Power and NET

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Net Force and Work

Situation 1: A car idles on a level surface at a constant velocity. It is observed moving a distance of 32 m. How much work is done on the car?

Constant velocity means no change in kinetic energy. No change in kinetic energy means no work is done. Or, constant velocity means no acceleration. No acceleration means no net force. No force, means no work is done.

Situation 2: You lift a 20 kg crate from the ground to a shelf 5 m high with a force of 215 N force. What is the velocity of the crate when it reaches the shelf?

Net force = 215-196=19 N. Work = 19 x 5 = 95 J = Change in K
V= 3.1 m/s

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Power

- Definition
  - the rate at which work is done
- Equation (Linear)

$$P = \frac{Work}{t} = \frac{Fd}{t} = Fv$$

- Unit of Measure
  - Joule/second (J/s) or Watt (W)
- Conversion
  - 1hp = 746 W

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Power

- Recall the different ways to solve for work and energy:
  - $W = Fd$
  - $W = \frac{1}{2} mv^2 - \frac{1}{2} mv_o^2$
  - $K = \frac{1}{2} mv^2$
  - $U_g = mgh$
  - $U_s = \frac{1}{2} k\Delta x^2$
- Any of these can be used in the top of the power equation.

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Power Sample Problem 1

- Adrienne lifts a 23 kg box on to a shelf that is 1.8 m above the floor. If it takes 1.4 s for her to move the box, how much power is generated?

$$U_g = mgh$$
$$U_g = (23)(9.8)(1.8)$$
$$U_g = 406\,J$$

$$P = \frac{W}{t}$$
$$P = \frac{U_g}{t}$$
$$P = \frac{406}{1.4} = 290\text{W}$$

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Power Sample Problem 2

- An electric motor lifts an elevator 9.00 m in 15.0s by exerting an upward force of 1.20 x 10^4 N. What is the power of the motor?

$$W = Fd$$
$$W = (1.2x10^4)(9.00)$$
$$W = 108{,}000\,J$$

$$P = \frac{W}{t}$$
$$P = \frac{108{,}000}{15.0}$$
$$P = 7{,}200\text{ W}$$

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