


Helping Students Understand Inquiry and Design

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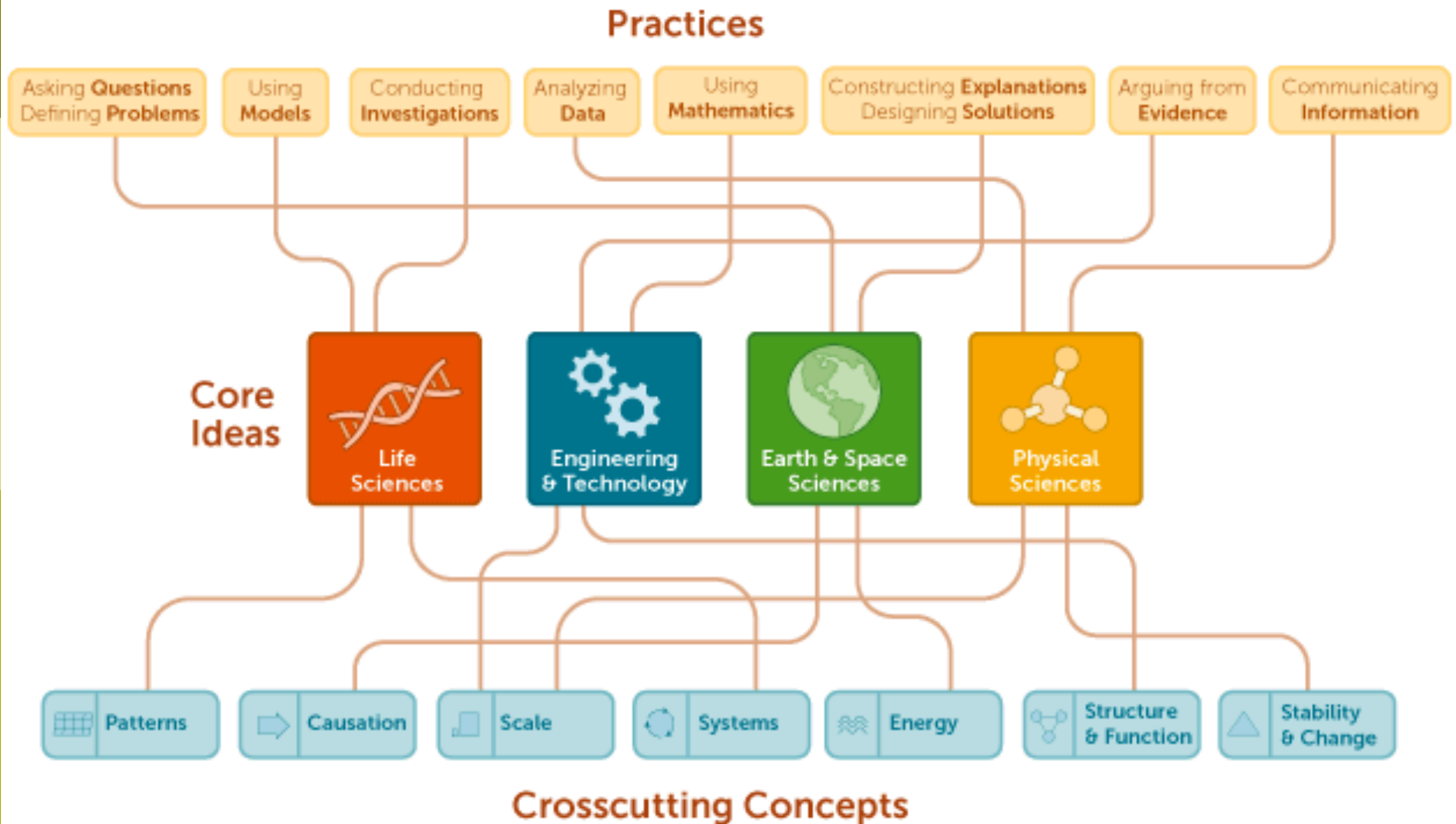
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INQUIRY
&
DESIGN

NGSS Inquiry and Design?



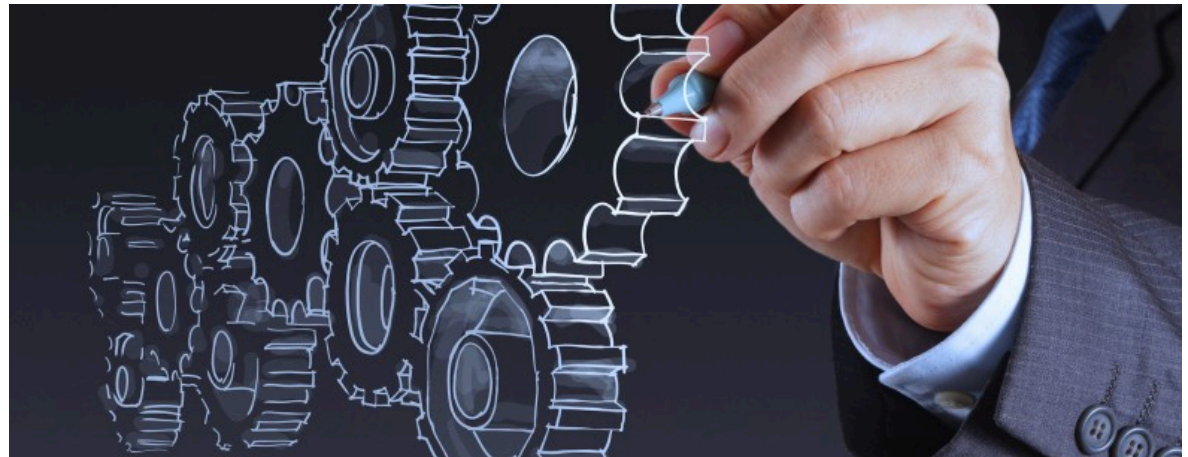
What is Science?

Science is the field of study / way of knowing concerned with describing and explaining the world around us.



What is Engineering?

“We use the term engineering in a very broad sense to mean any engagement in a systematic practice of design to achieve solutions to particular human problems.” Framework p. 11

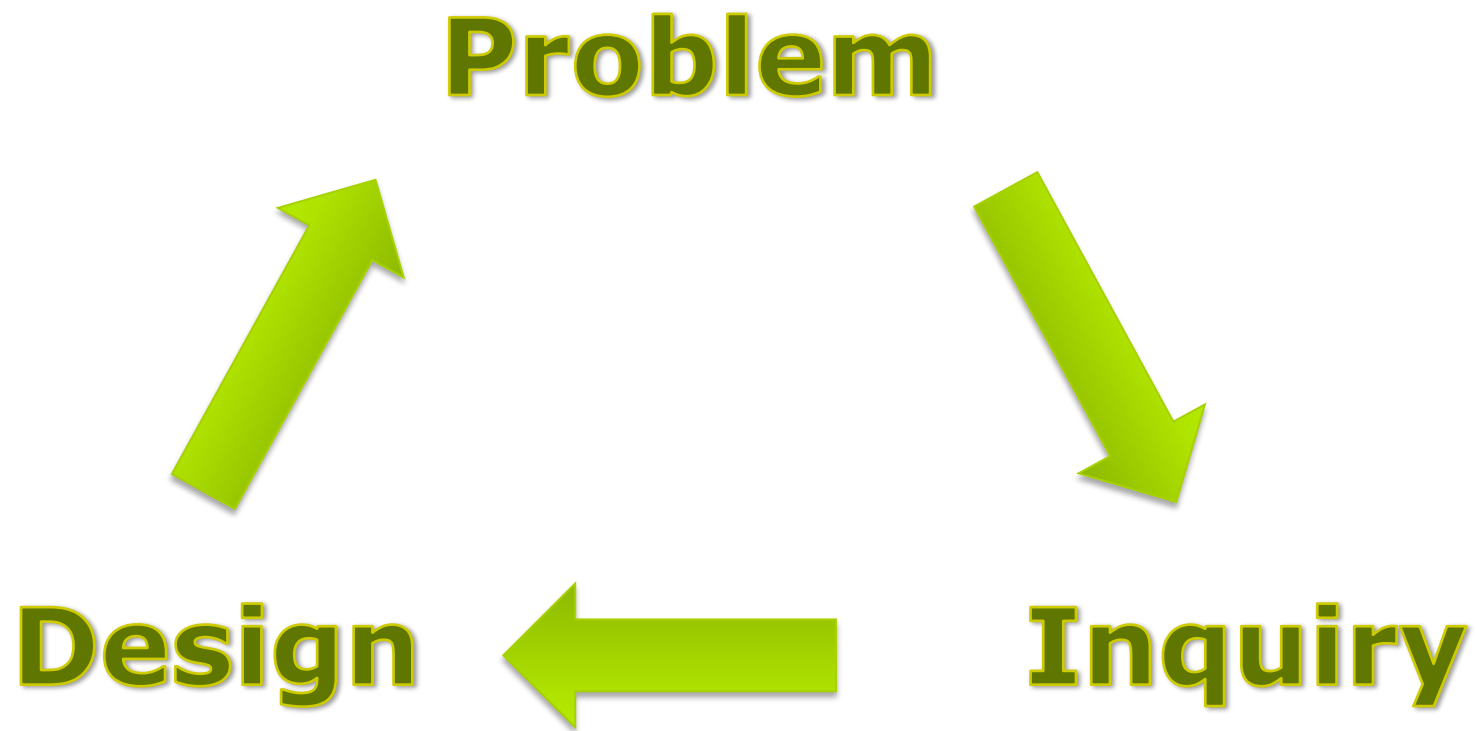


Why Engineering in Science?

- Explore practical use of science
- Not covered elsewhere
- Enhances interest in science

“We are convinced that engagement in the practices of engineering design is as much a part of learning science as engagement in the practices of science.” Framework p. 12

Inquiry-Design Cycle





Classic Bridge Design Problem

- How can we get cars across the river with the least material?
- Inquiry – How do forces work on a bridge?
- Design – What bridge design is best?

Inquiry – How do forces work?

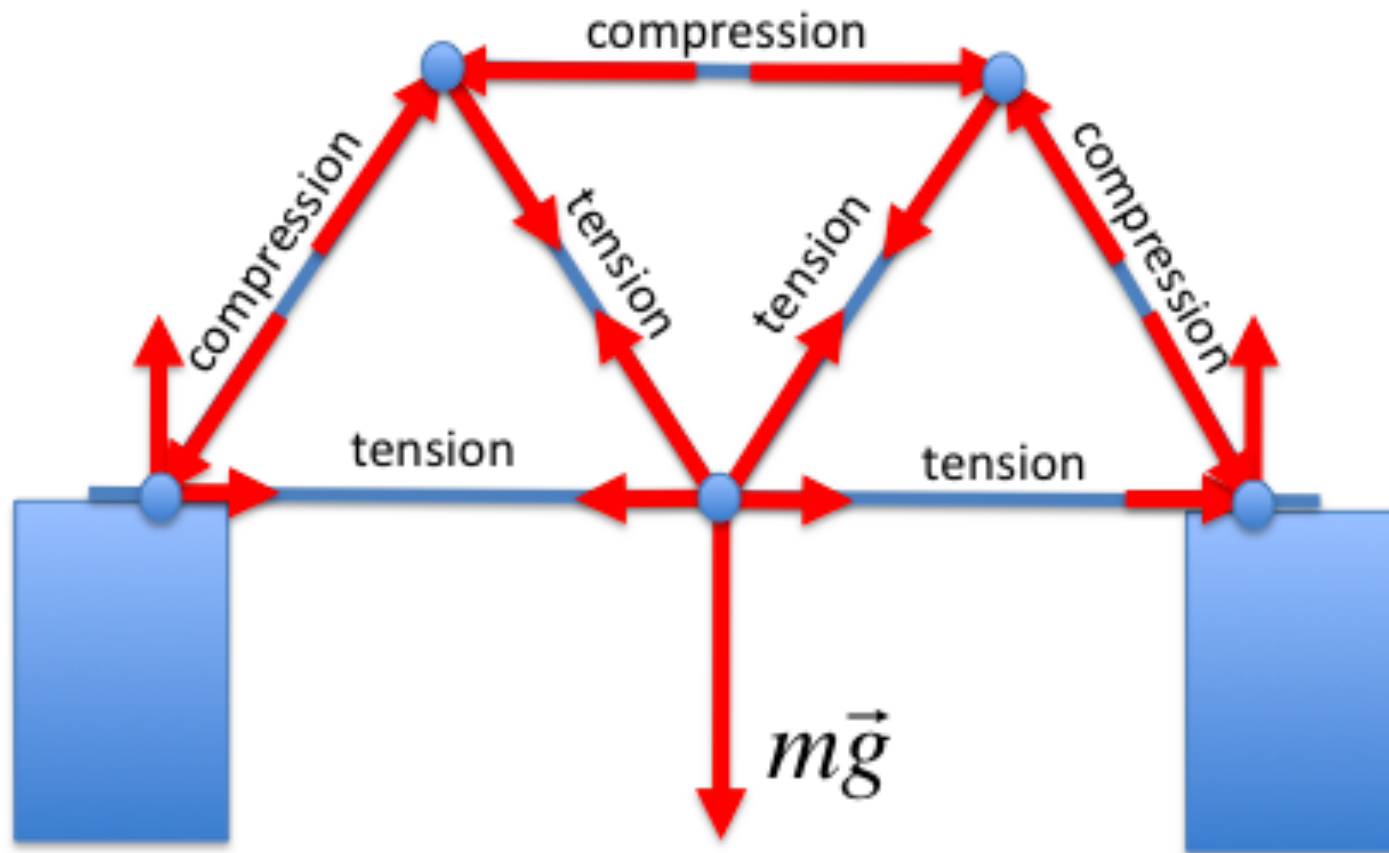
- **Why do some bridges hold more weight than others?**
- Build as many bridge types as you can.
- Test load capacity
- Describe the forces
- Newton's Laws
 - 1st Law – Forces in balance
 - 2nd Law – Force = mass x acceleration
 - 3rd Law – Every action has an equal and opposite reaction.

Bridge Idea Bank

- Flat
- Arch
- Folded beam
- Half fold
- Large triangles
- Small triangles (Pleated)

Understanding Forces

Arrows are forces on **hinges**!



Design


- Which bridge design will carry maximum weight with the lowest material?



Successful Bridge Design Principles

- ❑ Transfer force to the river banks
- ❑ Maximize compression
- ❑ Triangles rule
- ❑ Lots of small features are stronger than one large feature
- ❑ There are multiple solutions





INQUIRY
VS
DESIGN

High School

- **HS-PS2-1.** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- **PS2.A: Forces and Motion** Newton's second law accurately predicts changes in the motion of macroscopic objects.

Middle School Standards

- **MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- **PS2.A: Forces and Motion.** For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).