INTERMEDIATE SCIENCE
Grade 8

Eastern School District
Helping Each Student Achieve

Instructions:

All students are required to complete the Data Analysis question and **ONE** of the remaining Case Studies.

In some cases, there is a **Glossary** given with the Case Study to help with some of the terms.

Scientific Literacy Assessment
June 2012

Student Name: 2012 Key

Homeroom: _____

Data Analysis - **All students are required to do this section.**

Read the following and answer all questions in the space provided. (10 points)

Viscosity, by definition, is resistance to flow in fluids. For example: water is a low viscosity fluid; syrup is a high viscosity fluid.

Viscosity is the most critical physical property of oil as it affects both the wear rate of an engine and its fuel efficiency. Lower oil viscosity improves fuel consumption and performance.

In engines, the viscosity of oil will determine how easily it is pumped to the working components, how easily it will pass through the filter and how quickly it will drain back to the bottom of the engine once the engine is turned off. The lower the viscosity the easier it is for all of this to happen.

IVx DVy

Temperature (°C)	Viscosity	
	Oil A	Oil B
0	100	100
10	55	80
20	40	60
30	30	50
40	20	40
50	15	30
60	13	25
70	10	22
80	8	20
90	6	18
100	5	16

Honda is selecting new oil for a dirt bike engine. They have tested two different brands to see how they behave under the operating temperatures for their engine. The results are shown in the table.

1. State the suitable hypothesis for this experiment. (1)

As temperature increases, the viscosity of the oil will decrease.

2. In this experiment, identify the independent (manipulated) and dependent (responding) variables. (1)

Independent (manipulated): Temperature

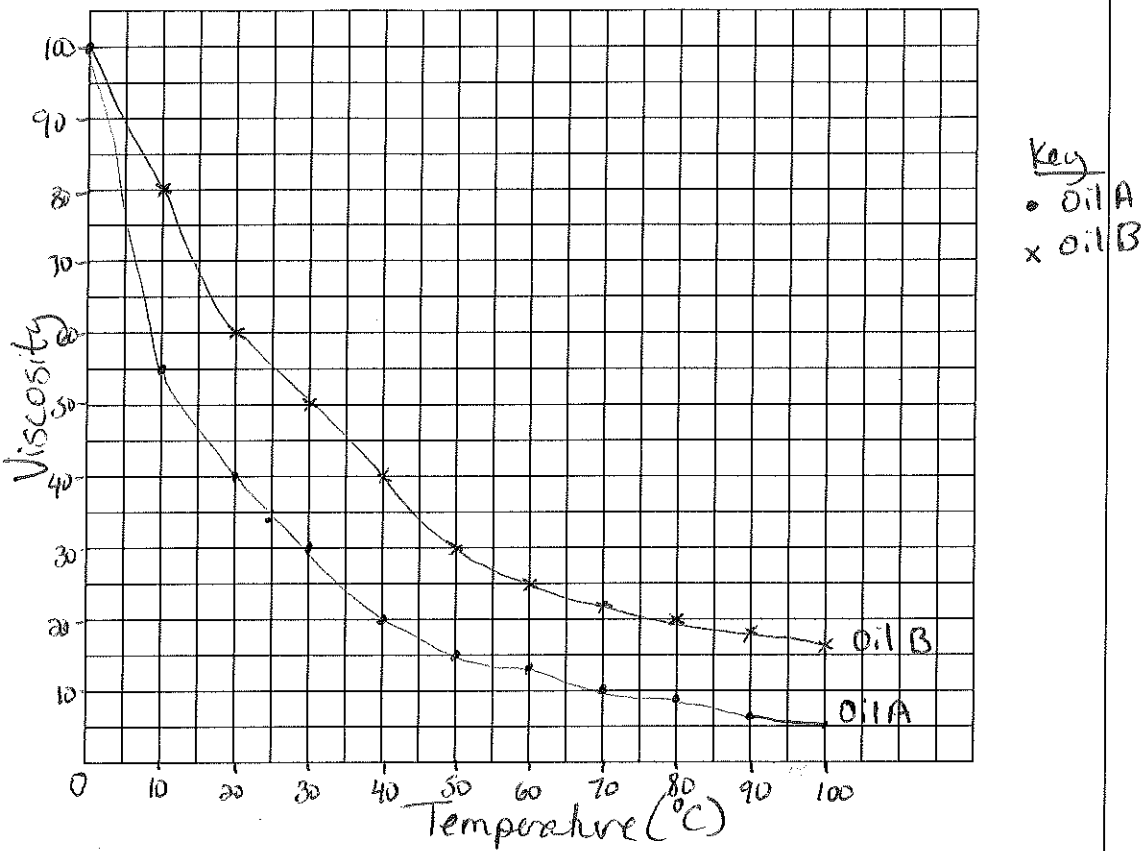
Dependent (responding): Viscosity

3. State two (2) variables which have to be kept constant (controlled) in order for the results to be valid. (1)

Many are acceptable... Vehicle must be the same (dirt bike), same operating conditions, same temperature outside, same testing method

4. Plot a fully labeled line graph of the data obtained in this experiment on the grid below. (4)

Title: How temperature affects oil viscosity



5. At what temperature would Oil A have a viscosity of 35? (1)

25°C (23°-27° is acceptable)

6. If Oil B has a temperature of 55 °C, what is its viscosity? (1)

Oil B has a viscocity of 27. (25-29 is acceptable)

7. State a suitable conclusion for this experiment (include a recommendation for Honda's choice of oil). (1)

As temperature increases, viscosity decreases. Honda should choose Oil A because the viscocity was lower at all temperatures throughout the experiment.

Students are required to do ONE of the Case Studies

Either: **Case Study I: Water's worldwide travels**

Scientists track the movement of 'virtual water,' used in the production of goods and exchanged among nations

Table 1: The Virtual water content of various products.

Product	VWC (L)
1 sheet of paper	10
1 cup of tea	35
1 orange	50
1 apple	70
1 egg	140
1 cup of coffee	140
1 glass of milk	200
1 hamburger	2400
1 cotton t-shirt	2700
1 pair of shoes	8000

Water runs downhill from mountaintops to streams to rivers to oceans. But downhill isn't the only way that water moves. A new study measures how water travels from country to country for human consumption. Scientists looked at water used to grow and make the products that get shipped from nation to nation as imports or exports. They call this a flow of "virtual water."

We typically think about water as the liquid that flows from a faucet. However, nearly 92 percent of the water used by people goes into growing crops, according to water researcher Arjen Hoekstra at the University of Twente in the Netherlands. He and his team recently studied the hidden travels of virtual water used in products made from things like crops and meats. These products are shipped around the world.

Every year, Canada loses the equivalent of twice the yearly **discharge** of the Athabasca River through the export of grains such as wheat, barley, rye and oats. This is a big issue in Alberta. Alberta, with just two percent of Canada's water supply, accounts for two-thirds of the country's water used for irrigation. This water is then exported through the sale of grains.

Table 2: Comparison of Virtual Water import/export 1997-2001

Country	Total Virtual Water (billion L/yr)	
	Exported Water	Imported Water
Canada	95,318	35,430
Australia	72,988	9,007
USA	229,303	175,811

Tracing the water trade, Hoekstra and his team turned up some surprising relationships. For instance, often an arid region sends virtual water to a wetter region. In Kenya, for example fertile land in the lake Naivasha region is used for industrial farms which ship more than 88 million tons of cut flowers to European markets. Cattle herders and communities are left with very limited access to a small portion of the lake. Massive amounts of water are shipped out of Kenya to European countries through this virtual water trade. As Severino Maitima, director of the Ewaso Ngiro River water authority, puts it: "The flower companies are exporting our water. A flower is 90 percent water. We are one of the driest regions in the world and we are exporting water to one of the wettest."

Poor information, mapping and research on our water supplies, as well as a lack of policies on access to fresh water sources for production, are putting our fresh water heritage at risk.

(Adapted from Science News for Kids: April 2, 2012 and Leaky Exports: May 2011)

Glossary

arid Having little or no rain; too dry or barren to support vegetation.

agriculture The science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool and other products

discharge The volume of water that flows through a certain section of the river at a given time.

1. Worldwide, what percent of water is used to produce food? (1) 1. D

A. 2 %
B. 88 %
C. 90 %
(D.) 92 %

2. What type of product requires the most water to produce? (1) 2. B

A. Apples
(B.) Milk
C. Oranges
D. Tea

3. What is virtual water? (1)

Water used to grow and make products that get shipped from nation to nation

4. Why is Alberta at risk from exporting virtual water? (1)

Because they have only 2% of canada's water + use 2/3 of canada's water for irrigation. Then they export the grain they grow.

5. Why are cattle herders in Kenya concerned about virtual water? (2)

Because the cut flower companies export water in flowers. A flower is 90% water. That area in Kenya is pretty dry and most of the available water is used on flowers leaving very little for the cattle herders + communities.

6. What are two things the government can do to ensure that there will be an adequate Canadian water supply for future generations? (2)

More information, mapping + research into Canada's water supply as well as more policies on access to fresh water resources.

7. Water shortages in the US and other countries have led to a demand for Canada to begin exporting freshwater. Describe one advantage and one disadvantage for Canada if this was to occur. (2)

Advantage: Money for Canadians through jobs + taxes.

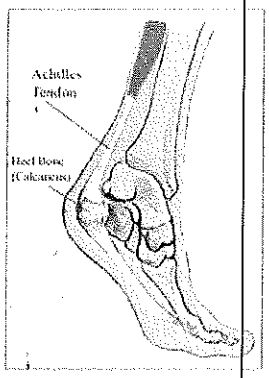
Disadvantage: Using up our water supply which seems fine now, but what if in future the situation becomes more serious?

Or: **Case Study II: Evolved to Run**

Read the following case study and answer the questions that follow. (10 points)

Neandertals and ancient ***Homo sapiens*** probably did not compete against each other in track and field events, but it is interesting to consider, and a recent study gives us a way to predict the results of such a match-up.

Ancient *Homo sapiens* would probably have won long-distance races, while Neandertals might have dominated hilly courses and jumping events. That's because of the shapes of their heel bones, say a team of scientists from the University of Arizona in Tucson and Harvard University. Ancient *Homo sapiens* are humans who lived during the Stone Age. Like modern humans, these early people had short bones in the backs of their heels. Researchers say that these short heels stretched the Achilles tendons tight.



Tendons connect muscles to bones, and the Achilles tendon links the heel to the muscles in the calf. It's the thickest and strongest tendon in the body, and it helps us walk, run and jump. When you run, the tendon acts like a spring that stores energy as it stretches, and releases energy as it relaxes.

A tight tendon, say the scientists behind the new study, boosted that spring action and helped early human runners save energy, allowing them to run far. We modern humans have the same-size heels as those early *Homo sapiens*, so next time you run a marathon, thank your heels.

Neandertals, a separate species from *Homo sapiens*, were also around during the Stone Age but are now extinct. Scientists say Neandertals had taller heels than ancient *Homo sapiens* or modern people so they probably tired out faster since their tendons required more energy. But a tall heel might have helped in other ways. Researchers hypothesize those tall heels supported Neandertals' ankles, helping them walk uphill or jump.

Scientists already had a hunch that Neandertals weren't good at long-distance running. Their bodies were shorter and stouter than those of modern people. Their inner-ear canals were smaller, too, which would have affected their balance.

The new study "provides a new line of evidence that Neandertals were not as suited for long-distance running as modern humans were," Herman Pontzer told *Science News.* Pontzer is an anthropologist at Hunter College in New York City and did not work on the study. Anthropologists like Pontzer and David Raichlen, one of the scientists who did work on the study, want to understand humankind and its history.

Raichlen and his team first brought eight trained runners into the lab to run on treadmills. As the runners ran, the scientists measured how much oxygen they were using. By measuring the amount of Oxygen used, scientists could determine how much energy the runners needed to keep up the pace. Next, the scientists measured the size of the volunteers' heel bones using MRI, or Magnetic Resonance Imaging. (A MRI uses magnetic fields to peek inside the human body.) The researchers used those images to connect energy use to heel size.

Then Raichlen and his team turned to the ancients. They reasoned that the Neandertals' bodies probably worked the same way as the ancient humans', so the

connection between heel size and energy use should work for both people and Neandertals. The researchers studied measurements from the fossilized heel bones of 13 ancient *Homo sapiens* and six Neandertals that lived between 30,000 and 100,000 years ago. Using those measurements — and using the work that matched energy use to heel size — the scientists found that Neandertals used more energy than the ancient people, when they ran at a constant speed.

Pontzer told *Science News* that why ancient people evolved to run farther than Neandertals still remains a mystery.

(Adapted from Science News for Kids: February 23, 2011)

Glossary

anthropology The scientific study of the origin, the behavior, and the physical, social and cultural development of humans.

Homo sapiens are humans who lived during the Stone Age.

Neandertals Humans' closest relatives, members of an extinct species (*Homo neanderthalensis*) that lived throughout most of Europe and parts of Asia and northern Africa.

Achilles tendon The large tendon connecting the heel bone to the calf muscle of the leg.

1. How many trained runners were used in Pontzer's study? (1) 1. C

A. 3
B. 6
(C) 8
D. 13

2. What information did the scientists collect using MRI? (1) 2 D

A amount of energy used by muscles
B. differences between *Homo sapiens* and Neandertals
C. oxygen level in blood
(D.) size of heel bones

3. What do ancient Homo sapiens and modern humans have in common? (1)

Same sized heels.

4. From the study what did Pontzer conclude about Neandertals? (1)

They had larger heels. Since heel size is related to energy use, larger heels mean more energy used so Neanderthals used more energy than ancient people when they ran at a constant speed.

5. How does the Achilles tendon allow us to walk, run, or jump? (2)

It acts like a spring that stores energy as it stretches and releases energy as it relaxes.

6. What is an advantage and disadvantage of taller heels for Neandertals? (2)

Advantage: tall heels supported ankles helping them walk uphill or jump.

Disadvantage: tired out faster / needed more food energy since their tendons required more energy

7. Why do you think ancient people evolved to run farther than Neandertals? (2)

Maybe Neanderthals found food on hills and needed to jump because their heels are more suited to that. Ancient people evolved to run farther because that is how they found their food. They hunted and then tracked their prey over long distances - they weren't fast, they could just go really far so they could tire their prey out over long distances.