



## Science Focus Unit 4 – Structures and Forces Review Booklet

### Focusing Questions:

How do structures stand up under a load?

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What forces act on structures,

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What materials and design characteristics contribute to their strength and stability?

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### Guiding Questions and Activities to Help you Study Key Concepts

**Topic 1** - Classification of Structures according to their origin (natural or manufactured) and according to how they are built (mass, frame, shell) - Similarities, in form or function, of manufactured structures to natural structures.

Describe the differences between **natural** and **manufactured structures**.

Natural Structures	Manufactured Structures

Can you detail examples of **manufactured structures** that have their design based on a **natural structure**?

Manufactured Structures	Design based on ...



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What modifications need to be made to certain types of frame structures to **stabilize** them? Give detailed examples, if you can. (p. 275)

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**Topic 2** - Factors considered by structural designers include: shape, function, appearance, safety, esthetics, cost, materials, and joints

What are some of the **common functions** of structures?

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What does '**aesthetically appealing**' mean?

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What is a '**margin of safety**'?

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What **factors** make building a structure more expensive?

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How do **material properties** determine their use?

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What are the common **different types of materials**?

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When choosing material for a structure, what considerations do **designers** need to get information about before making a decision?

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What are the two different types of **joints**?

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Describe the various types of **fasteners** - giving examples of each type.

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**Topic 3 - Measurement of Mass (How and units) - Measurement of Weight (How and units)**

Describe the difference between **mass** and **weight**.

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What **instruments** are use to measure mass and weight?

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What **units** are mass and weight calculated in and how were these units developed?

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Draw force diagrams that show a **balanced force** and an **unbalanced force**.

Balanced Force	Unbalanced Force



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**Topic 4** - External forces including live loads (changing or non-permanent) and dead loads (the weight of the structure itself) - Internal forces of tension, compression, shearing, buckling and bending

What is **deformation**?

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Describe the differences between **external** and **internal** forces, giving examples of each.

Internal Force	Examples
External Force	Examples

Draw force diagrams that illustrate the different **internal forces** that can act on a structure.

Internal Force -	Internal Force -
Internal Force -	Internal Force -



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Describe tensile strength, compressive strength, shear strength and torsion strength.

Type	Description of Structural Strength
Tensile	
Compressive	
Shear	
Torsion	

Identify the forces acting on different **parts of a bicycle** and the types of strengths of each of the main parts.

Bicycle part	Type of force acting on it	Type of Strength

How do **materials** get their strength?

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**Topic 5** - Deformation in structures - Properties of Materials to withstand internal forces. - Failure of materials under pressure from forces by snapping, buckling, bending, stretching, shearing and twisting

Describe how a **lever** can generate a large force.

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Describe the types of forces, which cause shear failure, buckling failure and torsion failure.

**Shear** \_\_\_\_\_

**Buckling** \_\_\_\_\_

**Torsion** \_\_\_\_\_

How can knowledge about **failure of materials** and structures be useful?

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What is **metal fatigue**?

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**Topic 6 - Choices in design and materials to strengthen a structure against specific kinds of forces - Frictional Forces**

What are the **three key methods** used by designers to help structures withstand forces and prevent failure?

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What is **corrugation**?

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What are **flying buttresses**?

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How can the way a material is made, **lower the cost** of making that material, but still be strong?

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How can you strengthen a **load-bearing** horizontal beam that is supported only at the ends?

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How can frictional forces be used to **stabilize** a structure?

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**Topic 7 - Structural stability (ability not to tip over)**

How can you locate the **center of gravity**?

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What is a '**thrust line**'?

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What are the key strategies used in making a **firm foundation**?

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What scientific principle does a **gyroscope** demonstrate and what **practical applications** can you describe that show a gyroscope in action?

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**Practical Applications:** \_\_\_\_\_  
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**Edquest Website** <http://edquest.ca>

Notes Index <http://www.edquest.ca/Notes/noteindex7.html>  
Review Quiz Index <http://www.edquest.ca/Tests/testindex7sf.html>

**SCIENCE FOCUS 7 Textbook**

Unit At A Glance p. 346

Unit Review pgs. 346- 349