Name: _____ **Date:** _____

Grade Level Conservation of Energy Problems KEY

Definition of Work… W = Fd Don't forget the force and the distance must be in the same plane.

1. Lee pushes horizontally with a 80 N force on a 20 kg mass 10 m across a floor. Calculate the amount of work Lee did.

2. The third floor of a house is 8 m above street level. How much work is needed to move a 150 kg refrigerator to the third floor?

3. Stan does 176 J of work lifting himself 0.3 m. What is Stan's mass?

4. A sled is pulled over level snow a distance of 500 m by a force of 124 N applied to a rope that makes an angle of 25^o with the snow. The vertical component of the force on the rope is 52.4 N. The frictional force acting on the sled is 50 N. How much work is done by the net force acting on the sled?

5. Mike pulls a sled across level snow with a force of 225 N along a rope that is 35^o above the horizontal. The vertical component of the force on the rope is 129 N. If the sled moved a distance of 65.3 m, how much work did Mike do?

6. A 845 N sled is pulled a distance of 185 m. The task requires 12000 J of work and is done by pulling on a rope with a force of 125 N. What is the horizontal component of the force along the rope?

7. Karen has a mass of 57 kg and she rides the up escalator at Woodley Park Station of the Washington DC Metro. Karen rode a distance of 65 along the incline to a height of 32.5 m, the longest escalator in the free world. How much work did the escalator do on Karen if it has an inclination of 30^o?

8. Chris carried a carton of milk, weight 10 N, along a level hall to the kitchen, a distance of 3.5 m. How much work did Chris do?

9. A student librarian picks up a 22 N book from the floor to a height of 1.25 m. He carries the book 8 m to the stacks and places the book on a shelf that is 0.35 m high. How much work does he do on the book?

10. A 4200 N piano is pushed up a 3.5 m frictionless plank that makes an angle of 30^o with the horizontal. The plank covers a horizontal distance of 3.03 m. Calculate the work done in sliding the piano up the plank.

11. While moving a heavy crate across the room, man exerts a horizontal force of 50 N for 6 m then he exerts a horizontal force of 75 N for 3 m and a horizontal force of 100 N for 2 m. How much work did he do against friction? (Assume all work done was against friction and the box moved at a constant speed.)

Power

12. An engine moves a boat through the water at a constant speed of 15 m/s. The engine must exert a force of 6000 N to balance the force that water exerts against the hull. What power does the engine develop?

13. A 188 W motor will lift a load at the rate (speed) of 6.5 cm/s. How great a load can the motor lift at this speed?

14. A ski lift lifts a line of skiers of total mass of 1100 kg along a 50^o "frictionless" incline a distance of 400 m in 125 s. The skiers moved a horizontal distance of 257.1 m. How much power does the ski lift use?

Kinetic and Potential Energy

15. Sally has a mass of 45 kg and is moving with a speed of 10 m/s. What is Sally's kinetic energy? Salle's speed changes to 5 m/s, what is her new kinetic energy? What is Sally's change in kinetic energy?

16. Shawn and his bike have a total mass of 45 kg. Shawn rides his bike 1.8 km in 10 minutes at a constant velocity. What is Shawn's kinetic energy?

17. Sally and Lisa each have a mass of 45 kg and they are moving together with a speed of 10 m/s. What is their combined kinetic energy?

18. How much potential energy does Tim, mass 67 kg, gain when he climbs a gymnasium rope a distance of 3.5 m?

19. A 6.4 kg bowling ball is lifted 2.1 m into a storage rack. Calculate the increase in the ball's potential.

20. Mary weighs 500 N and she walks down a flight of stairs to a level 5.5 m below her starting point. What is the change in Mary's potential?

21. A weightlifter raises a 180 kg barbell to a height of 1.95 m. What is the increase in the barbell's potential energy?

22. Ace raises a 12 N physics book from a table 75 cm above the floor to a shelf, 2.15 m above the floor. What is the change in potential energy

Conservation of Energy

23. A 50 kg skier is standing at the top of a 30 m hill. What would his maximum possible speed be at the bottom of the hill?

24. Suppose that skier had to come to a stop at the bottom of the hill, what average braking force would be necessary for him to stop in 75 from the base of the hill?

25. A 20,000 N cars is traveling at 30 m/s. The brakes are suddenly applied and the car slides to a stop. The average braking force between the tires and the road is 7,500 N. How far will the car slide once the brakes are applied?

26. A 5 kg ball is dropped from a height of 3 m onto a vertical spring, which has a force constant of 800 N/m. How much will the spring compress?

27. A 2000 kg car is traveling at 100 m/s, what force must the brakes exert to stop the car in 55 m before the car hits the black cow standing in the middle of the dark road at midnight?

28. A 150 kg man is standing on the 20^{th} step of a ladder which has steps 0.5 m apart. If he fell from this height, what would his kinetic energy be just before he hit the ground?

29. A vertical spring with a spring constant of 900 N/m has been compressed 0.8 m. The vertical spring is then used to launch a 2 kg ball straight up into the air. How high will the ball go?

30. A 100 kg skier is going 70 m/s at the bottom of the hill. What is the height of the hill?

1. 800 J	2. 11760 J	3. 59.9 kg	4. 31200 J	5. 12035 J	6. 64.9 N
7. 18155 J	8. 0 J	9. 7.7 J	10. 7350 J	11. 725 J	12. 90000 W
13. 2892 N	14. 26424 W	15. 2250 J & 563 J	16. 203 J	17. 4500 J	18. 2298 J
19. 132 J	20. -2750 J	21. 3440 J	22. 16.8 J	23. 24.2 m/s	24. 196 N
25. 122 m	26. 0.606 m	27. 181818 N	28. 14700 J	29. 14.7 m	30. 250 m