QUIZ / Mechanical Advantage   Part 1

NAME   DATE   CLASS PERIOD

Attach an extra sheet if you need more space for your answer.

1. Which axle is the driving axle and which axle is the driven axle when the gearbox is using Axle 2 to lift? (Axle 1 is the axle attached to the motor. Axle 4 is the axle farthest from the motor.)

2. What is the gear ratio when the gearbox is using axle 2 to lift?

3. Using the rotational speed you previously measured for the wheel when it was attached to axle 1, and the gear ratio you calculated between axle 1 and axle 2, what should be the rotational speed of the wheel on axle 2?

4. By what percentage does the measured value differ from the theoretical value?

5. Using the value you found when the gearbox lifted from the first axle, calculate the theoretical weight that the gearbox should lift from the second axle.

6. By what percentage does the measured value differ from the theoretical value?

7. What is the ratio of the maximum weight that the gearbox lifts now to the maximum weight that it lifted in condition 1?

8. Which axle is the driving axle and which axle is the driven axle when the gearbox is using Axle 3   to lift?

9. What is the gear ratio when the gearbox is using Axle 3 to lift?

10. Predict the rpm of the driven axle.

11. By what percentage does the measured value differ from the theoretical value?

12. What is the ratio of the rpm of the last axle to the rpm of the first axle?

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13. Using the values you found in the first two axles, predict the maximum weight that the gearbox could be expected to lift using the third axle.

14. What is the gear ratio between the driven and driving axle?

15. Predict the rpm of the driven axle.

16. By what percentage does the measured value differ from the theoretical value?

17. What is the ratio of the rpm of the last axle to the rpm of the first axle?

18. What is the slope of the lines in the RPM vs. Gear Ratio graph?

19. What is the slope of the lines in the Lifting Capability vs. Gear Ratio graph?

20. If the wheel used on the gearbox was smaller, would the gearbox be able to lift more weight, less weight, or the same amount of weight? If you knew its diameter, could you predict the amount a different-sized wheel would lift using gear ratios, the Lever Law, or both?

QUIZ / Mechanical Advantage   Part 2

NAME   DATE   CLASS PERIOD

Put a check in the o next to the correct answer.

1. Imagine a 40-tooth gear turning a 24-tooth gear. Which of the following statements is accurate?

   o The driven axle spins faster than the driving axle.

   o The driving axle spins faster than the driven axle.

   o The driven axle has greater torque than the driving axle.

2. Which of the following equations can be used to calculate torque?

   o $t = F/m$ o $t = m \cdot a$ o $t = F \cdot l$

3. What is the effect of placing an idler gear between two gears?

   o Increases the gear ratio.

   o Decreases the gear ratio.

   o Reverses direction of the driven gear.

4. What is the unit for Torque?

   o Newton·meter   o Newton   o Joule

5. When must a compound gear ratio be calculated?

   o When an idler gear exists between a driving gear and a driven gear.

   o When there are two gears on a single axle.

   o When the driving gear and the driven gear are different sizes.

6. How is a compound gear ratio calculated?

   o The individual gear ratios are multiplied by each other.

   o The individual gear ratios are added.

   o It is simply the ratio of teeth on the driven gear to teeth on the driving gear.

7. Imagine a 35-tooth gear turning a 7-tooth gear. The driving axle has an angular speed of 10 rpm. What is the angular speed of the driven axle?

   o 2 rpm   o 15 rpm   o 50 rpm

8. Imagine an 8-tooth gear turning a 24-tooth gear. The driving axle can lift a maximum load of 9 ounces. What is the maximum load that the driven axle could lift?

   o 3 ounces   o 9 ounces   o 27 ounces

9. Imagine you were constructing a device that used gears to bulldoze solid objects. Which of the following gear ratios for your device would be best-suited for this task?

   o 5:1   o 1:5   o 40:1   o 1:40

10. Imagine you were constructing a racing vehicle equipped with gears on the motors and wheels. Which of the following gear ratios would be best suited for reaching maximum speed?

   o 5:1   o 1:5   o 40:1   o 1:40