***** SAMPLE QUIZ *****

PHYSICS NAME ________________________

QUIZ: **AMUSEMENT PARK PHYSICS** DATE ______________ PERIOD ___

Questions 1-2 are based on **THE GRIZZLY**. Use the following data in your calculations, even though values may differ from the actual ride.

Number of cars in train: 6
Length of car: 2 meters
Time for train to pass bottom of first hill: 0.60 s

1. The speed at the bottom of the first hill is CLOSEST to
   a. 10 m/s b. 15 m/s c. 20 m/s d. 30 m/s e. 60 m/s

2. Your body feels pressed into your seat at the bottom of the hill, since your body tends to continue its downward motion while the train starts to move upward. The tendency of your body to continue its downward motion is known as
   a. resonance b. angular momentum c. superposition d. inertia
   e. torque

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Questions 3-5 are based on the **DROP TOWER**. Use the following data in your calculations, even though values may differ from the actual ride.

Distance of true "free fall": 23 m
Vertical distance from loading platform to top of tower: 40 meters
Mass of single rider: 80 kg
Time for rider to ascend tower: 6.0 s

3. The time for the free fall period is CLOSEST to
   a. 1.3 s b. 1.6 s c. 1.9 s d. 2.2 s e. 2.5 s

4. The work done in lifting a single person to the top of the tower is CLOSEST to
   a. 2 joules b. 3,000 joules c. 20,000 joules d. 30,000 joules

5. The power expended in lifting the person in the previous question is CLOSEST to
   a. 5 watts b. 150 watts c. 5,000 watts d. 150,000 watts

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Questions 6-9 are based on the **ORBIT**. Use the following data in your calculations, even though values may differ from the actual ride.

Radius of ride: 8 meters
Time for one full revolution: 4.0 s

6. The circumference of the ride is CLOSEST to
   a. 8 m b. 24 m c. 36 m d. 48 m e. 96 m

7. The speed of the ride is CLOSEST to

a. 2 m/s b. 6 m/s c. 9 m/s d. 12 m/s e. 24 m/s

8. .The centripetal acceleration of the ride is CLOSEST to
   a. 0.5 ms^2 b. 4.5 ms^2 c. 10 ms^2 d. 18 ms^2 e. 72 ms^2

9. When the ride is in its most vertical position, the greatest g-force would be experienced at the
   a. top b. side c. bottom

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10. The propulsion system of the **HMB ENDEAVOR** illustrates which of the following physics principles?
    a. diffraction b. resonance c. complementarity d. relativity

11. A rider sitting in a stationary roller coaster at the starting station experiences
    a. 0 g's vertically and 0 g's horizontally
    b. 1 g vertically and 1 g horizontally
    c. 1 g vertically and 0 g's horizontally
    d. 0 g's vertically and 1 g horizontally

12. A hill on a coaster ride is 25 meters high. Ignoring friction, the speed of the coaster at the bottom of the hill would be CLOSEST to
    a. 22 m/s b. 26 m/s c. 30 m/s d. 34 m/s e. 38 m/s

13. A "dual axis" ride that gives two simultaneous rotations is most closely associated with which of the following rides?
    a. **Centrifuge** b. **Drop Tower** c. **Grizzly** d. **Demon**
    e. **Endeavor**

14. As a rider travels UPWARD into a Klothoid loop, the radius of the loop
    a. increases b. decreases c. remains constant

15. The centripetal force experienced as a rider travels UPWARD into a Klothoid loop is
    a. decreased by change in speed and increased by change in radius
    b. increased by change in speed and decreased by change in radius
    c. increased by both change in speed and change in radius
    d. decreased by both change in speed and change in radius

Quantitative Problems
(no calculus needed)

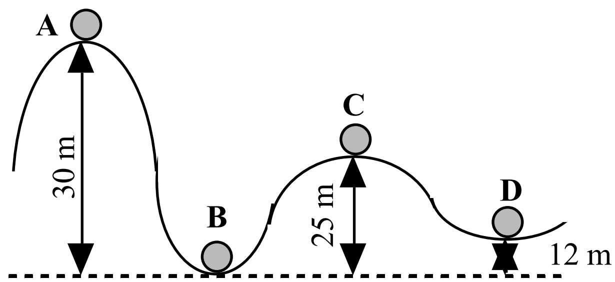
1. A roller coaster reaches the top of the steepest hill with a speed of 5.0 km/h. It then descends the hill which is at an average angle of 45^o and is 50-m long. What will its speed be when it reaches the bottom, neglecting friction?

2. A child moves with a speed of 1.80 m/s when 12.4 m from the center of a merry-go-round. Calculate the centripetal acceleration acting on the child.

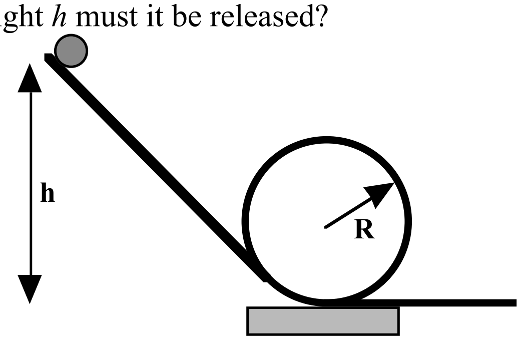
3. What minimum speed must a roller coaster be traveling when upside down at the top of a vertical loop if the passengers are not to fall out? Assume a radius of curvature of 8.0 m.

4. How much work must be done to stop a 1000-kg vehicle traveling at 30 m/s?

5. A roller coaster is shown to the right. Assuming no friction, calculate the speed at points B, C, D, assuming it has a speed of 2.10 m/s at point A.



6. A small mass *m* slides without friction along the looped apparatus shown below. If the object is to remain on the track, even at the top of the circle (whose radius is *r*), from what minimum height *h* must it be released?



Essay Questions

Qualitative

Answer each of the following questions. You need not write volumes in order to earn full credit. On the contrary, short answers that are to the point (perhaps through the use of an example) are more likely to earn higher scores. Be sure to use clear, complete and concise sentences. If you wish to earn full credit, it would also behoove you to check your answers for grammar, punctuation and spelling mistakes prior to handing in your exam.

1. Explain why you feel pushed against the outside wall of **Orbit** (or any other circular motion ride) even though you are always accelerating towards the center of the circular path.

2. Explain why most roller coaster aficionados prefer to ride in the front-most or rear-most seat of a coaster.

3. When a roller coaster train zooms over a hilltop and begins to drop, you tend to feel like you are lighter (or perhaps just your stomach feels lighter). This effect is particularly noticeable on rides like the **Drop Tower**. Why do you feel this way?

4. What is the advantage of using a Klothoid loop rather than a circular loop on rides such as **Demon**, **Vortex** and **Flight Deck**?

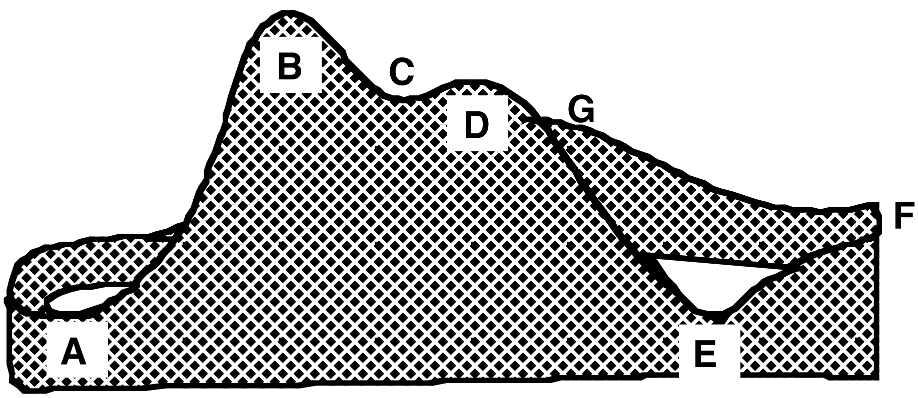
5. Explain how a horizontal accelerometer works.

Vocabulary

Match each word with the appropriate description from the lettered column. Each description is used only once.

_____ 1.	Mass	A.	A push or pull
_____ 2.	Acceleration	B.	Mass times velocity
_____ 3.	Friction	C.	Defined by Newton's First Law
_____ 4.	Velocity	D.	What causes objects to have inertia
_____ 5.	Inertia	E.	Shape of a roller coaster hill
_____ 6.	Momentum	F.	Energy of motion
_____ 7.	Kinetic Energy	G.	Resistance to motion caused by rubbing
_____ 8.	Parabola	H.	Energy of position
_____ 9.	Potential Energy	I.	An object's speed in a given direction
_____ 10.	Force	J.	A change in speed or direction

Roller Coaster Dynamics



Use the picture above to identify the locations to most appropriately match each condition.

_____ 11. Where the train has the most kinetic energy

_____ 12. Where the train has the least kinetic energy

_____ 13. Where the train has the greatest gravitational potential energy

_____ 14. Where the train has the least gravitational potential energy

_____ 15. Where the riders experience the greatest centripetal force