

Shedding Light on Motion Episode 8: Newton's Third Law of Motion Question Sheet

Name: _____

Part A 1. Newton's Third Law of Motion is often stated as a little kind of rhyme:

For every action, _____

2. Forces always come in pairs called _____ pairs.

Part B 3. Whenever Object A exerts a force on Object B, Object B exerts a same-sized / smaller / bigger force back on Object A.

4. The darker car (car A) is about to crash into the stationary white car (car B).



(a) What will happen to the speed of both cars during the collision and why?

(b) How does the size of force that car B experiences compare with the size of the force that car A experiences?

5. A heavy truck is about to crash into a car. The car has a mass that is one fifth that of the truck.



(a) How will the force that the car experiences compare with the force that the truck experiences?

(b) Given that $F_{\text{net}} = ma$, how will the accelerations of the two vehicles differ?

6. A student kicks a ball. Draw in the action reaction pairs and label them $F_{\text{foot on ball}}$ and $F_{\text{ball on foot}}$.



Part C 7. The two forces in an action-reaction pair are not always obvious. When you drop a ball, the Earth applies a force downwards on the ball. If this is the action force, where is the reaction force?

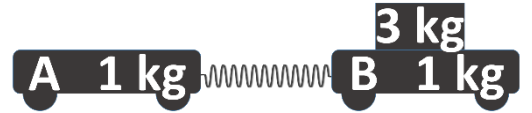
8. A spring is connected to two 1 kg trolleys which are then pulled apart before being let go.



(a) As the spring recoils, how big is the force on Trolley A compared to the force on Trolley B?

(b) What is the acceleration of Trolley A compared to Trolley B?

9. A 3 kg mass is added to Trolley B and the two trolleys are pulled apart again.



- (a) As the spring recoils, how big is the force on Trolley A compared to the force on Trolley B? (Hint: Remember Newton's Third Law!)

- (b) What is the acceleration of Trolley A compared to Trolley B?

- (c) Which trolley will reach the highest speed before they crash into each other?

10. Two twins standing on skateboards push off each other. Draw in (from each twin's centre of mass) the action-reaction pairs that act on each of them.

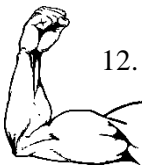


11. A compression spring is placed between two trolleys and the two trolleys are then pushed together before being let go, after which the spring pushes the trolleys apart.

- (a) Which trolley will accelerate at the higher rate? _____
- (b) Which trolley will experience the greater force? (Hint: TRICK QUESTION) _____
- (c) If Trolley A accelerates at a rate of 0.5 m/s/s, use the $F = ma$ equation to calculate the force acting on it.

- (d) Therefore, remembering Newton's Third Law, what is the Force acting on Trolley B?

- (e) Use the $F = ma$ equation again to calculate the acceleration of Trolley B. (Does your answer correspond to your intuition in Q11 a?)



12. Briefly describe how muscles work. _____

13. Label the two most obvious forces in the action-reaction pair involved when an athlete throws a 6 kg medicine ball. (Draw the arrows from the centre of mass of each "object".)



14. An astronaut is on a spacewalk in space suit outside the International Space Station. His safety tether breaks and he begins to float away from the space station. He still has a heavy 5 kg toolkit in his hand. How can he use it to save himself?

15. Briefly describe how a rocket engine works.

Diagram

