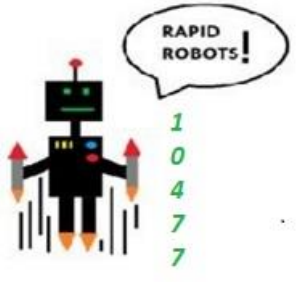
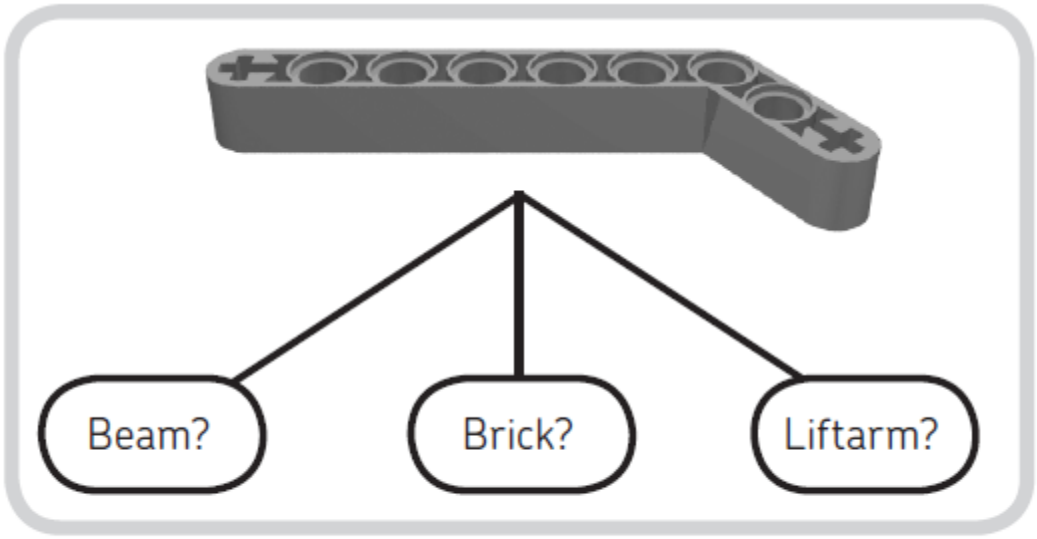
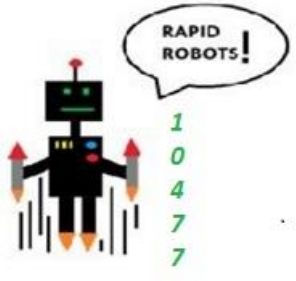



# Naming the Pieces

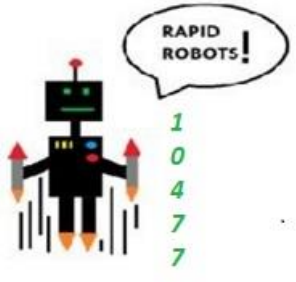



*Should we call this piece a* beam, *a* brick, *or a* liftarm*?*



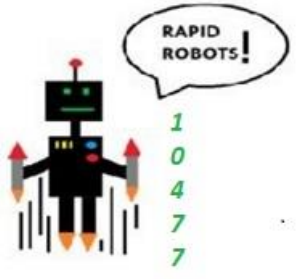

# What to learn about Lego Pieces

- ❑ Classifying the pieces
- ❑ Naming the pieces
- ❑ Measuring the pieces



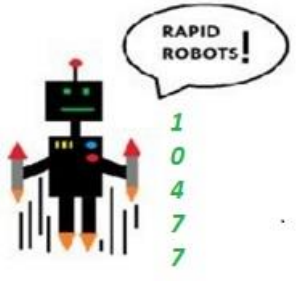

# Classifying the pieces

- Makes it easy to organize
- Understand the purpose of the pieces
- What are different categories of pieces




# Five Different Categories

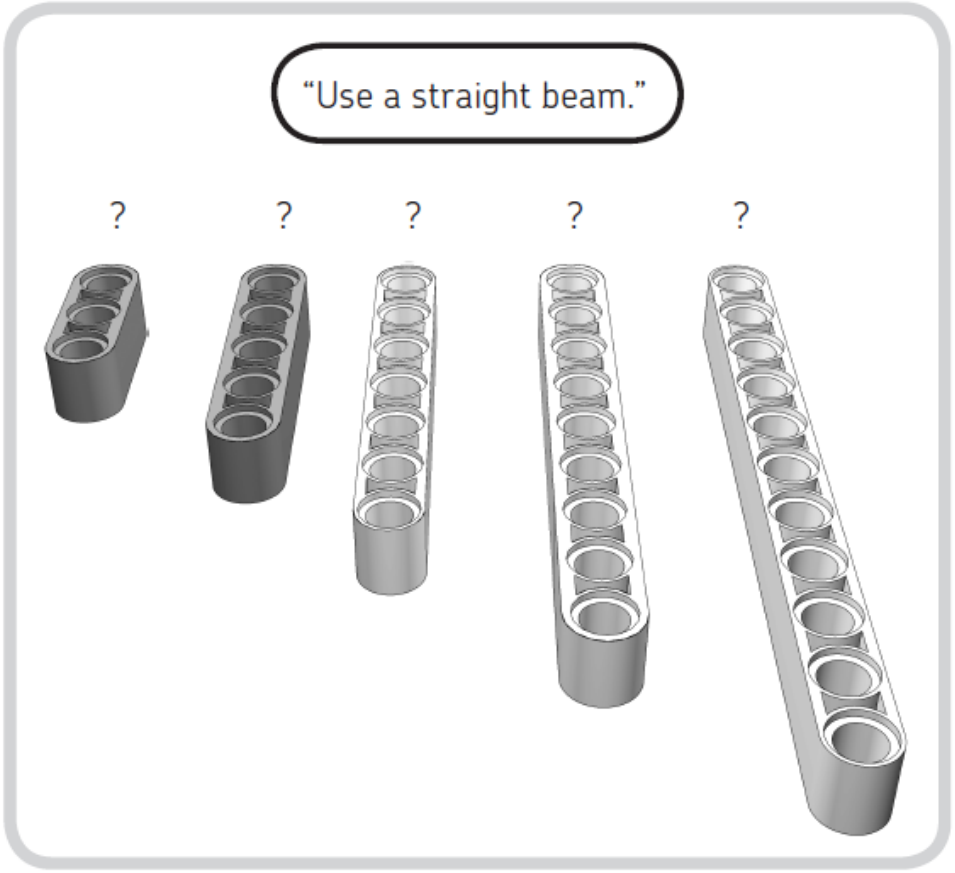
- ❑ Electronics
- ❑ Beams
- ❑ Connectors
- ❑ Gears
- ❑ Miscellaneous elements



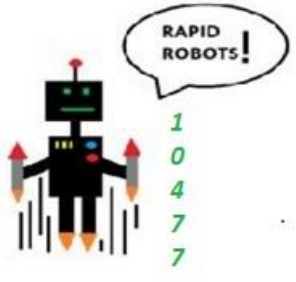

# Naming the Pieces

- Easy to communicate
- No standards/rules for naming
- Kids use different names

# Measuring the Pieces

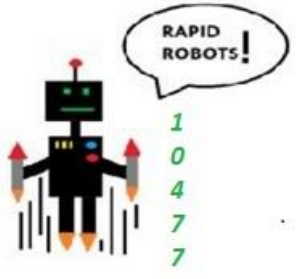



*If you're told to use a straight beam, which kind of straight beam should you choose?*




# Measuring the Pieces

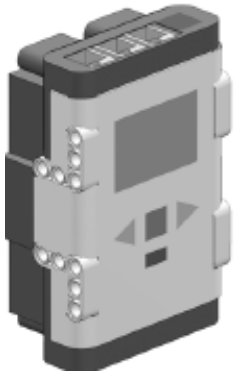
- Some pieces looks similar
- Measurement is needed to identify
- Helps to specify the exact piece



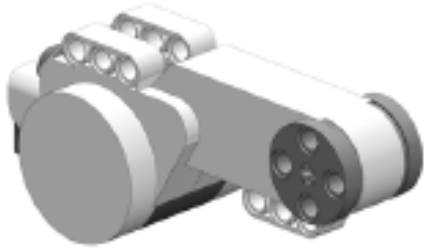

# Five Different Categories

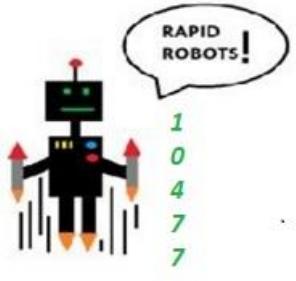
- *Electronics*
- Beams
- Connectors
- Gears
- Miscellaneous elements

# Classifying **Electronics**



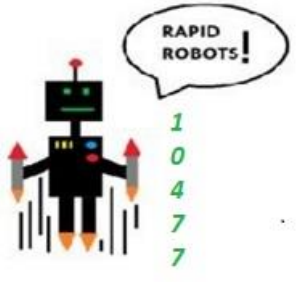
- Brick or Controller
- Motors
- Sensors
  - Light sensor, Color sensor, Touch sensor, …
- Electrical Cables






# Five Different Categories

- Electronics
- *Beams*
- Connectors
- Gears
- Miscellaneous elements



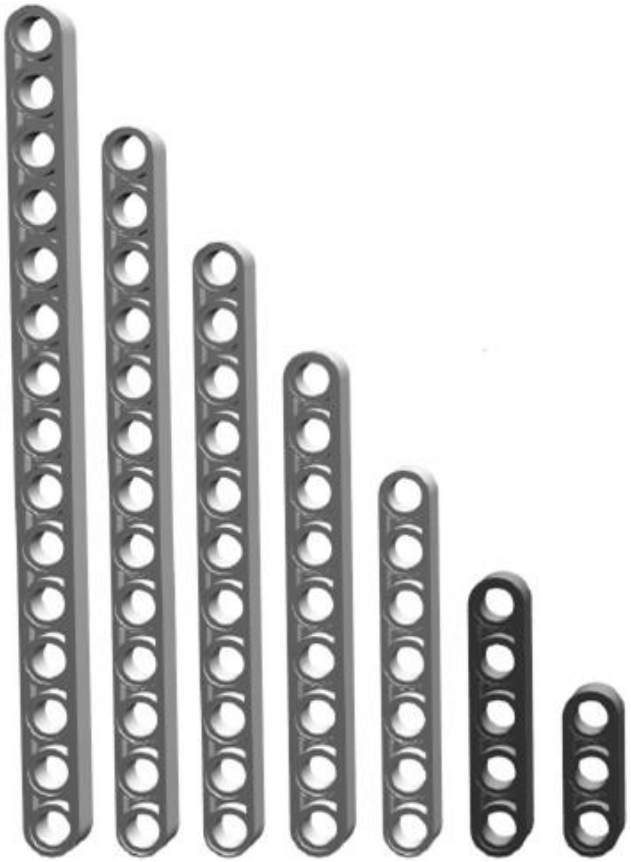

# Classifying **Beams**

Beams are like foundation, walls, roof to your house

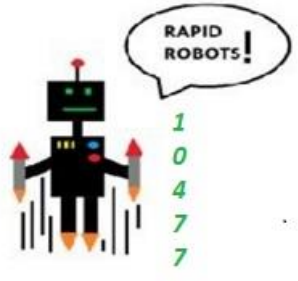
Four types of beams

- Straight beams
- Angled beams
- Half-beams

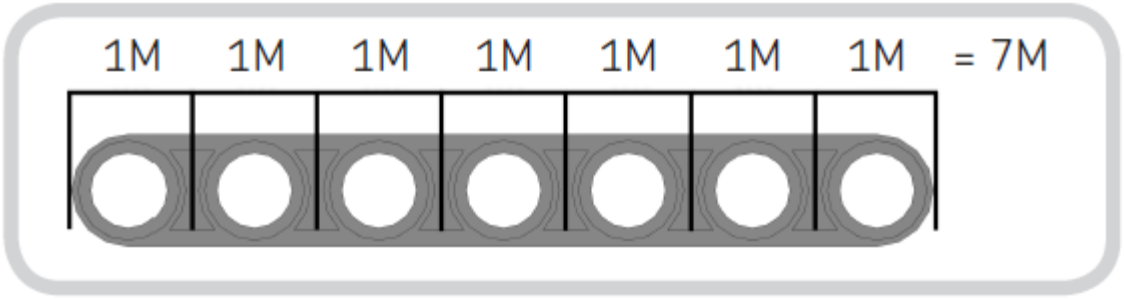
# Examining the Pieces- Straight Beams



- Smooth / Rounded ends
- Odd number of holes
- Round holes
- 15M straight beam
- 13M straight beam
- 11M straight beam
- 9M straight beam
- 7M straight beam
- 5M straight beam
- 3M straight beam




# Examining the Pieces- Measuring Beams




*Add up the number of modules to get a total measurement of 7M*

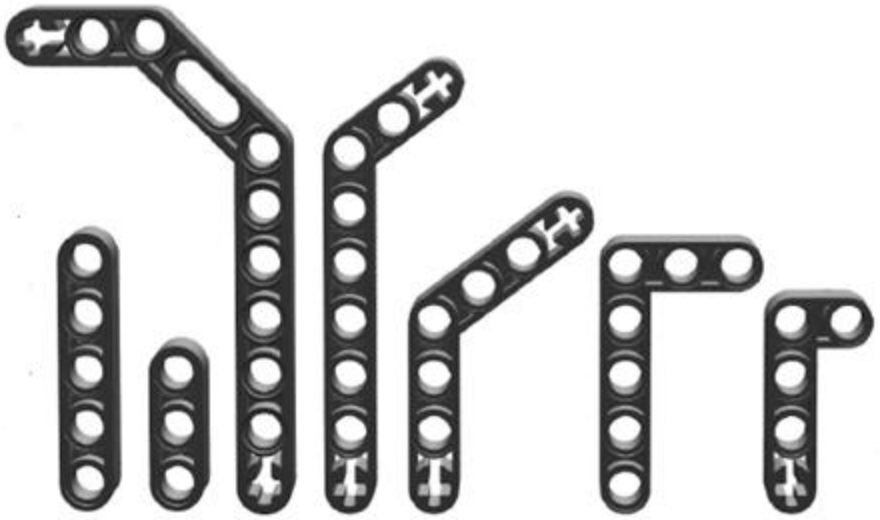
## Uses of straight beams

?????

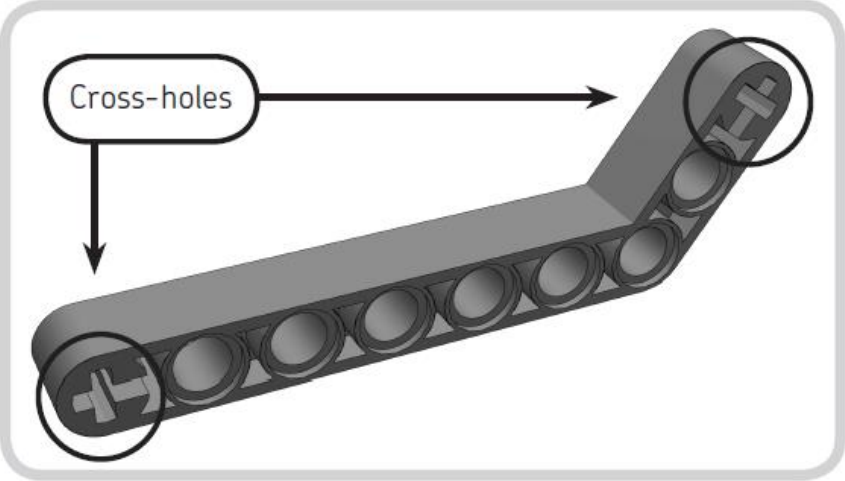
# Examining the Pieces- Angled Beams

## What are angled beams ?

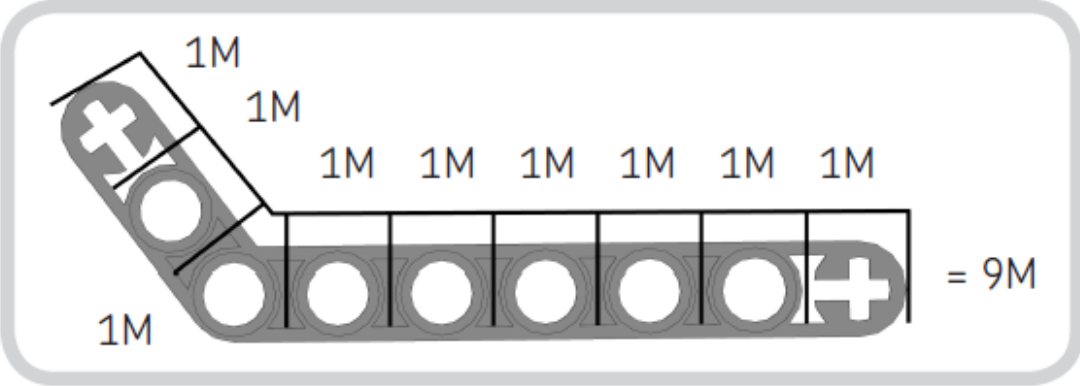
- One or more sections are angled
- Can be used as fingers or grabbing attachment



# Examining the Pieces- Angled Beams




*Some angled beams, such as this 9M angled beam, have cross-holes.*




*Measure an angled beam just as you would measure a straight beam.*

# Examining the Pieces- Half Beams

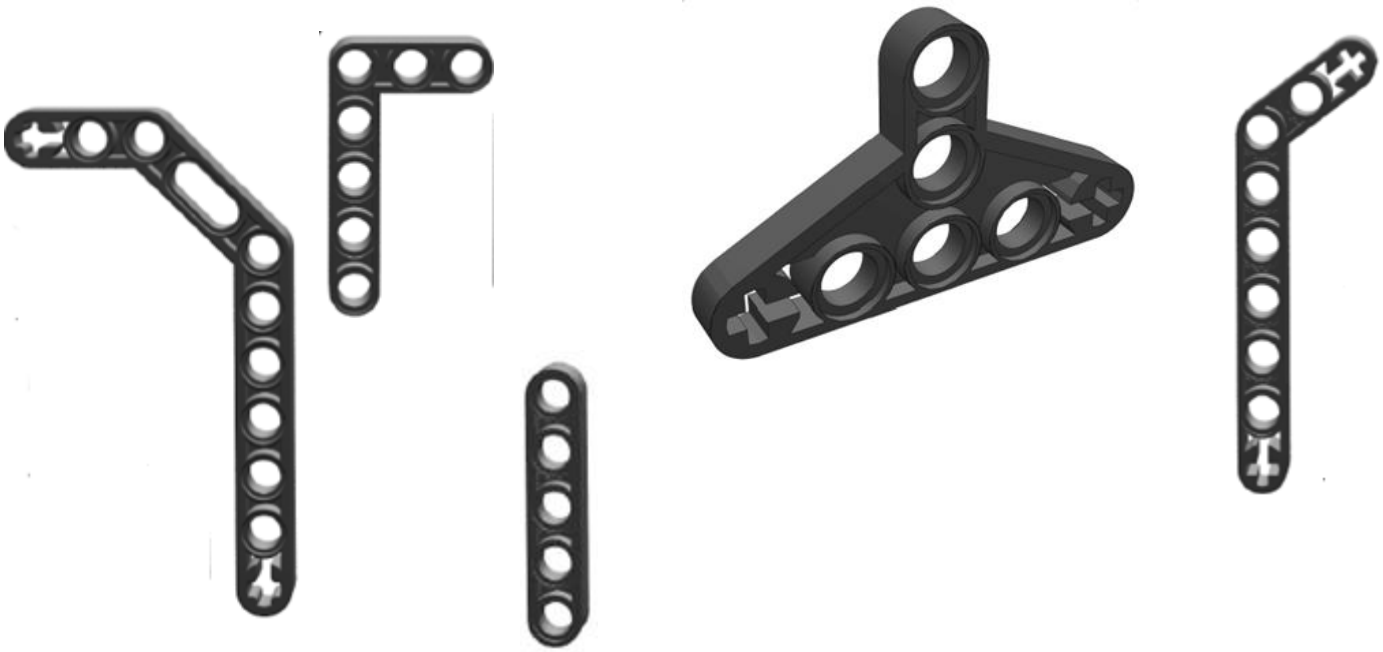
## What are half beams ?

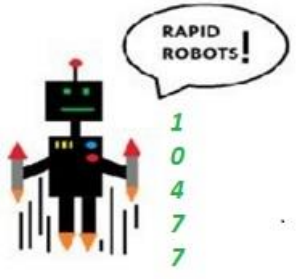
- Only Triangular half beams
- Used for structure and mechanical purpose
- No measurements

The triangular half-beam

# Examining the Pieces- Review

**Name these ……**

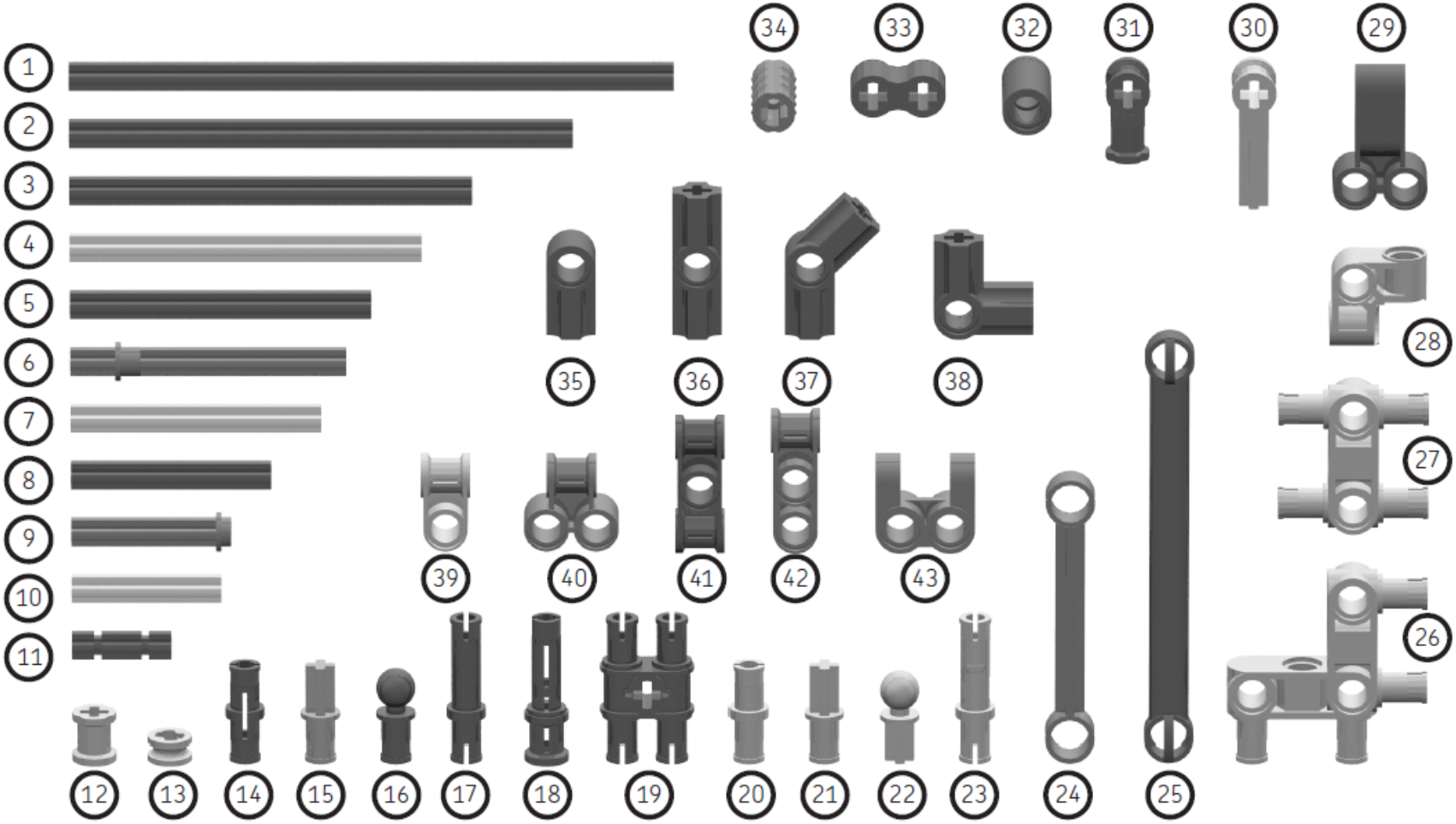





# Five Different Categories

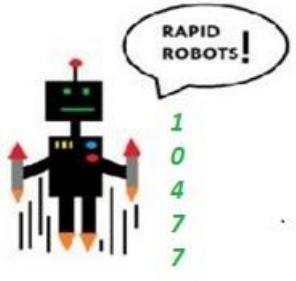
- Electronics
- Beams
- *Connectors*
- Gears
- Miscellaneous elements

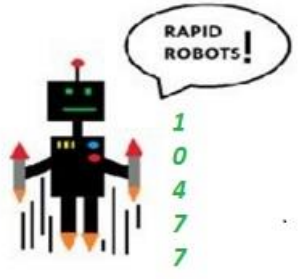
# Connectors in NXT



| number in figure | piece name |
|---|---|
| 1 | 12M axle |
| 2 | 10M axle |
| 3 | 8M axle |
| 4 | 7M axle |
| 5 | 6M axle |
| 6 | 5.5M stopped axle |
| 7 | 5M axle |
| 8 | 4M axle |
| 9 | 3M studded axle |
| 10 | 3M axle |
| 11 | 2M notched axle |
| 12 | Bushing |
| 13 | Half-bushing |
| 14 | Friction peg |
| 15 | Friction axle peg |
| 16 | Friction ball peg |
| 17 | 3M friction peg |
| 18 | Bushed friction peg |
| 19 | Double friction peg |
| 20 | Peg (smooth) |
| 21 | Axle peg (smooth) |
| 22 | Axle ball peg (smooth) |

| number in figure | piece name |
|---|---|
| 23 | 3M peg (smooth) |
| 24 | Steering link |
| 25 | 9M steering link |
| 26 | 5M pegged perpendicular block |
| 27 | 3M pegged block |
| 28 | Cornered peg joiner |
| 29 | Double peg joiner |
| 30 | Extended catch |
| 31 | Catch |
| 32 | Peg extender |
| 33 | Flexible axle joiner |
| 34 | Axle extender |
| 35 | #1 angle connector |
| 36 | #2 angle connector |
| 37 | #4 angle connector |
| 38 | #6 angle connector |
| 39 | Cross block |
| 40 | Double cross block |
| 41 | Inverted cross block |
| 42 | Extended cross block |
| 43 | Split cross block |






# Connectors in EV3

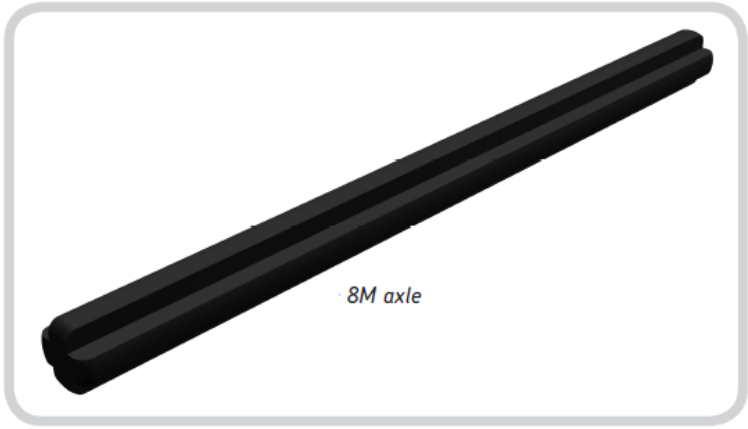
## What are Connectors?

- Used to hold structure together
- Most pieces in EV3 are connectors
- 3 types of connectors
  - Axles, Pegs and Connector blocks

# Connectors - Axles

## What are Axles?

- Most important connector
- Total of 72 axles in EV3 kit
- Even size axles are BLACK
- Odd size axles are GREY



# Connectors - Axles

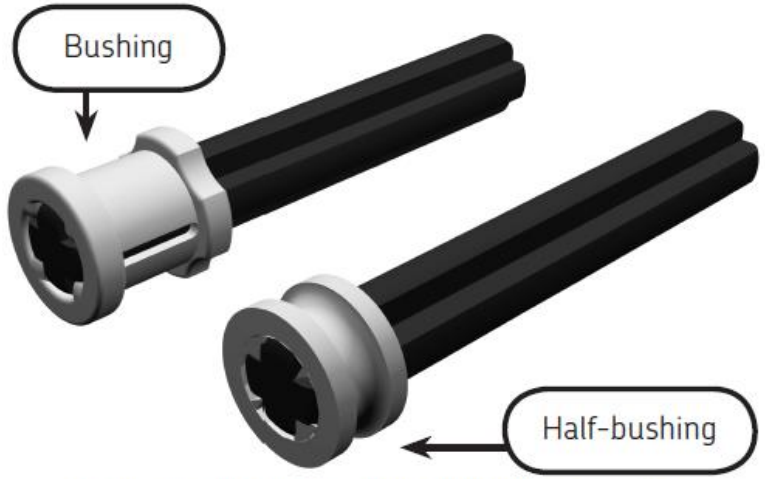
## How to use Axles?


*Using an axle in cross-holes creates a very rigid connection,*

# Connectors - Axles

## Why use bushing ?

- Used on pieces with cross hole
- Rigidly hold their place anywhere on axle
- Used to prevent axle from falling out of a round hole
- Very useful connector

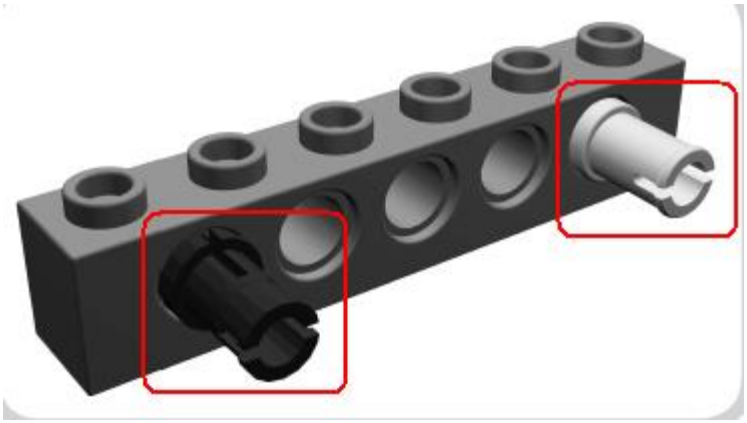



*The bushing and half-bushing are assistants to the axle.*

# Connectors - Pegs

## What are Pegs?

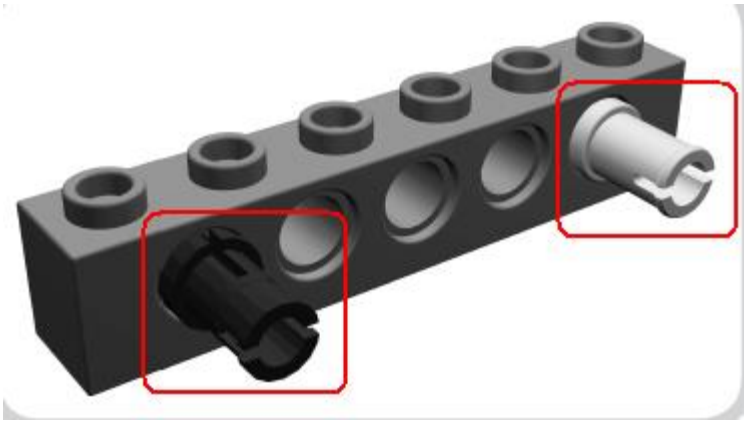
- Small piece that connects both sides
- Used to connect two or more pieces
- Total of 200 pegs in EV3 kit (35%)
- Pegs can snap into round-hole, cross-hole or both



# Connectors - Pegs

## Types of Pegs?

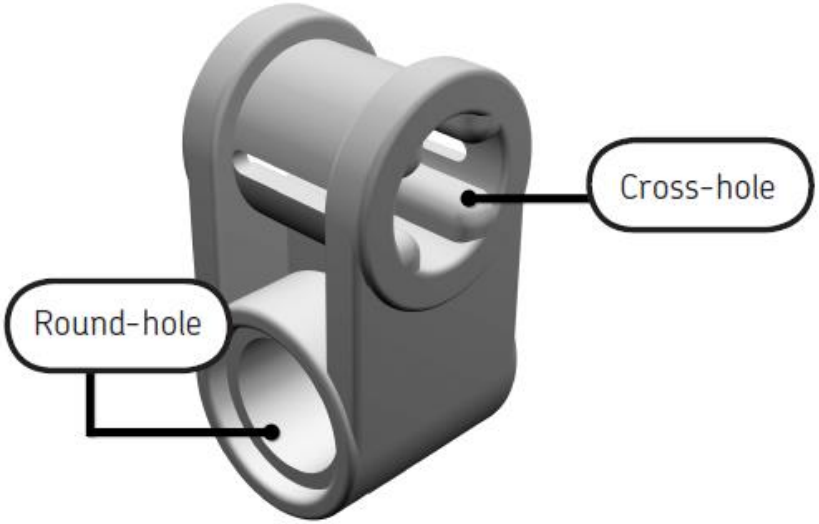
- Smooth Pegs – can move freely in place
- Friction Pegs – stiff and keep their position
- Twist each peg to see the difference

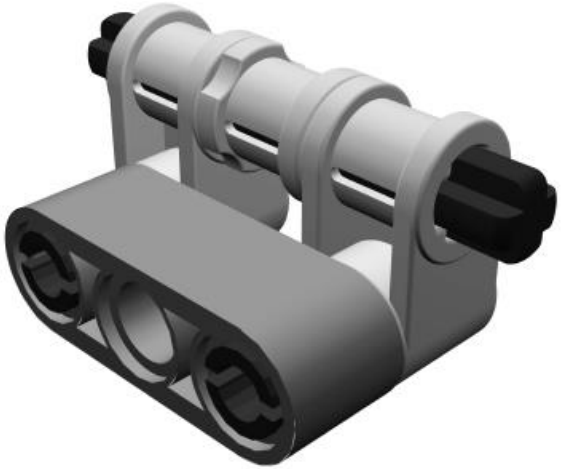


# Connectors – Cross Block

## Why use Cross Block ?

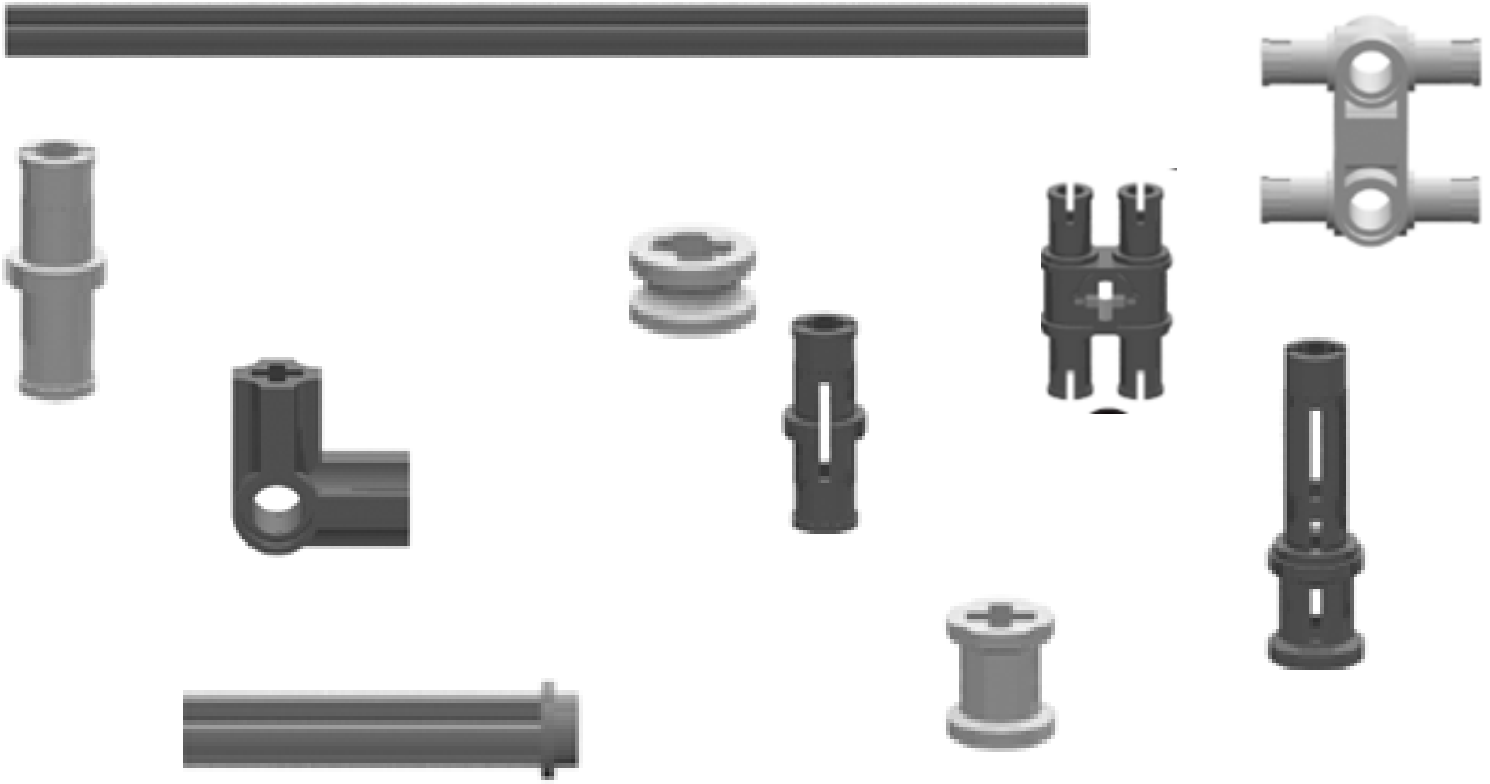
- Helps to build complex and strong mechanism
- Two cross blocks in combination with an axle, bushing, and friction pegs can position a beam in a manner that would be difficult to achieve using just beams with pegs or axles.

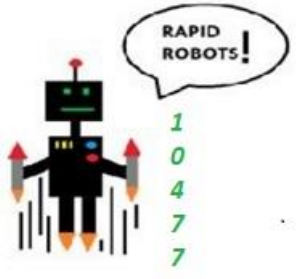


# Examining the Pieces- Review

**Name these ……**






# Five Different Categories

- ❑ Electronics
- ❑ Beams
- ❑ Connectors
- ❑ *Gears*
- ❑ Miscellaneous elements

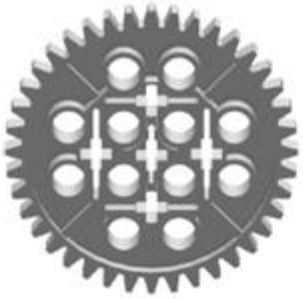
# How Gears look

8t (spur) gear

16t (spur) gear

24t (spur) gear

40t (spur) gear



12t double bevel gear

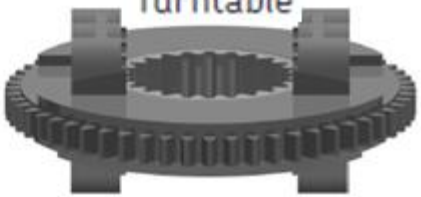
20t double bevel gear

36t double bevel gear

Worm gear

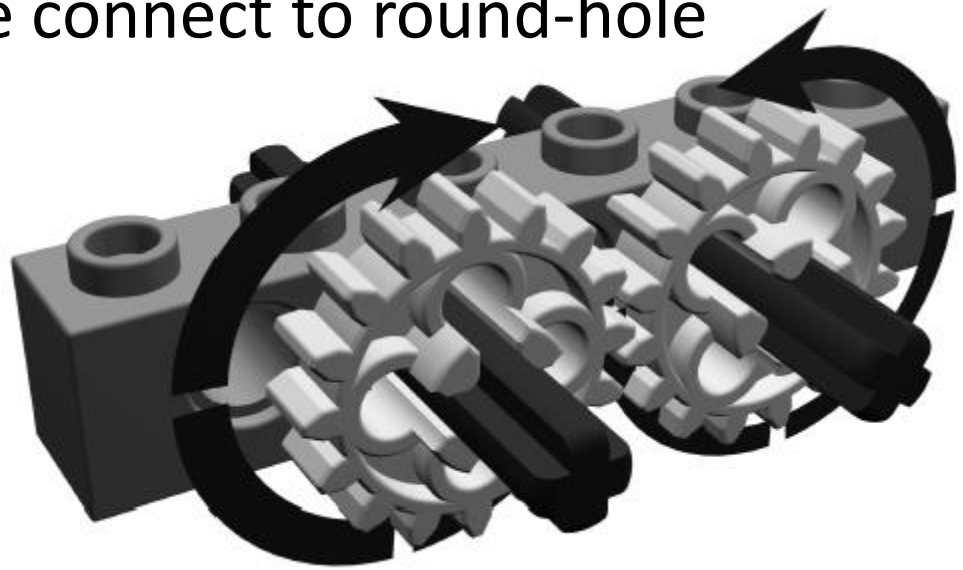
Knob wheel

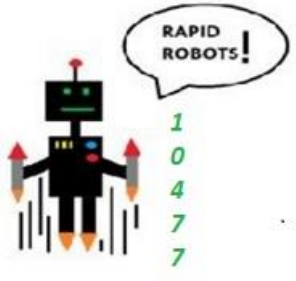
Turntable



# What is a Gear ?

- Gear is a wheel with teeth
- Teeth used to transmit motion
- When two gears engage, rotation of one gear causes the other gear to rotate
- Axles connect to gears at cross-holes
- Other end of axle connect to round-hole to move freely

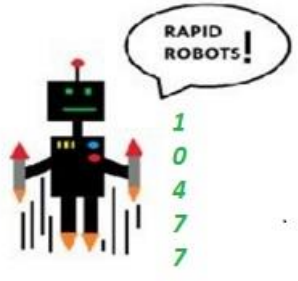





# What is a Gear …

- Motion starts at Axle and Gear transmit the motion

- How do we measure Gears
  - By counting teeth on the wheel (16t)



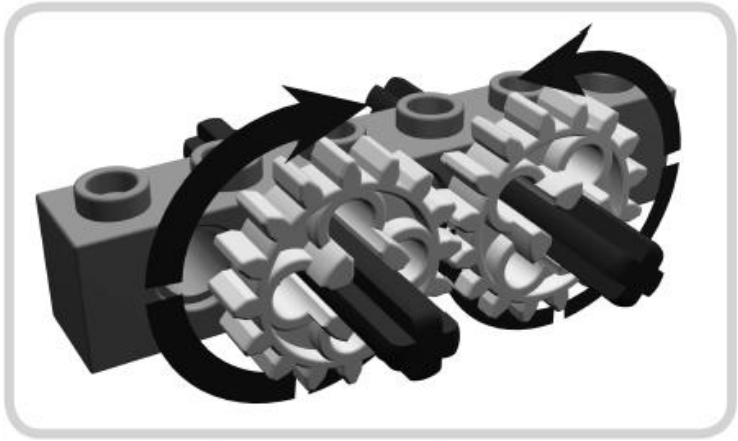

# Categories of Gears – SPUR Gear

- Simplest and common of gears
- Generally Spur gears are called just Gears
- 4 types of Spur gears in NXT (8t, 16t, 24t, 40t)

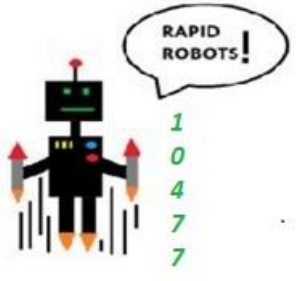
# Categories of Gears – Double bevel gear

- Very unique gear, look at the teeth
- The teeth act like 2 types of gears
- First as bevel gear
  - The teeth intersect/mesh  perpendicular angles
- Second as spur gear
  - The teeth mesh  when used in parallel
- 3 types of double bevel gears in NXT (12t, 20t, 36t)

20t double bevel gears



When two gears mesh, motion can transfer between the gears and, subsequently, their axles.

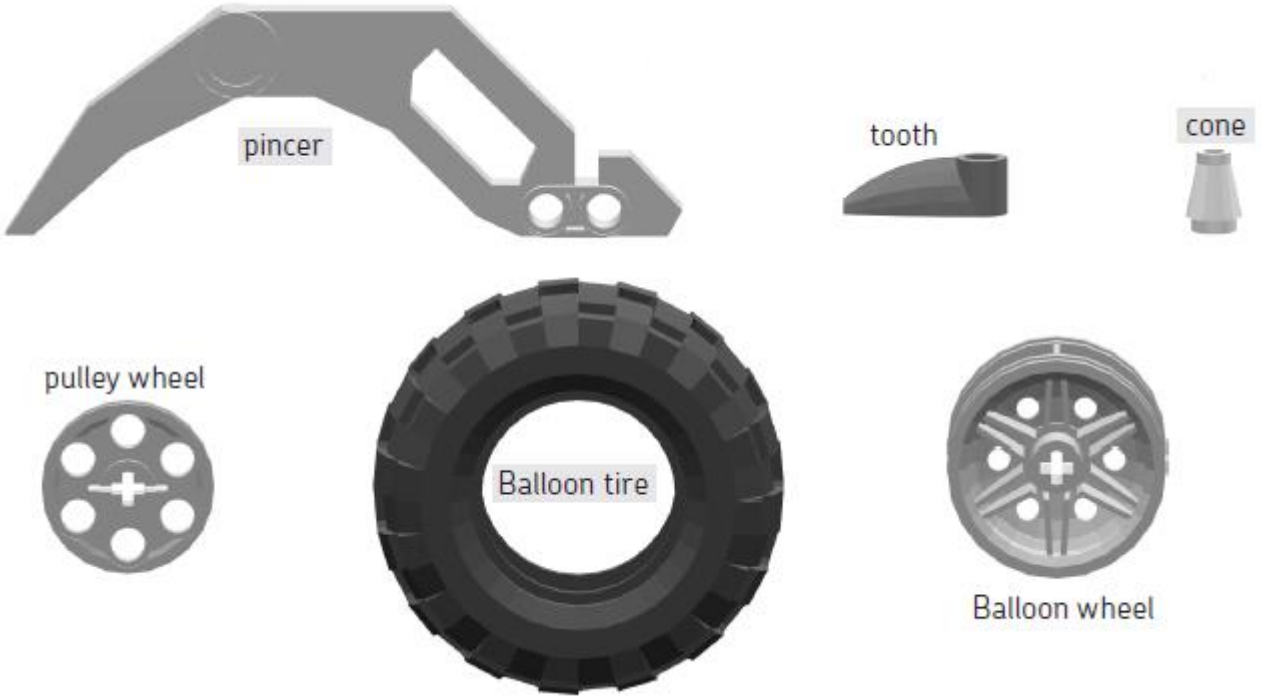



# Five Different Categories

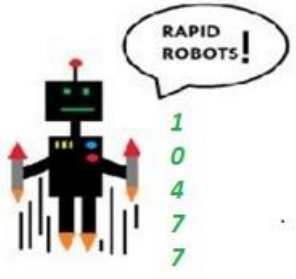
- Electronics
- Beams
- Connectors
- Gears
- *Miscellaneous elements*

# How Miscellaneous Elements look

- Now we learned that naming pieces is simple
- Can be used for different application
- Balloon tires and Pulley wheel used as robot wheels



# What we learned – Review




- ❑ About Lego Pieces
  - ✓ Classifying the pieces
  - ✓ Naming the pieces
  - ✓ Measuring the pieces

- ❑ 5 Categories of NXT Pieces
  - ✓ Electronics
  - ✓ Beams
  - ✓ Connectors
  - ✓ Gears
  - ✓ Miscellaneous elements

# Refer

Pictures used in this document are from web