

**Total time: 1 hr Total Points: 10 pt****Student Name:**

**Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.**

$$\text{speed} = \frac{\text{distance}}{\text{time}} \quad \text{velocity} = \frac{\text{displacement}}{\text{time}} \quad \text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$\text{velocity} = \text{initial velocity} + \text{acceleration} \times \text{time}$$

$$g = 9.8 \text{ m/s}^2 \quad F = ma \quad F_g = mg \quad F_{fr} = \mu F_N \quad \text{Torque} = \text{Force} \times \text{Lever Arm}$$

$$\text{momentum} = mv \quad \text{change in momentum} = \text{impulse} = (\text{force})(\text{time})$$

$$\text{work} = (\text{force})(\text{distance}) \quad \text{power} = \frac{\text{work}}{\text{time}} \quad \text{K.E.} = \frac{1}{2}mv^2 \quad \text{P.E.} = mgh$$

$$\text{rotational speed} = \frac{\text{angle swept}}{\text{time}} \quad \text{power} = \text{torque} \times \text{angular velocity}$$

$$\text{speed} = \text{rotational speed} \times 0.5 \times \text{wheel diameter} \quad \text{rpm} = \frac{\text{mph} \times \text{gear ratio} \times 336}{\text{tire diameter in inches}}$$

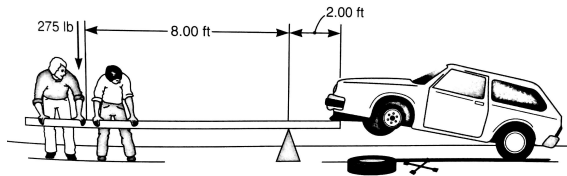
1. A flywheel of radius 27.0 cm has an angular speed of 47.0 rpm. What is that in rad/s?
2. Convert 620 rad/s into rpm
3. A shaft of radius 8.50 cm rotates 7.00 rad/s. Through what angular displacement does it go in 1.20 s?
4. Find the angular speed in rpm of the second hand of a wall clock.
5. Find the angular speed in rpm of the minute hand of a wall clock.
6. Find the angular speed in rad/s of the hour hand of a wall clock.
7. What power is delivered by an engine with torque 130 N.m at angular velocity of 65 rad/s.
8. A motor develops 0.75 kW of power at 200 rpm. What torque is applied to the motor shaft?
9. Find the angular velocity for a motor developing 650 W of power with a torque of 130 N.m.

$$\text{Gears: } T_1 N_1 = T_2 N_2$$

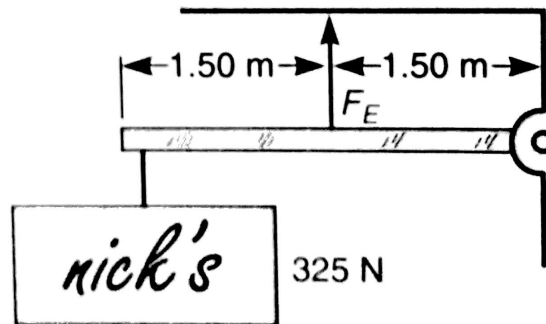
$$\text{Levers, Wheel-and-Axel: } F_1 \times (\text{lever arm}_1) = F_2 \times (\text{lever arm}_2)$$

$$\text{Mech. Advantage} = \frac{F_{\text{resistance}}}{F_{\text{effort}}}$$

10. A driver gear has 72 teeth and makes 85.0 rpm. Find the rpm of the driven gear with 144 teeth.
11. A driver gear with 40 teeth makes 154 rpm. How many teeth must the driven gear have if it makes 220 rpm?
12. The larger of two gears in a clock has 36 teeth and turns at a rate of 0.50 rpm. How many teeth does the smaller gear have if it rotates at  $1/30$  rev/s?
13. A pole is used to lift a car that fell off a jack. The pivot is 2.00 ft from the car. Two people together exert 275 lb of force 8.00 ft from the pivot. What force is applied to the car?



14. A wheelbarrow 6.00 ft long is used to haul a 120-lb load. How far from the wheel is the load placed so that a person can lift the load with a force of 45.0 lb force?
15. Find the Mechanical Advantage (MA) of the wheelbarrow
16. Find the force  $F_E$ , pulling up on the beam holding the sign.



17. An axle of radius 12.0 cm is used with a wheel of radius 62.0 cm. What force must be applied to the rim of the wheel to lift a weight of 975 N?
18. Find the Mechanical Advantage (MA) in the previous problem.
19. A wheel-and-axle has an effort force of 125 N and an effort radius of 17.0 cm. If the resistance force is 325 N, what is the resistance radius. Find the mechanical advantage.