Interacting Objects Activity – Fall 2016
Class #1 teacher instructions

Note: The idea for this class is to have student groups review their images (with forces drawn), turn one of them into a FBD, and identify all pairs of forces that are equal and opposite. Ideally, the FBDs done by groups should represent several different cases, including: 1) Stacked blocks on a horiz. surface with vertical interacting forces; 2) Blocks on a horiz surface with horiz interaction forces, and; 3) blocks on a slope.

Step 1 (start of class) (10-15 min.):

- Have groups review all images from their group (with forces drawn) on SMART Amp and correct any mistakes. Make sure groups work quickly. (This will be done in SMART Amp and JF & KL have groups work on SMART Boards, RA have groups work on computers)

Step 2 (10 min.):

- Have groups pick one photo and draw proper FBD of each interacting object (They do this in the centre-left block on their SMART Amp page and instead of drawing on top of the image they should create separate FBDs of each separate object drawn as an abstracted block).
    - Encourage a variety of different cases (see note above) by either assigning cases to groups or by circulating in the room and encouraging them to pick different cases.
    - Make sure groups pay attention to the relative magnitude of vectors and their directions so that the net forces on each are zero (accel=0).

Step 3 (5 min.):

- Have the groups identify all force pairs that are equal and opposite on their FBD (how they do this is up to you/them). (REMEMBER **don't** refer to the pairs as *3rd or 2nd Law pairs*.)

Step 3 (15 min.):

- Have groups present their images and FBDs to the class. As the groups present, make sure to correct any lingering mistakes in the FBDs and if needed, invoke the 2nd law and the need for the net force to be zero if accel is zero – **DO NOT INVOKE THE 3rd LAW.** (Note: If asked about a 3rd law pair and why they have to be equal and opposite, invoke the 2nd law on both/all objects together and include the (internal) interacting pair.)

Step 4 (10-15 min.):

- If needed or if the groups/class didn't pick one of each of the cases noted above, pick the missing case(s) from one of the provided images (shown below and included in "class#1 teacher SB file") and draw a proper FBD for each interacting object.
- Explain to the class that they have the following homework to do before next class:
    - They are to re-consider the image/photo that their group chose to draw a FBD of and draw the FBDs if the objects were accelerating.
    - Model what this would mean by reviewing your sample cases (Use "class#2 teacher SB file if you want) and then draw the forces ON ONLY ONE BODY (not more – don't want to give away the punch-line).
    - Explain that they will do this as homework in SMART Amp (same file as before but this time they do the FBD in the "Homework 2" area).

End. (If time remains in class do not have students begin working on their homework. Instead have some other task/activity to do so long as it <u>doesn't</u> involve interacting objects)

Provided images (these are in the teacher SB file):

1. 3 masses – acceleration vertically upwards: mass1=barbell, mass2=weightlifter, mass3=Earth

2. 3 masses – acceleration of car to left: mass1=car, mass2=person, mass3=Earth

3. 3 masses on a slope – acceleration up slope: mass1=T-bar, mass2=skiers, mass3=Earth