**Noteguide Momentum - Videos 6A Name**

**Videos 6A - Momentum**

What does Momentum mean:

Write down the formula for momentum: (Be sure to write down what all the symbols mean, and their units)

**p =**

Example: What is the momentum of a 145 g baseball going 40. m/s:

Example: 60 kg Fran is running at 4 m/s when she collides with 80 kg Joe head on. They hit and stop dead, so how fast was Joe going?

Whiteboards:

|  |  |
| --- | --- |
| 1. What is the momentum of a 22 g swallow going 5.2 m/s(0.11 kg m/s) | 2. What velocity must a 6.5 gram bullet have for its momentum to be 5.8 kgm/s?(890 m/s) |
| 3. A bowling ball has a momentum of 43.6 kgm/s when it is going 12 m/s. What is its mass?(3.6 kg) | Draw a picture of pretty flower here: |

**Noteguide Impulse - Videos 6B Name**

Write down the formula for impulse: (Be sure to write down what all the symbols mean, and their units)

**Impulse =**

Example: What impulse is imparted by exerting a 12 N force for 4.0 s?

Example: Impulse is the area under a F vs. t graph



Show your calculation here:

Whiteboards:

|  |  |
| --- | --- |
| 1. What is the impulse of a 6.12 N force acting for 2.3 seconds?(14 Ns) | 2. A rocket engine is rated at 14 Ns of impulse, and burns for 1.7 seconds. What is the thrust of the engine? (8.2 N) |
| 3. What is the impulse? (Area under the line)(560 Ns) | 4. What is the impulse? (Area under the line)(470 Ns) |

**Noteguide Impulse and Momentum - Videos 6C Name**

Write down what these symbols are below:

 **Impulse = F Δt = m Δv**

Example: A pitcher pitches a 0.145 kg baseball at +40. m/s, and the batter hits it directly back at -50. m/s to the outfield. What is the average force exerted by the bat if the collision lasted 0.013 s? (-1.0E3N)

Why Δv is tricky:

Whiteboards:

|  |  |
| --- | --- |
| What force for 10. seconds makes a 2.0 kg rocket speed up to 75 m/s from rest?(15 N) | A baseball bat exerts a force of 200. N on a 0.50 kg ball for 0.10 seconds. What is the ball’s change in velocity?(40 m/s) |
| Jolene exerts a 50. N force for 3.0 seconds on a stage set. It speeds up from rest to .25 m/s. What is the mass of the set?(600 kg) | Draw a cartoon dog here: |

**Deriving Newton's Second law:** (Write down the math steps from the last video)

**Noteguide for Rocket Science - Videos 6D Name**

Write down what these are in terms of Rockets:

 **F Δt = m Δv**

**F =**

**Δt =**

**m =**

**Δv =**

Example 1: A rocket burns fuel at a rate of 1.2 kg/s, with an exhaust velocity of 1250 m/s. What thrust does it develop?

Example 2: A model rocket engine develops 12.0 N of thrust with an exhaust velocity of 718 m/s. What is its fuel burn rate?

What is the rocket’s initial acceleration if it has a mass of 238 g?

**Whiteboards:**

|  |  |
| --- | --- |
| A certain rocket engine burns 0.0352 kg of fuel per second with an exhaust velocity of 725 m/s. What thrust does it generate?(25.5 N) | The Saturn V’s first stage engines generated 33.82 MN of thrust (33.82 x 106 N) with an exhaust velocity of 2254.7 m/s. What was its fuel burn rate?(15,000 kg/s) |
| A D12 engine generates 11.80 N of thrust burning fuel at a rate of 0.0143 kg/s. What is the exhaust velocity?If the rocket has a mass of 139 grams, what is the initial upward acceleration?(825 m/s, 75.1 m/s/s) |

**Draw a picture of a pretty pony here:**

**Vertical Acceleration of a Rocket**

What are the 4 steps for solving these:

1.

2.

3.

4.

Example 1: A rocket has a total mass of 12.0 kg, 10.0 kg of which is fuel. It consumes all of its fuel in 8.50 seconds with an exhaust velocity of 420. m/s What are its initial and final accelerations?

Example 2: A 21.0 kg rocket, 16.0 kg of which is fuel, burns its fuel at a rate of 0.820 kg/s with an exhaust velocity of 730. m/s. What are its initial and final acceleration as it takes off from earth?

**Noteguide for Types of Rockets - Videos 6E part 3 Name**

**Solid Fuel:**



**Liquid Fuel:**

How do you keep from tipping?

Why is there "Steam" coming off the rocket

**Saturn V rocket:**

 Label the diagram on the right

What is the main advantage of having multiple stages?

**Ion Propulsion**

Where does an ion drive get its energy?

**Noteguide for Conservation of Momentum - Videos 6E Name**

**Part 1 - Why Momentum must be conserved**

Write down a proof that momentum must be conserved:



Example: 60. kg Sally going 4.5 m/s collides head on with 80. kg Bob who is going 2.3 m/s.

Three steps: The diagram and problem

**Part 2 - Do the first four example problems below the first video: See if you can figure them out first, but if you can't, play the video...**

**Example 1**



(2.3 m/s)

**Example 2**



(-4.7 m/s)

(left)

**Example 3**



(1.73 m/s)

**Example 4**



(11.9 m/s)