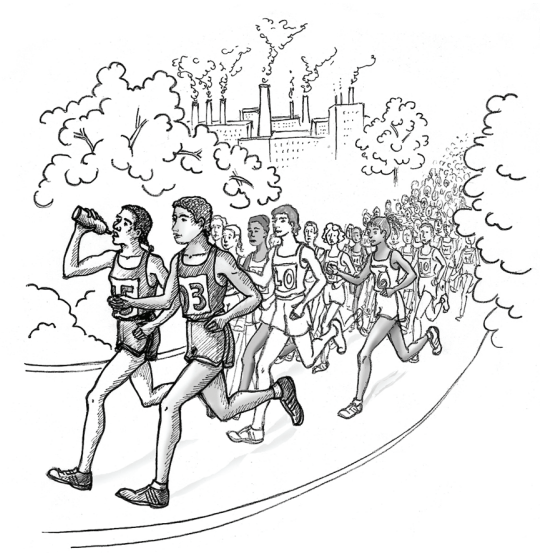
Applied Science and Technology
First Year of Secondary Cycle Two

Evaluation Situation

Technology for Today's Athlete



Evaluation Tools

Éducation,
Loisir et Sport
Québec

Prototype Examination
Applied Science and Technology
First Year of Secondary Cycle Two
557-306
2008

Task 1

Explain what you are being asked to do in this situation.
• *I must analyze the nutrition facts found on different labels and then match each label with the corresponding product.* • *I must name each of the substances found in each product and explain why it can benefit an athlete.*

Match each label with the corresponding product
and explain how each nutrient found in that product can benefit an athlete.

Energy Bar - Label number: 1

Explanation:
1) *Carbohydrates and fats provide a store of energy that will be released when physical effort is required.*
2) *Protein helps build and repair muscles.*

Energy Gel - Label number: 3

Explanation:
1) *Its high carbohydrate content supplies the energy needed during a competition.*
2) *Athletes need to replace salt lost through perspiration and must maintain a balance of electrolytes in their body.*

Recovery Bar - Label number: 2

Explanation:
1) *The carbohydrates and fats provide energy.*
2) *Protein repairs muscles following intense effort.*
3) *Sodium, potassium and vitamin C act as regulators.*

Competency 2 – Appropriate use of scientific and technological concepts, laws, models and theories

Competency 3 – Accurate interpretation of scientific and technological messages

Task 2

Explain what you are being asked to do in this situation.
• *I must explain why a marathon runner is more likely to be bothered by air pollution than a spectator (a person who is not exercising).* • *I must explain why a marathon runner could find it useful to wear a mask.*

Give two reasons why marathon runners would be more bothered by air pollution than a spectator during a competition. Explain why they might find it useful to wear a breathing mask.
1) *Since marathon runners inhale a greater volume of air (approximately 80 L/min.) than a spectator (approximately 5 L/min.), their respiratory system takes in more pollutants. A mask will filter out the pollutants so that marathon runners do not have to breathe them in.* 2) *By breathing mostly through the mouth when exerting themselves, athletes inhale air that is not filtered by the nasal cavity. The cilia and mucus in the nasal cavity provide the first line of defence by catching the impurities in the air. A mask filters out the air that marathon runners inhale through the mouth.* 3) *Gaseous pollutants can reach the alveoli and the bloodstream. This may alter the heart rate, bring about an inflammatory reaction and thicken the blood. It is known that red blood cells are more attracted to carbon monoxide (CO) than to oxygen (O_2). When athletes exert themselves, their blood receives less oxygen, since their heart rate is faster than that of someone who is not exercising. As a result, their performance may not be as good as it would be under better conditions. However, a mask will block out certain polluting particles, while allowing oxygen to pass through.* 4) *Any other acceptable answer that explains why it is useful for athletes to wear a mask.*

Competency 2 – Relevant explanations, solutions or actions

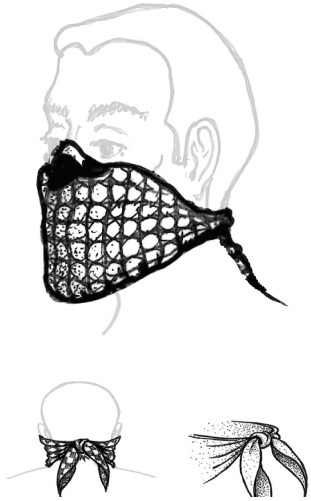
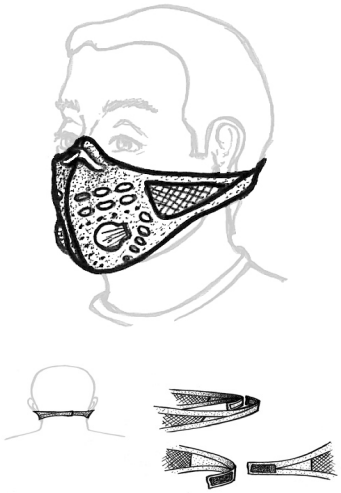
Competency 3 – Appropriate production or sharing of scientific and technological messages

Task 3

Explain what you are being asked to do in this situation.
• *I must analyze the ergonomic, technical and scientific aspects of these masks.* • *I must choose the mask that is most suitable for a marathon runner and justify my choice.*

Ergonomic Aspect

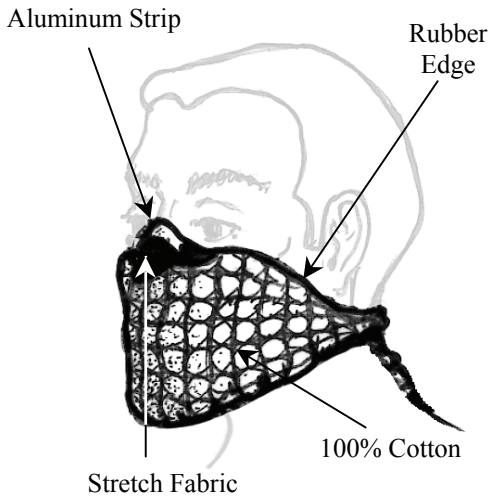
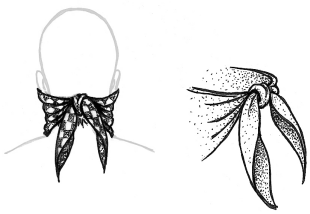
For each mask illustrated below, explain why it could or could not be adapted to different users. Give two reasons for each mask.

Mask 1	Mask 2	Mask 3
		
• *Given the size (length) of the mask, it can be adjusted to fit different head shapes and fastened at different levels (around the neck or ears).* • *The mask can fit different nose shapes.* • *The metal strip can be adjusted around the nose so that it fits the shape of the user's face.* • *The mask can be adjusted to fit different face shapes.*	• *The mask can be secured quickly thanks to the snap fastener.* • *The V-shaped head strap secures the mask and will not slide down the user's head.* • *The mask may be uncomfortable because it cannot be adjusted to fit the user's nose.* • *Because of its rigidity, the mask can be adjusted to fit only certain face shapes.*	• *Because of the velcro straps, the mask can be easily secured and adjusted to fit different head shapes.* • *The mask can fit different face shapes.* • *The metal strip can be adjusted around the nose so that it fits the shape of the user's face*

Note: Any other appropriate reason is acceptable.

Competency 2 – Relevant explanations, solutions or actions

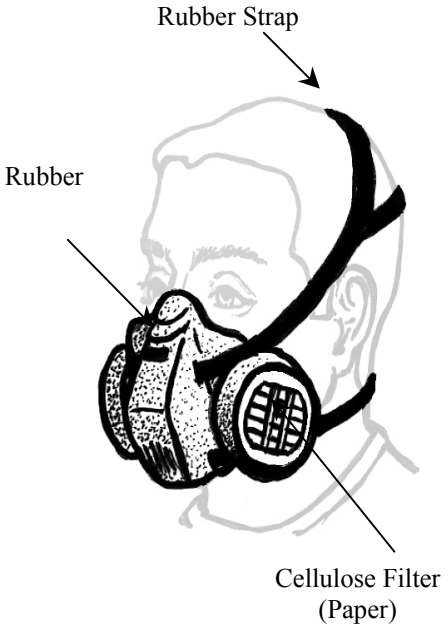
Technical Aspect

The technicians have chosen certain materials to make each element of the mask. Explain why these materials were chosen, giving one reason for each material.		
MASK 1	ELEMENT OF THE MASK	EXPLANATION
	The headband	*The mask can be easily fastened because the fabric is flexible and resistant.*
	The filter	*The cotton filter is light but can block out only the biggest particles.*
Tied behind the head 	The outer edge of the mask	*Because the aluminum is malleable, it can be easily bent to fit around the user's nose.* *The mask can be adjusted to the user's face because the rubber is flexible. The mask will not slip off, because the rubber adheres to the user's face.*

Note: Any other appropriate reason is acceptable.

Competency 2 – Relevant explanations, solutions or actions

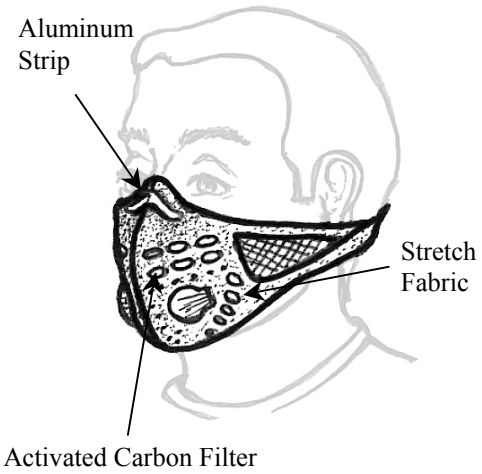
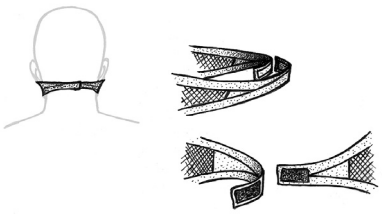
Technical Aspect

The technicians have chosen certain materials to make each element of the mask. Explain why these materials were chosen, giving one reason for each material.		
MASK 2	ELEMENT OF THE MASK	EXPLANATION
	The headband	*The elasticity and flexibility of the rubber means that the mask can be adjusted to the size of the user's head, and the mask can be easily secured with the snap fastener.*
	The filter	*The paper filter can block out some solid particles and some gaseous particles.*
Snap Fastener 	The outer edge of the mask	*Because of the flexibility and adhesiveness of the rubber, the mask can be adjusted to the user's face and provide an airtight seal.*

Note: Any other appropriate reason is acceptable.

Competency 2 – Relevant explanations, solutions or actions

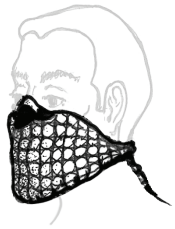
Technical Aspect

The technicians have chosen certain materials to make each element of the mask. Explain why these materials were chosen, giving one reason for each material.		
MASK 3	ELEMENT OF THE MASK	EXPLANATION
	The headband	*The velcro makes it easy to fasten the mask securely around the user's head.*
	The filter	*The activated carbon filter is very effective because it can block out most pollutants, while allowing oxygen to pass through.*
Velcro Straps 	The outer edge of the mask	*Because the aluminum is malleable, it can be easily bent to fit around the user's nose.* *The stretch fabric can be easily adjusted and fits snugly around the user's face.*

Note: Any other appropriate reason is acceptable.

Competency 2 – Relevant explanations, solutions or actions

Scientific Aspect

Using the particle model, draw a diagram showing how the filter in each mask works.	
Mask 1 	*The diagram should show a filter with large holes that allow most pollutants through. However, it blocks out dust and pollen particles. These particles are drawn as spheres or any other shape bigger than the holes in the filter.*
Mask 2 	*The diagram should show a filter with medium-sized holes. The diagram should also show that this filter blocks out pollen particles, certain types of ash and dust, certain components of smog and certain types of atmospheric dust. These pollutants are drawn as spheres or any other shape bigger than the holes in the filter.*
Mask 3 	*The diagram should show a filter with very small holes that allow only oxygen and nitrogen through. This filter blocks out all the other pollutants. These pollutants are drawn as spheres or any other shape bigger than the holes in the filter.*

Competency 2 – Appropriate use of scientific and technological concepts, laws, models and theories

Competency 3 – Use of appropriate scientific and technological terminology, rules and conventions

Which mask is the most suitable for a marathon runner? Justify your answer by referring to each element of the mask.
Ideally, students should choose Mask 3 because its characteristics are the most appropriate for a marathon runner: • *It can be easily fastened and unfastened (which is useful, for example, when you have to drink).* • *The activated carbon filter captures pollutants in the air (including tiny particles such as CO, NO_2 and SO_2).* • *It fits snugly around the user's face and can be adapted to any face shape.* • *The aluminum strip can be adjusted to fit different nose shapes.*

Note: Any other appropriate answer is acceptable.

Competency 2 - Suitable justification of explanations, solutions or actions

Competency 2 – Makes the most of his/her knowledge of science and technology (AST)

Evaluation Criteria	5	4	3	2	1
Appropriate use of scientific and technological concepts, laws, models and theories (pp. 2 and pp. 10 of the *Answer Booklet*)	Makes judicious use of concepts, which sometimes go beyond the requirements of the tasks to be performed	Makes appropriate use of the concepts related to the tasks to be performed	Makes use of concepts that are partially related to the tasks to be performed	Makes use of concepts that are largely inappropriate to the tasks to be performed	Makes use of concepts that are entirely inappropriate to the tasks to be performed
Relevant explanations or solutions (pp. 4, 6, 7, 8 and 9 of the *Answer Booklet*)	Provides clear and detailed explanations related to the tasks to be performed	Provides appropriate explanations related to the tasks to be performed	Provides incomplete explanations related to the tasks to be performed	Provides explanations that are sometimes incorrect or not very appropriate to the tasks to be performed	Does not take the background information into account in his/her explanations
Suitable justification of explanations, solutions, decisions or opinions (pp. 11 of the *Answer Booklet*)	Provides a clear justification for the chosen application based on technological or scientific principles that sometimes go beyond the requirements for the object in question.	Provides an appropriate justification for the chosen application based on technological or scientific principles.	Justifies the chosen application based on technological or scientific principles.	Gives largely incoherent reasons for choosing the application	Gives inappropriate reasons for choosing the application

Competency 3 – Communicates in the languages used in science and technology (AST)

Evaluation Criteria	5	4	3	2	1
Accurate interpretation of scientific and technological messages (pp. 2 of the *Answer Booklet*)	Rigorously selects the elements needed for the task. The selected elements are described in detail	Selects the main elements needed for the task	Selects some of the elements needed for the task	Selects elements that are not very useful for the task	Selects elements that are irrelevant to the task
Appropriate production or sharing of scientific and technological messages (pp. 4 of the *Answer Booklet*)	Presents a rigorously and coherently organized message that is easy to understand	Correctly organizes the elements of his/her message	Presents a relatively unstructured message	Lists the elements of the message without organizing them	Lists an insufficient number of seemingly unrelated elements
Use of appropriate scientific and technological terminology, rules and conventions (pp. 10 of the *Answer Booklet*)	Makes judicious and rigorous use of scientific and technological terminology, rules and conventions	Uses appropriate scientific and technological terminology for all the concepts involved	Uses scientific and technological terminology for the simplest concepts	Uses basic terminology	Uses inappropriate terminology