



Long Range Grade 4 Science and Technology Plan

Term 1: Structures and Mechanisms – Pulleys and Gears

Specific Expectations

Understanding Basic Concepts

- describe, using their observations, ways in which mechanical devices and systems produce a linear output from a rotary input (e.g., screw, crank and slider, rack and pinion, cam and cam follower);
- describe, using their observations, the purposes or uses of three classes of simple levers (e. g., wheelbarrow, tongs, seesaw);
- demonstrate an understanding of how linkages (systems of levers) transmit motion and force (e.g., by means of a fixed pivot, a moving pivot, and/or a fulcrum);
- demonstrate awareness that a moving mass has kinetic energy that can be transferred to a stationary object (e.g., a car hitting a wheelbarrow will cause the wheelbarrow to move);
- demonstrate awareness that friction (e.g., rubbing hands together) transforms kinetic energy into heat energy;
- investigate ways of reducing friction (e.g., use of ball bearings, lubricants) so that an object can be moved more easily.

Developing Skills of Inquiry, Design and Communication

- formulate questions about and identify needs and problems related to structures and mechanisms in their environment, and explore possible answers and solutions (e.g., test the effort required by different gear systems to lift the same load);
- plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;
- use appropriate vocabulary, including correct science and technology terminology, to describe their investigations (e.g., use terms such as *block* and *tackle* in describing pulley systems and *gear train* in describing gear systems);
- compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer (e.g., create a table recording how the action of a pulley

system is altered by changing the tension of the band connecting two pulleys);

- communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, drawings, charts, and oral presentations (e.g., draw a diagram of a proposed object and a diagram of the finished product);
- design, make, and use a pulley system that performs a specific task (e.g., a pulley system that closes a door or carries an object from one place to another);
- design and make a system of pulleys and/or gears for a structure (e.g., a potter's wheel) that moves in a prescribed and controlled way (e.g., fast, straight) and performs a specific function;
- manipulate pliable and rigid materials (e.g., modelling clay, wood) as required by a specific design task.

Relating Science and Technology to the World Outside the School

- demonstrate awareness that most mechanical systems are fixed and dependent on structures (e.g., elevators);
- compare in qualitative terms the performance of various mechanical systems (e.g., a block-and-tackle system, a single-pulley system), and describe how they are used;
- identify and make modifications to their own pulley and gear systems to improve the way they move a load (e.g., change the size of pulleys or gears used; use gears that change direction through a right angle);
- evaluate, in general terms (e.g., as more or less effective), the performance of a system that they have made and the performance of another system designed to do the same task;
- explain how various mechanisms on a bicycle function (e.g., levers for braking; gears and chains for changing speed);
- demonstrate awareness that finishing techniques can adversely affect the performance of a mechanical system (e.g., problems result if paint gets into a gear system);
- identify the properties of materials (e.g., pliability, rigidity) that are best suited for use in a structure that contains a mechanical system;
- describe the consequences of having a limited choice of materials when making a device or a structure;
- identify common devices and systems that incorporate pulleys (e.g., clotheslines, flagpoles, cranes) and/or gears (e.g., bicycles, hand drills, wind-up or grandfather clocks).