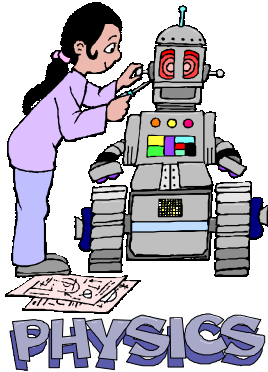


Science 9-Physics

A Review of Force, Work, Mechanical Advantage and Efficiency



10

Name _____

Due Date _____

Show Me Hand In

Correct and Hand In Again By _____

Answer the following questions in the spaces provided. Remember to use the necessary steps to solving problems.

NOTES

Force and **Weight** are two terms that can be interchanged with each other. Both are measured in **Newtons (N)**. The **Weight** of an object is also the **Load Force** of that object.

Questions

1. What are the weights of the objects having the following masses. Include the proper unit in your answers.

- | | |
|----------------|-------------------|
| a) 10 kg _____ | f) 367.8 g _____ |
| b) 25 kg _____ | g) 284.7 g _____ |
| c) 58 kg _____ | h) 198.3 g _____ |
| d) 278 g _____ | i) 234.2 kg _____ |
| e) 684 g _____ | j) 244 g _____ |

2. a) What is the proper formula for **Work**? _____
- b) What are the units for **Work**? _____
- c) What is the proper formula for **Mechanical Advantage**?

- d) Are there any units for **Mechanical Advantage**? _____
- e) What does **mechanical advantage** tell you? ie. If the M.A. = 8, what does that mean?
- f) What is the proper formula for **Efficiency**?

Answer the following questions in the spaces provided.

4. A computer with a mass of 80 kg needs to be lifted 1.5 meters to a desk. The mover decides to push it up a ramp that is 4 meters long. It takes 320 N of force to push the computer up the ramp.
- a) What is the **Load Force** (Gravitational Force) of the computer? _____
- b) How much **work** is it to lift the computer straight up?
- c) What is the **Effort Force** using the ramp? _____
- d) How much **work** is it to raise the computer with a ramp?
- e) Calculate the **Mechanical Advantage** of this ramp.
- f) Calculate the **Efficiency** of this ramp.

5. A turkey needs to be moved into an oven which is on the second floor (2.5 meters up).

a) What is the **force of gravity** on the turkey? _____

b) How much **work** will the cook need to do to move the 25 kg bird straight up?

c) Using the stairs, the cook can move the bird with force of only 125 N.
What is the **Mechanical Advantage** of using the stairs?

6. A science textbook has a mass of 8 kg. The text is carried by a student from the basement of their home to their bedroom [2 stories up (4 m straight up)].

a) What is the **work** that needs to be done in order to raise the text straight up?

b) If the person chooses to use the staircase which is 10 m in length, how much **force** will the student require? Assume that the work done using the stairs is the same as the work done lifting it straight up. ie. No Friction.

c) What is the **mechanical advantage** of using the staircase?

d) It is found that it actually takes the student 400 N of force to use the stairs. Calculate the **efficiency** of the stairs.

7. A first class lever is used to move an object with a mass of 65 kg. The lever moves when a force of 300 N is applied to the operator's end.
- a) What is the **load force**?
 - b) What is the **mechanical advantage** of using the lever?
 - c) The operator has to push her end of the lever down 5.2 meters in order to lift the object up a distance of 2.0 meters.
Calculate the **work input** of this lever.
 - d) Calculate the **work output** of this lever.
 - e) What is the **efficiency** of this simple machine?
8. A lever has a load force of 360 N and a load distance of 2 m. The effort distance turns out to be 3 m.
- a) Calculate the **effort force** required.
 - b) Calculate the **Mechanical Advantage** of this lever?
9. A lever has a load force of 450 N and a load distance of 5 m. The effort distance turns out to be 3 m.
- a) Calculate the **effort force** required.
 - b) Is this a 1st, 2nd or 3rd Class Lever? _____ Why?
 - c) What is the **Mechanical Advantage** of this lever?

10. Draw the following Levers and label them with a **fulcrum**, **load force** and **effort force**.

a) 1st Class Lever

b) 2nd Class Lever

c) 3rd Class Lever

11. List at least 2 places or devices where each of the following six machines are used.

a) Lever

b) Wedge

c) Inclined Plane

d) Wheel and Axle

e) Pulley

f) Screw

12. Which two simple machines does the following device use?



1. _____

2. _____

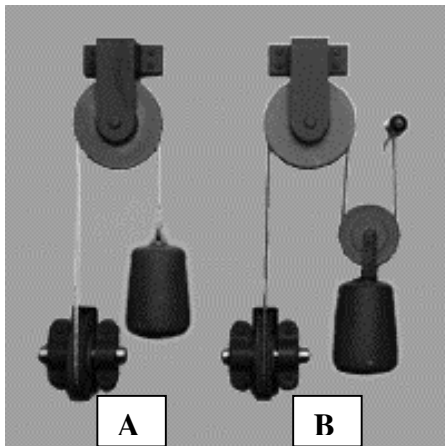
13. Which simple machine does this diagram indicate?



14. The following crowbar is acting as a _____ class lever.



15. Given the following pulley systems:



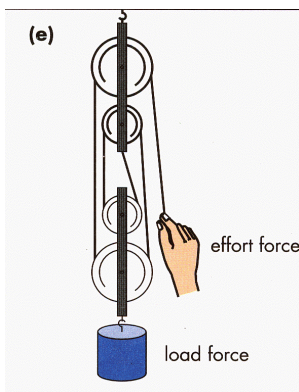
What is the **Mechanical Advantage** of

System “A” Answer _____

What is the **Mechanical Advantage** of

System “B” Answer _____

16. Consider the following pulley system:



How many strings are directly supporting the load? _____

What is the **Mechanical Advantage** of this system? _____

If the **Load Force** was 20 N, what would the **Effort Force** be?

Answer _____