Circular Motion Problems Practice Name:_____

Reflection and Self-Assessment

Completion: Circle the statement that best describes the completion of this practice.

- I completed every question on the practice.
- I did not complete some questions on the practice because:

_____

Answer Checking: Circle the statement that best describes how you checked your answers

- I checked all my answers against the key at the back and corrected any that were incorrect.
- I did not check all my answers and correct any mistakes because:

_____

Online Worked Solution: Circle the statement that best describes how you used the online worked solutions.

- I did not use the online worked solution at all.
- I used the online solution to understand some questions I got incorrect.
- I used the online solution to help me learn how to answer some questions.

Confidence: Circle the statement that best describes your confidence in answering questions of this type in the future.

- I am confident I can answer nearly any question of this type correctly without using notes or other assistance.
- I am confident I can answer **MOST** questions of this type correctly without using notes or other assistance.
- I am **NOT** confident I can answer most questions of this type correctly without using notes or other assistance.

Time: Circle the statement below that best describes the total amount of time you spent actively working on this practice:

Less than an hour	Between one and two hours	Between two and three hours	Between three and four hours	More than four hours

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1. A 0.35 kg ball is connected to a string and is swung in a vertical circle of radius 2.3 metres at a constant speed of 5.6 m/s.
    a. What is the period?

    b. What is the frequency?

    c. What is the tension in the string at the top of the circle?

    d. What is the tension in the string at the bottom of the circle?

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2. What is the minimum speed a 5.2 kg mass can be swung in a vertical circle of radius 0.25m?

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3. What is the maximum speed a 5.2 kg mass can be swung in a vertical circle of radius 0.25m if the string holding the mass can withstand a maximum tension of 85 N?

4. Two equal masses are swung at the same constant speed around circles of different radii. If one mass has two times the centripetal force acting on it compared to the other, how does its circle's radius compare to the other?

5. Two equal masses are swung around circles of the same radius. One is swung twice as fast as the other. How do the centripetal forces acting on the masses compare?

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6. A 0.65 kg ball is swung in a vertical circle of radius 0.40 metres, it makes a revolution every 0.56 seconds.
    a. What is the period?

    b. What is the frequency?

    c. Is the centripetal force acting on the ball the same throughout the circle?

    d. What is the centripetal force acting on the ball?

    e. What is the tension in the string at the top of the circle?

    f. What is the tension in the string at the bottom of the circle?

    g. What is the tension in the string when the ball is halfway between the top and bottom of the circle?

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7. A 64 kg person is in a Ferris wheel with radius of 8.0m which makes one complete revolution every 25 seconds.
    a. What is their apparent weight at the top of the ride?

    b. What is their apparent weight at the bottom of the ride?

8. A 45 kg person is in a Ferris wheel with radius of 18.0m which moves at a speed of 2.0 m/s.
    a. What is their apparent weight at the top of the ride?

    b. What is their apparent weight at the bottom of the ride?

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9. A 950 kg car is driving over the top of a hill which can be viewed as part of a circle of radius 820m. What is the maximum speed the car can drive over the hill without losing contact between the car and the ground?

10. A 1200 kg car is driving over the top of a hill which can be viewed as part of a circle of radius 250m. They travel at a speed of 25 m/s.
    a. What is the normal force acting on the car?

    b. What is the force of friction acting on the car at the top of the hill if coefficient of friction between the car and the road is 0.35?

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11. The Graviton is a classic amusement park ride. When you get in, you stand against the wall, 5.0 m from the centre of the ride and then the whole ride starts spinning quickly. At the max speed each revolution takes 1.6 seconds. A 45 kg person gets on the ride.

https://www.flickr.com/photos/unrulyjulie/10198149

    a. What is the centripetal force acting on the person when it is at max speed?

    b. If while spinning the wall suddenly fell away, what would happen to the person?

    c. What is the normal force the wall is applying to the person?

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12. In some versions of the Gravitron the floor drops away during the ride and people are held onto the wall by the force of friction between them and the wall. What is the minimum speed the ride could spin so that a 65 kg person could be held by the wall if the coefficient of friction between them and the wall is 0.22 and distance to the centre is 5.0 m?

13. A 2.3 gram dime is placed on a merry-go-round, which is spun with period of 7.0 seconds, the dime moves out from where it was initially placed but then stays on the spinner a certain distance from the centre. If the coefficient of friction between the dime and the merry-go-round is 0.19, how far from the centre does it end up?

https://commons.wikimedia.org/wiki/File:Tift_Park_merry-go-round.JPG

14. A student stands 1.2 m from the centre of a merry go round, what is the minimum period it can be spun with so that the student doesn't slide if they have a coefficient of friction of 0.34 with the merry go round? *Note that mass will cancel out.

15. Flying a fighter plane involves a lot of force being applied to the pilot. Often, we speak of the g-force acting on the pilot, however g-force isn't really a force, it is an acceleration, 1 g-force is 9.8 m/s^2. What is the g-force acting on a pilot of they are experiencing an acceleration of 17 m/s^2?

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16. A pilot is spun in a training centrifuge of radius 4.50 metres, experiencing 3.41 g-force of centripetal acceleration. What is the period of this rotation?

17. What is the maximum g-force provided by the normal force acting on a pilot who is flying a vertical circle of radius 750 m at a speed of 260 m/s?

18. A 1200 kg car goes over the top of a small hill which can be modelled as part of a circle of radius 150 m, while at the same time making a turn around a circle of radius 250 m. They are travelling at 25 m/s.
    a. What is the minimum coefficient of friction between the car and the ground that will allow it to successfully make the turn?

    b. What would the minimum coefficient of friction between the car and the ground be if the turn was on flat ground rather than a hill?

19. One problem of space travel is the lack of gravity and its effects on the bones of people. One way to generate artificial gravity is to have the whole space ship rotate to simulate Earth's gravity. If a space ship is a 550 m radius disc and the astronauts will walk around the inside of the disc with their heads towards the centre, what speed must it spin at to simulate Earth's gravity of 9.8 m/s^2?

20. A mass is attached to a string and swung around in a vertical circle of a certain radius, it is swung faster and faster until the string breaks. Will the string break at the highest point or the lowest point?

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Answer Key				
1a) 2.6 sec	1b) 0.39 Hz	1c) 1.3 N	1d) 8.2 N	2) 1.6 m/s
3) 2.9 m/s	4) The one with twice the F_c will have a radius half as large	5) The one with twice the speed will have a F_c four times greater than the other	6a) 0.56 sec	6b) 1.8 Hz
6c) Yes, same acceleration towards the centre throughout	6d) 33 N	6e) 26 N	6f) 39 N	6g) 33 N
7a) 590 N	7b) 660 N	8a) 430 N	8b) 450 N	9) 9.0×10^1 m/s
10a) 8800 N	10b) 3100 N	11a) 3500 N	11b) They would fly outwards	11c) 3500 N
12) 15 m/s	13) 2.3 m	14) 3.8 sec	15) 1.7 g's	16) 2.3 sec
17) 1.0×10^1 g's	18a) 0.44	18b) 0.26	19) 73 m/s	20) lowest point