
| ***Author(s):*** ***Michael Lucky Voiselle*** | | | ***Lesson Title:*** ***BODY POWER*** | | | |
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| ***Grade Span*** | | | ***ICLE Application Model*** | | | |
| ***K-4*** | ***5-8*** | ***9-12*** ***XX*** | ***A*** | ***B*** | ***C*** ***XX*** | ***D*** |

**Instructional Focus:**

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| **Measurement**<br>Students use a variety of tools and techniques of measurement in a problem-solving situation. Students communicate the reasoning used in solving these problems. |
| **Algebraic Concepts and Relationships**<br>Students use algebraic methods to investigate, model, and interpret patterns and functions involving numbers, shapes, data, and graphs in a problem-solving situation. Students evaluate and communicate the reasoning used in solving these problems. |
| **Science as Inquiry**<br>Students demonstrate knowledge and skills necessary to perform scientific inquiry. |
| **Science in Personal and Social Perspectives**<br>Students apply scientific principles to personal and social issues. |

**Performance Task**

Your task is to determine the power that can be produced by various human body parts. You will need a stopwatch, and a tape measure. Prior to proceeding, you and your group of 4 students are to define and understand the difference between the following 7 terms: work, power, force, energy, Joules, Watts and horsepower. Include these 7 terms in your conclusion write-up. You will need to apply the units of Joules, Watts and horsepower in your investigation.

Each student will select 3 different activities to perform in the minimum amount of time. Record the proper measurements of distance and time in a well-organized data table. For each activity, your data table should reflect force in kilograms, distance in meters, time in seconds, force converted to Newtons, Work in Joules, Power in Watts and horsepower.

Select 3 activities from the following; Climb a set of stairs, Lift a set of free weights by hand, Climb a vertical rope, Lift a set of leg weights, or any other activity that a measurable force acts through a distance. (Use the weight room at your school)

You need to perform each activity 3 times and average these times together. Record all timings, force lifted or moved, and the distance the force moved. Remember, work is the product of force and distance only if they act in the same direction. So if running stairs, the force lifted is the student's weight and the distance is the vertical displacement, not the distance along the stairs.

Show all mathematical computations and unit cancellations. The following conversions or formulas may be helpful: 2.2 pounds=9.8Newtons, Work= force times distance, 747.7Watts=1 Horsepower, Power=work divided by time.

You are to write a conclusion summary of your experiments, observations, group comments, and address the following questions. The write-up must be well written and free from spelling and grammatical errors.

1. Which activity resulted in the largest power produced? Which muscle group was used in this activity?
2. Did the activity with the largest force result in the largest power produced? Explain how a large force could result in a relatively small power production? Show mathematically.
3. Why must a student have an initial velocity of zero when the watch is started? In other words will the calculated power be incorrect if the student had a head start?
4. Could a simple machine like a pulley, winch, or lever increase the actual power that a student can produce? Explain your answer by conducting an experiment related to one of your three chosen activities. Then produce mathematical evidence for your conclusion.

**ICLE Essential Skills**

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| Apply in writing the rules and conventions of grammar, usage, punctuation, paragraphing and spelling. (ela1) |
| Present information in well-organized fashion that will be clear to the target audience. (ela11) |
| Understand ***basic algebraic properties*** (i.e., commutative: ab = ba; associative: ab(c) = a(bc); and distributive: a(b+c) = (ab)+(ac)). (m3) |
| Know and apply the principles of scientific inquiry. *(Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.) (Not Ranked s114)* |
| Know the metric system and the units of metric measure and convert metric units to English units. (s4) |
| Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way. (s5) |
| Understand and apply the concepts of work and power and how they relate to energy. An object experiences work when a force displaces the object; power is the time-rate of doing work. (s70) |

**Scoring Guide:**

RATE CRITERIA: 3=Excellent, 2=Satisfactory, 1=Unsatisfactory, 0=Does not attempt or does not understand

**CRITERIA**
**SCORE**

Experimental procedure and student contribution to group _____

Student participated in 3 different activities _____

Data tables were well organized _____

All mathematical computations were correct and units cancelled properly _____

Student performed an experiment with a simple machine and presented a comparison between humans and machine _____

Conclusion summary was well organized and addressed all questions _____

Student defined the 7 terms at the beginning of the experiment correctly _____

Summary was well written, well organized and free from spelling and grammatical errors _____

**Keywords**

| English Language Arts | Mathematics | Science |
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| **Reading** | **Algebra**<br>**Equations**<br>**Algebraic Operations**<br>**Math in Daily Life** | **Earth Science** |
| **Writing**<br>**Spelling**<br>**Grammar**<br>**Organization**<br>**Expository** | **Geometry** | **Life Science**<br>**Behavior** |
| **Communications** | **Statistics** | **Chemistry** |
| **Literature** | **Calculus** | **Physics**<br>**Biomechanics**<br>**Power**<br>**Work**<br>**Lab Experiments** |
| **Other** | **Trigonometry** | **Other** |