Chapter 5

Work and NRG

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Work

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Objectives

- **Recognize** the difference between the scientific and ordinary definitions of work.

- **Define** work by relating it to force and displacement.

- **Identify** where work is being performed in a variety of situations.

- **Calculate** the net work done when many forces are applied to an object.

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Work - Everyday

- When I carry a 35 kg box across the room, am I doing work on the box?

- When I do a wall sit, am I doing work on the wall?

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Work - Physics

- When I lift a 35 kg box off the ground, am I doing work on the box?

- When I push a car down the road, am I doing work on the car?

What is the difference between everyday work and physics work?

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Work - Physics

- **Work** is done on an object when a force causes a <u>displacement</u> of the object.

- **Work** is done only when components of a force are <u>parallel</u> to a displacement.

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Sign of Work

- Work can be positive or negative
  - Positive work happens when the force and the direction of displacement are…

  - Negative work happens when the force and the direction of displacement are…

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Work

- Work (J) = F_{net}(N) * displacement (m)
- W = Fd

- How much work is done on a box when a 50 N force (to the right) moves the box 3 meters (to the right)?

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Practice
W = Fd

How much work is done on a box pulled 3 meters by a force of 50 N at an angle of 30° above the horizontal?

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How much work is done when you apply a 195 N force to the right on a 45 kg box and it is moved 5 meters to the right across the floor? (the coefficient of kinetic friction is 0.24)   W = Fd

F_N = 9.81 * 45 = 441.45 N
F_f = 441.45 * 0.24 = 105.95 N (left)
F_{net} = 195 – 105.95 = 89.05 N (right)
W = 89.05 * 5 = 445.25 J

How much work is done when you apply a 250 N force (parallel to surface) on a 45 kg box and it is moved 5 meters across the floor?   W = Fd

(the coefficient of kinetic friction is 0.24 and the floor is elevated at an angle of 15 degrees N of E)

F_g = 9.81 * 45 = 441.45 N
F_{gy} = cos (15) * 441.45 = 426.41 N
F_f = 426.41* 0.24 = 102.34 N
F_{gx} = sin (15) * 441.45 = 114.26 N
$F_{net,x}$ = 250 – (114.26 + 102.34) = 33.4 N
W = 33.4* 5 = 167 J

Assignment

- Q: 1-3,5,6 – Due tomorrow
- 5.1 Pack
- SP - A