Mechanical Systems
Grade 8 – Unit 4 Test

1. A wheelbarrow is an example of what simple machine?
A   Class 1 lever
B   Class 2 lever
C   Class 3 lever
D   Wheel and Axle

2. A hockey stick is an example of what simple machine?
A   Class 1 lever
B   Class 2 lever
C   Class 3 lever
D   Inclined plane

3. Scissors are an example of what simple machine?
A   Class 1 lever
B   Class 2 lever
C   Class 3 lever
D   Wedge

4. A teeter-totter an example of what simple machine?
A   Class 1 lever
B   Class 2 lever
C   Class 3 lever
D   Inclined plane

5. A simple machine that converts rotational motion to linear motion is called …
A   Class 1 lever
B   Inclined plane
C   Wedge
D   Screw

6. A diving board is an example of what simple machine?
A   Class 1 lever
B   Class 2 lever
C   Class 3 lever
D   Inclined plane

7. The **Canadarm** is an example of what simple machine?

A   Class 4 lever

B   Class 3 lever

C   Class 2 lever

D   Class 1 lever

(Use the following diagram for the next question)

8. In the lever above, the Effort Force is applied at E. This makes it a …

A 1st Class lever
B 2nd Class lever
C 3rd Class lever
D 4th Class lever

9. Work is energy in action. It is measured in ...
A N/m (Newtons per meter)
B P.s.i (Pounds per square inch)
C J (Joules)
D Kg*m (Kilograms times meters)

10. *Mechanical Advantage* is the comparison of the force produced by a machine to the force applied to the machine. The formula used to calculate it is **MA = F$_L$ / F$_E$** . Use the formula to calculate the *mechanical advantage* to lift an SUV with a tree branch, acting as a 1st Class lever. The effort force applied to the tree branch is 500 N and the SUV weighs 5000 N. The mechanical advantage of the lever is ...
A 10
B 0.10
C 4500
D 5500

11. Calculate the mechanical advantage, when 736 N of force is used on a bicycle pedal, causing 81 N of force to move the bicycle forward.
A 917
B 655
C 9.08
D 0.11

12. It takes 120N of force to raise the flag up the flagpole. The load is 120N. What is the mechanical advantage? ...
A 0
B 1
C 120
D 240

13. The Mechanical Advantage of a lever can also be calculated using this formula …
    MA = Effort Arm/ Load Arm
    (*Reread question #10*) If the length of the branch between the effort and the fulcrum is 3m and the length of the branch from the fulcrum to the SUV is 0.3 m, what is the mechanical advantage of the lever?
A 0.1
B 2.7
C 3.3
D 10

14. Hockey players realize that the advantage of using a hockey stick, as a 3rd Class lever, is that the force they apply to the puck will move it ...
   A   with more accuracy
   B   a shorter distance
   C   with more force
   D   faster

15. The science of designing machines to suit people is called ergonomics. The primary criteria used in designing a machine ergonomically is...
   A   expense
   B   aesthetics
   C   comfort
   D   size

16. A device that consists of a small cylinder, with a handle or a crank, is called a ...
   A   radius
   B   winch
   C   fulcrum
   D   pinion

17. Gears are used in combination, with the teeth of the gears interlocking, so when one moves the other moves as well. Effort can be applied to the first gear (24 teeth), with the resulting effect on the second gear (12 teeth) being a ...
   A   speed advantage of 0.5
   B   speed advantage of 2
   C   force advantage of 2
   D   force advantage of 0.5

18. When gears are used in a gear train, the resulting effect is that each gear travels ...
   A   slower than the one next to it
   B   faster than the one next to it
   C   in an opposite direction than the one it is nearest to
   D   always in the same direction as the one next to it

19. A bicycle an example of gears that don't have to be touching one another to work together. This is possible because of a chain that connects the gears. This chain has links in it that fit into the teeth of the gears. A gear that has teeth that fit into the links of a chain is called a ...
   A   sprocket
   B   sprigget
   C   driving gear
   D   follower gear

20. The mechanical advantage of the block and tackle (complex combination of fixed and moveable pulleys) pictured here is ...
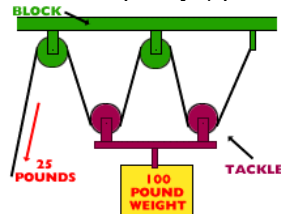

   A   3
   B   4
   C   5
   D   6

21. Using the gear train illustrated here to answer this question
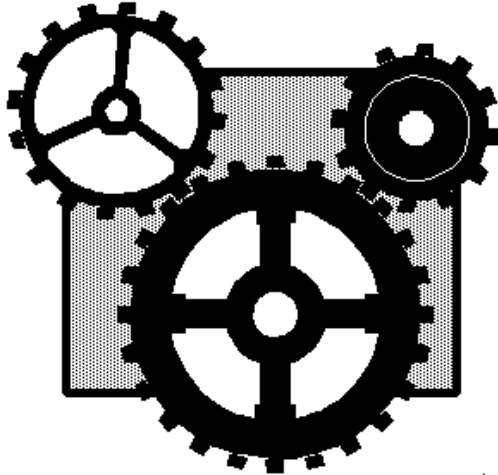
Identify the direction and speed of the 2nd follower gear if the driven gear is the 1st gear on the left and it is being turned clockwise ...

   A   **clockwise with a speed ratio of 1.34**
   B   **counterclockwise with a speed ratio of 1.34**
   C   **clockwise with a speed ratio of 2**
   D   **counterclockwise with a speed ratio of 2**

22. The pedals on a bicycle are attached to sprocket gears which are linked together by a chain. The type of energy that describes the motion created when you apply force to the pedal is ...
   A   **gravitational**
   B   **frictional**
   C   **potential**
   D   **kinetic**

23. (*Efficiency = work output / work input*) A pulley system lifts a 100N load with a force of 20N. The input distance is 3m and the output distance is 0.5m. The efficiency of this pulley system is ...
   A   **62.5%**
   B   **75.0%**
   C   **83.3%**
   D   **92.75%**

24. Efficiency can be increased by reducing frictional force. A sport that tries to reduce frictional force by sweeping the ice in front of the rock is ...
   A   **cycling**
   B   **curling**
   C   **rock climbing**
   D   **ice sculpturing**

25. When a skater moves across an ice surface, a thin layer of water is created, allowing the skate blade to slide across the surface with little friction. This layer of water is produced by the pressure of the ....
   A   **zamboni**
   B   **atmosphere**
   C   **skate blade**
   D   **ice temperature**

26. To calculate pressure the formula used is P = F / A. Units of pressure are ...
   A   joules
   B   kilojoules
   C   pascals
   D   kilograms

27. The heel of a stiletto shoe can exert a lot of pressure. If the area of the heel is $0.5cm^2$ and a force of 200N is exerted using the heel, what is the pressure exerted by the heel?
   A   10 Pa
   B   200 Pa
   C   400 Pa
   D   1000 Pa

28. Crash test dummies are used to test safety in vehicles. The reason for this is because they are ....
   A   inexpensive to use
   B   realistic
   C   easily repaired
   D   non-living

29. Pascal's law states that ...
   A   **pressure exerted on a contained fluid is transmitted equally in all directions**
   B   **force exerted on a contained fluid is transmitted equally in all directions**
   C   **hydraulics exerted on a contained fluid is transmitted equally in all directions**
   D   **pneumatics exerted on a contained fluid is transmitted equally in all directions**

30. A cherry picker uses hydraulics to raise a working platform. 10N of force are applied to the small piston in the hydraulic system to raise a load of 50N (on the large piston) a distance of 0.5m. How far would the small piston have to be pushed to accomplish this task?
   A   5 m
   B   2.5 m
   C   0.5 m
   D   25 m

31. If the area of the small piston on the left is $0.5m^2$ and the area of the large piston is $5.5m^2$,
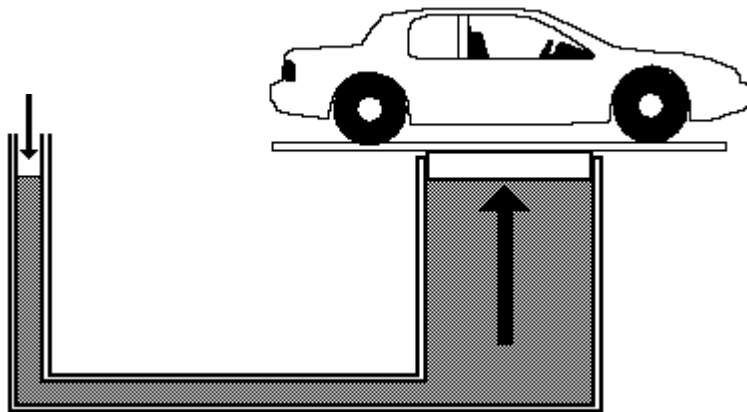
   The mechanical advantage of the illustrated hydraulic lift here would be ...
   A   1.1
   B   6.0
   C   2.5
   D   11

32. In the hydraulic lift from the previous question (Question # 31) the advantage is force and the disadvantage is...

  A pressure
  B speed
  C distance
  D compression

33. In early times, people with buckets usually transported water from one place to another. A scientist later invented a device to make it easier, which used the motion of a simple machine. The device was called ...

  A Achilles ramp
  B Achilles pulley
  C Archimedes wedge
  D Archimedes screw

34. During the research phase, when a device is improved upon, certain criteria are taken into account. Of the criteria listed below, which would be the **least** important ...

  A safety
  B efficiency
  C effectiveness
  D convenience

35. Comfort is an important consideration when designing a machine or improving upon an existing machine. The science that designs machines for comfort is called ...

  A bionics
  B economics
  C ergonomics
  D meganomics

36. Use the illustration, of a hydraulic disc brake system, below to answer the question.
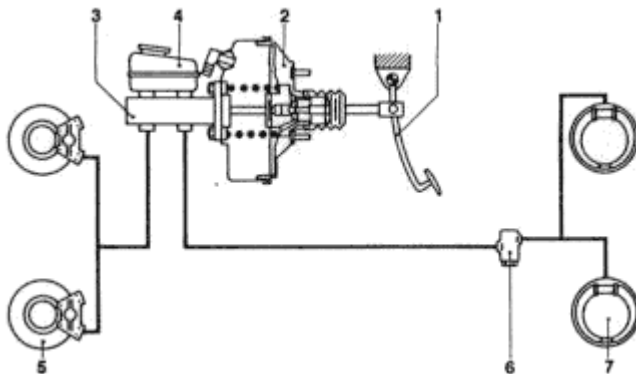
The effort force required to slow the vehicle in this disc brake hydraulic system would be applied at number ...

  A 1
  B 3
  C 5
  D 7

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Answer Key

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