Review Questions

1. Which combination of units can be used to express work?
   (1) newton · second/meter
   (2) newton · meter/second
   (3) newton/meter
   (4) newton · meter

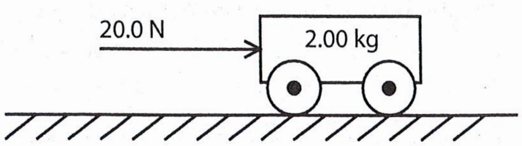
2. A jack exerts a vertical force of 4.5×10^3 newtons to raise a car 0.25 meter. How much work is done by the jack?
   (1) 5.6×10^{-5} J
   (2) 1.1×10^3 J
   (3) 4.5×10^3 J
   (4) 1.8×10^4 J

3. If a 2.0-kilogram mass is raised 0.050 meter vertically, the work done on the mass is approximately
   (1) 0.10 J
   (2) 0.98 J
   (3) 9.8 J
   (4) 40. J

4. A total of 640 joules of work is done on a 50.-kilogram object as it is moved 8.0 meters across a level floor by the application of a horizontal force. Determine the magnitude of the horizontal force applied to the object.

5. Work is being done when a force
   (1) acts vertically on a cart that can only move horizontally
   (2) is exerted by one team in a tug of war when there is no movement
   (3) is exerted while pulling a wagon up a hill
   (4) of gravitational attraction acts on a person standing on the surface of Earth

6. In the diagram below, a horizontal force with a magnitude of 20.0 newtons is used to push a 2.00-kilogram cart a distance of 5.00 meters along a level floor.



Determine the amount of work done on the cart.

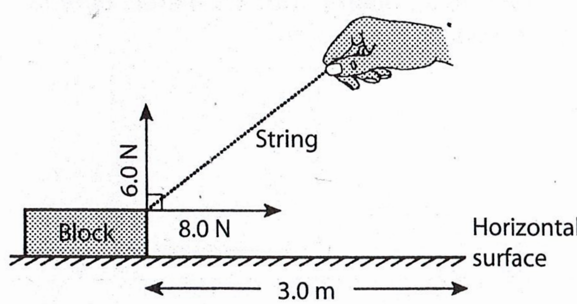
7. A constant force with a magnitude of 1.9×10^3 newtons is required to keep an automobile having a mass of 1.0×10^3 kilograms moving at a constant speed of 20. meters per second. The work done in moving the automobile a distance of 2.0×10^3 meters is
   (1) 2.0×10^4 J
   (2) 3.8×10^4 J
   (3) 2.0×10^6 J
   (4) 3.8×10^6 J

8. A student does 300. joules of work pushing a cart 3.0 meters due east and then does 400. joules of work pushing the cart 4.0 meters due north. The total amount of work done by the student is
   (1) 100. J
   (2) 500. J
   (3) 700. J
   (4) 2500 J

9. A constant horizontal force of 20.0 newtons east applied to a box causes it to move at a constant speed of 4.0 meters per second. Calculate how much work is done against friction on the box in 6.0 seconds.

10. A horizontal force with a magnitude of 3.0 newtons applied to a 7.0-kilogram mass moves the mass horizontally a distance of 2.0 meters. Determine the work done against gravity in moving the mass.

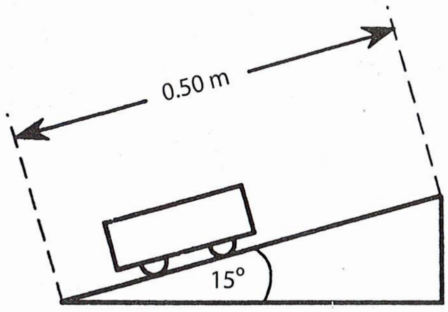
11. A student pulls a block along a horizontal surface at constant velocity. The diagram below shows the components of the force exerted on the block by the student.



Calculate the work done against friction.

12. A total of 8.0 joules of work is done when a constant horizontal force of 2.0 newtons to the left is used to push a 3.0-kilogram box across a counter top. Determine the total horizontal distance the box moves.

13. The diagram below shows a 9.8-newton cart being pulled 0.50 meter along a plane inclined at 15° to the horizontal. The amount of work required is 1.3 joules.



If the cart was raised 0.50 meter vertically instead of being pulled along the inclined plane, the amount of work done would be

(1) 0.0 J (2) 1.3 J (3) 4.9 J (4) 9.8 J

14. A crane raises a 200-newton weight to a height of 50 meters in 5 seconds. The crane does work at the rate of

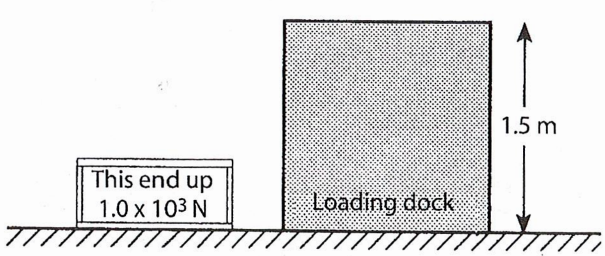
(1) 8×10^{-1} W
(2) 2×10^{1} W
(3) 2×10^{3} W
(4) 5×10^{4} W

15. What is the maximum amount of work that a 5000.-watt motor can do in 10. seconds?

(1) 5.0×10^{1} J
(2) 5.0×10^{2} J
(3) 5.0×10^{3} J
(4) 5.0×10^{4} J

16. An engine rated at 5.0×10^{4} watts exerts a constant force of 2.5×10^{3} newtons on a vehicle. Determine the average speed of the vehicle.

17. The diagram below shows a 1.0×10^{3}-newton crate to be lifted at constant speed from the ground to a loading dock 1.5 meters high in 5.0 seconds.



What power is required to lift the crate?

(1) 1.5×10^{3} W
(2) 2.0×10^{2} W
(3) 3.0×10^{2} W
(4) 7.5×10^{3} W

18. 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 10.0 meters in 8.0 seconds?

(1) 320 W
(2) 500 W
(3) 4,900 W
(4) 32,000 W

19. Determine the power developed by a man weighing 6.0×10^{2} newtons who climbs a rope at a constant speed of 2.0 meters per second.

20. Student *A* lifts a 40.-newton box from the floor to a height of 0.30 meter in 2.0 seconds. Student *B* lifts a 30.-newton box from the floor to a height of 0.40 meter in 4.0 seconds. Compared to student *A*, student *B* does

(1) less work but develops more power
(2) more work but develops less power
(3) the same work but develops less power
(4) the same work but develops more power

21. A 5.0×10^{2}-newton girl develops 250 watts of power as she runs up two flights of stairs to a landing a total of 5.0 meters vertically above her starting point. Calculate the time required for the girl to run up the stairs.

22. A motor having a maximum power rating of 8.1×10^{4} watts is used to operate an elevator with a weight of 1.8×10^{4} newtons. What is the maximum weight this motor can lift at an average speed of 3.0 meters per second?

(1) 6.0×10^{3} N
(2) 1.8×10^{4} N
(3) 2.4×10^{4} N
(4) 2.7×10^{4} N

23. A girl weighing 500. newtons takes 50.0 seconds to climb a flight of stairs 18 meters high. Calculate the girl's vertical power output.

24. If the time required for a student to swim 500. meters is doubled, the power developed by the student will be

(1) halved
(2) doubled
(3) quartered
(4) quadrupled

25. Calculate the average speed of a 4.0×10^{2}-newton weight being lifted vertically by a 2.00×10^{3}-watt motor.

Forms of Energy

As already noted, energy and work are related. The joule is the SI unit for both quantities, which are scalar. When one system does work on another system, the second system gains an amount of energy equal to