

Reading Standards for Literacy in Science and Technical Subjects 6–12

Key Ideas and Details

- 6-8.RST.1** Cite specific textual evidence to support analysis of science and technical texts.
- 9-10.RST.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- 11-12.RST.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Integration of Knowledge and Ideas

- 6-8.RST.8.** Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
- 9-10.RST.8.** Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.
- 11-12.RST.8.** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Identifying Ordered Pairs from a Table

High Daily Temperature

Time (days)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature(°C)	27	28	31	30	34	38	42	18	20	24	28	29	33	38	38

- Task 1a:** Identify the variables in the data table above
- Identify the ordered pairs in the above data table
- Name the unit for time and the unit for temperature in the above data table
- Which day had the highest recorded temperature?
- What are the two days that had a recorded temperature of 28°C?

- Task 1b:** What other questions could be answered by using the data from the above table?

- Task 1c:** What questions are raised, and not necessarily answerable, from analyzing the data table?

Using Evidence to Support a Claim

Task 3a: Consider the following claim:

The cheetah is the world's fastest animal.

Use the data table below to support or refute this claim.

Animal	Body Length (in inches)	Speed (in miles per hour)
Cheetah	50*	70
Pronghorn Antelope	53	61
Gray Fox	27*	42
House Cat	18*	30
Human	72	25

*excluding tail length

Task 3b: What questions are raised about the claim from analyzing this data table?

Task 3c: Read the following paragraphs and complete the new data table

The Peregrine Falcon

The Peregrine Falcon (*Falco peregrinus*), sometimes known in North America as Duck Hawk, is a medium-sized falcon about the size of a large crow: 38-53 cm (15 to 21 inches) long. Peregrine Falcons have a wingspan of about 1 meter (40 inches). Males weigh 570-710 grams; the noticeably larger females weigh 910-1190 grams.

The Peregrine Falcon is the fastest creature on the planet in its hunting dive, the stoop, in which it soars to a great height, then free falls at speeds in excess of 300 km/h (185 mph) into either wing of its prey, so as not to harm itself on impact. Although not self-propelled speeds, due to the fact that the falcon gathers the momentum and controls its dive, capture (if any) and landing in its own right, technically there is no faster animal. The fastest speed recorded is 390 km/h (242.3 mph). The fledglings practice the roll and the pumping of the wings before they master the actual stoop.

Animal	Body Length (in inches)	Speed (in miles per hour)
Cheetah	50*	70
Pronghorn Antelope	53	61
Gray Fox	27*	42
House Cat	18*	30
Human	72	25
Peregrine Falcon	21	242.3

Task 3d: What questions are raised about the original claim (re: cheetah) by the addition of this information?

Using Evidence to Support a Claim (continued)

Task 4a: Read the article about Hummingbirds. Circle the authors claim. Complete the data table.

Hummingbirds outpace fighter pilots

The birds are faster than fighter jets relative to size and withstand g-forces that would make the average human black out

Alok Jha, science correspondent , theguardian.com, Tuesday 9 June 2009 19.12 EDT

Hummingbirds are the fastest animals on Earth, relative to their body size. They can cover more body lengths per second than any other vertebrate and for their size can even outpace fighter jets and the space shuttle – while withstanding g-forces that would make a fighter pilot black out.

Christopher James Clark, a zoologist at the University of California, Berkeley, took high-speed pictures of male Anna's hummingbirds (2.8 inches long) performing dives as part of their courtship ritual. He measured them moving at up to 385 body lengths per second (blps), which is around 27.3 meters per second (61.42 mph).

This is the highest speed ever recorded for a vertebrate, relative to its size. The only animals that can move faster relative to their body size are insects such as fleas...

...Its maximum dive speed of 385blps is faster than peregrine falcons (203blps) and swallows (350blps) diving in pursuit of prey. "Incidentally," wrote Clark, "it is also greater than the top speed of a fighter jet with its afterburners on, 150blps (885 meters per second), or the space shuttle during atmospheric re-entry, 207blps (7,700 meters per second)."

Animal	Body Length (in inches)	Speed (in miles per hour)	Body Lengths per Second (BLPS)
Cheetah	50*	70	24.64
Pronghorn Antelope	53	61	17.6
Gray Fox	27*	42	27.37
House Cat	18*	30	29.3
Human	72	25	6.6
Peregrine Falcon	21	242.3	203
Anna's Hummingbird	2.8	61.42	385

To calculate BLPS: (speed in miles / hour)(1 hour / 3600 seconds)(63,360 inches / 1 mile)(1 BL / body inches)

Task 4b: Alok Jha uses BLPS rather than MPH to define Earth's fastest animal. Analyze his line of reasoning.

Task 4c: In the third paragraph, Alok Jha writes, "This is the highest speed ever recorded for a vertebrate, relative to its size. The only animals that can move faster relative to their body size are insects such as fleas..." Does his own writing contradict his claim?

Task 4d: What steps would you need to take to determine the world's fastest animal based on BLPS?

Considering Opposing Viewpoints

Task 5a: Read the comments posted about Alok Jha’s Hummingbird article. Analyze the reasoning of each.



tumblehome 10 June 2009 8:25am

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Pedantry warning, well actually physics warning.

Body lengths per second doesn't mean much. If you consider the stored energy in muscles, other things being equal it is proportional to body weight. But the cross section of muscles (which determines the force they can produce) increases as only the 2/3 power of body weight, as of course does the cross sectional area which determines wind resistance in birds and water resistance in fish.

Therefore, all birds with a similar body plan would be expected to achieve roughly the same maximum flight speed, but the bigger they are the harder it is to get off the ground (because the available lifting force increases more slowly than the mass.) Small birds are more manoueverable, large birds should have longer endurance (because their wind resistance increases more slowly than their stored energy.) Works for aircraft, too.

The idea that if a hummingbird (say) was scaled up to the size of a condor, it would achieve some enormous speed, is quite wrong.

In the same way the idea often presented in school biology books that if a flea was scaled up to the size of a human being, it would be able to jump tall buildings, is also quite wrong. If a flea was scaled to human size, it wouldn't be able to jump at all because its weight would be so much greater in relation to the available muscle force.

Not to knock hummingbirds, but cod statistics really irritate me.



magpie44 10 June 2009 3:02pm

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it is not really a fair or true comparison however blue marlin if taken out of water and allowing for decreased resistance through air as opposed to water are capable of speeds greater than 3 x the speed of sound - am not sure how this compares mathematically to the blps measurement used in the article but that has to rate as impressive at least - still i will remember to doff my metaphorical hat next time I see a hummingbird - providing of course i an actually see the hummingbird.

Task 5b: Have these perspectives impacted your point of view? Briefly describe any new thinking and explain steps you could take to deepen your understanding.

Task 5c: Reflect on today’s learning.

Review the standards for Reading in Science and Technical Subjects. Besides 1 & 8, what Standards were supported with this lesson?