same instant
  - B) never strikes the ground
  - C) strikes the ground at approximately the same time as one dropped vertically from the same point at the same instant
  - D) travels in a straight line
  - E) strikes the ground much sooner than one dropped from the same point at the same instant
10. Acceleration is defined as:
- A) rate of change of position with time
  - B) speed divided by time
  - C) rate of change of velocity with time
  - D) a speeding up or slowing down
  - E) change of velocity
11. An object is moving on a circular path of radius  $\pi$  meters at a constant speed of 4.0 m/s. The time required for one revolution is:
- A)  $2/\pi^2 \text{ s}$
  - B)  $\pi^2/2 \text{ s}$
  - C)  $\pi/2 \text{ s}$
  - D)  $\pi^2/4 \text{ s}$
  - E)  $2/\pi \text{ s}$

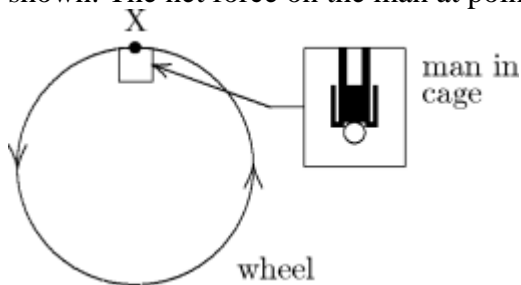
12. An object moving in a circle at constant speed:
- A) must have only one force acting on it
  - B) is not accelerating
  - C) is held to its path by centrifugal force
  - D) has an acceleration of constant magnitude
  - E) has an acceleration that is tangent to the circle
13. An airplane is flying north at 500 km/h. It makes a gradual  $180^\circ$  turn at constant speed, changing its direction of travel from north through east to south. The process takes 40 s. The average acceleration of the plane for this turn is:
- A)  $12.5 \text{ m/s}^2$ , north
  - B)  $12.5 \text{ m/s}^2$ , east
  - C)  $12.5 \text{ m/s}^2$ , south
  - D)  $25 \text{ m/s}^2$ , north
  - E)  $25 \text{ m/s}^2$ , south
14. The airplane shown is in level flight at an altitude of 0.5 km and a speed of 150 km/h. At what distance  $d$  should it release a heavy package to hit the target X? Take the magnitude of the local gravitational strength to be  $10 \text{ N/kg}^2$ .



- A) 150 m
- B) 295 m
- C) 420 m
- D) 2550 m
- E) 15,000 m

15. If a certain car, going with speed  $v_1$ , rounds a level curve with a radius  $R_1$ , it is just on the verge of skidding. If its speed is now doubled, the radius of the tightest curve on the same road, with the same force on the car, that it can round is:
- A)  $2R_1$
  - B)  $4R_1$
  - C)  $R_1/2$
  - D)  $R_1/4$
  - E)  $R_1$

16. A giant wheel, having a diameter of 40 m, is fitted with a cage and platform on which a man of mass  $m$  stands. The wheel is rotated in a vertical plane at such a speed that the force exerted by the man on the platform is equal to his weight when the cage is at X, as shown. The net force on the man at point X is:



- A) zero
  - B)  $mg$ , down
  - C)  $mg$ , up
  - D)  $2mg$ , down
  - E)  $2mg$ , up
17. A large cannon is fired from ground level over level ground at an angle of  $30^\circ$  above the horizontal. The muzzle speed is 980 m/s. Neglecting air resistance, the projectile will travel what horizontal distance before striking the ground?
- A) 4.3 km
  - B) 8.5 km
  - C) 43 km
  - D) 85 km
  - E) 170 km

18. An airplane makes a gradual  $90^\circ$  turn while flying at a constant speed of 200 m/s. The process takes 20.0 seconds to complete. For this turn the magnitude of the average acceleration of the plane is:
- A) zero
  - B)  $40 \text{ m/s}^2$
  - C)  $20 \text{ m/s}^2$
  - D)  $14 \text{ m/s}^2$
  - E)  $10 \text{ m/s}^2$
19. Two bodies are falling with negligible air resistance, side by side, above a horizontal plane. If one of the bodies is given an additional horizontal acceleration during its descent, it:
- A) strikes the plane at the same time as the other body
  - B) strikes the plane earlier than the other body
  - C) has the vertical component of its velocity altered
  - D) has the vertical component of its acceleration altered
  - E) follows a straight line path along the resultant acceleration vector
20. A stone is tied to the end of a string and is swung with constant speed around a horizontal circle with a radius of 1.5 m. If it makes two complete revolutions each second, the magnitude of its acceleration is:
- A)  $0.24 \text{ m/s}^2$
  - B)  $2.4 \text{ m/s}^2$
  - C)  $24 \text{ m/s}^2$
  - D)  $240 \text{ m/s}^2$
  - E)  $2400 \text{ m/s}^2$

## Answer Key

1. B
2. B
3. A
4. C
5. D
6. C
7. C
8. C
9. C
10. C
11. B
12. D
13. E
14. C
15. B
16. D
17. D
18. D
19. A
20. D