

Chapter Problems

Period and Frequency:

Classwork

1. An object is spun around in circular motion such that it completes 100 cycles in 25 s.
 - a. What is the period of its rotation?
 - b. What is the frequency of its rotation?
2. An object completes 2500 cycles in 25 s.
 - a. What is the period of its rotation?
 - b. What is the frequency of its rotation?
3. An object is spun around in circular motion such that its period is 12s.
 - a. What is the frequency of its rotation?
 - b. How much time will be required to complete 86 rotations?

Homework

4. An object completes 10 cycles in 50 s.
 - a. What is the period of its rotation?
 - b. What is the frequency of its rotation?
5. An object is spun around in circular motion such that its frequency is 12 Hz.
 - a. What is the period of its rotation?
 - b. How much time will be required to complete 86 rotations?
6. An object is spun around in circular motion such that its frequency is 500 Hz.
 - a. What is the period of its rotation?
 - b. How much time will be required to complete 7 rotations?

Velocity and Acceleration

Classwork

7. A 5.0 kg object is spun around in a circle of radius 1.0 m with a period of 4.0s.
 - a. What is the frequency of its rotation?
 - b. *What is its velocity?
 - c. *What is its acceleration?
8. A 15.0 kg mass is spun in a circle of radius 5.0 m with a frequency of 25 Hz.
 - a. What is the period of its rotation?
 - b. *What is its velocity?
 - c. *What is its acceleration?

Homework

9. A 0.5 kg object is spun around in a circle of radius 2.0 m with a period of 10.0s.
 - a. What is the frequency of its rotation?
 - b. *What is its velocity?
 - c. *What is its acceleration?

10. A 500 kg mass is spun in a circle of radius 25 m with a velocity of 250 m/s.
- *What is the period of its rotation?
 - *What is its frequency?
 - What is its acceleration?

Dynamics of UCM

Classwork

11. What is the acceleration of an object that has a velocity of 25 m/s and is moving in a circle of radius 10m?
12. An object is experiencing an acceleration of 12 m/s^2 while traveling in a circle at a velocity of 3.1 m/s. What is the radius of its motion?
13. A 61 kg object is experiencing a net force of 25 N while traveling in a circle of radius 35 m. What is its velocity?
14. A 0.25 kg object is experiencing a net force of 15 N while traveling in a circle at a velocity of 21 m/s. What is the radius of its motion?
15. An object is experiencing a centripetal acceleration of 36 m/s^2 while traveling in a circle of radius 15 m. What is its velocity?
16. A 61 kg object is experiencing a net force of 250 N while traveling in a circle of radius 1.5 m. What is its velocity?

Homework

17. An object is experiencing an acceleration of 12 m/s^2 while traveling in a circle of radius 5.0 m. What is its velocity?
18. What is the net force acting on a 5.0 kg object that has a velocity of 15 m/s and is moving in a circle of radius 1.6m?
19. What is the acceleration of an object that has a velocity of 37 m/s and is moving in a circle of radius 45m?
20. An object is experiencing a centripetal acceleration of 2.0 m/s^2 while traveling in a circle at a velocity of 0.35 m/s. What is the radius of its motion?
21. What is the net force acting on a 52 kg object that has a velocity of 17 m/s and is moving in a circle of radius 1.6m?
22. A 6.8 kg object is experiencing a net force of 135 N while traveling in a circle at a velocity of 45 m/s. What is the radius of its motion?

General Problems

Class Work

23. *A 0.65 kg ball is attached to the end of a string. It is swung in a vertical circle of radius 0.50 m. At the top of the circle its velocity is 2.8 m/s.
- Draw a free body diagram for the ball when it is at the top of the circle. Next to that diagram indicate the direction of its acceleration.
 - Use that free body diagram to set up the equations needed to determine the Tension in the string.
 - Solve those equations for the Tension in the string.
24. *A 0.65 kg ball is attached to the end of a string. It is swung in a vertical circle of radius 0.50 m. At the bottom of the circle its velocity is 2.8 m/s.
- Draw a free body diagram for the ball when it is at the bottom of the circle. Next to that diagram indicate the direction of its acceleration.
 - Use that free body diagram to set up the equations needed to determine the Tension in the string.
 - Solve those equations for the Tension in the string.

Homework

25. *A 0.25 kg ball is attached to the end of a string. It is swung in a vertical circle of radius 0.6 m. At the top of the circle its velocity is 3 m/s.
- Draw a free body diagram for the ball when it is at the top of the circle. Next to that diagram indicate the direction of its acceleration.
 - Use that free body diagram to set up the equations needed to determine the Tension in the string.
 - Solve those equations for the Tension in the string.
26. *A 0.25 kg ball is attached to the end of a string. It is swung in a vertical circle of radius 0.6 m. At the bottom of the circle its velocity is 3 m/s.
- Draw a free body diagram for the ball when it is at the bottom of the circle. Next to that diagram indicate the direction of its acceleration.
 - Use that free body diagram to set up the equations needed to determine the Tension in the string.
 - Solve those equations for the Tension in the string.

Class Work

27. *A ball is attached to the end of a string. It is swung in a vertical circle of radius 1.5 m. What is the minimum velocity that the ball must have to make it around the circle?
28. *A ball is attached to the end of a string. It is swung in a vertical circle of radius 0.75 m. What is the minimum velocity that the ball must have to make it around the circle?
29. **A car is going over the top of a hill whose curvature approximates a circle of radius 200 m. At what velocity will the occupants of the car appear to weigh 20% less than their normal weight (or their normal weight times 0.8)?
30. **A car is going through a dip in the road whose curvature approximates a circle of radius 200 m. At what velocity will the occupants of the car appear to weigh 20% more than their normal weight (or their normal weight times 1.2)?
31. **The occupants of a car traveling at a speed of 30 m/s note that on a particular part of a road their apparent weight is 15% higher than their weight when driving on a flat road.
 - a. Is that part of the road a hill or a dip?
 - b. What is the vertical curvature of the road?

Homework

32. *A ball is attached to the end of a string. It is swung in a vertical circle of radius 0.33 m. What is the minimum velocity that the ball must have to make it around the circle?
33. *A ball is attached to the end of a string. It is swung in a vertical circle of radius 2.5 m. What is the minimum velocity that the ball must have to make it around the circle?
34. **A car is going over the top of a hill whose curvature approximates a circle of radius 350m. At what velocity will the occupants of the car appear to weigh 10% less than their normal weight?
35. **A car is going through a dip in the road whose curvature approximates a circle of radius 150m. At what velocity will the occupants of the car appear to weigh 15% more than their normal weight?
36. **The occupants of a car traveling at a speed of 40 m/s note that on a particular part of a road their apparent weight is 30% lower than their weight when driving on a flat road.
 - c. Is that part of the road a hill or a dip?
 - d. What is the vertical curvature of the road?

Class Work

37. **A car, traveling at a speed of 25 m/s, rounds a flat curve whose radius is 125 m.

- a. Draw a side view free body diagram for the car. Indicate the direction of acceleration.
- b. Use that free body diagram to set up the equations needed to determine the frictional force acting on the car.
- c. Solve those equations for the coefficient of friction between the tires and the road.

Homework

38. **A car, traveling at a speed of 32 m/s, rounds a flat curve whose radius is 250 m.

- a. Draw a side view free body diagram for the car. Indicate the direction of acceleration.
- b. Use that free body diagram to set up the equations needed to determine the frictional force acting on the car.
- c. Solve those equations for the coefficient of friction between the tires and the road.

Answers

<p>1) a) 0.25 s b) 4 Hz</p> <p>2) a) 0.01 s b) 100 Hz</p> <p>3) a) 0.083 Hz b) 1032 s</p> <p>4) a) 5s b) 0.2 Hz</p> <p>5) a) 0.083s b) 7.2s</p> <p>6) a) 0.002s b) 0.014s</p> <p>7) a) 0.25 Hz b) 1.6 m/s c) 2.56 m/s²</p> <p>8) a) 0.04s b) 785 m/s c) 123,245 m/s²</p> <p>9) a) 0.1 Hz b) 1.257 m/s c) 0.79 m/s²</p>	<p>10) a) 0.63 s b) 1.59 Hz c) 2,500 m/s²</p> <p>11) 62.5 m/s²</p> <p>12) 0.8 m</p> <p>13) 3.8 m/s</p> <p>14) 7.35 m</p> <p>15) 23 m/s</p> <p>16) 2.5 m/s</p> <p>17) 7.7 m/s</p> <p>18) 705 N</p> <p>19) 30.4 m/s²</p> <p>20) 0.06 m</p> <p>21) 9393 N</p> <p>22) 102 m</p>	<p>General Problems</p> <p>23) a) F_T, mg, and a down b) $F_T + mg = mv^2/r$ c) 3.83 N</p> <p>24) a) F_T up, mg, a down b) $F_T - mg = mv^2/r$ c) 16.57 N</p> <p>25) a) F_T, mg, and a down b) $F_T + mg = mv^2/r$ c) 1.3 N</p> <p>26) a) F_T up, mg, a down b) $F_T - mg = mv^2/r$ c) 6.2 N</p> <p>27) 3.83 m/s</p> <p>28) 2.71 m/s</p> <p>29) 19.8 m/s</p> <p>30) 19.8 m/s</p> <p>31) a) dip b) 612 m</p> <p>32) 1.80 m/s</p> <p>33) 4.95 m/s</p> <p>34) 18.52 m/s</p> <p>35) 14.85 m/s</p> <p>36) a) hill b) 544 m</p> <p>37) 0.51</p> <p>38) 0.42</p>
---	--	--