Work, Energy and Power

Choose one answer per question. Circle A, B, C, or D.

1. A student supports a stack of books for 10 seconds. The stack stays in the same position the entire time. How much mechanical work does the student’s upward force do on the stack?

A. 0 joules
B. 10 joules
C. 20 joules
D. It depends on the weight of the books.

2. A model elevator moves upward. Gravity pulls downward on its cabin. What is the sign of the work gravity does on the cabin while it rises?

A. Zero
B. Positive
C. Negative
D. It changes from positive to negative if the cabin rises at constant speed.

3. Two students each transfer the same amount of energy to raise identical classroom props. One transfers it in half the time. How does that student’s average power compare with the other’s?

A. It is half as large.
B. It is twice as large.
C. It is the same.
D. It is four times as large.

4. An electric reading lamp runs at a steady temperature. What happens to the electrical energy it receives?

A. It becomes only thermal energy, even though the lamp emits light.
B. It all stays stored in the lamp.
C. It supplies light, and any part that warms the surroundings vanishes.
D. It leaves as light and as thermal energy transferred to the surroundings.

5. Two gliders move at the same speed along an air track. Glider A has three times the mass of glider B. How does A’s kinetic energy compare with B’s?

A. It is nine times as large.
B. It is three times as large.
C. It is one-third as large.
D. It is the same.

6. A student pushes a supply crate with a constant 18-newton force in the direction of its 6-meter displacement. How much work does the student’s push do?

A. 108 joules
B. 24 joules
C. 12 joules
D. 3 joules

7. A student pulls a teaching model horizontally 4 meters with a 25-newton force at 60 degrees above the horizontal. Use a cosine of 0.50 for that angle. How much work does the pull do?

A. 200 joules
B. 100 joules
C. 25 joules
D. 50 joules

8. A tabletop lifting model does 480 joules of useful work in 12 seconds. What is its average useful power?

A. 48 watts
B. 12 watts
C. 40 watts
D. 5,760 watts

9. A 6-kilogram tray is raised from 0.30 meter above the floor to 1.10 meters. Use 10 meters per second squared for gravitational acceleration. How much does its gravitational potential energy increase?

A. 48 joules
B. 18 joules
C. 66 joules
D. 84 joules

10. A small lamp draws a constant 8 watts for 5 minutes. How much electrical energy does it use during that time?

A. 4,800 joules
B. 40 joules
C. 300 joules
D. 2,400 joules

11. A 2-kilogram glider initially moves at 3 meters per second on a level air track. The net work done on it is positive 7 joules. What is its final speed?

A. 7 meters per second
B. 2 meters per second
C. 4 meters per second
D. 10 meters per second

12. A sliding block starts up a ramp with 12 joules of kinetic energy. Over the part of the ramp studied, gravitational potential energy increases by 8 joules, and friction converts 3 joules of mechanical energy into thermal energy. No other energy transfers occur. How much kinetic energy remains?

A. 4 joules
B. 1 joule
C. 7 joules
D. 9 joules

13. A model pump uses 240 joules of electrical energy and does 180 joules of useful work raising water. What is its efficiency for the raising task?

A. 80%
B. 25%
C. 60%
D. 75%

14. Two devices each deliver 360 joules of useful lifting work. Device A averages 100 watts of input for 6 seconds. Device B averages 60 watts of input for 9 seconds. Which device has the higher efficiency?

A. Device B, because it uses less input energy for the same useful work.
B. Device A, because taking less time always means higher efficiency.
C. Device A, because drawing more input power means it wastes less energy.
D. They have the same efficiency because they do the same useful work.

15. A tabletop hoist draws 80 watts with 75% efficiency. It lifts a 12-kilogram load at constant speed through a vertical distance of 3 meters. Use 10 meters per second squared for gravitational acceleration. How long does the lift take?

A. 8 seconds
B. 4.5 seconds
C. 6 seconds
D. 18 seconds