

Keeping Track of Momentum 1

Hit and Stick Collisions

Apprentice Difficulty Level

Question Group 1

Question 1

A red cart is moving rightward with a momentum of $60 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart of equal mass that is initially at rest. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 2

A red cart is moving rightward with a momentum of $50 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart of equal mass that is initially at rest. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 2

Question 3

A red cart is moving rightward with a momentum of $45 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart that is initially at rest. The blue cart has twice the mass of the red cart. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 4

A red cart is moving rightward with a momentum of $60 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart that is initially at rest. The blue cart has twice the mass of the red cart. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 3

Question 5

A red cart is moving rightward with a momentum of $45 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart that is initially at rest. The red cart has twice the mass of the blue cart. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 6

A red cart is moving rightward with a momentum of $60 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart that is initially at rest. The red cart has twice the mass of the blue cart. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 4

Question 7

A red cart is moving rightward with a momentum of $40 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart that is initially at rest. The red cart has three times the mass of the blue cart. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 8

A red cart is moving rightward with a momentum of $40 \text{ kg}\cdot\text{cm/s}$ when it collides with a blue cart that is initially at rest. The blue cart has three times the mass of the red cart. The two carts stick together and move to the right with the same speed after the collision.

Enter the momentum values (in $\text{kg}\cdot\text{cm/s}$) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 5

Question 9

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	120	90	-30
Blue Cart	0	30	+30
System	120	120	0

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart equals the momentum of the blue cart.

The system momentum before the collision equals the system momentum after the collision.

The momentum of the red cart and the momentum of the blue cart equal the total momentum.

The momentum of the red cart is the same before and after the collision; the same is true of the blue cart.

Question 10

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	150	100	-50
Blue Cart	0	50	+50
System	150	150	0

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart equals the momentum of the blue cart.

The system momentum before the collision equals the system momentum after the collision.

The momentum of the red cart and the momentum of the blue cart equal the total momentum.

The momentum of the red cart is the same before and after the collision; the same is true of the blue cart.

Question Group 6

Question 11

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	120	90	-30
Blue Cart	0	30	+30
System	120	120	0

Neither the red cart nor the blue cart have a momentum change.

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart is equal to the momentum of the blue cart.

The momentum lost by the red cart is equal to the momentum gained by the blue cart.

The momentum of the red cart is equal and opposite to the momentum of the blue cart.

Question 12

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	150	100	-50
Blue Cart	0	50	+50
System	150	150	0

Neither the red cart nor the blue cart have a momentum change.

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart is equal to the momentum of the blue cart.

The momentum lost by the red cart is equal to the momentum gained by the blue cart.

The momentum of the red cart is equal and opposite to the momentum of the blue cart.

Master Difficulty Level**Question Group 7****Question 13**

A 0.50-kg red cart is moving rightward with a speed of 50 cm/s when it collides with a 0.50-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 25 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 14

A 0.50-kg red cart is moving rightward with a speed of 60 cm/s when it collides with a 0.50-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 30 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 8

Question 15

A 1.00-kg red cart is moving rightward with a speed of 60 cm/s when it collides with a 0.50-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 40 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 16

A 1.00-kg red cart is moving rightward with a speed of 75 cm/s when it collides with a 0.50-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 50 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 9

Question 17

A 0.50-kg red cart is moving rightward with a speed of 60 cm/s when it collides with a 1.00-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 20 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 18

A 0.50-kg red cart is moving rightward with a speed of 90 cm/s when it collides with a 1.00-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 30 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 10

Question 19

A 0.50-kg red cart is moving rightward with a speed of 40 cm/s when it collides with a 1.50-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 10 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 20

A 0.50-kg red cart is moving rightward with a speed of 80 cm/s when it collides with a 1.50-kg blue cart that is initially at rest. The two carts stick together and move to the right with a speed of 20 cm/s after the collision.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 11

Question 21

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	80	60	-20
Blue Cart	0	20	+20
System	80	80	0

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart equals the momentum of the blue cart.

The system momentum before the collision equals the system momentum after the collision.

The momentum of the red cart and the momentum of the blue cart equal the total momentum.

The momentum of the red cart is the same before and after the collision; the same is true of the blue cart.

Question 22

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	60	45	-15
Blue Cart	0	15	+15
System	60	60	0

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart equals the momentum of the blue cart.

The system momentum before the collision equals the system momentum after the collision.

The momentum of the red cart and the momentum of the blue cart equal the total momentum.

The momentum of the red cart is the same before and after the collision; the same is true of the blue cart.

Question Group 12

Question 23

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	80	60	-20
Blue Cart	0	20	+20
System	80	80	0

Neither the red cart nor the blue cart have a momentum change.

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart is equal to the momentum of the blue cart.

The momentum lost by the red cart is equal to the momentum gained by the blue cart.

The momentum of the red cart is equal and opposite to the momentum of the blue cart.

Question 24

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	60	45	-15
Blue Cart	0	15	+15
System	60	60	0

Neither the red cart nor the blue cart have a momentum change.

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart is equal to the momentum of the blue cart.

The momentum lost by the red cart is equal to the momentum gained by the blue cart.

The momentum of the red cart is equal and opposite to the momentum of the blue cart.

Wizard Difficulty Level**Question Group 13****Question 25**

A 1.00-kg red cart is moving rightward with a speed of 60.0 cm/s when it collides with a 0.50-kg blue cart that is moving rightward with a speed of 30.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 50.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 26

A 1.00-kg red cart is moving rightward with a speed of 50.0 cm/s when it collides with a 0.50-kg blue cart that is moving rightward with a speed of 20.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 40.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 14

Question 27

A 0.50-kg red cart is moving rightward with a speed of 80.0 cm/s when it collides with a 1.00-kg blue cart that is moving rightward with a speed of 20.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 40.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 28

A 0.50-kg red cart is moving rightward with a speed of 45.0 cm/s when it collides with a 1.00-kg blue cart that is moving rightward with a speed of 15.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 25.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 15

Question 29

A 0.50-kg red cart is moving rightward with a speed of 60.0 cm/s when it collides with a 1.00-kg blue cart that is moving leftward with a speed of 12.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 12.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 30

A 0.50-kg red cart is moving rightward with a speed of 60.0 cm/s when it collides with a 1.00-kg blue cart that is moving leftward with a speed of 24.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 4.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 16

Question 31

A 1.50-kg red cart is moving rightward with a speed of 60.0 cm/s when it collides with a 0.50-kg blue cart that is moving leftward with a speed of 40.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 35.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question 32

A 0.50-kg red cart is moving rightward with a speed of 60.0 cm/s when it collides with a 1.50-kg blue cart that is moving leftward with a speed of 12.0 cm/s. After the collision, the two carts stick together and move to the right with a speed of 6.0 cm/s.

Enter the momentum values (in kg•cm/s) of each individual cart and of the system of two carts before and after the collision. Also indicate the change in momentum of each cart.

	Before Collision	After Collision	Momentum Change
Red Cart			
Blue Cart			
System			

Question Group 17

Question 33

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	90	70	-20
Blue Cart	30	50	+20
System	120	120	0

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart equals the momentum of the blue cart.

The system momentum before the collision equals the system momentum after the collision.

The momentum of the red cart and the momentum of the blue cart equal the total momentum.

The momentum of the red cart is the same before and after the collision; the same is true of the blue cart.

Question 34

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	150	80	-70
Blue Cart	-30	40	+70
System	120	120	0

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart equals the momentum of the blue cart.

The system momentum before the collision equals the system momentum after the collision.

The momentum of the red cart and the momentum of the blue cart equal the total momentum.

The momentum of the red cart is the same before and after the collision; the same is true of the blue cart.

Question Group 18

Question 35

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	90	70	-20
Blue Cart	30	50	+20
System	120	120	0

Neither the red cart nor the blue cart have a momentum change.

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart is equal to the momentum of the blue cart.

The momentum of the red cart is equal and opposite to the momentum of the blue cart.

The momentum change of the red cart is equal and opposite to the momentum change of the blue cart.

Question 36

Consider the following completed table for the collision between a red cart and a blue cart. Two of the cells of the table have been highlighted. Identify the statement that best describes this data.

	Before Collision	After Collision	Momentum Change
Red Cart	150	80	-70
Blue Cart	-30	40	+70
System	120	120	0

Neither the red cart nor the blue cart have a momentum change.

The momentum of the red cart and the blue cart does not change.

The momentum of the red cart is equal to the momentum of the blue cart.

The momentum of the red cart is equal and opposite to the momentum of the blue cart.

The momentum change of the red cart is equal and opposite to the momentum change of the blue cart.