Name: _____ Date: _____ Physical Science Period: _____

UNIT 3: Chapter 14 Work, Power & Machines Test Review – Answer Key

SPS8. Students will determine relationships among force, mass, and motion.
   e. Calculate amounts of work and mechanical advantage using simple machines.

Answer the following questions:

1. Define force.

   Force is a push or a pull on an object.

2. What is the equation for force? *(Identify each SI unit in the force equation)*

   Force (N) = mass (kg) x acceleration (m/s^2)

3. Define work.

   Work is the product of force and distance.

4. What is the equation for work? *(Identify each SI unit in the work equation)*

   Work (J) = Force (N) x Distance (m)

5. Define power.

   Power is the rate at which work is done.

6. What is the equation for power? *(Identify each SI unit in the power equation)*

   Power (W) = Work (J) / time (s)

7. What is mechanical advantage?

   MA is the number of times that a machine increases the input force.

8. What are the six different simple machines?

   SAWLIP: Screw, Wheel and Axle, Wedge, Lever, Inclined Plane, and Pulley

9. Give an example of each of the six simple machine:
   a. *Screw – bottle cap, bottom of a light bulb*

   b. *Wheel & Axle – steering wheel, wagon wheels*

   c. *Wedge – axe, zipper*

   d. *Lever – scissors, wheel barrow, broom*

   e. *Inclined plane - ramp*

   f. *Pulley – flag pole, window blinds*

10. What class of levers changes the direction of the force? *1st class levers*

11. What class of levers increases the distance of the force? *3rd c lass levers*

12. What class of levers increases the force? *2rd class levers*

13. What is the acronym used to memorize the three classes of levers? Define each letter and draw what each

    letter represents *(please follow the example provided below).*

F	O	I	L
fulcrum in the middle	output/resistance in middle	input/effort in the middle	**Lever**

O	△	I		I	O	△		O	I	△	

14. What class of levers always has the output (resistance) in the middle? ***2ʳᵈ class levers***

15. What class of levers always has the input (effort) in the middle? ***3ʳᵈ c lass levers***

16. What class of levers always has the fulcrum in the middle? ***1ˢᵗ class levers***

17. What strategy do you use to identify the Mechanical Advantage of a pulley system?

> ***Count the number of supporting rope sections;***
>
> ***if the rope is being <u>pulled down</u> subtract 1,***
>
> ***if the rope is being <u>pulled up</u> just count the supporting ropes***

18. For work to be done on the object, the object has to _***move***_.

19. Any part of a force that **does not** act in the direction of an object's motion does no _***work***_ on an object.

20. A device that changes the size or direction of force used to do work is called a(an) ***machine.***

21. The force that is exerted on a machine is called the ***effort*** force. **(*Input*)**

22. The force that is exerted by the machine is called the ***resistance*** force. **(*output*)**

23. Besides a reduction in friction, the only way to increase the amount of work output of a machine is to ***increase*** the work input.

24. The mechanical efficiency of any machine is always ***less*** than 100 percent, because of ***friction***.

25. The fulcrum is always between the effort force and the resistance force in a(an) ***1st***-class lever

26. The effort force is always between the fulcrum and the resistance force in a(an) ***3rd***-class lever

27. The resistance force is always between the fulcrum and the effort force in a(an) ***2nd***-class lever

28. Two or more simple machines working together make up a(an) ***compound*** machine.

29. Explain if work is done when you lift a book? *(use the terms force, distance, direction and move)*

> ***Work is done when you lift a book because the force is applied in the same direction as the movement of the book.***

30. Explain if work is done when you carry a book? *(use the terms force, distance, direction and move)*

> ***Work is not done when you lift a book because the force applied is not in the same direction as the movement of the book.***

31. Why don't you do work as you hold a book motionless over your head?

> ***No work is done because the book is not moving.***

32. Why is the work output of a machine never equal to the work input?

> ***The work output of a machine is never equal to the work input because some of the input is lost to friction.***

Answer the following questions. You MUST show your work!!! Draw a picture if needed to answer the question.

33. If 25 N of force is used to push a rock 4.5 m how much work is done?

> W = F x D →   ***112.5 J***

34. A woman drives her car onto a ramp for repairs. The ramp is 3.2 m long and it raises the car 0.9 m. Calculate the mechanical advantage of the ramp.

MA = De/Dr →   *3.56*

35. It takes 1780 N of force to lift an elevator 36 m.   If this is done in 25 s, what is the power of the elevator during the process?
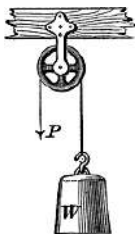
P = W/t →   *2563.2W*

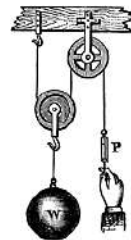36. How high is the table if 68 J of work is used to lift a 3.4 N box from the floor to the table?

D = W/F →   *20m*

37. If it takes you 5.25 seconds to move a 450 N box 4.50 m, how much power do you use?

P = W/t →   *385.7W*

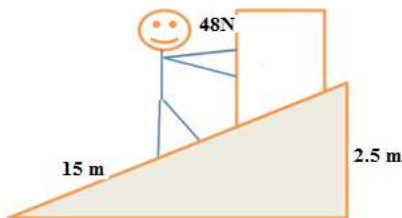38. Find the MA of the pulleys shown below:

MA = 1   MA = 2

39. The bleachers are 150 m long and 60 m high, what is their mechanical advantage?

MA = l/h →   150/60 = *2.5*

40. You apply 478 N of force to a jack to lift a 7850N car, what is the car's mechanical advantage?

MA = Fr/Fe→   *16.42*

41.

a.   How much work is done in the illustration?   *720J*

b.   What is the mechanical advantage of the ramp? *MA = 6*

42. An apple weighing 1.25 N falls a distance of 3.25 m. How much work is done on the apple?

W = F x D →   *4.0625J*