B - Machines B - Nov 7 Country-wide SO Practice - 11-07-2020

1. Each multiple-choice is one point.

2. For a problem that involves using pi, please use 3.14 for pi.

3. Tiebreaker questions are identified with a (T#) where the number indicates the sequence of consultation. In the event of a tie, the supervisor will first look at T1, then T2, etc. until the is broken. Tiebreaker questions count toward the overall grade and are only used as tiebreakers in the event of a tie.

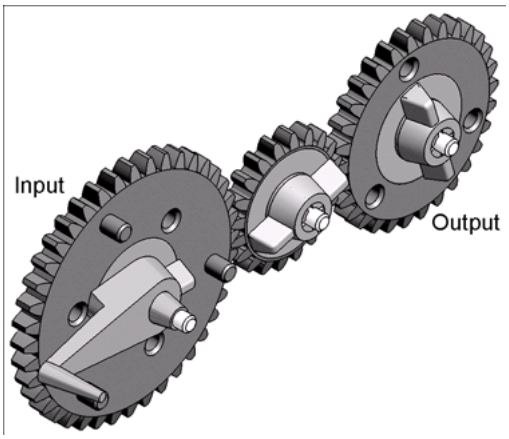
1. (1.00 pts) The ratio of output force to input force of a simple machine is called the

- A) fulcrum
- B) efficiency
- C) pivot arm
- D) lever torque
- E) mechanical advantage

2. (1.00 pts) A pulley system can

- A) Change the direction of a force
- B) Multiply the force
- C) Increase the amount of work done
- D) Both A & B
- E) Both B & C

3. (1.00 pts)
The gear train below consists of a 40-tooth (input), 20-tooth, and 30-tooth (output) gear. If the input gear rotates 15 times, how many times will the output gear rotate?



- A) 10 times
- B) 24 times
- C) 20 times
- D) 30 times

4. (1.00 pts) An example of a 2nd class lever is a

- A) seesaw
- B) wheelbarrow
- C) pliers
- D) tweezers

5. (1.00 pts) In a 3rd class lever, the mechanical advantage is

- A) always greater than 1.
- B) sometimes greater than 1.
- C) always equal to 1.
- D) always less than 1.

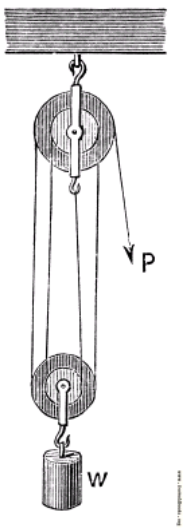
6. (1.00 pts)
The wheels on a car are 24 inches in diameter. In order for the car to travel exactly 200 feet (assuming no skidding or slipping), the wheel would need to revolve approximately

- A) 2.65 times
- B) 24.2 times
- C) 8.33 times
- D) 31.8 times

7. (1.00 pts) When used to drive a screw, a screwdriver functions as _.

- A) a wheel and axle
- B) a screw
- C) an inclined plane
- D) a lever

8. (1.00 pts) If the pulley system (shown below) is lifting a 40 lb load, what is the minimum amount of the effort that must be applied to the system?



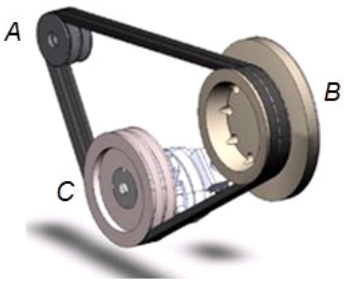
A) 8 lb

B) 20 lb

C) 10 lb

D) 40 lb

9. (1.00 pts)
In the belt and pulley system shown below, Pulley A has a diameter of 5 in, Pulley B has a diameter of 8 in, and Pulley C has a diameter of 9 in. If Pulley A is delivering 80 ft-lb of torque, then Pulley C is receiving approximately _.



A) 80 ft-lb of torque

B) 128 ft-lb of torque

C) 144 ft-lb of torque

D) 400 ft-lb of torque

10. (1.00 pts) In physics, work is

A) actual divided by ideal

B) effort minus resistance

C) force times distance

D) something to be avoided

11. (1.00 pts) Ideal mechanical advantage is based on

A) effort & resistance forces

B) effort & resistance distances

C) inquiry-based calculations

D) static equilibrium

12. (1.00 pts)
A screwdriver is used to pry open a can of paint. When it is inserted in place, the length from the outside edge of the can to the tip of the screwdriver is 1 inch. The total length of the screwdriver is 8 inches. The lid on the paint can is providing 100 lb of resistance.

What is the ideal mechanical advantage of the system? _

A) 8

B) 10

C) 14

- [x] D) 7
- [ ] E) 80

13. (1.00 pts)
A screwdriver is used to pry open a can of paint. When it is inserted in place, the length from the outside edge of the can to the tip of the screwdriver is 1 inch. The total length of the screwdriver is 8 inches. The lid on the paint can is providing 100 lb of resistance. What is the effort force? _ pounds.

- [ ] A) 28.189
- [ ] B) 22.325
- [ ] C) 18.657
- [x] D) 14.286

14. (1.00 pts)
A civil engineer must design a wheelchair-accessible ramp next to a set of steps leading up to a building. The height from the ground to the top of the stairs is 18 in. Based on ADA codes, the slope must be 1:10 or less.

Using the ADA code, what is the allowable minimum length in inches of the ramp base? _ inches

- [ ] A) 270
- [x] B) 180
- [ ] C) 80
- [ ] D) 100

15. (1.00 pts)
A civil engineer must design a wheelchair-accessible ramp next to a set of steps leading up to a building. The height from the ground to the top of the stairs is 18 in. Based on ADA codes, the slope must be 1:10 or less.

Using the known height and calculated base length, what is the length of the slope in inches of the ramp? _ inches

- [x] A) 181
- [ ] B) 30.12
- [ ] C) 13.453
- [ ] D) 92

16. (1.00 pts)
A civil engineer must design a wheelchair-accessible ramp next to a set of steps leading up to a building. The height from the ground to the top of the stairs is 18 in. Based on ADA codes, the slope must be 1:10 or less.

What is the ideal mechanical advantage of the ramp? _

- [ ] A) 22
- [x] B) 10
- [ ] C) 100
- [ ] D) 18

17. (1.00 pts)
A civil engineer must design a wheelchair-accessible ramp next to a set of steps leading up to a building. The height from the ground to the top of the stairs is 18 in. Based on ADA codes, the slope must be 1:10 or less.

If a person and wheelchair have a combined weight of 260 lb, how much ideal effort force is required to travel up the ramp?

- (●) A) about 26 pounds
- ( ) B) about 181 pounds
- ( ) C) about 11 pounds
- ( ) D) about 2613 pounds

18. (1.00 pts) The machine output divided by input and then multiplied by 100 will equal ____.

- ( ) A) watt-hours
- ( ) B) energy
- (●) C) efficiency
- ( ) D) work ration

19. (1.00 pts) The efficiency of a 120 V 2 HP motor that draws 24.8 A is ____ %. (T#1)

- ( ) A) 25
- (●) B) 50
- ( ) C) 75
- ( ) D) 90

20. (1.00 pts) A DC generator driven by a 15.5hp motor delivers 45.5A at 220V. The efficiency of the generator is:

- ( ) A) 77.9%
- ( ) B) 81.7%
- ( ) C) 92.5%
- (●) D) 86.57%

21. (1.00 pts) The imaginary circle around which the teeth on a gear are uniformly spaced is called the _____ circle.

- ( ) A) gear
- (●) B) pitch
- ( ) C) pressure
- ( ) D) parallel

22. (1.00 pts) A turning or twisting force is known as _/

- ( ) A) work
- ( ) B) thrust
- (●) C) torque
- ( ) D) leverage

23. (1.00 pts) _____ is a non-SI unit of power that is still used in the United States, especially in reference to the power output of combustion engines. (T#5)

A) efficiency
B) horsepower
C) ideal effort force
D) ideal mechanical advantage

24. (1.00 pts) A _____ is the energy required to apply a force of one newton over a distance of one meter.

A) newton
B) joule
C) btu
D) calorie

25. (1.00 pts) One horsepower is equal to ____ W.

A) 100
B) 333
C) 746
D) 1800

26. (1.00 pts)
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

27. (1.00 pts) 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) 30

28. (1.00 pts) 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.

29. (1.00 pts) 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

30. (1.00 pts)
The wheels on a bicycle 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

31. (1.00 pts)
The wheels on a bicycle have a 10" radius. Assuming no sliding or slip between the wheel and the road, the bicycle will travel _____ inches for everyone full revolution of the wheels. (T#2)

- A) 628
- B) 62.8
- C) 314
- D) 31.4

32. (1.00 pts) A doorknob is an example of a _____.

- A) screw
- B) wheel and axle
- C) pulley
- D) wedge

33. (1.00 pts) Which simple machine can NOT be used to increase force?

- A) wheel and axle
- B) lever
- C) fixed pulley
- D) moveable pulley

34. (1.00 pts) A fixed pulley is used to change the

- A) effort
- B) work
- C) direction
- D) time

35. (1.00 pts) A pulley is made up of a rope or chain and a

- A) lever
- B) wheel
- C) fulcrum
- D) ball

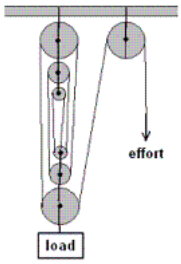
36. (1.00 pts) If the pulley system shown in the figure below is lifting a 50 lb. load, what is the minimum amount of effort that must be applied to the system?

- A) 1 pound
- B) 8.33 pounds
- C) 10 pounds
- D) 50 pounds

37. (1.00 pts) 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

38. (1.00 pts) Determine the mechanical advantage of this pulley system.



- A) 3
- B) 6
- C) 7

D) 8

39. (1.00 pts) Given the pulley configuration below, how many pounds of effort force would a user have to exert on the rope to lift the 60 lb load?

A) 15 lbs
B) 30 lbs
C) 25 lbs
D) 20 lbs

40. (1.00 pts) 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

41. (1.00 pts)
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

42. (1.00 pts) In a 2nd class lever the distance from the effort to the fulcrum is _____ the distance from the load to the fulcrum.

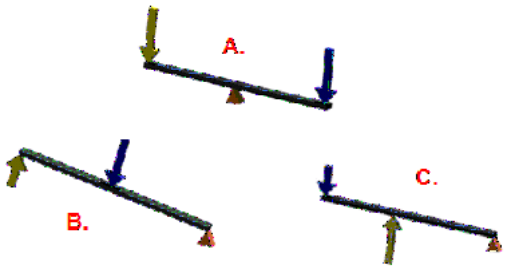
A) less than
B) less than or equal to
C) equal to
D) greater than or equal to
E) greater than

43. (1.00 pts) 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

- [x] B) less than
- [ ] C) greater than
- [ ] D) greater than or equal to

44. (1.00 pts) Which of the levers pictured is a first-class lever?



- [x] A) A
- [ ] B) B
- [ ] C) V

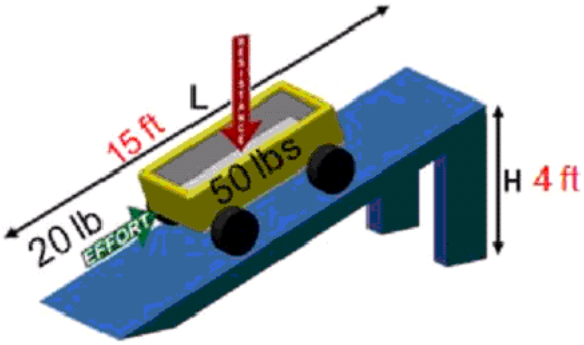
45. (1.00 pts) A ramp is used to raise an object 3 feet from the ground. The base of the ramp is 10 feet long. The slope of the ramp is _____.

- [x] A) 10.44
- [ ] B) 3.33
- [ ] C) 3.48
- [ ] D) 0.958
- [ ] E) None of these.

46. (1.00 pts) 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 _____. (T#3)

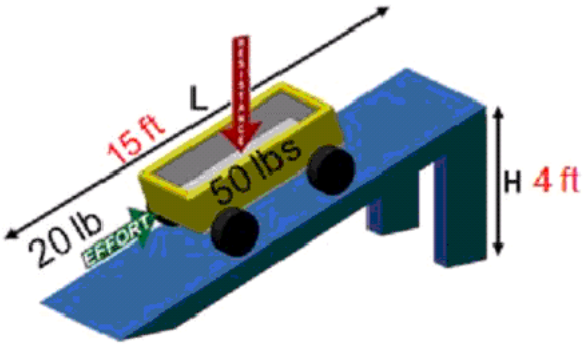
- [ ] A) 10.44
- [ ] B) 3.33
- [x] C) 3.48
- [ ] D) 0.958
- [ ] E) None of these

47. (1.00 pts) Calculate the efficiency of the inclined plane pictured below.



- (●) A) 67
- ( ) B) 50
- ( ) C) 100
- ( ) D) 33.3

48. (1.00 pts) 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) 800 ft.lb
- ( ) E) None of these

49. (1.00 pts) A student is using the ramp shown to raise an object 4 feet above the ground. The mechanical advantage of the ramp is

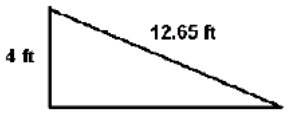


Figure 5

- ( ) A) 0.316
- (●) B) 3.163

C) 1.05

D) 3.0

50. (1.00 pts) Simple machines help us move things by changing the size or direction of the

A) force

B) motor

C) axle

D) fulcrum

51. (1.00 pts) There are really only _____ basic kinds of simple machines. (T#4)

A) 1

B) 2

C) 3

D) 4

E) 5

F) 6

52. (1.00 pts) If a simple machine in a the 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

53. (1.00 pts)
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

54. (1.00 pts) 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

55. (1.00 pts) A car's steering wheel uses a type of gear called the _____.

A) helical gear
B) straight tooth bevel gear
C) worm and wheel
D) rack and pinion

56. (1.00 pts) An elevator uses a type of gear called the _____.

A) worm and wheel
B) cam and follower
C) rack and pinion
D) wheel and axle

57. (1.00 pts) A gear train can change the rotational speed and _____ between the input and output shafts of a mechanical system.

A) angle
B) motion
C) torque
D) pressure

58. (1.00 pts) A _____ consists of a spur gear that interfaces with a flat bar into which straight gear teeth have been cut.

A) cam and follower
B) pressure angle
C) rack and pinion
D) simple gear train

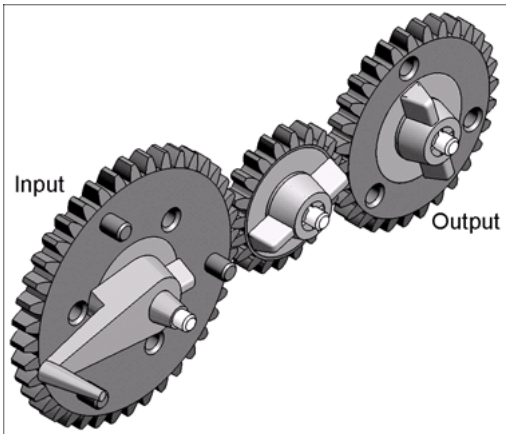
59. (1.00 pts) Gears have specially designed teeth that are defined by a mathematical curve, called a(n) _____.

A) pitch circle
B) compound gear train
C) diametral pitch
D) involute curve

60. (1.00 pts) Study the gear train below. The purpose of the center gear is to

A) allow the drive and driven gear to rotate in the same direction.
B) allow the drive and driven gear to rotate in the opposite direction.
C) increase the output RPM's of the driven gear
D) increase the output torque of the driven gear

61. (1.00 pts)
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

62. (1.00 pts) 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

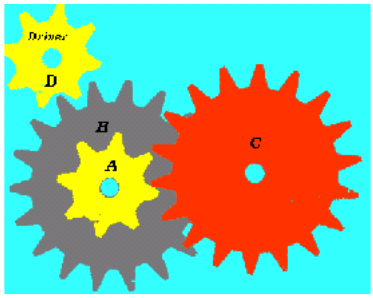
63. (1.00 pts) If the input (driver) gear is 15 teeth and the output (driven) gear is 60 teeth, what is the gear ratio?

- A) 5:6
- B) 4:1
- C) 1:4
- D) 1:2

64. (1.00 pts) What can a gear train do?

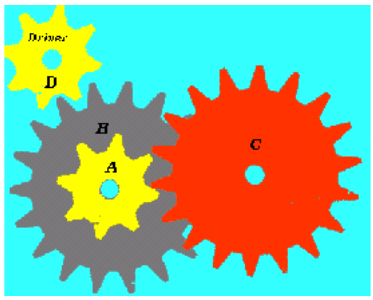
- A) change the output direction
- B) change the torque
- C) change the speed
- D) all of the above
- E) none of the above

65. (1.00 pts) 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

66. (1.00 pts) If the Driver (D) turns clockwise, which direction will gear C turn?

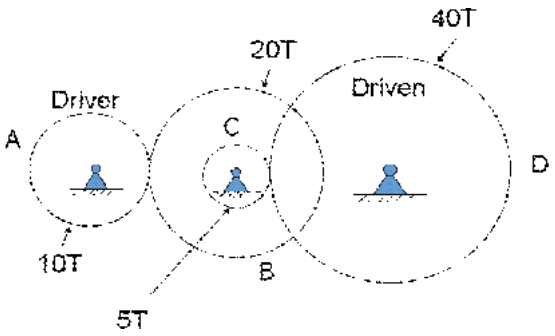


- A) cw
- B) ccw
- C) need more infomation

67. (1.00 pts) If a 20-toothed gear rotates 6 times, how many times will a 40-toothed gear rotate that is meshed with it?

- A) 3 times
- B) 6 times
- C) 9 times
- D) 12 times

68. (1.00 pts)
A compound gear train below 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

69. (1.00 pts) A linkage is basically a series of interconnected _____.

- A) pulleys
- B) levers
- C) screws
- D) inclined plane

70. (1.00 pts) The _____ converts rotary motion to intermittent linear motion.

- A) cam and follower
- B) gear train
- C) ball bearing
- D) roller chain

71. (1.00 pts) James Watt made important improvements to the _____, including a parallel linkage system.

- A) steam engine
- B) internal combustion engine
- C) automobile
- D) elevator

72. (1.00 pts) A _____ is a mechanical device that is used to reduce friction where two surfaces meet and slide against each other as a result of linear and/or rotary motion.

- A) gear
- B) crank
- C) bearing
- D) rocker

73. (1.00 pts) A _____ is a screw thread that shares similar geometric features as the gear (called a wheel) to which it meshes.

- (●) A) worm
- ( ) B) chain mechanism
- ( ) C) pin joint
- ( ) D) pulley

74. (1.00 pts)
The figure below 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 RPM, then pulley B is spinning at _____ RPM

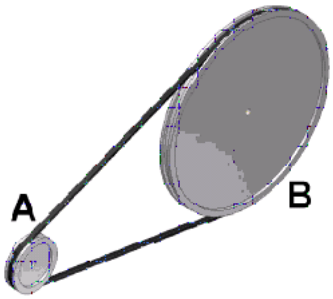


Figure 7

- ( ) A) 4
- ( ) B) 64
- ( ) C) 240
- (●) D) 15

75. (1.00 pts) Chain drive ratio is a the ratio between the rotational speeds of the input and output _____ of a roller chain drive system.

- (●) A) sprockets
- ( ) B) chains
- ( ) C) gears
- ( ) D) teeth.

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