

Section 2.0 An understanding of mechanical advantage and work helps in determining the efficiency of machines.

Student _____

Class _____

2.1 Machines Make Work Easier

1. Roads in the mountains have sections to help vehicles up a steep incline, by making sharp turns back and forth in opposite directions, after raising the vehicle a little higher in altitude. These roads are an example of a simple machine – the inclined plane, and are called ...
 - A reversals
 - B switchbacks**
 - C zig zags
 - D turnabouts

2. Your car has a flat tire, but you don't have a jack to lift it up, so you can change the tire. What machine could you make that would make it possible to lift the car ...
 - A lever**
 - B wedge
 - C pulley
 - D ramp

3. Mechanical advantage is the amount by which a machine can multiply a force. The force that the machine applies to the object is called the ...
 - A input force
 - B output force**
 - C force ratio
 - D Newton force

4. To calculate mechanical advantage, or force ratio, you divide the output force by the input force. A machine that is able to move an object that weighs 36 Newtons with 6 Newtons of force has a mechanical advantage of ...
 - A 6**
 - B 30
 - C 36
 - D 42

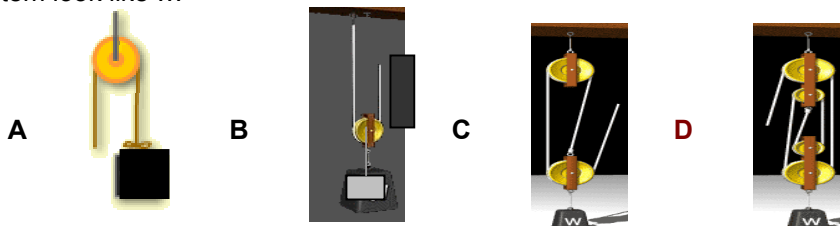
5. A pulley system can provide a mechanical advantage.

Look at the illustration and identify what the mechanical advantage of this pulley system is.



- A 2 **B 3** C 4 D 5

6. If it takes 45 N of force to lift a 180 N carton using a pulley system, what would the pulley system look like ...



7. Speed Ratio is calculated by dividing the ...
A Output distance by the input distance
B Input distance by the output distance
C Output force by the input distance
D Input force by the output distance
8. To calculate the speed ratio of a pulley system, you count...
A all the ropes
B only the ropes supporting the load
C only the ropes applying force
D all ropes that are movable
9. In most machines, you don't get something for nothing. When you gain a mechanical advantage, you are gaining ...
A force
B speed
C distance
D resistance
10. A bicycle is a useful machine because it gets us from place to place much faster than we could walk. As a machine it has a mechanical advantage of less than one, but what about speed ratio? The speed ratio of a bicycle is ...
A 1
B more than 1
C less than 1
D cannot be determined
11. What can account for the fact that mechanical advantage and speed ratio are different in real situations?
A Improper calculations
B Faulty equipment
C Force of friction
D Loss of energy
12. Efficiency is a measure of how well a machine does work. Dividing the mechanical advantage by the speed ratio and multiplying the result by 100 will determine the efficiency of the machine. A pulley system that has a speed ratio of 3 and a mechanical advantage of 2 has an efficiency of
A 33%
B 67%
C 60%
D 30%

2.2 The Science of Work

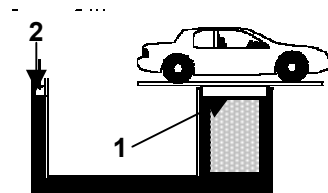
13. The scientific definition of work is ... "Work is done when a force acts on an object to make the object move." Which statement below describes work being done.
A Hank worked very hard to get all his homework done.
B Doing math is hard work if you don't like numbers.
C It was hard work for Sam to move the desk two meters.
D It was hard work trying to move the car, but it wouldn't budge.
14. Work is calculated using the formula – $W = F \times d$. If you lift a box onto your desk that is .4 meters off the floor, using 50 Newtons of force, how much work are you doing?
A 20 Joules
B 125 Joules
C 50.4 Joules
D 49.6 Joules

15. In a car, what provides the force (energy source) that makes work (the car moving) possible?
- A engine
 - B transmission
 - C gasoline
 - D wheels
16. Using a machine does not mean that less work is done. This is because ...
- A Work input is never equal to work output
 - B Work input is equal to work output
 - C Less force means less distance
 - D More force means more distance
17. When determining the efficiency of a certain machine, the students found that 1600J of work were needed to get 1200J of work from the machine. The efficiency of this machine was ...
- A 2800J
 - B 400J
 - C 75 %
 - D 25%

2.3 The Big Movers - Hydraulics

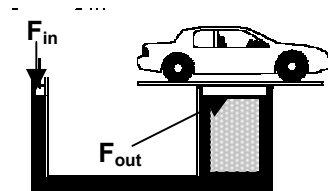
18. A hydraulic system is able to move heavy loads because it uses this under pressure ...
- A air
 - B water
 - C liquid
 - D nitrogen
19. Hydraulic systems are used in many different applications. A hair stylist would use hydraulics in their shop to do this ...
- A mix chemicals and dyes
 - B operate electric shears
 - C run the neon signs
 - D raise and lower the chair
20. Pressure is the measure of the force applied to a specific area. The unit of measurement is named after Blaise Pascal who worked with fluids. The unit of measure is the ...
- A blaise
 - B pascal
 - C kilogram
 - D cubic centimeter
21. Pascal's Law states that pressure applied to an enclosed fluid is transmitted ...
- A to the walls of the container which double the pressure
 - B equally in all directions throughout the fluid
 - C by the transfer force in the fluid
 - D to the opposite piston where it increases the force
22. Pascal's law enables these types of systems to work very effectively – hydraulics, which use a liquid and pneumatics, which use ...
- A air
 - B oil
 - C water
 - D grease

23. A common application of the hydraulic system is the hydraulic jack, like the one shown here ...



The piston identified by # 1 is the ...

- A syringe piston
 B hoist piston
 C **output piston**
 D input piston
24. The mechanical advantage in a hydraulic system is provided by the ...
 A small piston
 B large piston
 C flexible connection
 D **pressure in the fluid**
25. A good example of a hydraulic system at work inside the body is the ...
 A Respiratory system
 B Digestive system
 C **Circulatory system**
 D Excretory system
26. The hydraulic jack, like the one shown here, identifies the input force piston and the output force piston ...
 $F_{in} = 50N$
 $F_{out} = 1500N$



The mechanical advantage of this hydraulic jack is ...

- A **30**
 B 300
 C 1000
 D 2000
27. If the area of the *input piston*, in the hydraulic lift shown in the question above, is $5cm^2$, what would be the area of the *output piston*?
 A $10cm^2$
 B $30cm^2$
 C **$150cm^2$**
 D $300cm^2$
28. The disadvantage of the hydraulic system is similar to the disadvantage of levers and pulleys. To increase the force on the output piston, the input piston has to ...
 A have less friction
 B create more pressure
 C **move a greater distance**
 D be attached to the load