Define the following:

A. Elastic Collision: Objects bounce

B. Inelastic Collision: Objects stick together

C. Friction: causes heat and wear, always opposes motion

D. Joule: Newton meter

E. Watt: Joules per second

Problems:

1. What is the momentum of an object that is 64 kg and is travelling at 9 m/s?
   
   \[ 64 \times 9 = 576 \text{ kgm/s} \]

2. If an object that is 343 kg is travelling at 12 m/s to the east, a second 201 kg object is travelling a 33 m/s to the west, they collide and stick together, what is the result of the collision?
   
   \[ (343 \times 12) + (201 \times (-33)) = (343 + 201) V_3 \]
   \[ 4116 + (-6633) = 544 V_3 \]
   \[ -2517 / 544 = -4.6 \text{ m/s} \]

3. A Ford Expedition with a mass of 2500 kg hits a Smart Car with a mass of 1136 kg head on and they stick together. They were both travelling at 17 m/s, but in opposite directions. Which way do they end up moving and how fast?
   
   \[ (2500 \times 17) + (1136 \times (-17)) = (2500 + 1136) V_3 \]
   \[ 42500 + (-19312) = 3636V_3 \]
   \[ 23188 / 3636 = 6.38 \text{ m/s} \]
4. You push a box with a force of $32\text{N}$ for a distance of $10\text{m}$. How much work was done?

$$W = Fd = 32 \times 10 = 320 \text{ J}$$

5. You lift that same box up $2\text{m}$, how much work was done?

$$W = mgh, 32\text{N} = mg, \text{ so } W = (32)h = 32(2) = 64 \text{ J}$$

6. You carry that same box on your shoulder a distance of $20\text{m}$. How much work was done?

Carrying is not work!

7. If you lift a $30 \text{ kg}$ box up $5\text{m}$ in $3\text{ seconds}$, how much power did you use?

$$W = mgh \text{ and } P = \frac{W}{t}, \text{ so } P = \frac{mgh}{t} \quad 30(9.8)5 / 3 = 490 \text{ W}$$

8. What takes more power to accomplish: lifting a $40\text{kg}$ box up $7\text{m}$ in $4\text{ seconds}$, or a $5\text{N}$ box up the same height in the same amount of time?

Same as above, so $40(9.8)7 / 4 = 686 \text{ W}$, and $Fd / t = 5(7) / 4 = 8.75 \text{ W}$

9. If you weigh $60\text{kg}$ and ran up our stairs ($4\text{m}$) in $5\text{ seconds}$, how much power did you generate?

Again, $W = mgh \text{ and } P = \frac{W}{t}, \text{ so } P = \frac{mgh}{t} \quad 60(9.8)4 / 5 = 470.5 \text{ W}$

10. If you generate $200 \text{ Watts}$ of power running up stairs in $8\text{ seconds}$, how much work did you do?

$$P = \frac{W}{t}$$  
$$W / 8 = 200$$  
$$W = 1600 \text{ J}$$