Applied Science and Technology
First Year of Secondary Cycle Two

Evaluation Situation

Technology for Today's Athlete

Student Booklet

Time: 2 hours 30 minutes

Éducation,
Loisir et Sport
Québec

Prototype Examination
Applied Science and Technology
First Year of Secondary Cycle Two
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The 29th Olympiad will be held in Beijing in the summer of 2008, 112 years after the first modern Olympic games. The athletes of ancient Greece have little in common with today's athletes. Performance levels have increased tremendously, and numerous records are broken every year.

Athletes have made such remarkable progress thanks to the development of new technologies (for example, those used to manufacture sports equipment) and innovative training methods, among other things.

Nutrition and the air that athletes breathe are of great importance. Poor nutrition or polluted city air can have a major impact on athletes' performances. A breathing mask and certain food products may help athletes during their competition.

What foods should they choose so that they can perform as well as possible during training sessions and competitions?

What can athletes do to adapt to the air conditions of the city where the Olympic games will be held?

To better understand how athletes are able to accomplish these extraordinary feats, you will be required to answer different questions by carrying out the three tasks described below.

Task 1

Athletes who eat properly wonder whether there are food products that could help them in their sport. There are special products on the market such as energy bars, energy gels and recovery bars. Depending on their nature, these products are designed to be used at different times throughout a competition. They also differ in terms of their nutritional composition. Analyze the nutrition facts (composition and quantities) found on different labels, and then match each label with the corresponding product (energy bar, energy gel or recovery bar). Name each of the nutrients in each product and explain how it benefits athletes.

Task 2

There is so much air pollution in Beijing that the marathon may have to be cancelled. However, air pollution does not affect spectators in the same way as it does athletes. Why air pollution affects athletes and spectators differently and why athletes might find it useful to wear a mask?

Task 3

Since athletes have no control over the quality of the air they breathe, the Olympic organizing committee has considered allowing them to wear a breathing mask. Several types of masks are available on the market. However, if you examine the ergonomic, technical and scientific aspects of these different models, are they all suitable for marathon runners?

The background information provided will help you carry out all this work.

BACKGROUND INFORMATION

Task 1

Nutrition for Athletes

Nutrition is very important for athletes because certain types of nutritional deficiencies cause a variety of health problems (e.g. muscle aches, cramps, fatigue, reduced endurance) that can hamper their performance.

Athletes have specific needs before, during and after their competition. For many years, the nutrition industry has worked relentlessly to attract them by constantly offering them new products that are claimed to be better adapted to their needs.

Before the competition

Top-level athletes require a diet consisting of nutrients that will **prevent hunger**, maintain hydration and **provide enough stored energy**. Certain energy bars attempt to meet these needs.

During the competition

During competitions lasting more than two hours, athletes must take in foods that will keep them hydrated, **replenish lost electrolytes**, and allow them to **maintain their pace** and to **avoid exhaustion**. Energy gels play this role.

After the competition

Athletes must make sure they are properly hydrated and replace **all** the nutrients they lost during the competition. Recovery bars can meet these needs.

The three labels below give nutrition facts for three of these products.

LABEL 1	
NUTRITIONAL COMPOSITION PER 100 g	
Protein	18.7 g
Carbohydrates	45.8 g
Fat	13.5 g
Sodium	0 g
Energy value	380 kcal or 1596 kJ

LABEL 2	
NUTRITIONAL COMPOSITION PER 100 g	
Protein	33 g
Carbohydrates	40 g
Fat	12 g
Sodium	114 mg
Potassium	190 mg
Vitamin C	0.6 mg
Energy value	400 kcal or 1672 kJ

LABEL 3	
NUTRITIONAL COMPOSITION PER 100 g	
Protein	0 g
Carbohydrates	76 g
Fat	0 g
Sodium	27 mg
Energy value	300 kcal or 1300 kJ

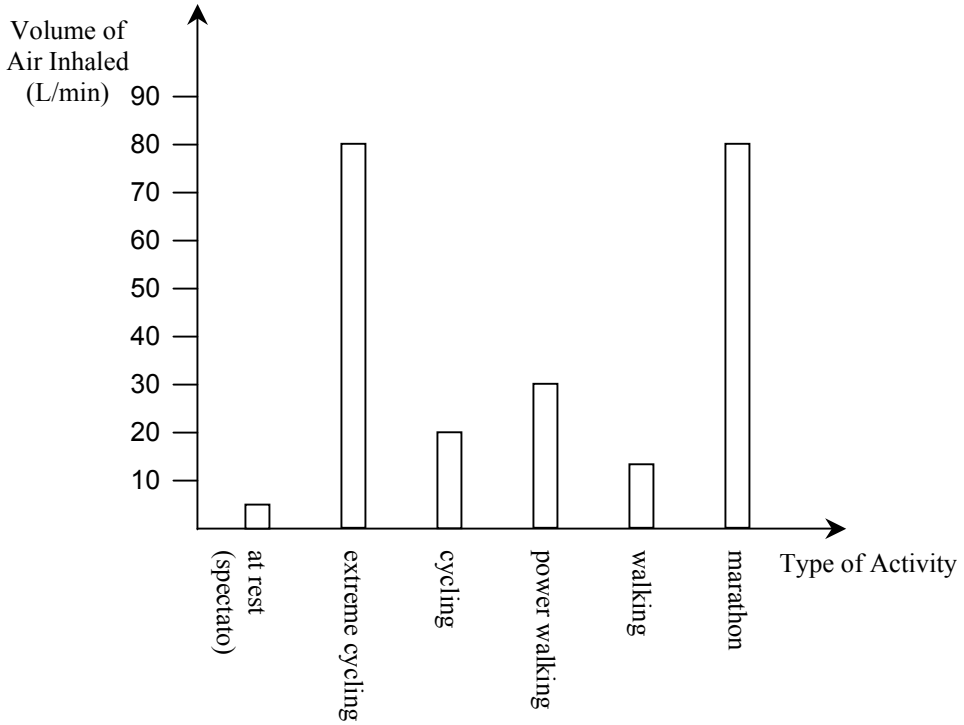
Tasks 2 and 3

Air Pollution

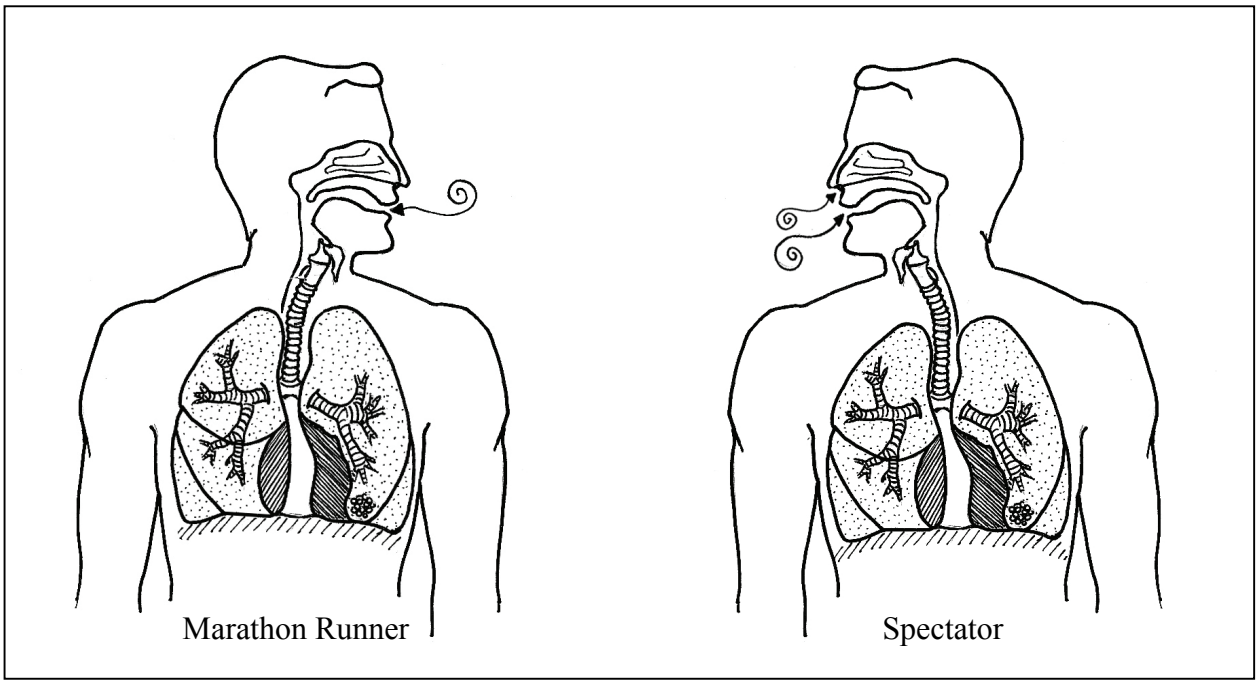
In Beijing, marathon runners might want to use a breathing mask. During their competition at the Beijing games, athletes will have to deal with heat, high humidity and the problem of air pollution. The substances found in the air could irritate the respiratory tract and trigger asthma attacks. In addition, these pollutants can be harmful if they reach the bloodstream because they may alter the heart rate, bring about a generalized inflammatory reaction and thicken the blood. Pollution is as bad for the heart as it is for the lungs. Moreover, it is known that red blood cells are more attracted to carbon monoxide (CO) than to oxygen (O_2).

Because of the great physical effort required during a competition, athletes may feel the negative effects of pollution more intensely than spectators. Some athletes, such as marathon runners, may be even more affected, which is why they may find a breathing mask useful.

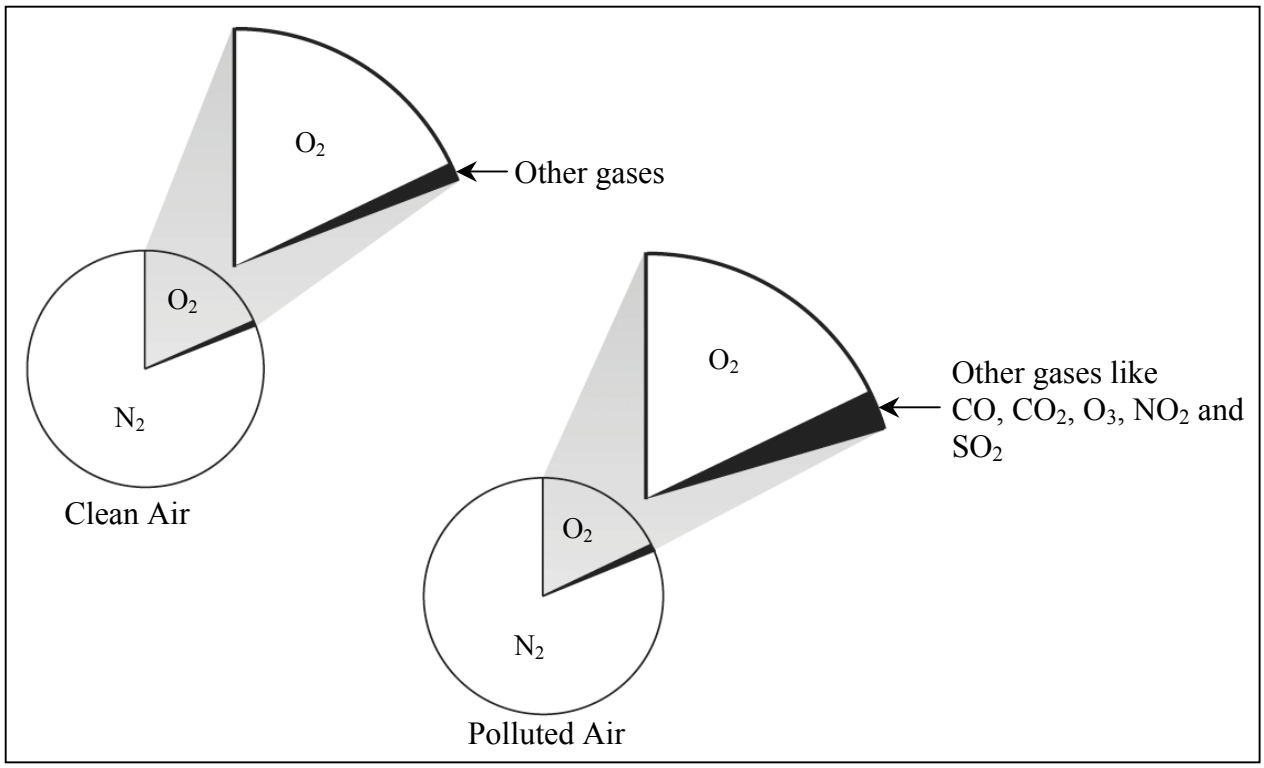
VOLUME OF AIR INHALED (IN LITRES PER MINUTE)
DURING DIFFERENT TYPES OF PHYSICAL ACTIVITY



DIFFERENCE BETWEEN THE RESPIRATION
OF A MARATHON RUNNER AND THE RESPIRATION OF A SPECTATOR



GASES AS A PROPORTION OF THE MAKE-UP OF CLEAN AIR AND POLLUTED AIR



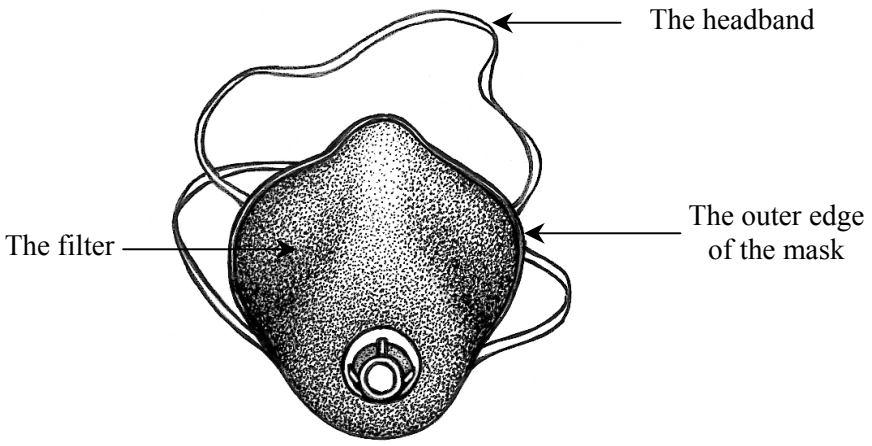
Analyzing Breathing Masks

Concerned with the health of its athletes, the Canadian Olympic Committee would like to provide the most vulnerable athletes with a protective mask to help them breathe. Certain types of masks have already been considered. You are part of a team of technicians working to determine the characteristics that a breathing mask should have. The team must analyze different aspects of three different masks.

Listed below are the three aspects to be considered in carrying out this task (see Appendix I for a definition of these terms).

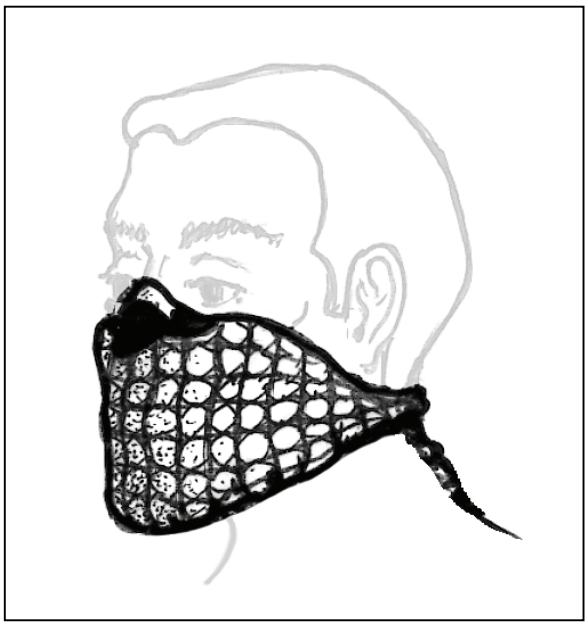
- Ergonomic aspect
- Technical aspect
- Scientific aspect

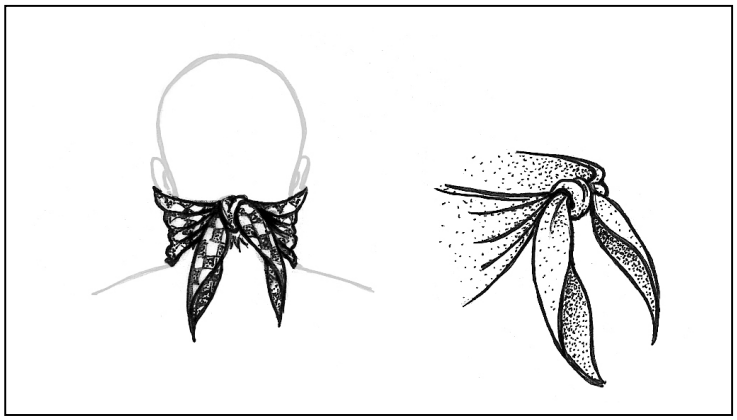
Three elements to be considered in your analysis are illustrated in the diagram below.



Masks to Be Analyzed

Mask 1

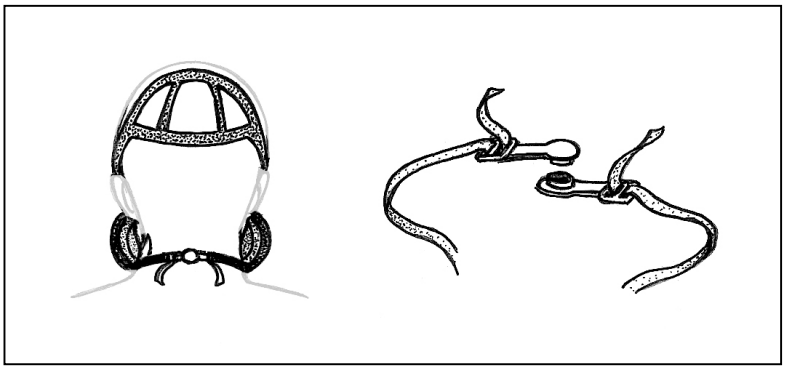




Made of:

- Aluminum
- Rubber
- Stretch fabric
- 100% cotton

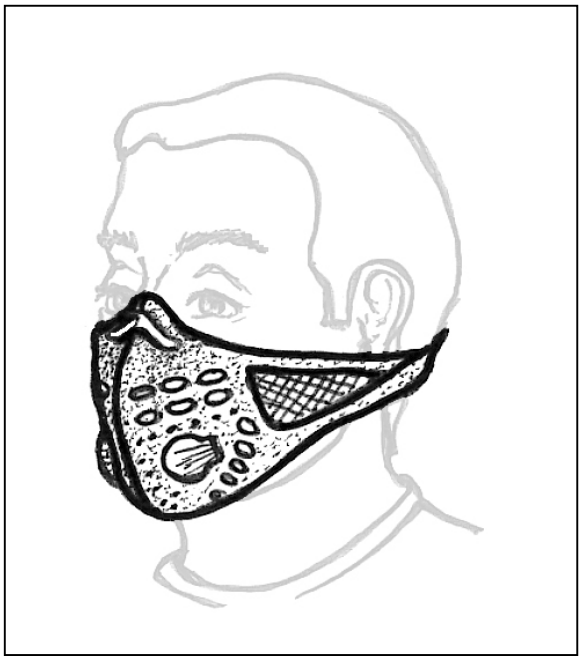
Mask 2

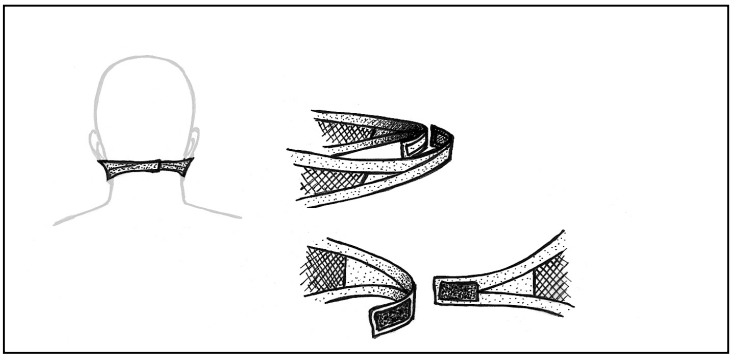


Made of:

- Snap fastener (plastic)
- Rubber
- Cellulose (paper filter)

Mask 3





Made of:

- Aluminum
- Activated carbon filter
- Stretch fabric
- Velcro

Different solid and gaseous particles were measured in relation to a standard. The standard has a value of 1. The tables below indicate the sizes of the particles and what can be blocked out by filters.

Table I

Sizes of Different Solid or Gaseous Particles

SOLID OR GASEOUS PARTICLES	SIZES OF PARTICLES IN RELATION TO THE STANDARD
Pollen	50 to 100
Ash and dust	0.5 to 100
Smog	0.01 to 2.5
Gaseous pollutants (NO, CO, CO_2, SO_2)	0.01 to 0.8
N_2	< 0.01
Atmospheric dust	0.01 to 2.5
Tobacco smoke	0.01 to 1
O_2	< 0.01

Table II

Sizes of particles blocked out by different filters

	SIZE IN RELATION TO THE STANDARD						
	100	50	10	5	1	0.1	0.01
Cloth filter							
Cellulose filter (paper)							
Activated carbon filter							

ASPECTS OF THE ANALYSIS OF A TECHNICAL OBJECT (TO)

TECHNOLOGICAL ASPECT

This aspect refers to the design and serial production of the TO.

SOCIAL ASPECT

This aspect refers to the TO's impact on society and society's impact on the TO's design.

SCIENTIFIC ASPECT

This aspect refers to the scientific principles explaining and governing the TO.

ETHICAL ASPECT

This aspect refers to the moral acceptability of the TO.

TECHNICAL ASPECT

This aspect refers to the techniques used to create the TO.

HISTORICAL ASPECT

This aspect refers to the development of the TO and to discoveries that led to our ability to create it.

ERGONOMIC ASPECT

This aspect refers to the adaptation of the TO to its user.

ECONOMIC ASPECT

This aspect refers to the production costs of the TO and the impact of its production on the economy.

AESTHETIC ASPECT

This aspect refers to the harmony of shapes and the beauty of the TO.

ENVIRONMENTAL ASPECT

This aspect refers to the environmental impact of producing and using the TO.