Name: _____ Date: _____

PHYSICS
Work, Power, and Energy

Calculations of WORK AGAINST GRAVITY & POWER

Work is defined as using a constant parallel force to displace and object. In other words, for work to happen, a force must be able to move an object from one place to another. If the object does not move, no work is performed. Also, the force that moves the object must be parallel to the direction of motion. The unit for work is JOULES (J).

Power is defined at the rate (how fast) at which work is performed. Power is also defined as the rate (how fast) that energy is used or consumed by matter as work is performed. The unit for power is WATTS (no symbol, spell out the word).

Work Against Gravity

Work against gravity is the work when an object is lifted upward against the downward force of gravity to a given height above a permanent surface. h is the height. The greater the value of h (the higher it is lifted) the more work is performed. The work against gravity equation includes the mass (m) of the object being lifted and the acceleration of Earth's gravity field (g).

Work against gravity

$$W = m \cdot g \cdot h$$

Power

$$P = \frac{W}{t}$$

W = work (J)
m = mass (kg)
g = 9.81 m/s^2
P = power (Watts)
t = time (s)
h = height (m)

- Show all of your work in the box under the question.
- Identify the number in the problem. Time must be in seconds.
- Correctly match them with their variables.
- Use the correct equation.
- Solve the problem.

1.

Margaret walked up four flights of stairs, 14 meters, in 45 seconds. Margaret has a mass of 55 kg.

Calculate the work.	Calculate the power.

2.

Julio walked up stairs to the 7th floor of the hospital. He climbed a total of 24 meters in 2 minutes. Julio has a mass of 110 kg.

Calculate the work.	Calculate the power.

3.

A crane lifted four steel beams from the ground to a height of 190 meters in 2 minutes. The total mass of the beams is 300 kg.

Calculate the work.	Calculate the power.

4.

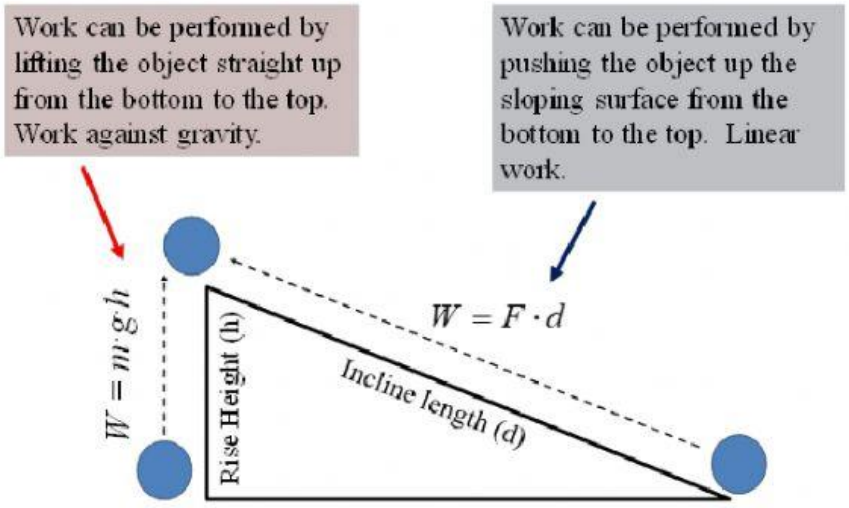
A crane lifted four steel beams from the ground to a height of 108 meters in 1 minute. The total mass of the beams is 140 kg.

Calculate the parallel force.	Calculate the power.

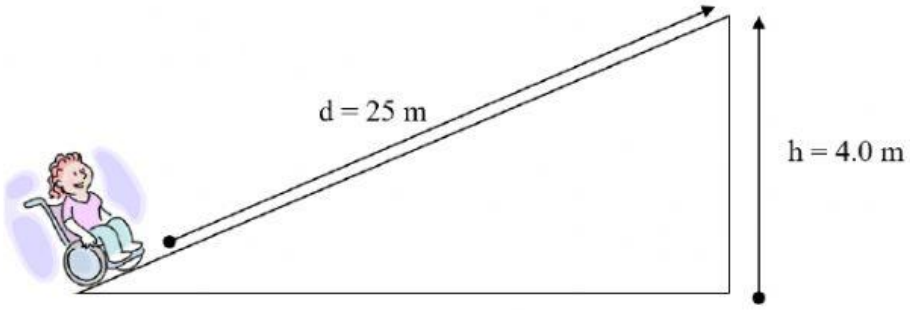
Part 2. Work, power, and force on an inclined plane. The amount of work to move an object from the bottom to the top of an inclined plane is the same regardless of how the object gets there. The forces are different.

$$W_{WAG} = W_{linear}$$
$$m \cdot g \cdot h = F \cdot d$$

W = work (J)
m = mass (kg)
h = height (m)
g = 9.81 m/s^2
F = parallel force (N)
d = distance on slope (m)

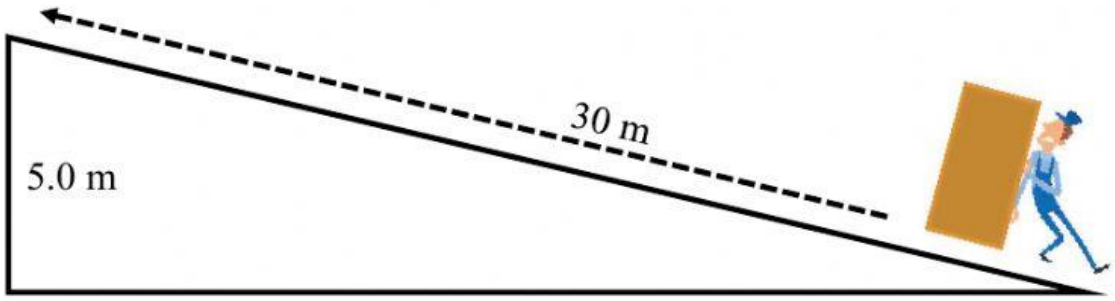


1. Leah rolled herself up the ramp to the library's front door in 40 seconds. The height of the ramp is 4.0 meters. The length of the ramp's sloping surface is 25 meters. The combined mass of Leah and her wheelchair is 80 kg. Assume no friction.



Calculate the work	Calculate the power	Calculate the parallel force

2. Reggie pushes a refrigerator up a 30 m slope to the top in 2 minutes. The rise height of the ramp is 5.0 m. The mass of the refrigerator is 120 kg. Assume no friction.



Calculate the work	Calculate the power	Calculate the parallel force