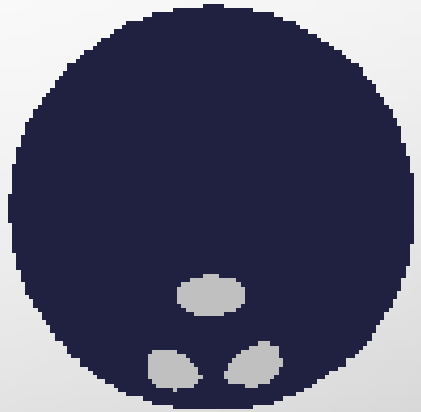
CHAPTER 8: MOMENTUM PROBLEMS

BE ABLE TO CALCULATE MOMENTUM AND IMPULSE

MOMENTUM IS A MEASURE OF HOW HARD IT IS TO STOP A MOVING OBJECT.

THE EQUATION FOR MOMENTUM IS: $P = M \times V$

- WHAT IS THE MOMENTUM OF A 8 KG BOWLING BALL AT 2 M/S?
  - **GIVENS:**
    - MASS = 8 KG
    - VELOCITY = 2 M/S
    - MOMENTUM = ?
  - **EQUATION:**
    - $P = M \times V$
    - $P = (8KG) \times (2M/S)$
    - $P =$ ***16 KG M/S***



IMPULSE IS THE FORCE APPLIED TIMES (X) THE TIME IT IS APPLIED, IMPULSE IS EQUAL TO THE CHANGE IN MOMENTUM.

THE EQUATION RELATING IMPULSE AND MOMENTUM: $F(T) = \Delta M(V)$

- IF THE BOWLING BALL RUNS INTO A PILLOW AND STOPS IN .5 SECONDS, WHAT IS THE CHANGE IN MOMENTUM, WHAT IS THE FORCE ON THE PILLOW, WHAT IS THE FORCE ON THE BALL?
- **GIVENS: (BEFORE)**
  - MASS = 8 KG
  - VELOCITY = 2 M/S
  - MOMENTUM = 16 KG M/S
- **GIVENS: (AFTER)**
  - MASS = 8 KG
  - VELOCITY = 0 M/S
  - MOMENTUM = 0 KG M/S
- **CHANGE IN MOMENTUM** = 0 – 16 = *-16 KG M/S*

- **FORCE** (*SAME BUT OPPOSITE IN DIRECTION*)
  - F (T) = ΔP (ΔMV)
  - F (.5 SEC) = -16 KG M/S
  - F = -16 KG M/S ÷ .5 SEC
  - F = *-32 N*

THE LAW OF CONSERVATION OF MOMENTUM TELL US THAT MOMENTUM IS NOT LOST IN THE ABSENCE OF OUTSIDE FORCES.

#1 MOMENTUM BEFORE EQUALS MOMENTUM AFTER

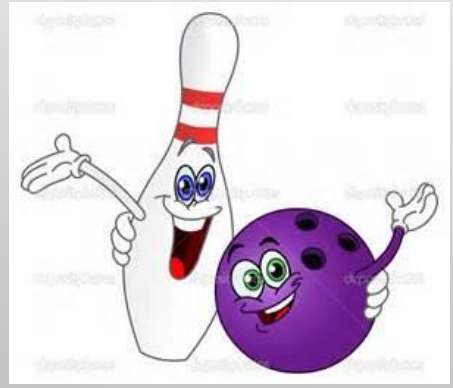
IF THE TWO OBJECTS STICK THE EQUATION IS: $M_1V_1 + M_2V_2 = M_TV_T$

- A 2 KG BLOB OF PUTTY MOVING AT 3M/S SLAMS INTO A 2KG BLOB OF PUTTY AT REST, WHAT IS THE SPEED OF THE TWO STUCK TOGETHER BLOBS?
  - **GIVENS:**
    - M_1 = 2KG
    - V_1 = 3 M/S
    - M_2 = 2 KG
    - V_2 = 0 M/S
  - **EQUATION:**
    - $M_1V_1 + M_2V_2 = M_T V_T$
    - (2KG)(3M/S) + (2KG)(0 M/S) = (2KG x 2KG) (X)
    - 6 KG M/S = 4KG(X)
    - X = ***1.5 M/S***

IF THE TWO OBJECTS DO NOT STICK THE EQUATION IS: $M_1V_1 + M_2V_2 = M_1V_1 + M_2V_2$

(BEFORE) (AFTER)

- A 7 KG BOWLING BALL ROLLS AT A SPEED OF 9 M/S. IT HITS A 2 KG PIN, GIVING IT A VELOCITY OF 14 M/S. WHAT IS THE NEW SPEED OF THE BOWLING BALL?
- **GIVENS: (BEFORE)**
  - M1 = 7 KG
  - V1 = 9 M/S
  - M2 = 2 KG
  - V2 = 0 M/S
- **GIVENS: (AFTER)**
  - M1 = 7KG
  - V1 = ?
  - M2 = 2KG
  - V2 = 14 M/S

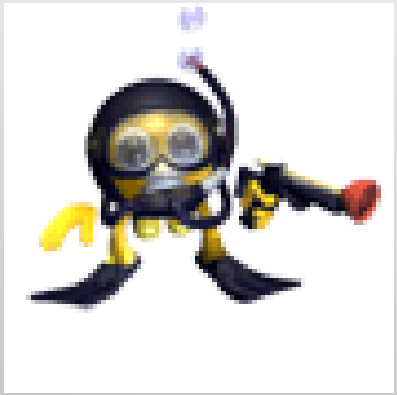


- **EQUATION:**
  - $M_1V_1 + M_2V_2 = M_1V_1 + M_2V_2$
  - (7KG)(9M/S) + (2KG)(0M/S) = (7KG)(V_1) + (2KG)(14M/S)
  - 63 KG M/S = (7KG)(V_1) + 28 KG M/S
  - 35 KG M/S = 7KG(V_1)
  - V_1 AFTER = ***5 M/S***

2 IN A SYSTEM THE MOMENTUM DOES NOT CHANGE, IF THE SYSTEM STARTS WITH ZERO MOMENTUM AND THERE ARE ONLY TWO OBJECTS, THEN THE *MOMENTUM OF THE TWO OBJECTS IS EQUAL AND OPPOSITE*

THE EQUATION FOR EQUAL AND OPPOSITE MOMENTUM IS: $M_1V_1 = M_2V_2$

- A 65 KG SCUBA DIVER SHOOTS A 2KG SPEAR AT A SPEED OF 15 M/S. WHAT IS THE SCUBA DIVERS ***BACKWARD*** VELOCITY?
- **GIVENS:**
  - M1 = 65 KG
  - V1 = ?
  - M2 = 2 KG
  - V2 = 15 M/S



- EQUATION:
  - $M_1V_1 = M_2V_2$
  - ***(65KG)(?) = (2KG)(15M/S)***
  - ***65KG(X) = 30 KG M/S***
  - ***X (VELOCITY1) = -.462 M/S***