Conservation of momentum problems answer key

Conservation of Energy and Momentum Worksheet

Recall the basic relations:	Equations:
$E_i = E_f$ $P_i = P_f$ $\Delta E \Delta t \geq \frac{h}{2\pi}$ $\Delta p \Delta x \geq \frac{h}{2\pi}$	1. $E = K + U + mc^2$ (usually $U = 0$) 2. $E = \sqrt{(pc)^2 + (mc^2)^2}$ for all particles 3. $E = hf$ (for a photon) 4. $p = mv$ (for a massive particle at low speeds) 5. $p = \frac{E}{c}$ (for a massless particle)

Constants:
$h = 6.63\times10^{-34}\ J\cdot s = 4.14\times10^{-21}\ MeV\cdot s$
$c = 3.00\times10^{8}\ m/s$
Mass of electron = mass of positron = 9.1×10^{-31} kg = $.511\ MeV/c^2$
Mass of hydrogen atom = 1.67×10^{-27} kg

Example 1:
A gamma ray photon has energy equal to 5 MeV. What is its:
a. momentum (in kg-m/s)?
b. momentum (in MeV/c)?
c. frequency (in s^{-1})?

Example 2:
An electron and positron are at rest in a particular frame of reference. What is their:
a. total energy (in J)?
b. total energy (in MeV)?

Example 3
A 5 MeV gamma ray turns into an electron-positron pair moving in the same direction as the gamma ray. What is:
a. the total momentum of the electron and positron (in MeV/c)?
b. the total energy of the electron and positron (in MeV) using energy conservation?
c. the total energy of the electron and positron using Equation 2 (above) (in MeV)?
d. the difference in energy between the results of (b) and (c)?

Example 4:
Using the result (d) from Example 3, and the uncertainty principle, for how much time can the electron-positron pair exist before they must annihilate (turn back into a gamma ray)?

Physics - Graff
Chapter 9 – Momentum Worksheet
Name:________
What's your p?______

Part 1: Circle or calculate the best answer for the following questions. Check your work with the answers.

1. Which object has the least momentum?
Object A: m = 1 kg, v = 100 m/s
Object B: m = 10 kg, v = 12 m/s
Object C: m = 0.5 kg, v = 1000 m/s
Object D: m = 100 kg, v = 2 m/s

2. If a 54 Ns impulse (recall, impulse is force*time, so it is measured in Newtons*seconds) is given to a 6-kg object, then the transfer of momentum is
a. 6 Ns
b. 9 Ns
c. 54 Ns
d. 324 Ns

3. Which quantities do not occur in equal and opposite pairs when two objects interact?
a. impulses
b. forces
c. accelerations
d. transfers of momentum

4. A firecracker is placed in the midst of a motionless cluster of billiard balls on a table. When the firecracker explodes, the balls scatter in all directions. The total momentum of the balls immediately after the explosion is
a. more than before the explosion.
b. less than before the explosion.
c. the same as before the explosion.
d. impossible to tell.

5. Alice and Bob are of equal mass (60kg). Alice has a momentum of 60 kg*m/s. Bob is at rest. Alice runs into Bob and stops, while Bob starts moving.

a. What is Alice's momentum after the collision?

b. What is Bob's momentum after the collision?

c. How fast is Bob's moving after the collision?

Worksheet: Conservation of Momentum [illegible]

[illegible]

Name: ____Answer Key______________

Force and Momentum Calculations

You should remember from your reading last week that Newton's second law of motion states that the acceleration of an object is directly proportional to the net force on the object in the same direction as that net force. This is expressed mathematically as F=ma where F=force, m=mass, and a=acceleration.

Solve the following problems using this equation (show your work!):

1. You push a friend on a sled. Your friend and the sled together have a mass of 70 kg. If the net force on the sled is 35 N, what is the sled's acceleration?

   F=ma so a=F/m
   a=35 N/70 kg = 0.5 m/s²

2. If the mass of a helicopter is 4500 kg and the net force on it is 18,000 N, what is the helicopter's acceleration?

   F=ma so a=F/m
   a=18,000 N/4,500 kg = 4 m/s²

3. An 85 kg mass has an acceleration of 5.5 m/s². What is the net force applied?

   F=ma
   F=85 kg x 5.5 m/s² = 467.5 N

4. What is the mass of an object that has an acceleration of 55 m/s² when a net force of 20 N is applied? (round to the nearest tenth)

   F=ma so m=F/a
   m=20 N/ 55 m/s² = 0.3636 kg = 0.4 kg

Physics 10-20 Impulse and Momentum Formative Worksheet

Learning Target
1. I can apply the concepts of Impulse and Momentum to the motion of objects in a system.
a. I can define the terms impulse and momentum.
b. I can state that the change in momentum is equal to the impulse applied to the object.
c. I can apply the Impulse-Momentum Theorem to solve for a given unknown
d. I can apply the Law of Conservation of Momentum to analyze

Name: Key Period: ______

1. The momentum of an object depends upon the object's A, D. Pick two quantities.
a. mass - how much stuff it has
b. acceleration - the rate at which the stuff changes its velocity
c. weight - the force by which gravity attracts the stuff to Earth
d. velocity - how fast and in what direction it's stuff is moving
e. position - where the stuff is at

2. The two quantities needed to calculate an object's momentum are mass and velocity.

3. Calculate the momentum value of .... (Include appropriate units on your answers.)

a. ... a 2.0-kg brick moving through the air at 12 m/s.
P = mv
2kg · 12 m/s 24 kg·m/s

b. ... a 3.5-kg wagon moving along the sidewalk at 1.2 m/s.
3.5kg · 1.2 m/s = 4.2 kg·m/s

4. With what velocity must a 0.53-kg softball be moving to equal the momentum of a 0.31-kg baseball moving at 21 m/s?
P = mv → v = P/m = .31 · 21 m/s = 6.51 kg·m/s
softball = 6.51 / .53kg = 12.2 m/s

Answer key conservation of momentum problems worksheet answers. How does conservation of momentum work. Momentum conservation problems. Conservation of momentum practice problems answer key. What does the conservation of momentum state. Conservation of momentum answers. Unit 4b conservation of momentum practice problems answer key.

To every action there is a reaction that is equal in magnitude and opposite direction (Newton's third law). Suppose we have two objects O1 (mass m1) and O2 (mass m2) that are moving towards each other along a line on a smooth frictionless surface, they then collide. If F12 (action) is the force exerted by O1 on O2 and F21 (reaction) is the force exerted by O2 on O1, then according to Newton's third law, we write F12 = - F21 (action and reaction are equal in magnitude and oppsite direction, F12 and F21 are vectors) F12 = m1 a1 ; a1 acceleration of object O1 and is given by (Δv / Δt) F21 = m2 a2 ; a2 acceleration of object O2 and is given by (Δv / Δt)Substitute to obtain m1 (Δv / Δt)O1 = - m2 (Δv / Δt)O2m1 (Δv)O1 = m2 (Δv)O1Let v1i (initial) and v1f (final) be the speeds of O1 before and after collision respectively and v2i (initial) and v2f (final) be the speeds of O2 before and after collision respectively. m1 (v1f - v1i) = - m2 (v2f - v2i)which may also be written as m1 v1i + m2 v2i = m1 v1f + m2 v2f Momentum BEFORE interaction = momentum AFTER interactionThe above shows that when no external forces are acting on a system, the momenta before and after interaction are equal and therefore there is conservation of momemntum.Example 1A 35 Kg boy jumps (from rest) into a moving trolley of mass 70 Kg and already moving at a velocity of 5 m/s to the right. What is the speed of the trolley after the boy has jumped in ?Solution to Example 1We have two items: the boy and the trolley.interaction is when the boy jumps onto the trolley.Let v1i and v2i be the velocities of the boy and the trolley before the boy jumps in (initial velocities) v1i = 0 and v2i = 5 m/sThe moment Pi of the system boy-trolley before the jump pi = moment of boy + moment of trolley = 35 × 0 + 70 × 5 = 350 Kg m/sLet v be the velocity of the trolley (with the boy in it) , the momentum of the trolley is p = (35 + 70) vConservation of momentum 350 = (35 + 70) v v = 350 / 105 = 3.3 m/s to the right.Example 2A 35 Kg boy running at a velocity of 2 m/s to the right, jumps onto a trolley at rest of mass 70 Kg. What is the speed of the trolley and the boy after the boy has jumped in?Solution to Example 2A system of two items: the boy and the trolley and the interaction is when the boy jumps onto the trolley.Let v1i and v2i be the velocities of the boy and the trolley before the boy jumps in v1i = 2 and v2i = 0The moment Pi of the system boy-trolley before the jump pi = moment of boy + moment of trolley = 35 × 2 + 70 × 0 = 70 Kg m/sLet v be the velocity of the trolley (with the boy in it), the momentum of the trolley is p = (35 + 70) vMomenta are equal before and after intercation: conservation of momenta 70 = (35 + 70) v v = 70 / 105 = 0.7 m/s to the right.Example 3A 5 Kg gun fires a bullet of 15 grams at a velocity of 1000 m/s to the right. What is the velocity of recoil of the gun?Solution to Example 3We assume a motion to the right to be the positive.A system of two objects: the bullet and the gunInteraction is when the bullet is fired.Initial velocities: Let v1i and v2i be the velocities of the gun and the bullet before the gun is fired. v1i = 0 and v2i = 0The moment Pi of the system (gun and bullet) before firing the gun is pi = moment of gun + moment of bullet = 5 × 0 + 0.015 × 0 = 0Final velocities: Let v1f be the velocity of gun and v2f the velocity of the bullet (final velocities), the momentum after the gun is fired is p = 5 × v1f + 0.015 × 1000Momenta are equal before and after interaction: conservation of momenta 0 = 5 × v1f + 15 v1f = - 15 / 5 = - 3 m/s to the left (minus sign).More References1 - Higher Level Physics - IB Diploma - Chris Hamper - Pearson2 - Physics - Raymond A. Serway and Jerry S. FaughnHolt, Reinehart and Winston - Harcourt Education Company Momentum can be described as the sum product of the mass of an object and its velocity. This means that momentum measures the force produced by an object’s mass and velocity. The formula for calculating momentum is = Momentum = mass X velocity Or P = MV Where P = momentum, V = velocity and M = mass Based on the above definition, it is clear that the momentum of a car and a bicycle both travelling at 20 m/s will not be the same, because although the velocity of the two objects are the same, their mass is different. The car would have greater momentum, due to its larger mass. Note that: The SI unit for velocity = m/s SI unit for Mass = kg So therefore momentum = kg x m/s and SI unit for momentum is kg x m/s Momentum must always have a direction and so the final answer must reflect the direction of the momentum or velocity. Momentum Practice Problems 1. Find the momentum of a round stone weighing 12.05kg rolling down a hill at 8m/s. Formula – P= kg x m/s = 12.05kg x 8m/s = 96.4 kg x m/s down hill Note that the final answer has the proper SI unit of momentum (kg x m/s) after it and it also mentions the direction of the movement. 2. A cannon ball weighing 35kg is shot from a cannon towards the east at 220mls, calculate the momentum of the cannon ball. Formula – P= kg x m/s = 35kg x 220m/s = 7700 kg x m/s east Momentum questions generally appear with general science and/or basic physics. Tests with momentum questions: GED — HESI — NLN PAX — TEAS 1. Three cars are travelling down an even road at a velocity of 110 m/s, calculate the car with the highest momentum if they are all moving at the same speed, but the first car weighs 2500kg, second car weighs 2650kg and third car weighs 2009kg? a. First car b. Second car c. Third car d. All have same momentum 2. What is the momentum of a log of wood that weighs 700kg rolling down a hill at 4.6m/s. a. 3320 kg x m/s down hill b. 3320 kg x m/s c. 3320 down hill d. 3320 M 3. An object that weighs 500g is rolling along the road at 3.5m/s, what is the momentum of the object? a. 124.9 kg x m/s along road b. 17. 50 kg x m/s along road c. 1750 kg x m/s along road d. 1.75 kg x m/s along road 4. A javelin is thrown into a field at 18m/s. if the Javelin weighs 1.5kg, what is the momentum? a. 1.2 kg x m/s into the field b. 12 kg x m/s into the field c. 27 kg x m/s into the field d. 2.7 kg x m/s into the field 5. Which of these object has greater momentum, a 2kg truck moving east at 3.5m/s or a 4.3kg truck moving south at 1.5m/s? a. First truck at 7 kg x m/s moving east b. Second truck at 7.45 kg x m/s due south c. First truck at 6.45 kg x m/s due east d. Second truck at 7 kg x m/s due south 6. A bullet weighing 350g is shot towards a target at a velocity of 250m/s. Calculate the momentum of the bullet a. 1.4 kg x m/s towards target b. 87.5 kg x m/s towards target c. 87500 kg x m/s towards target d. 8.75 kg x m/s towards target 1. B Momentum is a product of velocity and mass. If they are all traveling at the same speed, the car that weighs the most would have the highest momentum. 2. A 4.6 X 700 = 3220 down the hill 3. D First convert 500g to kg = 500/1000 = 0.5kg, momentum = 0.5 x 3.5 = 1.75 kg x m/s along the road. 4. C p = 1.5 x 18 = 27 kg x m/s into the field. 5. A The momentum of first object = 2 x 3.5 = 7; momentum of second truck = 4.3 x 1.5 = 6.45. First truck has more momentum at 7 kg x m/s moving east. 6. B First convert 350g to kg = 350/1000 = 0.35kg. Momentum of bullet = 0.35 x 250 = 87.5 kg x m/s towards target. Written by, Brian Stocker MA., Complete Test Preparation Inc. Date Published: Thursday, June 11th, 2020 Date Modified: Saturday, April 2nd, 2022

08/09/2021 · Physics Fundamentals Worksheet Answers Promotiontablecovers Momentum Conservation Ans Pdf Worksheet Conservation Of Momentum 1 Key Name A 1 250 Kg Car Is Stopped At A Traffic Light A 3 550 Kg Truck Moving At Course Hero Experiment 2 Conservation Of Momentum Pdf Free Download Pin On Physical Science Activities mass of the orbiter mass of the external fuel tank… full empty time after liftoff of… solid rocket booster (SRB) separation main engine cutoff (MECO) exhaust velocity of the main engines type of fuel used in the main engines the Space Shuttle's "destination" in space Chapter 8 Answer Key: Momentum, Change in Momentum and Impulse. Chapter 9 Answer Key: Conservation of Momentum. Chapter 10 Answer Key: Work and Mechanical Energy. Chapter 11 Answer Key: Conservation of Mechanical Energy. Chapter 12 Answer Key: Power, Work and Eneregy. Chapter 13 Answer Key: Friction and Accelerated Motion. 29/07/2015 · As mentioned in the article on the law of conservation of linear momentum, to solve momentum problems in 2 dimensions, one needs to consider momenta in and directions. Momentum will be conserved along each direction separately. Example 5. A ball of mass 0.40 kg, traveling at a speed of 2.40 m s-1 along the axis collides with another ball of … 08/09/2021 · Physics Fundamentals Worksheet Answers Promotiontablecovers. Momentum Conservation Ans Pdf Worksheet Conservation Of Momentum 1 Key Name A 1 250 Kg Car Is Stopped At A Traffic Light A 3 550 Kg Truck Moving At Course Hero. This Editable 5 Page Worksheet Asks Students To Calculate Conservation Of Momentum Problems By Writing … 08/09/2021 · Physics Fundamentals Worksheet Answers Promotiontablecovers. Momentum Conservation Ans Pdf Worksheet Conservation Of Momentum 1 Key Name A 1 250 Kg Car Is Stopped At A Traffic Light A 3 550 Kg Truck Moving At Course Hero. This Editable 5 Page Worksheet Asks Students To Calculate Conservation Of Momentum Problems By Writing … 11/06/2020 · Answer Key 1. B Momentum is a product of velocity and mass. If they are all traveling at the same speed, the car that weighs the most would have the highest momentum. 2. A 4.6 X 700 = 3220 down the hill 3. D First convert 500g to kg = 500/1000 = 0.5kg, momentum = 0.5 x 3.5 = 1.75 kg x m/s along the road. 4. C 28/10/2021 · Check also: conservation and physics worksheet conservation of momentum answers A 75 0 g ball is rolling at a speed of 57 0 cm s. The answer key at the end of each worksheet allows for a self evaluation. The Exploding Carts Interactive Animates Several.

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