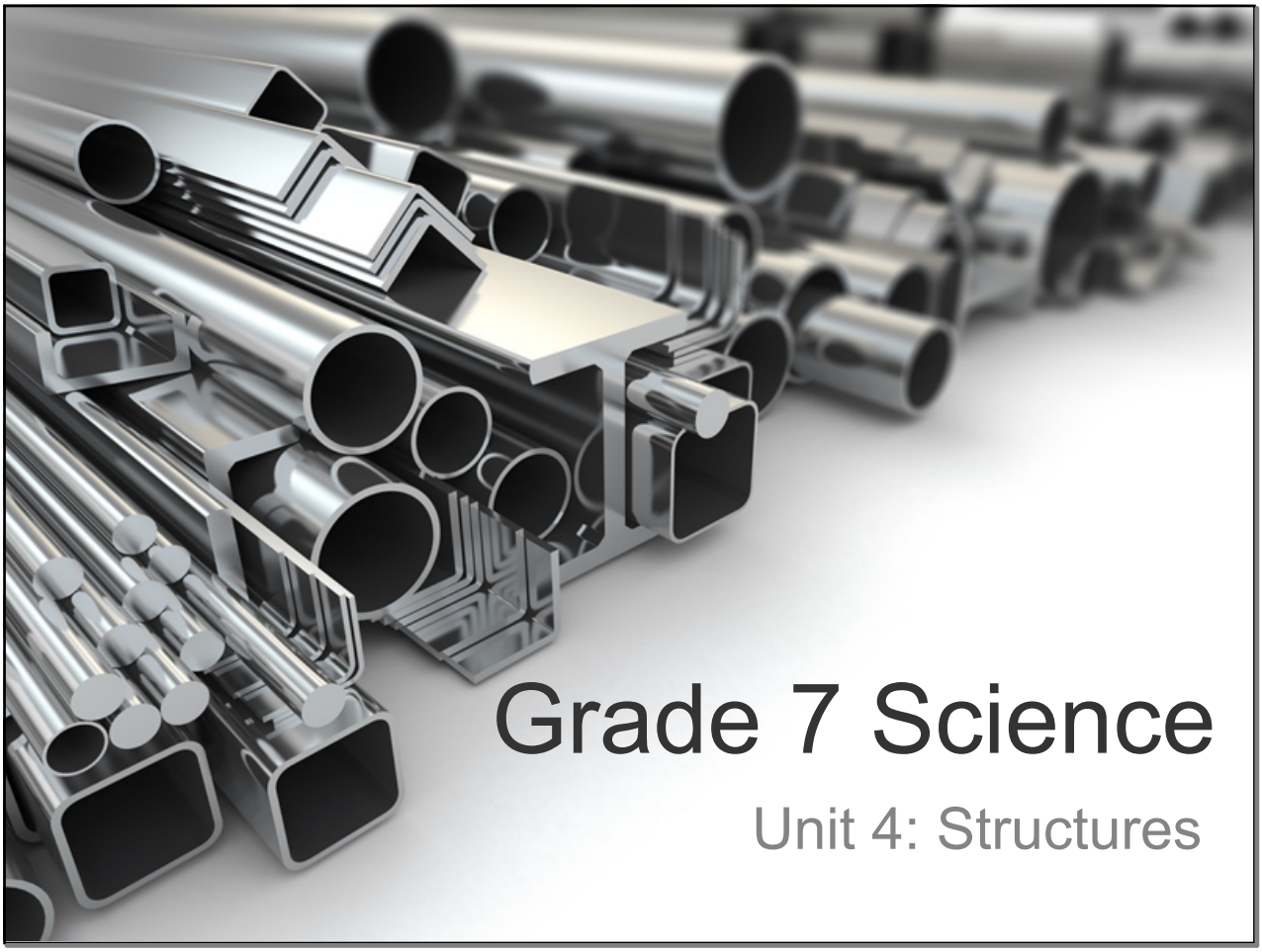

Grade 7 Science

Unit 4: Structures

Review of Definitions

What is mass?	The amount of matter in an object.
What is weight?	The force of gravity exerted on a mass.
What is a force?	A push or pull that can cause movement.

kg
N
N

Structural Efficiency

What does the word efficiency mean? The ability to accomplish a job with a minimum expenditure of time and effort.

What would an efficient structure be? A structure that can hold a lot of mass without having a high mass itself.

We define structural efficiency as a ratio of the mass a structure can support to the mass of the structure itself. In equation form, it looks like this:

$$Structural\ Efficiency = \frac{Maximum\ Mass\ Supported}{Mass\ of\ Structure}$$

Structural Efficiency

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This equation can be a little overwhelming, let's see what we can do about that:

Let Structural Efficiency = S.E.
Let Maximum Mass Supported = m_{sup}
Let mass of structure = m_{str}

$$\longrightarrow \quad S.E. = \frac{m_{sup}}{m_{str}}$$

Memorize this for homework

What units would we use for S.E.? None - it is mass divided by mass (kg/kg), meaning the two cancel out.

Structural Efficiency

Racing bikes are built to be very light. Why?
Would you want a bike with a high or low structural efficiency?

$SE = \frac{M_{sup}}{M_{str}}$

$SE = \frac{50\ ants}{1\ ant}$

$SE = 50$

Ants are said to be able to carry 50 times their own weight.
What is wrong with that statement?
What is the correct way to say it?
What does the statement mean?

My friend Fooch has a mass of about 150 kg.
I once gave him a piggy back!!!
I had a mass of 65 kg.
How do I compare to an ant?

Structural Efficiency

1. A group of students wanted to test the structural efficiency of a stool in Mr. C's room, and they started piling on top of it. The stool has a mass of 3.5 kg, and combined the students a mass of 268 kg. At this point, what is the structural efficiency of the stool?

$M_{str} = 3.5kg$
$M_{sup} = 268\ kg$
$SE = ?$

$SE = \frac{M_{sup}}{M_{str}}$

$SE = \frac{268}{3.5}$

$SE = 76.57$

∴ The structural efficiency of the stool is about 76.6

2. If a table has a structural efficiency of 56 and can hold 942 kg, what is the mass of the table?

$M_{str} = ?$
$M_{sup} = 942kg$
$SE = 56$

$SE = \frac{M_{sup}}{M_{str}}$

$56 = \frac{942}{M_{str}}$

$M_{str} = 16.8\ kg$

∴ The table has a mass of 16.8kg.