**Vertical Circle and Orbit Examples**

Vertical Circle:

1. A physics teacher twirls a roll of masking tape in a 2.2 m radius vertical circle. What is the minimum velocity at the top of the circle that will keep the string from going slack? (4.6 m/s)
2. A rider moving in a 5.1 m radius vertical circle feels 4.5 “g”s at the bottom of the circle. A) How many “g”s is the ride pulling? B) How many “g”s do they feel at the top? C) What is their tangential velocity? (3.5 “g”s, 2.5 “g”s, 13 m/s)
3. A 2.00 kg object moves in a 4.25 m radius vertical circle with a period of 3.00 seconds. Find the force needed at the top, and at the bottom. (17.7 N Down, 56.9 N up)
4. A 7.0 kg mass moves at a uniform speed of 5.0 m/s in a 4.0 m radius circle on the end of a rod. What force is needed at the top and at the bottom? (25 N up, 110 N up)
5. A 2.72 kg mass moves at a uniform speed in a 1.95 m radius circle on the end of a rod. At the top, the rod is exerting a downward force of 4.01 N on the mass. a) What is the centripetal acceleration of the mass? b) What is its period? c) What force does the rod exert at the bottom? (11.3 m/s/s, 2.61 s, 57.4 N up)
6. An 11.5 kg mass moves at a uniform speed in a 1.43 m radius circle on the end of a rod. At the bottom, the rod is exerting an upward force of 156 N on the mass. a) What is the centripetal acceleration of the mass? b) What is its speed? c) What force does the rod exert at the top? (3.76 m/s/s, 2.32 m/s, 69.6 N up)

Orbit :

1. What is the orbital velocity 3400 m from the center of a 5.6 x 1018 kg asteroid? (331.4 ≈ 330 m/s)
2. You find that you can orbit at 516 m/s 12,150 m from the center of a small moon. What is its mass? (4.85 x 1019 kg)
3. What distance from the center of the moon is your orbital velocity 120 m/s? (3.4 x 108 m)
4. A satellite orbits a planet at a distance of 7.5 x 106 m from the center every 8900 seconds. What is the mass of the planet? (3.2 x 1024 kg)
5. What is the period of orbit of a satellite that orbits 1.95 x 106 m from the center of the moon? (7730 s)
6. What is the radius of an orbit with a period of 3.16 x 107 s around the sun? (1.50 x 1011 m – yep – it’s the earth)

Use  or 

These come from these formulas in the data packet:

  

G = 6.67 x 10-11 Nm2/kg2

Useful things to know:

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| Mass of the Earth | 5.97x1024 kg | Radius of the Moon | 1.738x106 m |
| Mass of the Moon | 7.35x1022 kg | Radius of the Earth | 6.38x106 m |
| Mass of the Sun | 1.99x1030 kg | Earth-Moon Distance | 3.84x108 m |
|  |  | Earth-Sun Distance | 1.496x1011 m |