

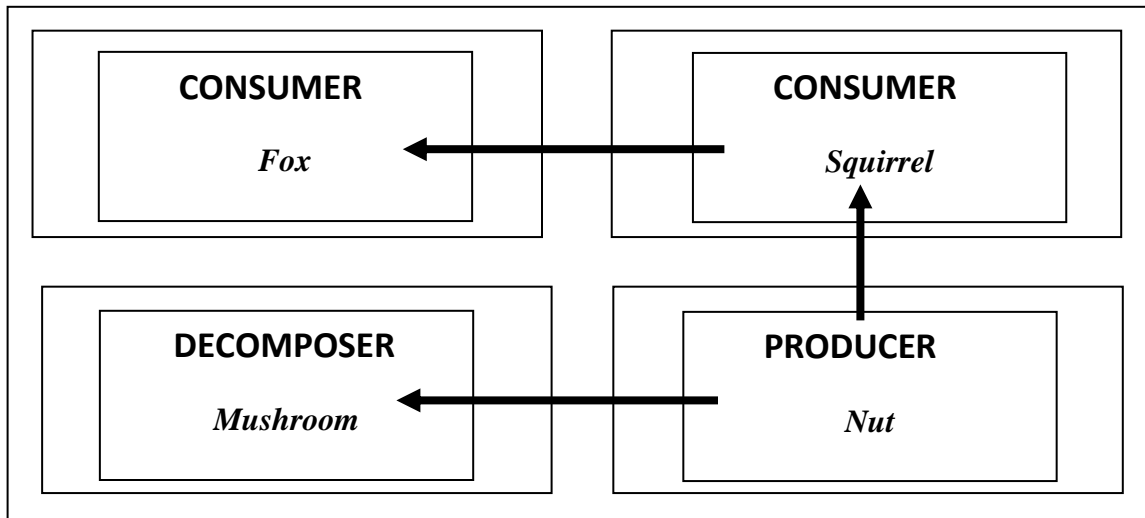
# SCIENCE AND TECHNOLOGY

June 2009 answers

## PART A

### SHORT-ANSWER QUESTIONS

1.



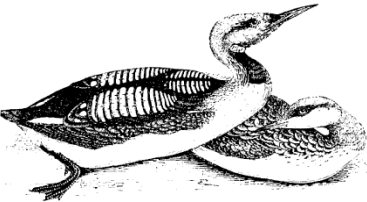
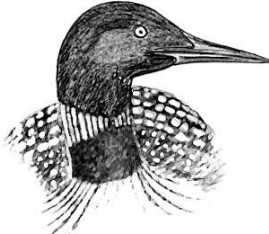
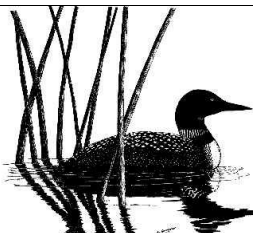

**N.B.:** Do not penalize students for drawing an arrow between the consumers and the decomposer.

2. Polarity of sphere A: **Negative**

Polarity of sphere B: **Negative**

Behaviour of the spheres when they are next to each other: **They repel each other.**

3. **Solution**

Loon		concentration
 A	$3.0 \text{ mg}/100 \text{ g} =$	$3.0 \text{ mg}/0.100 \text{ kg} = 30 \text{ ppm}$
 B	$0.0003 \text{ g}/100\text{g}$	$0.3 \text{ mg}/0.100 \text{ kg} = 3 \text{ ppm}$
 C	$0.020\text{g}/1.0 \text{ kg} =$	$20 \text{ mg}/1.0 \text{ kg} = 20 \text{ ppm}$
 D	$0.2 \text{ mg}/10 \text{ kg}$	$= 0.02 \text{ ppm}$

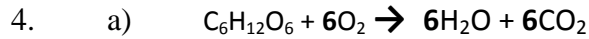
$$\mathbf{D < B < 5 \text{ ppm} < C < A}$$

Based on these analyses, loons C and A could experience reproductive problems because their blood results reveal mercury concentrations exceeding 5 ppm.

The lowest concentration appears in loon   D

The highest appears in loon A

The loon(s) which could develop reproductive problems include(s) C & A



b)  $60g + 64g = 36g + x$

$x = 88g$

## Part B

### Forming an Opinion

#### 5A. Give Your Opinion

I am **for** the proposed beef feedlot

I am **against** the proposed beef feedlot

#### Examples of scientific arguments

**Factor 1: Market Value of Forests** – *If each of the 615 acres of deciduous bush has 20 trees/acre, that amounts to close to 250 000 trees. If the trees are medium- sized each tree contains about 50 board feet of lumber and that amounts to about 12 500 000 board feet of lumber. If the average value of the lumber is \$4.50 per board foot, that amounts to \$56 250 000 of revenue for the lumber before expenses. If we assume that half of the revenue will be spent on harvesting the trees, sawing them into lumber and getting them to market the net revenue will be about \$28 million dollars. This money will go into the local economy once.*

**Factor: 5: Wetlands and Cranberry Production** – *Assume that the 5 acres of cranberry bog are off-limits to cattle and hence remain productive. If each acre yields 160 barrels of cranberries, the bog will yield 800 barrels and will generate 800 barrels x \$67/barrel = \$53 600 of gross revenue. Assume that the expenses amount to 10% of the revenue the bog will yield \$48 240 of revenue year after year*

**Factor 6: Beef Farming** - *If each of the 615 acres harvested of trees and planted in grass and grains can support 50 steers that amounts to 30 750 steers. If we assume that it takes about 2 years to finish a steer, and once finished and marketed each steer brings \$800, that amounts to  $\$24\,600\,000/2 = \$12\,300\,000$  per year of gross revenue. If we assume that about 90% of this gross revenue is expenses, the farm will bring in \$1 107 000 of net revenue per year. This money will go into the local economy year after year.*

#### Examples of other types of arguments

**Factor: Employment** - *Many local people will be hired to harvest the bush; lumber jacks, loggers, carpenters, heavy machine operators, mechanics, furniture makers, millwright for saw mills, and cabinet makers. Also, many local people will be hired to feed the cattle, run the slaughter house, work the land, and truck the meat to the stores. Many seasonal workers will be hired year after year to farm and harvest the cranberries.*

**Other factor** - *A fertilizer industry may develop to process the manure and bag it for use by local gardeners, the bags to be sold in the spring by stores such as Canadian tire.*

N.B.: Accept any other appropriate answer

**Competency 2: Suitable justification of explanation, solutions, decisions or opinions (criterion 4)**

**MARKING KEY**

5 marks	Justifies his/her opinion using more than three of the different factors presented in the background information, giving one relevant scientific argument for each.
4 marks	Justifies his/her opinion using three different factors presented in the background information, giving at least two relevant scientific arguments.
3 marks	Justifies his/her opinion using two different factors presented in the background information, giving one relevant scientific arguments.
2 marks	Gives his/her opinion using one of the factors presented in the background information, but gives no relevant scientific argument.
0 marks	Gives his/her opinion using incorrect factors or fails to give an opinion.

5A. Give Your Opinion

I am **for** the proposed beef feedlot

I am **against** the proposed beef feedlot

### Examples of scientific arguments

**Factor 1: The Carbon Cycle.** - *Cutting down this hardwood forest will decrease a carbon sink, thus the amount of carbon dioxide that would normally be used by these trees for photosynthesis remains unused in the atmosphere. The brush is going to be burned, released carbon dioxide into the atmosphere directly. In fact, deforestation contributes on average 33% to sources of extra unnatural carbon dioxide in the atmosphere. Since carbon dioxide is a greenhouse gas and helps to control the temperature of the climate, the increase in carbon dioxide levels in the atmosphere will impact this cycle (heating up the Earth). This carbon dioxide will remain in the atmosphere and increase global warming or it will have to be absorbed by other reservoirs (sinks) such as fresh water, ocean water, soil and sediments.*

**Factor 2: Market Value of Forests.** – *Although a lot of money will go into the local economy when the forest is harvested, this money will go into the local economy only once. Also, the local furniture-building company will lose its selected lumber and will have to go further afield to find high-quality lumber, thus increasing its costs to operate. This company might move out of the area, thus decreasing the revenue in terms of taxes to the town.*

**Factor 3: Water Pollution and Livestock.** – *Since the manure from the livestock will be disposed of by using it as fertilizer (secondary benefit) and, as such, is sprayed onto fields and pastures as raw, untreated liquified slurry, this may lead to contamination of surface and ground water (sources of drinking water) especially if done in the fall as it would be concentrated in spring runoff. Since the town is downstream from this proposed feedlot and uses the river as its source of drinking water, measures would have to be taken to ensure the river was cleaned of any excess toxins by the time it reached the town. This would cost money and plants and animals would be affected negatively.*

**Factor 4; Methane Production.** – *Large herds of livestock release methane as a result of their digestive processes, 18% of total greenhouse gas emissions.. In fact, livestock emit three different greenhouse gases; methane contributes 37% to the greenhouse gasses emitted by livestock, nitrous oxide (65%) and carbon dioxide (9%). Cutting down forests (carbon sinks) and implementing beef farming (carbon sources) would add large amounts of greenhouse gases into the environment, contributing to the greenhouse effect.*

### Examples of other types of arguments

**Factor 5: Wetland and Cranberry Production** - *The wetland that includes the only local cranberry bog could be affected by the contaminated runoff and perhaps cranberries harvested from this wetland could not be used for consumption due to safety concerns. The people that rely on the cranberry bog to make their living would not have a source of revenue OR would have to pay extensively to put measures in place to clean the river water so it would not contaminate the bog. Also, if the water is contaminated, this could adversely affect the rich biological diversity of organisms that are found within the wetland bog. Since the plants in wetlands help to purify water, recycle nitrogen and phosphorous and maintain a balanced carbon cycle, any change in balance in the wetland could disturb this ecosystem and have wider-reaching effects.*

**Other factor -**

**Factor 6: Beef farming.** *Demand and price of beef can change thus there is no guarantee of a consistent income for this business*

N.B.: Accept any other appropriate answer

**Competency 2: Suitable justification of explanation, solutions, decisions or opinions (criterion 4)**

**MARKING KEY**

5 marks	Justifies his/her opinion using more than three of the different factors presented in the background information, giving one relevant scientific argument for each.
4 marks	Justifies his/her opinion using three different factors presented in the background information, giving at least two relevant scientific arguments.
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2 marks	Gives his/her opinion using one of the factors presented in the background information, but gives no relevant scientific argument.
0 marks	Gives his/her opinion using incorrect factors or fails to give an opinion.

**Carbon Cycle, Greenhouse Gases, Global Warming, Economy and the Environment.**

5 B. Impact of the proposal on the carbon cycle, on greenhouse gases, on global warming, on the environment and on the economy.

**Example answer**

Carbon cycle, greenhouse gases, global warming, the environment, and the economy  
*During photosynthesis, vegetation (trees, plants, algae and phytoplankton) absorb the carbon dioxide in the*

*atmosphere or dissolved in water and produces glucose (sugar) and oxygen. If there is a surplus of carbon dioxide in the atmosphere, the excess can also be dissolved in water.*

*Carbon dioxide is one of the greenhouse gases in the atmosphere that contribute to global warming. As greenhouse gases increase, more of the energy emitted by Earth is reflected back and Earth's temperature increases. As a result more of the ice at the poles melts, the water level of the oceans rise, more coastal areas are flooded, and the weather becomes more unpredictable. Some areas are able to grow crops requiring more heat units while other areas turn into deserts. The economy is affected because more money is needed to air condition homes, relocate buildings and adjust to the changes in the temperature.*

*If the municipal council approves the proposal, many of the trees in the wooded area will be cut down, and the beef cattle on the land will produce more manure. Water runoff from the feedlot and the slaughter house will pollute the river and this will affect the ability of the marsh to cleanse the water. The town downstream that gets its drinking water from the river will have to treat the water, increasing its cost. Because of the pollution, the cranberry marsh may cease to produce cranberries for market and some seasonal workers will become unemployed.*

*Some positives include decreased winter heating costs, increased long term employment in the slaughter house and for trucking, decreased cost of local-grown beef, increased production of fertilizer from cow manure, more steakhouse restaurants, and increased market for local-grown grain for feedstock*

N.B.: Accept any other appropriate answer.

## **Competency 2: Relevant explanations or solutions (criterion 3)**

### **MARKING KEY**

- 5 marks Gives clear and detailed explanations and mentions at least two consequences of higher levels of carbon dioxide in the atmosphere, greenhouse gases, global warming, the economy, and the environment.
- 4 marks Gives appropriate explanations and mentions two consequences of higher levels of carbon dioxide in the atmosphere, greenhouse gases, global warming, the economy, and the environment.
- 3 marks Gives partial explanations and mentions one consequence of higher levels of carbon dioxide in the atmosphere, greenhouse gases, global warming, the economy, and the environment.
- 2 marks Gives inaccurate or incomplete explanations and mentions one inappropriate consequence of higher levels of carbon dioxide in the atmosphere, greenhouse gases, global warming, the economy, and the environment.
- 0 marks Gives no explanations and mentions no consequences of higher levels of carbon dioxide in the atmosphere, greenhouse gases, global warming, the economy, and the environment.

## **Part C**

### **Long Answer Questions**

6. Answer:

- Tomatoes would be a better choice.
- Tomatoes can grow in different types of soils.
- Clay soil has a low air content and does not have good drainage.
- If you planted asparagus the roots would rot because there would be a lot of water that would accumulate in clay soil.
- The pH of the soil 6.5 which is slightly acidic which what tomatoes like.
- Tomatoes will produce more fruit if there is less nitrogen

7. a) Nature of the solution:

- The three solutions are electrolytes (acids, bases and salts).

b) Ionic dissociation:

- When dissolved in water, electrolytic molecules separate into positively and negatively charged ions. These ions are free to move in the solution and allow the flow of an electric current.

c) The nature of the materials used in the conductivity meter:

- The electrodes and wires in a conductivity meter are made of metals. One of the properties of metals is that they conduct electricity.

d) The components or construction of the conductivity meter:

- There is a battery in the conductivity meter that provides the electric potential in order to start the flow of current. The “circuit” created includes the battery, electrodes, wires, light bulb and electrolytic solution.

8. *According to the Rutherford-Bohr model, electrons arranged in energy levels revolve around a nucleus composed of protons.*

*Since the electrons are far from the nucleus, the force holding them is not as strong. This explains why electrons rather than protons have a tendency to travel. Friction transfers the electrons from the outer energy level to the atoms of another substance. This is why some substances become positively or negatively charged depending on whether they lose*



*or gain electrons, and why acrylic dust is attracted by the piece of acrylic that has been cut out, because the friction caused by cutting the acrylic gives the dust and the piece opposite charges.*

Accept any other appropriate answer, such as the use of diagrams representing electrostatic action.

Competency 2 – Relevant explanations or solutions (criterion 3)

**MARKING KEY**

5 marks	Explains electrostatic action using the correct model and indicating the correct displacement of charges.
4 marks	Correctly explains electrostatic action without mentioning the final charge of the two substances in question.
3 marks	Partially explains electrostatic action, mentioning the displacement of charges but without referring to the model.
2 marks	Gives an incorrect explanation of electrostatic action, mentioning the displacement of positive charges.
0 marks	Gives an explanation unrelated to electrostatic action.