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
Science and Technology
First Year of Secondary Cycle Two
555-306
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 pollution than a spectator (a person who is not exercising).*

Give two reasons why marathon runners would be more bothered by air pollution than a spectator during a competition.
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.* 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.* 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.* 4) *Any other acceptable answer.*

Competency 2 – Relevant explanations or solutions

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 explain how a sprinter perceives two different signals.* • *I must explain how the signals are transmitted through his/her body to the muscles.* • *I must explain the difference between sound waves and light waves.*

Explain how a sprinter perceives a light signal and a sound signal.

Explain how the information will be transmitted to his/her muscles.

Light Signals

The light wave (stimulus) is captured by the eye (retina). The optic nerve (sensory nerve) will convey the information to the brain (visual zone). The information will then be sent to the muscles through the motor nerve. As he/she comes out of the starting block, the sprinter will make a voluntary movement.

Sound Signals

The sound (stimulus) is captured by the auricle and conveyed to the eardrum. As the eardrum vibrates, so do the ossicles. The ossicles will then set into motion the liquid in the cochlea, which contains the receptor cells that capture the information that will be sent through the auditory nerve to the brain (auditory zone). The information will then be conveyed to the muscles through the motor nerve. As he/she comes out of the starting block, the sprinter will make a voluntary movement.

Note that a solution presented as a conceptual network diagram would also be acceptable.

Competency 2 – Relevant explanations or solutions

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

Explain the difference between these two types of waves.
Sound waves: longitudinal mechanical waves that must be propagated through a material medium *Light waves: transverse electromagnetic waves that can be propagated through a vacuum or a material medium*

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

Task 4

Explain what you are being asked to do in this situation.
• *I must give my opinion on whether or not the fight against doping should continue.*

EXAMPLES OF ARGUMENTS TO SUPPORT THE TWO POSITIONS

■ **Yes, I think that the fight against doping should continue.**

☐ No, I do not think that the fight against doping should continue.

OUTLINE OF REASONING	
Scientific or technological arguments	➢ *I think that it is important to continue the fight against doping because athletes who take performance-enhancing substances will suffer negative health effects. For example:* • *anabolic steroids: muscle tears, behavioural difficulties, hormonal disruption (may stop menstruation), potentially fatal cardiovascular problems* • *amphetamines: loss of appetite, sleep disorders or behavioural difficulties, heart problems and even death* • *corticosteroids: muscle tears, heart failure, developmental abnormalities in children* • *EPO: potentially fatal high blood pressure, strokes and heart attacks* ➢ *I think it is important to continue the fight against doping because with genetic modifications, athletes of the future would have little in common with today's athletes. You would have to be superhuman to compete with genetically modified athletes.*
Arguments related to the ethical, economic, social, legal, political or other aspects of the issue.	➢ *I think it is important to continue the fight against doping because athletes who take performance-enhancing substances are a bad example for young people, who may come to believe that winning is impossible without the use of doping substances. Lilly White's case shows that you can perform at a high level without the help of doping products.* ➢ *I think that it is important to continue the fight against doping because it is illegal to use these substances. If they are caught, athletes could face severe penalties.* ➢ *I think it is important to continue the fight against doping because there are social costs related to detoxification and the side effects that athletes experience when they use performance-enhancing products.**

* Ideas not mentioned in the background information and deemed relevant by the teacher are also acceptable.

☐ Yes, I think that the fight against doping should continue.

■ **No, I do not think that the fight against doping should continue.**

OUTLINE OF REASONING	
Scientific or technological arguments	➢ *I think that it is useless to continue the fight against doping because there are many performance-enhancing substances and detection methods are inadequate.* ➢ *I think it is useless to continue the fight against doping because biotechnological advances related to performance-enhancing substances outpace the development of detection methods.* ➢ *I think it is useless to continue the fight against doping, since doping is often hard to detect because masking agents are used to hide performance-enhancing substances.*
Arguments related to the ethical, economic, social, legal, political or other aspects of the issue.	➢ *I think it is useless to continue the fight against doping because organizations such as WADA do not have enough money to deal with the problem effectively.* ➢ *I think it is useless to continue the fight against doping because some athletes like Billy Braggart are treated leniently even though they have admitted using doping products. Braggart earned fame and fortune while using performance-enhancing substances. He will even be able to compete again once his ban expires.* ➢ *I think it is useless to continue the fight against doping because, in my opinion, it's a waste of government money. The money spent on these efforts cannot stop doping. Money should be spent on prevention rather than on methods of detecting substance use among athletes.** ➢ *I think it is useless to continue the fight against doping because athletes from more technologically advanced countries have many more ways of cheating without getting caught.**

* Ideas not mentioned in the background information and deemed relevant by the teacher are also acceptable.

Competency 2 - Suitable justification of explanations, solutions decisions or opinions.

Competency 3 - Accurate interpretation of scientific and technological messages

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

Evaluation Criteria	5	4	3	2	1
Appropriate use of scientific and technological concepts, laws, models and theories (p.2 and p.7 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 (p.4 and p.6 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 (p.9 of the *Answer Booklet*)	Justifies and defends his/her opinion clearly by going beyond the background information and the scientific or technological principles involved	Provides an appropriate justification for his/her opinion based on the background information and scientific or technological principles	Justifies his/her opinion based in part on the background information and scientific or technological principles	Presents a largely incoherent opinion	Presents an incoherent opinion that does not take the background information into account

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

Evaluation Criteria	5	4	3	2	1
Accurate interpretation of scientific and technological messages (p.2 and p.10 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 (p.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 (p.6 and p.7 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