

Energy Unit Review

Energy Unit Test will cover the following:

- ☐ Work
- ☐ Mechanical energy (potential energy and kinetic energy)
- ☐ Thermal energy
- ☐ Law of conservation of energy
- ☐ Power
- ☐ Efficiency

Use: $g = 9.81 \text{ N/kg}$

1. Potential energy is the energy an object has due to its _____.
2. How much potential energy is gained by a 20 kg bag of sugar lifted from the floor to a shelf 2.0 m high?
[$3.9 \times 10^2 \text{ J}$]
3. A ball with a mass of 25 kg is suspended by a string from the ceiling. In this position it possesses 100 J of Potential Energy with respect to the floor. If the string is cut, what velocity will the ball strike the floor at?
[2.8 m/s]
4. A 20 g bullet is shot vertically upward with $3.6 \times 10^5 \text{ J}$ of Kinetic Energy. What maximum height will it reach? [$1.8 \times 10^6 \text{ m}$]
5. A car of mass 1250 kg travels down a hill 45 m high. If the total kinetic energy at the bottom of the hill was $1.5 \times 10^5 \text{ J}$, how much energy was lost due to friction/heat? [$4.0 \times 10^5 \text{ J}$]
6. How much work is done by a 70 kg worker exerting a force of 1000 N against an immovable wall? [0 J]
7. If 125 J of work are used to push a 12 kg box along a table using 65 N of force, how far will the box travel?
[1.9 m]
8. An athlete is able to raise his body a distance of 2.1 m in a time span of 1.50 s. What average power does he develop? (his body mass is 60 kg) [$8.2 \times 10^2 \text{ W}$]
9. A 35 kg ball is raised to a height of 15 m and is then dropped. What is its total energy when it is half-way back to the ground? [$5.2 \times 10^3 \text{ J}$]
10. A 30 N force moves a mass through a distance of 10 m in 20 s. What is the power? [15 W]
11. Which of the following requires the most power?
 - a. climbing 2 flights of stairs in 6 s.
 - b. climbing 1 flight of stairs in 4 s.
 - c. running down 3 flights of stairs in 14 s.
 - d. climbing 3 flights of stairs in 12 s.
12. An engine does $1.2 \times 10^4 \text{ J}$ of work in 60 minutes. What is the engine's power? [3.3 W]

[a]

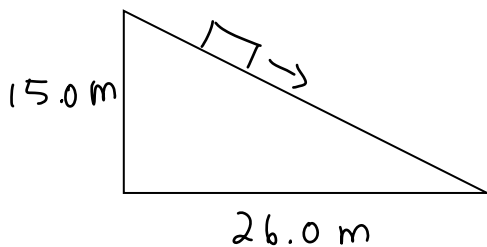
13. A mass of 30 kg is lifted at a steady speed from the ground to a platform 1.5 m above the ground. Calculate the work done on the mass. $[4.4 \times 10^2 \text{ J}]$

14. A person did 5,400 J of work in pushing a car a distance of 60 m. What average force did the person exert? $[90 \text{ N}]$

15. What is the gravitational potential energy of a 20.0 kg box if it is lifted 950 cm respective to the ground? $[1.86 \times 10^3 \text{ J}]$

16. What is the kinetic energy of a 700g ball rolling down a hill at 24.0 m/s? $[202 \text{ J}]$

17. A heavy box slides down a frictionless incline as shown in the diagram. If the box starts from rest at the top of the incline, what is the speed at the bottom? $[17.2 \text{ m/s}]$



18. King Kong is running at a speed of 15.0 m/s and grabs a hanging vine. How high can King Kong swing? $[11.5 \text{ m}]$

19. A 200kg box is pulled 14.0 m along a level surface by a rope. If the rope makes an angle with the surface of 30.0° , and the force exerted through the rope is 175 N, how much work is done on the box? $[2.12 \times 10^3 \text{ J}]$

20. An insulated container contains 540g of water at 35.0°C . If 400g of copper ($c=390 \text{ J/kg}\cdot^\circ\text{C}$) at temperature 115°C is added, what is the final temperature when the mixture it is completely mixed? $[40.1^\circ\text{C}]$
Hint: $\Delta E_{\text{hw}} + \Delta E_{\text{hc}} = 0$

21. A 200 W electric motor is used to lift a 63.0 kg mass to a height of 7.00 m in 24.0 s. What is the efficiency of the motor? $[90.1\%]$

22. You exert a force of 250 N in pulling 16.0 m of rope using a pulley system to lift a 635 N object 4.50 m. What is the efficiency of the pulley system? $[71.4\%]$

23. State the Law of Conservation of Energy. Back up your explanation mathematically.

24. What force is needed to push a 55.0 kg box up the incline described in the diagram below if the efficiency of the machine (ramp) is 75.7%? $[356 \text{ N}]$

