Collisions(momentum worksheet

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Quiz & Worksheet - Physics Lab on Momentum Conversion

1. What is momentum?

- A quantity of motion equal to the product of the mass and the velocity of the object.
- A quantity of motion equal proportional only to the mass of an object.
- A quantity of motion equal proportional only to the velocity of an object.
- The same as the mass of an object.
- The motion energy an object has.

2. What is conservation of momentum?

- It says that momentum is neither created nor destroyed, it only moves from one place to another.
- It says that momentum is created, but cannot be destroyed.
- It says that momentum is destroyed, but cannot be created.
- It says that energy is neither created nor destroyed, it only moves from one place to another.
- It says that you should save momentum as much as possible, because it's valuable.

3. Why does momentum seem to disappear when you push a shopping cart and let it stop on its own?

- Because momentum can be absorbed by the Earth and ground.
- Because conservation of momentum doesn't apply when friction is present.
- Because momentum isn't always conserved.
- Because physics isn't perfect.
- Because the surface has friction.

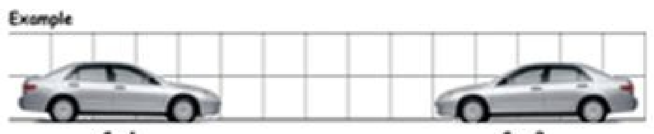
Name.............................. Class.......... Date................

Momentum Calculations of a 2 car collision

Aims

In this exercise you will calculate the momentum (p=mv) of the 2 cars before collision and their momentum after the collision to allow you to find out the velocties after collision or the mass of the car.

Example



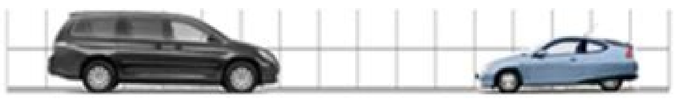
Car1 **Car 2**

Car 1 has a mass of 1000kg and a starting velocity of 10m/s. Car 2 has a mass of 1000kg and a starting velocity of 0m/s. The 2 cars move together immediately after collision.

Calculate their velocity.

Momentum of car 1 **before collision**= 1000kg x 10m/s= 10000kg m/s
Momentum of car 2 **before collision**=1000kg x 0m/s= 0kg m/s
Let v represent velocity of the cars **after collision.**
Momentum of car 1 after collision= 1000 kg x v
Momentum of car 2 after collision= 1000 kg x v
1000 x v + 1000 x v = 10000 + 0 ; 2000 kg x v = 10000 kg m/s
10000 kg m/s ÷ 2000 kg = 5m/s = v

Question 1



Car 1	Car 2
Mass = 2000 kg	Mass = 500 kg
Start Velocity = 6 m/s	Start Velocity = 0 m/s

Calculate their velocity. (The cars move together immediately after collision)

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Worksheet: Power and Ohm's Law Name ____________________

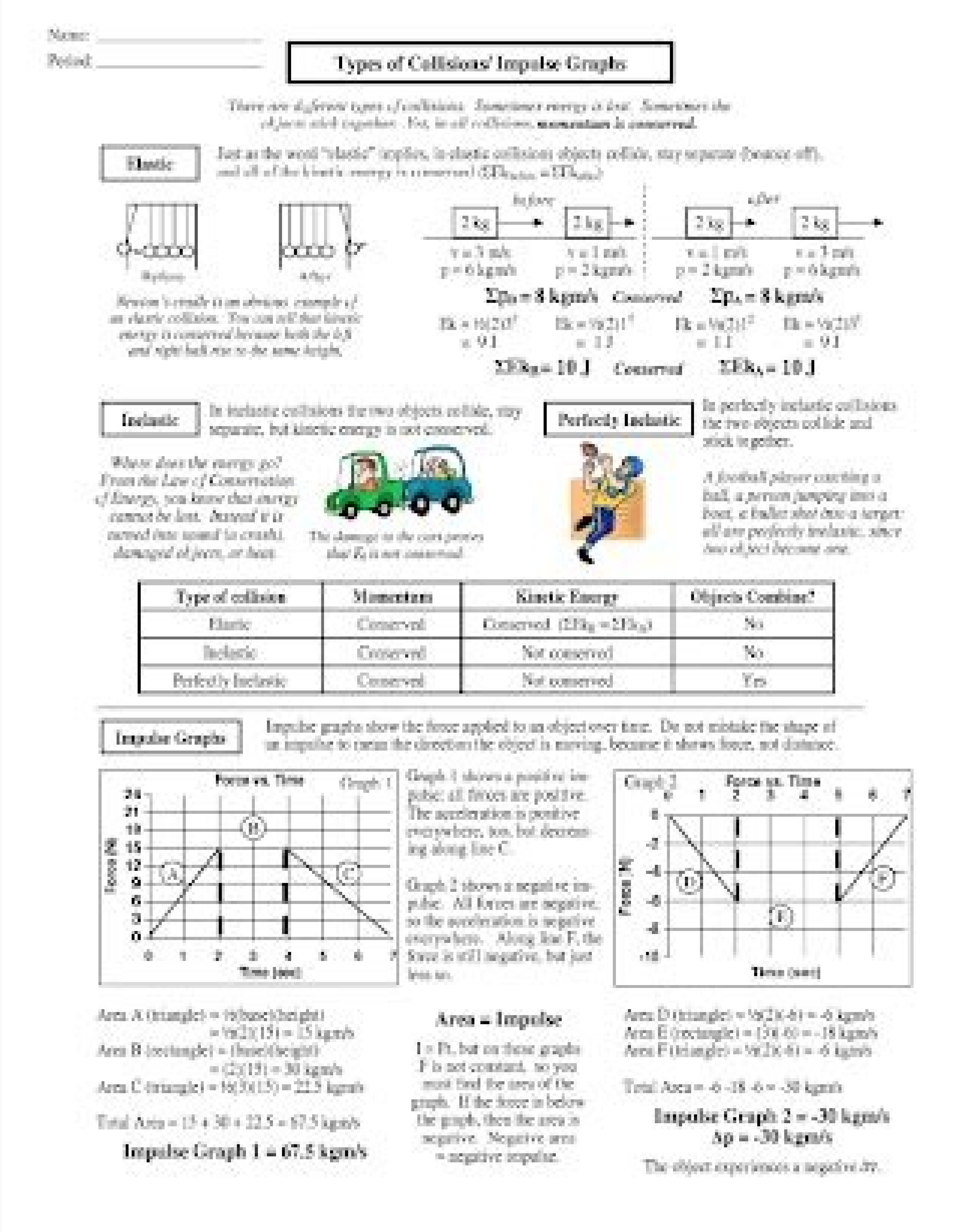
1. State Ohm's Law ____________________
2. Give the units for: V ________ ; I ________ ; R ________
3. Restate these units, using J, s, and/or c: V ________ ; I ________
4. State the **electric power formula**: ______________
5. Give the unit: P _____ ; Restate, using J, s, and/or c: P ________
6. Another formula for calculating power is: P =

   Rearrange the formula to solve for energy: E =
7. The kilowatt hour (kwh) is a unit for ________________ which Power Companies sell to their customers. Why doesn't the power company use the MKS unit, watt second instead?

   ____

   For these problems, show the formula used. Do your work on the back.
8. What is the resistance of an electric frying pan that draws 11 amps when connected to a 110 v circuit?
   What is the power of the frying pan?
9. If a 120 v line to a socket is limited to 15 a by a fuse, will it operate a 1200 w dryer without blowing the fuse?
10. If the power company charges us 8 cents/ kw-h for electricity, what does it cost to operate the 1200 W hair dryer for 15 minutes?
11. If the power company sells electrical energy at 11 cents/KWh, how much does it cost to run a 100. W radio for 3.0 hours?
12. What is the resistance of a 150 W light bulb running on a 120 V circuit?

Do At Home: List the power rating on 5 electrical appliances in your home.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Period: ____________

Types of Collisions/ Impulse Graphs

There are different types of collisions. Sometimes energy is lost. Sometimes the objects stick together. Yet, in all collisions, **momentum is conserved.**

Elastic — Just as the word "elastic" implies, in elastic collisions objects collide, stay separate (bounce off), and all of the kinetic energy is conserved ($\Sigma Ek_{before} = \Sigma Ek_{after}$)

Newton's cradle is an obvious example of an elastic collision. You can tell that kinetic energy is conserved because both the left and right balls rise to the same height.

before		after	
v = 3 m/s	v = 1 m/s	v = 1 m/s	v = 3 m/s
p = 6 kgm/s	p = 2 kgm/s	p = 2 kgm/s	p = 6 kgm/s

Σp_B = 8 kgm/s *Conserved* **Σp_A = 8 kgm/s**

$Ek = ½(2)3^2 = 9$ J | $Ek = ½(2)1^2 = 1$ J | $Ek = ½(2)1^2 = 1$ J | $Ek = ½(2)3^2 = 9$ J

ΣEk_B = 10 J Conserved **ΣEk_A = 10 J**

Inelastic — In inelastic collisions the two objects collide, stay separate, but kinetic energy is not conserved.

Where does the energy go? From the Law of Conservation of Energy, you know that energy cannot be lost. Instead it is turned into sound (a crash), damaged objects, or heat.

The damage to the cars proves that E_k is not conserved.

Perfectly Inelastic — In perfectly inelastic collisions the two objects collide and stick together.

A football player catching a ball, a person jumping into a boat, a bullet shot into a target: all are perfectly inelastic, since two object become one.

Type of collision	Momentum	Kinetic Energy	Objects Combine?
Elastic	Conserved	Conserved ($\Sigma Ek_B = \Sigma Ek_A$)	No
Inelastic	Conserved	Not conserved	No
Perfectly Inelastic	Conserved	Not conserved	Yes

Impulse Graphs — Impulse graphs show the force applied to an object over time. Do not mistake the shape of an impulse to mean the direction the object is moving, because it shows force, not distance.

Graph 1 shows a positive impulse: all forces are positive. The acceleration is positive everywhere, too, but decreasing along line C.

Graph 2 shows a negative impulse. All forces are negative, so the acceleration is negative everywhere. Along line F, the force is still negative, but just less so.

Area A (triangle) = ½(base)(height) = ½(2)(15) = 15 kgm/s
Area B (rectangle) = (base)(height) = (2)(15) = 30 kgm/s
Area C (triangle) = ½(3)(15) = 22.5 kgm/s

Total Area = 15 + 30 + 22.5 = 67.5 kgm/s

Impulse Graph 1 = 67.5 kgm/s

Area = Impulse

I = Ft, but on these graphs F is not constant, so you must find the area of the graph. If the force is below the graph, then the area is negative. Negative area = negative impulse.

Area D (triangle) = ½(2)(-6) = -6 kgm/s
Area E (rectangle) = (3)(-6) = -18 kgm/s
Area F (triangle) = ½(2)(-6) = -6 kgm/s

Total Area = -6 -18 -6 = -30 kgm/s

Impulse Graph 2 = -30 kgm/s
Δp = -30 kgm/s

The object experiences a negative Δv.

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