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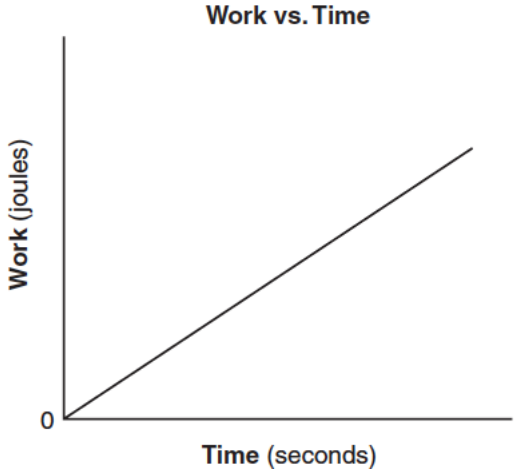
WEP-Work and Power

1. The work done in accelerating an object along a frictionless horizontal surface is equal to the change in the object's
   1. momentum
   2. velocity
   3. potential energy
   4. kinetic energy

2. The graph below represents the relationship between the work done by a student running up a flight of stairs and the time of ascent.



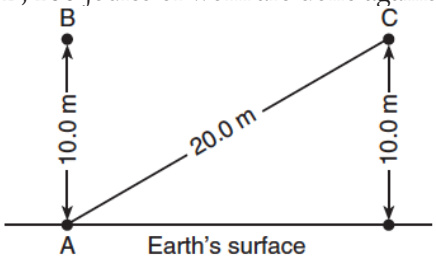
   What does the slope of this graph represent?
   1. impulse
   2. momentum
   3. speed
   4. power

3. A student does 60 joules of work pushing a 3.0-kilogram box up the full length of a ramp that is 5.0 meters long. What is the magnitude of the force applied to the box to do this work?
   1. 20 N
   2. 15 N
   3. 12 N
   4. 4.0 N

4. A boat weighing 900 newtons requires a horizontal force of 600 newtons to move it across the water at 15 meters per second. The boat's engine must provide energy at the rate of
   1. 2.5×10^{-2} J
   2. 4.0×10^{1} W
   3. 7.5×10^{3} J
   4. 9.0×10^{3} W

5. A motor used 120 watts of power to raise a 15-newton object in 5.0 seconds. Through what vertical distance was the object raised?
   1. 1.6 m
   2. 8.0 m
   3. 40 m
   4. 360 m

6. The diagram below shows points A, B, and C at or near Earth's surface. As a mass is moved from A to B, 100 joules of work are done against gravity.



   What is the amount of work done against gravity as an identical mass is moved from A to C?
   1. 100 J
   2. 173 J
   3. 200 J
   4. 273 J

7. One watt is equivalent to one
   1. N·m
   2. N/m
   3. J·s
   4. J/s

8. Two weightlifters, one 1.5 meters tall and one 2.0 meters tall, raise identical 50-kilogram masses above their heads. Compared to the work done by the weightlifter who is 1.5 meters tall, the work done by the weightlifter who is 2.0 meters tall is
   1. less
   2. greater
   3. the same

9. A 40-kilogram student runs up a staircase to a floor that is 5.0 meters higher than her starting point in 7.0 seconds. The student's power output is
   1. 29 W
   2. 280 W
   3. 1.4×10^{3} W
   4. 1.4×10^{4} W

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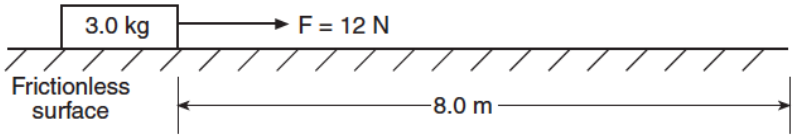
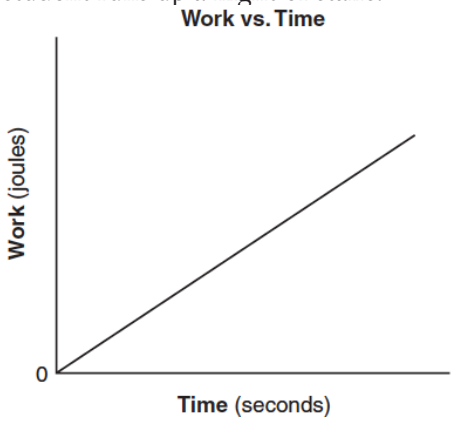
WEP-Work and Power

10. A 3.0-kilogram block is initially at rest on a frictionless, horizontal surface. The block is moved 8.0 meters in 2.0 seconds by the application of a 12-newton horizontal force, as shown in the diagram below.



What is the average power developed while moving the block?
1. 24 W
2. 32 W
3. 48 W
4. 96 W

11. The graph below shows the relationship between the work done by a student and the time of ascent as the student runs up a flight of stairs.



The slope of the graph would have units of
1. joules
2. seconds
3. watts
4. newtons

12. The amount of work done against friction to slide a box in a straight line across a uniform, horizontal floor depends most on the
1. time taken to move the box
2. distance the box is moved
3. speed of the box
4. direction of the box's motion

13. What is the average power developed by a motor as it lifts a 400-kilogram mass at a constant speed through a vertical distance of 10 meters in 8 seconds?
1. 320 W
2. 500 W
3. 4,900 W
4. 32,000 W

14. The work done in lifting an apple one meter near Earth's surface is approximately
1. 1 J
2. 0.01 J
3. 100 J
4. 1000 J

15. A 70-kilogram cyclist develops 210 watts of power while pedaling at a constant velocity of 7.0 meters per second east. What average force is exerted eastward on the bicycle to maintain this constant speed?
1. 490 N
2. 30 N
3. 3.0 N
4. 0 N

16. A 95-kilogram student climbs 4.0 meters up a rope in 3.0 seconds. What is the power output of the student?
1. 130 W
2. 380 W
3. 1200 W
4. 3700 W

17. Which is an SI unit for work done on an object?
1. $\frac{kg \bullet m^2}{s^2}$
2. $\frac{kg \bullet m^2}{s}$
3. $\frac{kg \bullet m}{s}$
4. $\frac{kg \bullet m}{s^2}$

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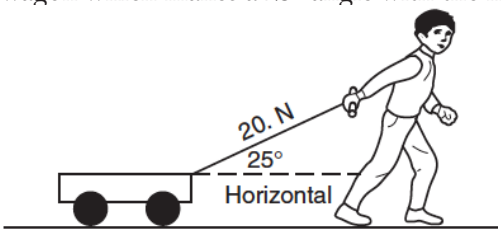
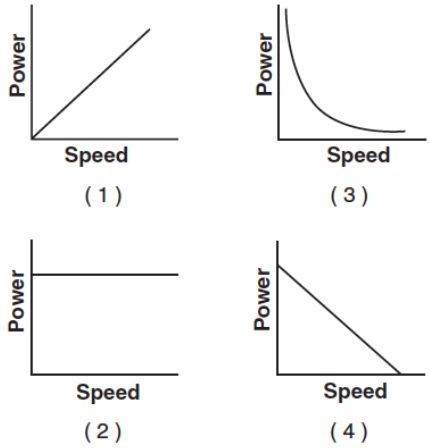
WEP-Work and Power

18. As shown in the diagram below, a child applies a constant 20-newton force along the handle of a wagon which makes a 25° angle with the horizontal.



How much work does the child do in moving the wagon a horizontal distance of 4.0 meters?
1. 5.0 J
2. 34 J
3. 73 J
4. 80 J

19. Which graph best represents the relationship between the power required to raise an elevator and the speed at which the elevator rises?



20. A 110-kilogram bodybuilder and his 55-kilogram friend run up identical flights of stairs. The bodybuilder reaches the top in 4.0 seconds while his friend takes 2.0 seconds. Compared to the power developed by the bodybuilder while running up the stairs, the power developed by his friend is
1. the same
2. twice as much
3. half as much
4. four times as much

21. Which quantity is a vector?
1. impulse
2. power
3. speed
4. time

22. Which quantity is a measure of the rate at which work is done?
1. energy
2. power
3. momentum
4. velocity

23. What is the average power required to raise a 1.81×10^4-newton elevator 12.0 meters in 22.5 seconds?
1. 8.04×10^2 W
2. 9.65×10^3 W
3. 2.17×10^5 W
4. 4.89×10^6 W

24. A 15.0-kilogram mass is moving at 7.50 meters per second on a horizontal, frictionless surface. What is the total work that must be done on the mass to increase its speed to 11.5 meters per second?
1. 120 J
2. 422 J
3. 570 J
4. 992 J

25. A truck weighing 3.0×10^4 newtons was driven up a hill that is 1.6×10^3 meters long to a level area that is 8.0×10^2 meters above the starting point. If the trip took 480 seconds, what was the *minimum* power required?
1. 5.0×10^4 W
2. 1.0×10^5 W
3. 1.2×10^{10} W
4. 2.3×10^{10} W

26. A joule is equivalent to a
1. N·m
2. N·s
3. N/m
4. N/s

27. What is the power output of an electric motor that lifts a 2.0-kilogram block 15 meters vertically in 6.0 seconds?
1. 5.0 J
2. 5.0 W
3. 49 J
4. 49 W

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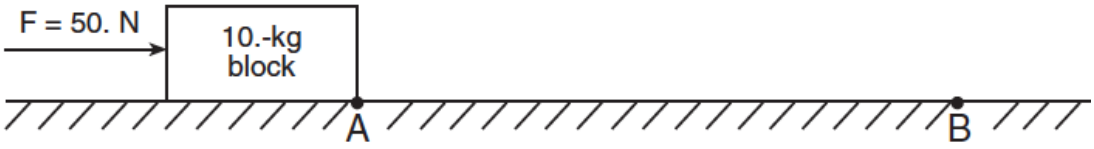
WEP-Work and Power

Base your answers to questions 28 and 29 on the information and diagram below.

A 10-kilogram block is pushed across a floor by a horizontal force of 50 newtons. The block moves from point A to point B in 3.0 seconds.



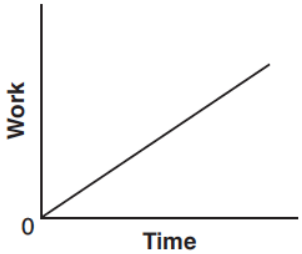
28. Using a scale of 1.0 centimeter = 1.0 meter, determine the magnitude of the displacement of the block as it moves from point A to point B.

29. Calculate the power required to move the block from point A to point B in 3.0 seconds. [Show all work, including the equation and substitution with units.]

30. How much work is required to lift a 10-newton weight from 4.0 meters to 40 meters above the surface of Earth?
    1. 2.5 J
    2. 3.6 J
    3. 3.6×10^2 J
    4. 4.0×10^2 J

31. Student A lifts a 50-newton box from the floor to a height of 0.40 meter in 2.0 seconds. Student B lifts a 40-newton box from the floor to a height of 0.50 meter in 1.0 second. Compared to student A, student B does
    1. the same work but develops more power
    2. the same work but develops less power
    3. more work but develops less power
    4. less work but develops more power

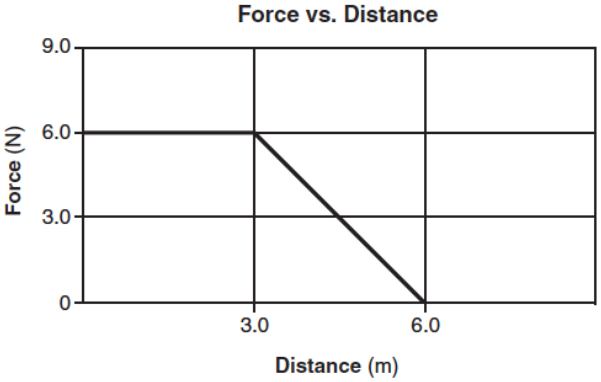
32. The graph below represents the relationship between the work done by a person and time.



Identify the physical quantity represented by the slope of the graph.

33. A 60-kilogram student climbs a ladder a vertical distance of 4.0 meters in 8.0 seconds. Approximately how much total work is done against gravity by the student during the climb?
    1. 2.4×10^3 J
    2. 2.9×10^2 J
    3. 2.4×10^2 J
    4. 3.0×10^1 J

34. A box is pushed to the right with a varying horizontal force. The graph below represents the relationship between the applied force and the distance the box moves.



What is the total work done in moving the box 6.0 meters?
    1. 9.0 J
    2. 18 J
    3. 27 J
    4. 36 J

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WEP-Work and Power

35. The total work done in lifting a typical high school physics textbook a vertical distance of 0.10 meter is approximately
    1. 0.15 J
    2. 1.5 J
    3. 15 J
    4. 150 J

36. Through what vertical distance is a 50-newton object moved if 250 joules of work is done against the gravitational field of Earth?
    1. 2.5 m
    2. 5.0 m
    3. 9.8 m
    4. 25 m

37. A small electric motor is used to lift a 0.50-kilogram mass at constant speed. If the mass is lifted a vertical distance of 1.5 meters in 5.0 seconds, the average power developed by the motor is
    1. 0.15 W
    2. 1.5 W
    3. 3.8 W
    4. 7.5 W

38. What is the maximum amount of work that a 6000-watt motor can do in 10 seconds?
    1. 6.0×10^1 J
    2. 6.0×10^2 J
    3. 6.0×10^3 J
    4. 6.0×10^4 J

39. How much work is done by the force lifting a 0.1-kilogram hamburger vertically upward at constant velocity 0.3 meter from a table?
    1. 0.03 J
    2. 0.1 J
    3. 0.3 J
    4. 0.4 J

40. The watt·second is a unit of
    1. power
    2. energy
    3. potential difference
    4. electric field strength

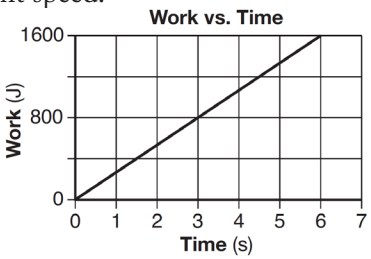
41. Which quantity has both a magnitude and direction?
    1. energy
    2. impulse
    3. power
    4. work

42. Two elevators, A and B, move at constant speed. Elevator B moves with twice the speed of elevator A. Elevator B weighs twice as much as elevator A. Compared to the power needed to lift elevator A, the power needed to lift elevator B is
    1. the same
    2. twice as great
    3. half as great
    4. four times as great

43. What is the maximum height to which a motor having a power rating of 20.4 watts can lift a 5.00-kilogram stone vertically in 10 seconds?
    1. 0.0416 m
    2. 0.408 m
    3. 4.16 m
    4. 40.8 m

44. If a motor lifts a 400-kilogram mass a vertical distance of 10 meters in 8.0 seconds, the minimum power generated by the motor is
    1. 3.2×10^2 W
    2. 5.0×10^2 W
    3. 4.9×10^3 W
    4. 3.2×10^4 W

45. The graph below represents the work done against gravity by a student as she walks up a flight of stairs at constant speed.



Compared to the power generated by the student after 2.0 seconds, the power generated by the student after 4.0 seconds is
    1. the same
    2. twice as great
    3. half as great
    4. four times as great

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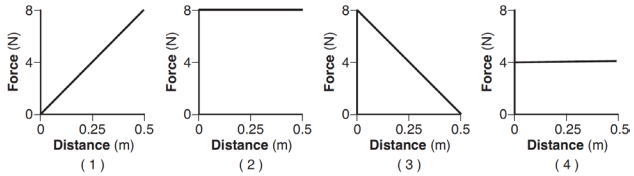
WEP-Work and Power

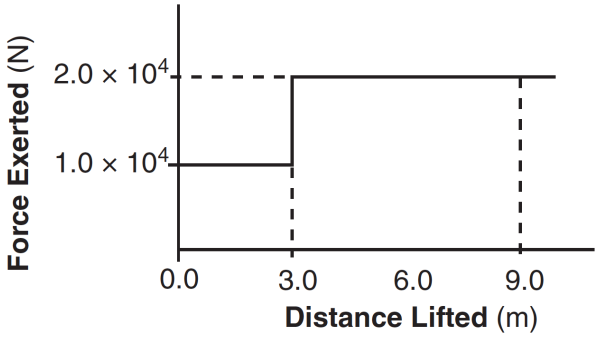
46. Which graph best represents the greatest amount of work?



47. Calculate the average power required to lift a 490-newton object a vertical distance of 2.0 meters in 10 seconds. [Show all work, including the equation and substitution with units.]

48. Which combination of fundamental units can be used to express the amount of work done on an object?
    1. kg·m/s
    2. kg·m/s^2
    3. kg·m^2/s^2
    4. kg·m^2/s^3

49. The graph below represents the relationship between the force exerted on an elevator and the distance the elevator is lifted.



How much total work is done by the force in lifting the elvator from 0.0 m to 9.0 m?
    1. 9.0 × 10^4 J
    2. 1.2 × 10^5 J
    3. 1.5 × 10^5 J
    4. 1.8 × 10^5 J

50. An electric motor has a rating of 4.0 × 10^2 watts. How much time will it take for this motor to lift a 50-kilogram mass a vertical distance of 8.0 meters? [Assume 100% efficiency.]
    1. 0.98 s
    2. 9.8 s
    3. 98 s
    4. 980 s

51. Calculate the minimum power output of an electric motor that lifts a 1.30 × 10^4-newton elevator car vertically upward at a constant speed of 1.50 meters per second. [Show all work, including the equation and substitution with units.]