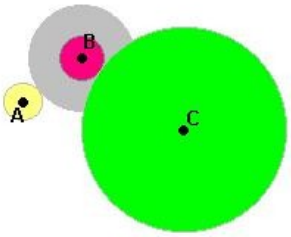
DAY 14

Homework Assignment (see syllabus for homework collection information)

1. A Ferris Wheel has mass 5000 kg and diameter 15 m. The mass is concentrated around the rim of the wheel like a hoop.

   What power (in Hp) is required to accelerate the wheel from rest to 1 RPM in 15 seconds?

2. In the figure shown, shaft A is connected directly to a ¼ Hp motor that rotates at 750 RPM.

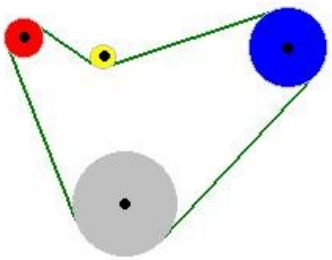


   The yellow gear is attached to shaft A and is 2 inches in diameter. The gray and pink gears are attached to shaft B and measure 6 and 2.5 inches in diameter. The green gear is attached to shaft C and measures 12 inches in diameter. All gears are well-lubricated.

   Determine the rotational speed ω in RPM and the torque available at the shaft τ in ft-lb at shaft A, B, and C.

3. A wheel measures 25 inches in diameter and weighs 30 lbs. When spun at 100 RPM and left to coast, the wheel comes to rest in 30 seconds thanks to friction in its axle. How much power would be required to keep it rotating at a constant 100 RPM?

4. In the figure shown, the gray pulley measures 2 ft in diameter and is rotating at 1500 RPM powered by a 250 Hp motor.

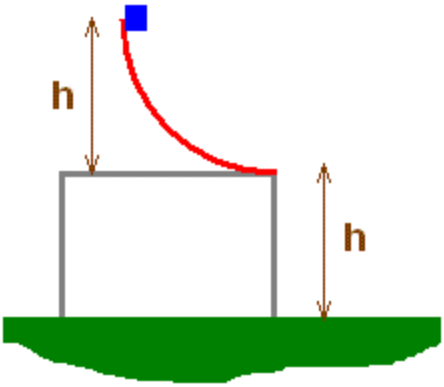


   Pulley diameters:
   Red pulley – 8 inches
   Yellow pulley – 4 inches
   Blue pulley – 16 inches

   Find the rotation speeds and available torques for all four shafts. What is the linear speed of the belt?

5. A ball moving at 10 m/s rolls off the top of a 1 m high table. How far from the edge of the table will it hit the floor?

6. In the figure shown, the block is released from rest, slides down the curved track (which is very smooth and well-waxed), and leaves the top of the table moving horizontally. How far from the table does the block land?



7. A motor and a gearbox are to run a lift as shown in the figure. Data on the gearbox are as follows:

   Gear A is attached to the motor's crankshaft. Gears A & C & drum E have diameters of 5". Gears B & D have diameters of 20". Friction is present in the system to the extent that for each rotation of the motor's crankshaft 15 J of work is lost to heat.

   Two different motors, A & B, are being considered for the lift. Motor A is rated at 5.0 Hp @ 3500 RPM. Motor B is rated @ 4.0 Hp at 3000 RPM.

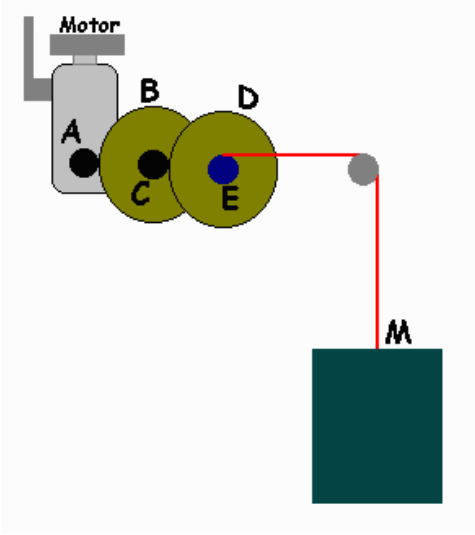
   Data for both motors is given at right.

   Graph the power output of each engine vs. the engine's rotational speed in RPM. Put both plots on the same graph.

   For both engines, graph the maximum weight that can be raised by the lift (in lbs) vs. the engine's rotational speed in

   RPM. Put both plots on the same graph.

   Which engine was able to lift the most weight if installed in the lift? For each engine, at what speed was the engine able to lift the most mass?



According to motor A's manufacturer, the power output of the motor as a function of RPM's is as follows:

RPM	Power (Hp)
0	0
500	.5
750	1.0
1000	1.2
1500	1.6
2000	1.9
2500	2.5
3000	4.0
3500	5.1
4000	4.5
4500	4.3

According to motor B's manufacturer, the power output of the motor as a function of RPM's is as follows:

RPM	Power (Hp)
0	0
500	.75
750	1.5
1000	2.0
1500	2.9
2000	3.5
2500	3.8
3000	4.0
3500	3.8
4000	3.2
4500	3.0