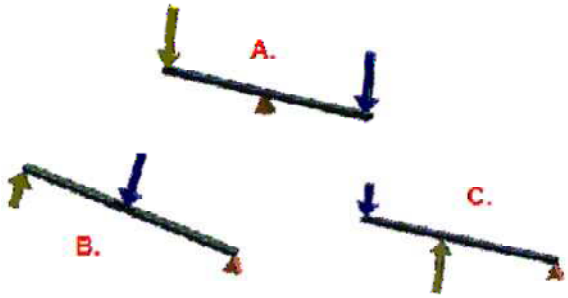
Name: _____ **Class:** _____ **Date:** _____ **ID: A**

POE Practice Test - Simple Machines

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. What type of engineer would focus with vibration analysis, lubrication, gears and bearings?
   a. Aeronautical Engineering
   b. Mechanical Engineering
   c. Civil Engineering
   d. Environmental Engineering
2. Which of the levers pictured is a first class lever?



   a. A
   b. B
   c. C
3. Study the gear train in Figure 6. The purpose of the center gear is to

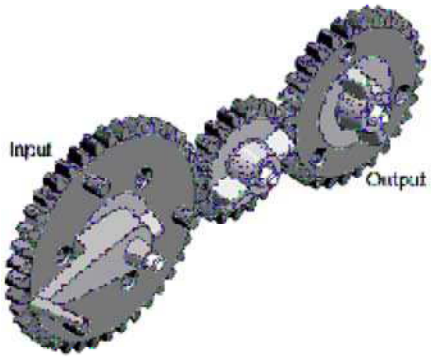


Figure 6

   a. allow the drive and driven gear to rotate in the same direction.
   b. allow the drive and driven gear to rotate in opposite directions
   c. increase the output RPM's of the driven gear
   d. increase the output torque of the driven gear
4. In a third class lever, the distance from the effort to the fulcrum is _____ the distance from the load/resistance to the fulcrum.
   a. less than or equal to
   b. less than
   c. greater than
   d. greater than or equal to
5. When used to pry open a can of paint, a scewdriver functions as

   a. a screw.
   b. an inclined plane.
   c. a wheel and axle.
   d. a lever.

6. Given the pulley configuration shown in Figure 4, how many pounds of efort force would a user have to exert on the rope to lift the 60 lb load

Figure 4

a. 25 lbs
b. 15 lbs
c. 20 lbs
d. 30 lbs

7. A POE student is using the ramp shown in Figure 5 to raise an object 4 feet above the ground. The mechanical advantage of the ramp is

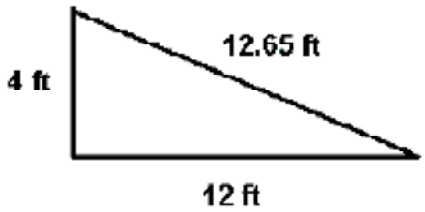


Figure 5

a. 0.316
b. 3.163
c. 1.05
d. 3.0

8. Figure 7 represents a belt driven system. Pulley B, which has a diameter of 16 inches, is being driven by pulley A, which has a diameter of 4 inches. If pulley A is spinning at 60 RPMs, then pulley B is spinning at _____ RPMs

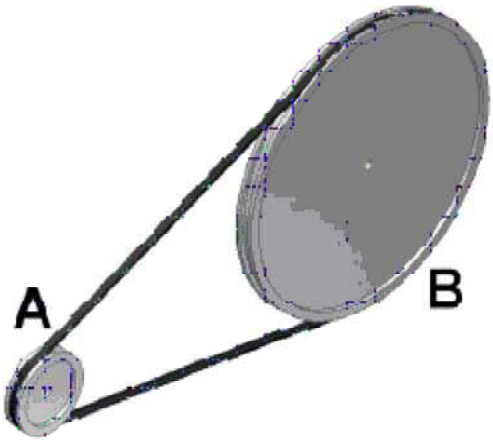


Figure 7

a. 4
b. 64
c. 240
d. 15

9. If a simple machine requires an effort force that is less than the force of the load being moved, then that simple machine exhibits _____

a. mechanical advantage.
b. rotary motion.
c. linear motion.
d. static equilibrium.

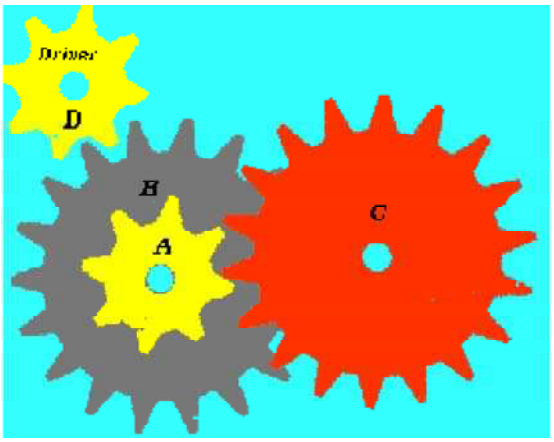
10. When calculating gear ratio, which of the following has an indirect relationship to the others?

a. Torque
b. Diameter of the gear
c. Angular velocity
d. number of teeth

11. In a 2nd class lever the distance from the effort to the fulcrum is _____ the distance from the load to the fulcrum.

a. less than
b. less than or equal to
c. equal to
d. greater than or equal to
e. greater than

12. A wheelbarrow is an example of which class of lever?
    a. 1st class
    b. 2nd class
    c. 3rd class
    d. 4th class
13. Scissors are an example of which class of lever?
    a. 1st class
    b. 2nd class
    c. 3rd class
    d. 4th class
14. _____ is calculated by multiplying the force times the distance traveled.
    a. Effort
    b. Mechanical Advantage
    c. Load
    d. Work
15. According to the following thread note what does 3/8 mean?
    a. Pitch
    b. Diameter of the screw
    c. Threads per inch
    d. Length of the screw
16. A force of 50 lbs is applied to a 1-foot diameter wheel. The wheel is turning a .25" diameter axle. How much mechanical advantage does the wheel provide?
    a. 24
    b. 48
    c. 4
    d. 12.5
17. If friction is included in a simple machine, the amount of effort required to move a load will be _____ what is calculated using the formulas for simple machines.
    a. less than
    b. less than or equal to
    c. equal to
    d. greater than or equal to
    e. greater than
18. Another name for an input force is _____.
    a. effort
    b. resistance
    c. load
    d. push
19. If the input (driver) gear is 15 teeth and the output (driven) gear is 60 teeth, what is the gear ratio?
    a. 5:6
    b. 4:1
    c. 1:4
    d. 1:2
20. What can a gear train do?
    a. Change out put direction
    b. Change force
    c. Change speed
    d. All of the above
    e. None of the above
21. A turning or twisting force is known as _____
    a. work.
    b. thrust.
    c. torque.
    d. leverage.
22. Given a second class lever with a distance of 5 feet from the fulcrum to the effort and a distance of 33 inches from the resistance to the fulcrum, what is the maximum amount of weight that can be lifted with 25lbs of effort?
    a. 165 lbs
    b. 13.75 lbs
    c. 45.45 lbs
    d. 3.79 lbs
23. Suppose a wheel with a 15 inch diameter is used to turn a water valve stem with a radius of .95 inches. What is the Mechanical Advantage?
    a. 15.8
    b. 7.89
    c. 14.25
    d. 7.125
    e. none of these.

24. 

If gear A turns 4 times how many times will gear C turn?
   a. 9 times
   b. 1.78 times
   c. 56 times
   d. 0.45 times

25. If the Driver (D) turns clockwise, which direction will gear C turn?
   a. Clockwise
   b. Counter clockwise
   c. need more information

26. If a simple machine in a frictionless environment requires more effort force than resistance force, then the mechanical advantage value would be _____
   a. one
   b. greater than one
   c. less than one
   d. zero

27. The wheel of a bicycle makes one full revolution. The radius of the wheel is 10". Assuming no sliding or slip between the wheel and the road, the distance traveled by the bicycle is _____ inches.
   a. 628
   b. 62.8
   c. 314
   d. 31.4
   e. none of these

28. A ramp is used to raise an object 3 feet from the ground. The base of the ramp is 10 feet long. The mechanical advantage of the ramp is _____.
   a. 1.044
   b. 3.33
   c. 3.48
   d. 0.958
   e. none of these

29. What is the effort needed to push a 75 pound weight up this ramp?
   a. 21.00 lbs
   b. 261.00 lbs
   c. 261.55 lbs
   d. 21.55 lbs
   e. none of these

30. A gear train has consists of 3 gears, A, B, and C in that order. Gear A has 10 teeth, gear B has 18 teeth, and gear C has 16 teeth. The middle gear, gear B, will turn counter clockwise at what rate if gear A is moving at 60 RPM
   a. 333.33 RPM
   b. 108.00 RPM
   c. 108.33 RPM
   d. 33.33 RPM
   e. none of these

31. What is the overall gear ratio for the ABC gear train?
   a. 5:8
   b. 8:9
   c. 8:5
   d. 9:5

32. If 15 lb-ft of torque is applied at the drive gear, what is the output at the driven gear?
   a. 9.375 lb-ft
   b. 24 lb-ft
   c. 160 lb-ft
   d. 0.625 lb-ft
   e. none of the above

33. What is the weight (resistance) you could lift using a first-class lever if you apply 20 lbs of effort? The effort arm is 10 feet and the resistance arm is 5 feet.
   a. 10 lbs
   b. 20 lbs
   c. 30 lbs
   d. 40 lbs

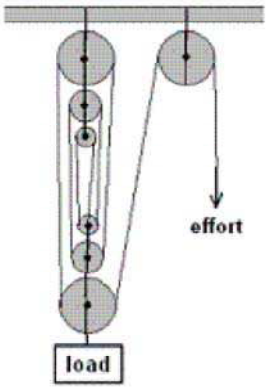
34. Find the mechanical advantage of a wheel and axle system if the wheel has a radius of 1.5 feet and the axle has a radius of 6 inches if the force is put on the axle.
    a. 0.25
    b. 0.33
    c. 2.0
    d. 3.0

35. Vehicles have an engine that uses a small axle (effort) to turn a much larger wheel against the ground (load). In this scenario, which of the following best describes the mechanical advantage?
    a. A value less than 0
    b. A value equal to 0
    c. A value between 0 and 1
    d. A value equal to 1
    e. A value greater than 1

36. If the pulley system shown in Figure 5 is lifting a 50 lb. load, what is the minimum amount of effort that must be applied to the system?

    a. 1 lb
    b. 8.33 lbs
    c. 10 lbs
    d. 50 lbs

37. Determine the mechanical advantage of the pulley system shown in the diagram to the right.



    a. 3
    b. 6
    c. 7
    d. 8
    e. none of these

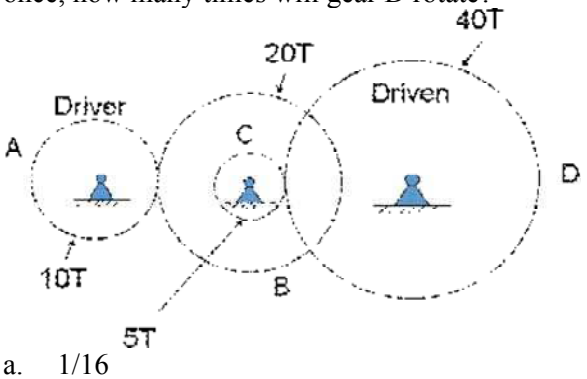
38. A pulley with 3 supporting strands would require 30 lbs to lift how much weight in pounds?
    a. 10
    b. 33
    c. 90
    d. 270

39. The fixed point of rotation on a lever is a(n)
    a. fulcrum
    b. center point
    c. wedge
    d. pivot

40. If a 20-toothed gear rotates 6 times, how many times will a 40-toothed gear rotate?
    a. 3 times
    b. 6 times
    c. 9 times
    d. 12 times

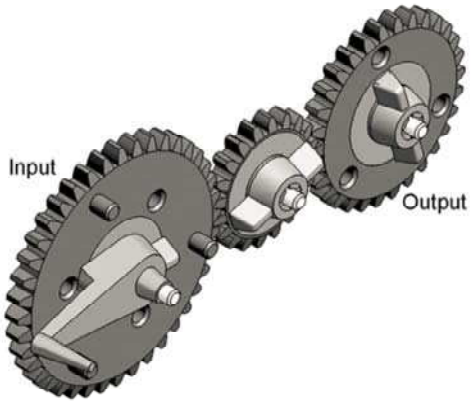
41. What is the mechanical advantage of a 3/8" diameter screw with 20 threads per inch if a 1.5" diameter screwdriver is used to install the screw?
    a. 94
    b. 47
    c. 118
    d. 24

42. A compound gear train above consists of 4 gears with teeth as marked. A is the driver gear and gears B and C share the same shaft. If gear A rotates once, how many times will gear D rotate?



a. 1/16
b. 4
c. 1/4
d. 1/2

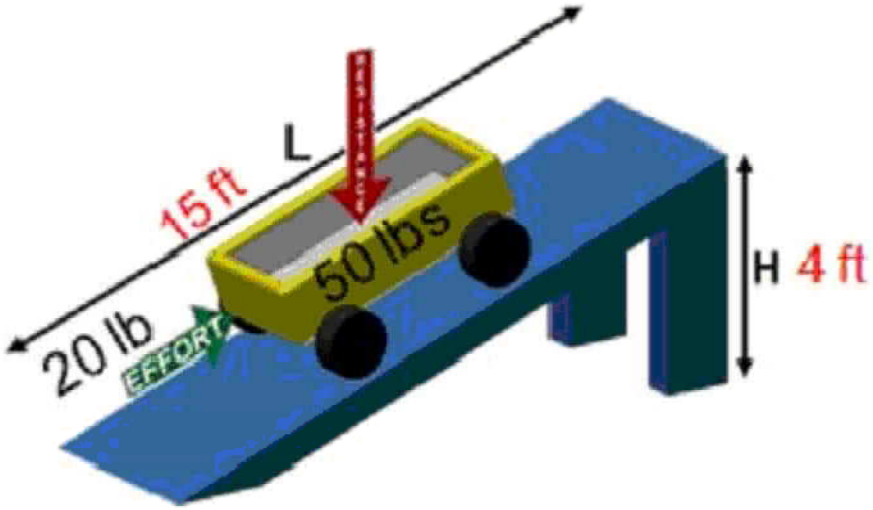
43. The gear train below consists of a 40-tooth (input), 20-tooth, and 30-tooth (output) gear. If the input gear rotates 10 times, how many times will the output gear rotate?



a. 7.5 times
b. 15 times
c. 13.3 times
d. 20 times

44. The wheels on a bucycle have a 10" radius. If the bike must travel exactly 2000", how many revolutions are required? Assume that no sliding or slipping occurs between the wheel and the road.
a. 31.8
b. 62.8
c. 314
d. 31.4

45. Calculate the work needed to move the cart to the top of the inclined plane.



a. 100 ft•lb
b. 500 ft•lb
c. 200 ft•lb
d. 80 ft•lb
e. none of these.

46. Calculate the efficiency of the inclined plane pictured above.
a. 66.7%
b. 50%
c. 100%
d. 33.3%
e. none of these

Problem

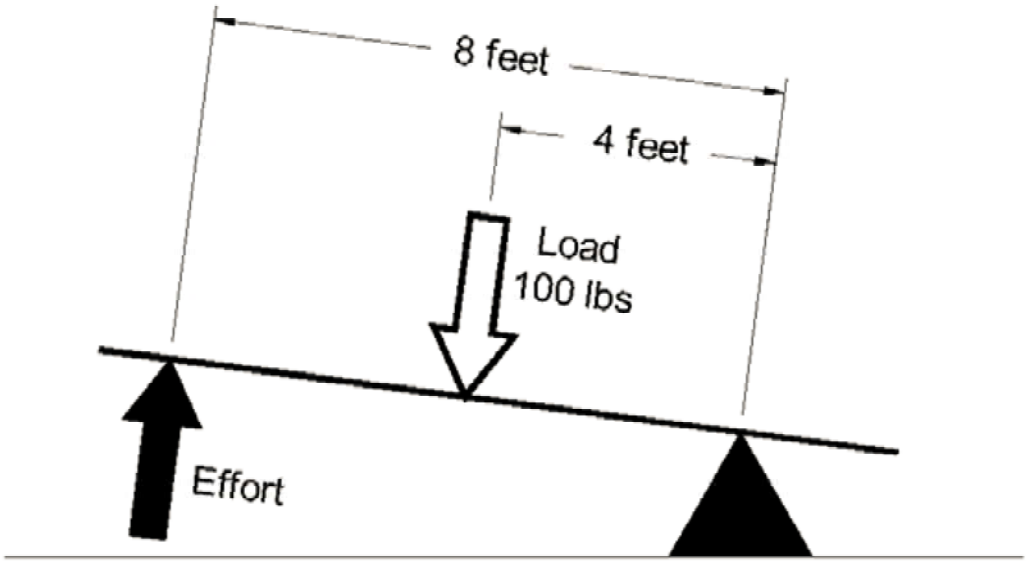
47. A wheel barrow is used to lift a 150 lb load. The length from the wheel axle to the center of the load is 2 ft. The length from the wheel and axle to the effort is 6 ft.
a. What is the ideal mechanical advantage of the system?
b. Using static equilibrium calculations, calculate the effort force needed to overcome the resistance force in the system.

48. An industrial water shutoff valve is designed to operate with 10 lb of effort force. The valve will encounter 100 lb of resistance force applied to a 2 in. diameter axle.
a. What is the required actual mechanical advantage of the system?
b. What is the required wheel diameter to overcome the resistance force?

49. A worker on a zip line crew lifts participants weighing approximately 200 lb several times during a day from the ground 20 feet below. A block and tackle system with 50 lb of effort force is designed to lift the materials.
a. What is the required actual mechanical advantage?
b. How many supporting strands will be needed in the pulley system?

50. A simple gear train is composed of three gears. Gear A is the driver and has 10 teeth, gear B has 8 teeth, and gear C has 20 teeth.
a. If the output is at C, what is the gear ratio?
b. If gear A rotates at 60 rpm, how fast is gear C rotating?
c. If the output of torque at gear C is 150 ftlb, what is the input torque at gear A?

51.



a. What class of lever is shown in the figure? Justify your answer (How do you know?)
b. How much effort force is needed to balance the 100 lb load?