

**Unit 4 Test**\_\_\_\_\_  
Student\_\_\_\_\_  
Class**1.1 Simple Machines – Meeting Human Needs**

1. Mechanical systems for transporting water were developed by Roman engineers thousands of years ago. These systems supplied water to cities that were many kilometers from the water supply. The systems were known as ...  
**A sakias**  
**B aqueducts**  
**C mill wheels**  
**D Persian wheels**
2. Archimedes designed a system for moving water from one place to another. His machine is still used today. It is based on the simple machine - the ...  
**A lever**  
**B wedge**  
**C screw**  
**D inclined plane**
3. Scissors are a combination of what two machines?  
**A lever and wedge**  
**B lever & inclined plane**  
**C wheel and axle**  
**D wedge and inclined plane**
4. A simple machine that converts rotational motion to linear motion is called ...  
**A Class 1 lever**  
**B Inclined plane**  
**C Wedge**  
**D Screw**
5. A simple machine, similar in shape to the inclined plane, but used to increase the force of moving an object is the ...  
**A Class 1 lever**  
**B Screw**  
**C Wheel and axle**  
**D Wedge**
6. Simple machines can be used for 4 different purposes. The purpose of scissors is to ...  
**A Transfer the force**  
**B Multiply the force**  
**C Increase or decrease the speed**  
**D Change the direction of a force**

**1.2 The Complex Machine – A Mechanical Team**

7. The penny farthing was an early bicycle design that used only these types of simple machines ...  
**A Levers and pulleys**  
**B Incline plane & Screw**  
**C Levers & wheel and axle**  
**D Pulleys & wheel and axle**

8. Devices that help that are made up of several simple machines are called complex machines. Because all the simple machines work together in these devices, they are considered to be a ...
- A **system**
  - B **subsystem**
  - C **new technology**
  - D **complicated device**
9. Linkages and transmissions are parts of a system that perform a specific function. The function they perform is to ...
- A **increase torque**
  - B **increase speed**
  - C **transfer weight**
  - D **transfer force**
10. Transmissions are special types of linkages. It is used to transfer energy from the engine to the wheels in a car. A transmission contains a number of these that allow the driver to apply a large force to move objects slowly or a small force to move objects quickly. They are ...
- A **chains**
  - B **fan belts**
  - C **gears**
  - D **linkages**
11. Gears can also change the direction of motion. In an eggbeater, the crank turns the driving gear, which in turn makes the beaters rotate. The transfer of motion is ...
- A **vertical to horizontal**
  - B **horizontal to vertical**
  - C **linear to rotational**
  - D **rotational to linear**
12. If a smaller gear is used to drive a larger gear, the gear train is a reducing gear. If a larger gear is used to turn a smaller gear, the gear train is a ...
- A **parallel gear**
  - B **multiplying gear**
  - C **linear gear**
  - D **rotational gear**
13. On a bicycle, gears are made up of flat, toothed disks called ...
- A **linkages**
  - B **sprockets**
  - C **pinions**
  - D **spokes**

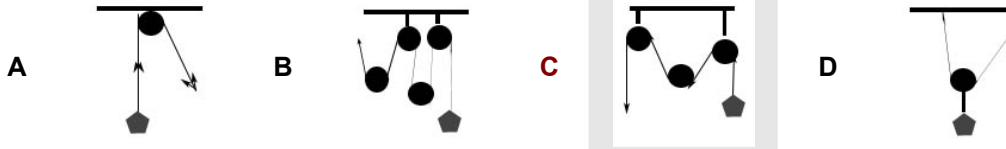
### 2.1 Machines Make Work Easier

14. What accounts for mechanical advantage and speed ratio being different in real situations?
- A **Improper calculations**
  - B **Faulty equipment**
  - C **Force of friction**
  - D **Loss of energy**
15. 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**

16. 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 zig zags**  
**B reversals**  
**C turnabouts**  
**D switchbacks**

17. If it takes 90 N of force to lift a 270 N carton using a pulley system, what would the pulley system look like ...



18. 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**

19. Efficiency is a measure of how well a machine works. Divide the mechanical advantage by the speed ratio and multiply the result by 100 to determine the efficiency of a machine. A pulley system with a speed ratio of 5 and a MA of 3 has an efficiency of ....

**A 30%**  
**B 33%**  
**C 40%**  
**D 60%**

## 2.2 The Science of Work

20. 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.**

21. 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**

22. 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**

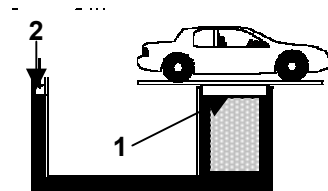
23. When determining the efficiency of a certain machine, the students found that 1600J of work were needed to get 1200J of work from the machine. The efficiency of this machine was ...

**A 2800J**  
**B 400J**  
**C 75 %**  
**D 25%**

24. ( $\text{Efficiency} = \text{work output} / \text{work input} \times 100$ ) A pulley system that lifts a 100N load with a force of 20N. requires an input distance is 3m with an output distance of 0.5m. The efficiency of this pulley system is ...
- A 62.5%
  - B 75.0%
  - C 83.3%
  - D 92.75%
25. Crash test dummies are used to test safety in vehicles. The **main reason** for this is because they are ....
- A inexpensive to use
  - B realistic
  - C easily repaired
  - D non-living

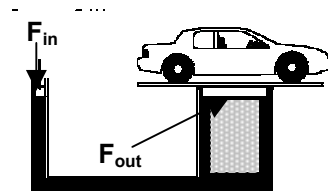
### 2.3 The Big Movers - Hydraulics

26. **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
27. Pneumatic systems use air and are used in many different applications. Dentists would use pneumatics in their office to do this ...
- A run the tooth drill
  - B run the amalgum mixer
  - C operate x-ray machine
  - D raise and lower the chair
28. A common application of the hydraulic system is the hydraulic lift, like the one shown here ...



The piston identified by # 2 is the ...

- A syringe piston
  - B hoist piston
  - C output piston
  - D input piston
29. The hydraulic jack, like the one shown here, identifies the input force piston and the output force piston ...
- $F_{in} = 50\text{N}$   
 $F_{out} = 1500\text{N}$



The mechanical advantage of this hydraulic jack is ...

- A 30
  - B 300
  - C 1000
  - D 2000
30. If the area of the **input piston**, in the hydraulic lift shown in the question above, is  $5\text{cm}^2$ , what would be the area of the **output piston**?
- A  $10\text{cm}^2$
  - B  $30\text{cm}^2$
  - C  $150\text{cm}^2$
  - D  $300\text{cm}^2$

**3.1 Evaluating Mechanical Devices**

31. 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 function
  - B efficiency
  - C effectiveness
  - D convenience
32. The design of mountain bikes to handle the rough terrain they would be used in, is considered to be evaluating a function because of this influence ...
- A mass appeal
  - B mass demand
  - C environment
  - D ergonomics
33. Opening a can has evolved from the earliest cans which were made from iron in 1810. These can were opened by using a ...
- A church key
  - B push button
  - C removable tab
  - D hammer and chisel
34. The design and development of opening mechanisms for aluminum cans went through four distinct designs. To get the liquid out of the can you need one large hole or two smaller holes. If two holes are needed, the first is designed to let air into the can, and the second hole is designed to ...
- A create pressure
  - B restrict the flow
  - C let the fluid out
  - D be just for show
35. Another simple machine was built into the removable tab top. It consisted of a small ring that acted like a lever and would make the necessary hole by removing the tab from the can. This was a huge improvement, but it also created a huge problem. The problem it created was ...
- A scientific
  - B environmental
  - C industrial
  - D commercial
36. **CSA** is a non-government association that tests and approves a wide range of products to ensure they are safe for use by the consumer. CSA stands for ...
- A Consumer Standards Agency
  - B Consumer Safety Association
  - C Canadian Standards Agency
  - D Canadian Standards Association

**3.2 Technology Develops through Change**

37. A particle accelerator is a huge complex machine that does this ...
- A creates new particles
  - B breaks up atoms
  - C makes new elements
  - D creates space in particles

38. Sometimes a new device is designed when someone who thinks there can be an easier way to do something makes an observation. An inventor observed a driver manually cleaning snow and ice off the windshield of a streetcar in freezing cold weather, this observation prompted the invention of this ...
- A windshield heater
  - B windshield washer
  - C windshield wiper
  - D windshield defroster
39. New technologies often develop from scientific research that seems to be unrelated. Particle accelerator research experiments led to the technology behind trains powered by electricity and magnets. These trains ‘float’ on the tracks. They are known as ...
- A MAGIC
  - B MALLEG
  - C MAVEEG
  - D MAGLEV
40. Robots are extremely complex devices and vary widely in appearance, depending on the job they are designed to do. A simple robot however has some or all of these basic parts: body, motor devices, power source, sensors, output devices, microprocessors. **Spirit** and **Opportunity** are robot rovers on the planet Mars. The solar panels on the robots are examples of these basic parts ...
- A Motor devices
  - B Sensors
  - C Power source
  - D Microprocessors
41. Robot technology was originally designed to ...
- A Entertain comic book readers
  - B Improve the margin of safety in all products
  - C Improve the assembly of consumer products
  - D Replace workers because of high wages

42. To test the success of a protective egg carton (with a mass of 100g), Jackson (who mass is 80kg), carried it up to the roof. It was dropped from a height of 4m.

How much work was done by Jacobs to test the egg protection device?  
(Show your work)

$80\text{kg} = 800\text{N}$   
 $100\text{g} = 1\text{N}$   
 $801\text{N} \times 4\text{m} = 3204\text{J}$

3	2	0	4
	.	.	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

43. A hydraulic lift was used to lift a load of 564N up three shelves high in a warehouse. The operator found that the distance it moved was 2.8m. If the mechanical advantage of the hydraulic lift was 10.

How much effort force was needed to lift the load?

(Show your work)

$564\text{N} / 10 = 56.4$

5	6	.	4
	.	.	
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9