Chapter 14 Review Sheet – Work, Power, and Machines

1. Work is the product of _____force_____ and _____distance_____.
2. For a force to do work on an object, some of the force must act in the _____same_____ direction as the object moves.
3. In terms of work, what happens if there is not movement?
   no work is done
4. (True) or False: If all of the force acts in the same direction as the motion, all of the force does work.
5. True or (False): If part of the applied force acts in the direction of motion, none of the force does work.
6. (True) or False: If none of the force is applied in the direction of the motion, the force does no work.
7. **When does a weightlifter do work? (EXPLAIN.)**
   When he lifts the barbell off the ground
   ① force is applied in direction of motion ② barbell is moving
8. **When is a weightlifter applying a force but NOT doing work? (EXPLAIN.)**
   When he is holding barbell above head
   ① the barbell is not moving
9. Work and distance are _____directly_____ proportional, while work and force are _____directly_____ proportional.
10. What is the SI unit for the following: force, distance, and work.
    Newtons   meter   joule   J = Nm
    (N)   (m)   (J)
11. _____Power_____ is the rate of doing work.
12. **What are two ways you can increase your power?**
    ① increase amount of work in a given amount of time
    ② do a given amount of work in less time
13. Power and work are _____directly_____ proportional, while power and time are _____inversely_____ proportional.
14. What is the SI unit for the following: work, time, and power.
    Joule(J) second(s)   watt(W) $W = \frac{J}{s}$
15. What is the other common unit for power?
    horse power
16. How many watts are equal to one horsepower?
    746W = 1hp
17. A machine is a device that changes a _____force_____.
18. Machines can change a force in 3 ways. List those ways.
    ① size of force needed
    ② direction of a force
    ③ distance over which a force acts
19. A small force exerted over a large distance becomes a _____large_____ force exerted over a _____small_____ distance.
20. A machine that decreases the distance through which you exert a force _____increases_____ the amount of force required.

21. (True) or False: The force exerted on the machine is the input force.
22. True or (False): The force exerted on the machine is the output force.
23. Describe how input force, input distance and work input relate to an oar.

- Input force: force exerted on oar handles
- Input distance: distance oar handles move
- Work input: work done to move the handle

24. Describe how output force, output distance, and work output relate to an oar.

- Output force: force the end of oar exerts on the water
- Output distance: distance end of oar moves through the water
- Work output: work done to move the water and propel the boat

25. All machines use some amount of input work to overcome ___friction___.

26. Work done by a machine is always ___less___ than the work done on a machine; output work is ___less___ than input work.

27. (True) or False: You cannot get more work out of a machine than you put into it.

28. The mechanical advantage of a machine is the number of times that the machine increases an ___input force___.

29. Which value is always less than the other: ideal mechanical advantage or actual mechanical advantage? EXPLAIN! Actual mechanical advantage is always less due to friction

30. ___Actual___ mechanical advantage (AMA) is determined by measuring the actual forces on a machine.

31. What is the equation for AMA?

$$AMA = \frac{output\ force}{input\ force}$$

32. ___Ideal___ mechanical advantage (IMA) is the mechanical advantage of a machine in the absence of friction.

33. What is the equation for IMA?

$$IMA = \frac{input\ distance}{output\ distance}$$

34. (True) or False: There is no unit for AMA or IMA.

35. The percentage of work input that becomes work output is the ___efficiency___ of a machine.

36. Why is the efficiency of a machine always less than 100 percent?

friction

37. Efficiency is usually expressed as a ___percentage___.

38. What is the equation for efficiency?

$$Efficiency = \frac{work\ output}{work\ input} \times 100\%$$

39. What are some ways in which friction can be reduced?

low friction materials, lubricants, WD-40, grease, rolling friction, slick surface

40. Match each type of simple machine to its correct description:
_____1__ a. A rigid bar that is free to move around a fixed point.
_____6__ b. A simple machine that consists of a rope that fits into a groove in a wheel.
_____3__ c. A slanted surface along which a force moves an object to a different elevation
_____2__ d. A simple machine that consists of two disks or cylinders, each one with a different radius
_____5__ e. A slanted surface wrapped around a cylinder
_____4__ f. A V shaped object whose sides are slanted and slope towards each other.

1. Lever
2. Wheel and Axle
3. Inclined Plane
4. Wedge
5. Screw
6. Pulley

41. What is a fulcrum?
Fixed Point the bar of a lever rotates around

42. How are levers classified?
Based on locations of input force, output force, and fulcrum

43. For a first class lever, the ___fulcrum___ is in the middle. Depending on the position, the ideal mechanical advantage can be greater than, equal to, or less than ___1___.

44. For a second class lever, the ___output force___ is in the middle.
    a. The input distance is ___greater___ than the output distance, therefore, the IMA is ___greater than 1___

45. For a third class lever, the ___input force___ is in the middle.
    a. The input distance is ___less___ than the output distance, therefore, the IMA is ___less than 1___.

46. Give a real life example of a first class, second class, and third class lever.
Screwdriver opening Paint lid   wheelbarrow   broom

47. What are real-life examples of a wheel and axle?
• merry go round   • door knob   • Steering wheel   • Screwdriver

48. What are real-life examples of an inclined plane?
• Skateboard ramp   • ladder   • Stairs   • hill   • ramp

49. Which wedge would have a greater IMA: a thin wedge or a thick wedge of the same length?
thin wedge

50. What are real-life examples of a wedge?
• door stop   • needle   • edge of scissors   • vegetable peeler

51. True or False: Screws with threads father apart have a greater ideal mechanical advantage.

52. What are real-life examples of a screw?
• Screw   • bottle cap   • light bulb

53. A fixed pulley can change the ___direction___ of a force but not the ___size___ of a force, while a movable pulley is able to change both.

54. A ___compound___ machine is a combination of two or more simple machines that operate together.

55. Give a real life example of a compound machine?
Scissors: edge is a wedge while handles are a lever