3D Force Diorama
Bug Meets Car

An average Goliath Beetle has a mass of 50g. An average car has a mass of 1300kg. An average bettle and an average car crash into each other and the car exerts a force of 6000N on the bug. The bug splats on the windshield of the car. How much force does the bug exert on the car? What is the acceleration of the bug and of the car?

1. How much force does the bug exert on the car?
   The bug exerts 6000N of force on the car but in the opposite direction of the force the car exerts on the bug. According to Newton's 3^{rd} Law, every action has an equal and opposite reaction. Therefore, the car exerts 6000N of force on the bug and the bug exerts -6000N of force on the car. The negative sign indicates direction.

2. Find the acceleration of the car.

   Given: $m_c = 1300kg$; $F_{c\to b} = 6000N$

$$\Sigma F = ma$$
$$6000N = (1300kg)a$$
$$\frac{6000N}{1300kg} = a$$
$$a = 4.62\frac{m}{s^2}$$

3. Find the acceleration of the bug.

   Given: $m_b = 50g = .05kg$; $F_{b\to c} = -6000N$

$$\Sigma F = ma$$
$$-6000N = (.05kg)a$$
$$\frac{-6000N}{.05kg} = a$$
$$a = -120,000\frac{m}{s^2}$$