Newton's Third Law Worksheet - (Action-Reaction)

Try to answer the questions below.

1. A diver dives off of a raft - what happens to the diver? The raft? How does this relate to Newton's Third Law?
   Action Force: Diver push raft  Reaction Force: Raft pushes diver

2. A tennis racquet hits a tennis ball. Why doesn't the racquet swing backwards when the ball hits it? (Shouldn't it swing back because of action-reaction forces?)
   doesn't go back but does slow down also
   $M_{racket} > m_{ball}$  $a_{racket} < a_{ball}$

3. What action-reaction forces are involved when a rocket engine fires? Why doesn't a rocket need air to push on?
   Action Force: Rocket push exhaust  Reaction Force: exhaust pushes rocket
   not pushing air, pushing exhaust

4. What forces are acting on a book sitting on a table? Are action-reaction forces involved in this situation?
   $W + N$ Normal is reaction force to book pushing table

5. If two people each standing on a scooter board push off of each other what happens (Newton's 3rd Law)?
   they go in opposite directions

6. In #5 how would the distance moved by the scooter boards compare if one person had a lot more mass than the other person?
   $m_1 > m_2$  $a_1 < a_2$  $b/c$ $F_i = F_e$

7. If a person standing on a scooter board pushes off of a wall, what happens? Can this situation be explained in terms of Newton's 3rd Law (action-reaction)?
   person pushes wall = wall pushes person

8. How is shooting a shotgun related to Newton's 3rd Law? b. Why does a rifle have less "kick" than a shotgun?
   gun pushes bullet, so
   bullet pushes gun
   $F_{rifle} < F_{shotgun}$
Use Newton's third law (law of action-reaction) and Newton's second law (law of acceleration: \( a = F_{net}/m \)) to complete the following statements by filling in the blanks.

a. A bullet is loaded in a rifle and the trigger is pulled. The force experienced by the bullet is \( = \) (less than, equal to, greater than) the force experienced by the rifle. The resulting acceleration of the bullet is \( > \) (less than, equal to, greater than) the resulting acceleration of the rifle.

b. A bug crashes into a high speed bus. The force experienced by the bug is \( = \) (less than, equal to, greater than) the force experienced by the bus. The resulting acceleration of the bug is \( > \) (less than, equal to, greater than) the resulting acceleration of the bus.

c. A massive linebacker collides with a smaller halfback at midfield. The force experienced by the linebacker is \( = \) (less than, equal to, greater than) the force experienced by the halfback. The resulting acceleration of the linebacker is \( < \) (less than, equal to, greater than) the resulting acceleration of the halfback.

d. The 10-ball collides with the 14-ball on the billiards table (assume equal mass balls). The force experienced by the 10-ball is \( = \) (less than, equal to, greater than) the force experienced by the 14-ball. The resulting acceleration of the 10-ball is \( = \) (less than, equal to, greater than) the resulting acceleration of the 14-ball.

1. In the example below, the action-reaction pair is shown by the arrows (vectors), and the action-reaction described in words. In (a) through (g) draw the other arrow (vector) and state the reaction to the given action. Then make up your own example in (h).

Example:

- Fist hits wall. Wall hits fist.
- Head bumps ball. (a) Ball bums head
- Windshield hits bug. (b) Bug hits windshield
- Bat hits ball. (c) Ball hits bat
- Hand touches nose. (d) Nose touches hand
- Hand pulls on flower. (e) Flower pulls hand

- Athlete pushes bar upward. Compressed air pushes balloon surface outward. (f) Bar pulls athlete, (g) Balloon pushes air in