YOU be the JUDGE

Éduc alcool

LES Science and technology

STUDENT WORKBOOK
SECONDARY 3

Putting Alcohol to the Test of Science

INTRODUCTION TO THE LEARNING AND EVALUATION SITUATION

Our relationship to alcohol should be based on scientific fact, and it's important to know what those facts are.

This learning and evaluation situation is an opportunity for you to become aware of and adopt healthy habits, in the event that you ultimately decide to drink. You'll use what you already know and gather the scientific information you need—about binge drinking, calculating blood alcohol content, what happens when you mix alcohol with energy drinks, etc.—to help the characters in this module agree on how to behave, should they find themselves in the presence of alcohol at parties.

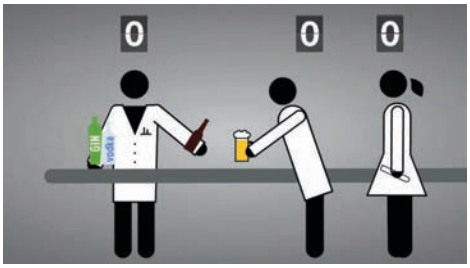
While the situations illustrated here are fictional, they can be a useful starting point for conversations about the impact of alcohol on the human body, and about the living world and the material world, with a particular focus on the digestive, respiratory, circulatory, excretory and nervous systems.

Name: _____

Date: _____

Group: _____

GETTING STARTED



Just say the word "alcohol" and an image, an ad, a slogan or a fact seems to pop into your mind, doesn't it? But what do we really know about alcohol? What exactly do we know about those little ethanol molecules that constitute pure alcohol?

If you consider that more than 80% of Quebecers drink fairly regularly, it would make sense for people to know something about what they're doing. Providing such information is part of Éduc'alcool's mission.

Watch the following video:
La science a testé l'alcool (Alcohol has been scientifically tested)

✦ Define the following terms, using reliable sources:

• Ethyl alcohol (ethanol): _____

• Blood alcohol content (BAC): _____

✦ What kind of information do you need to calculate a person's BAC?

Activity 1 A party at Isabelle's

Fred is trying to convince his parents to let him go to a party at Isabelle's on Friday night with his friends from Sec 3. His parents aren't crazy about the idea because they're worried that there might be alcohol at the party.

1 In your opinion, what would the arguments on both sides be?

List at least three arguments Fred could use to reassure his parents.

List at least three arguments his parents could use to convince Fred not to drink.

Interprets the issue appropriately. *Suggests an initial solution.*	

2 **Research:** Fred's conversation with his parents highlights certain facts about the effects of alcohol on the human body. Using reliable sources, such as the Éduc'alcool website, see if you can find new information that can help resolve the issue.

Assignment

Study the effects of alcohol on the human body using information found on the Éduc'alcool website (educalcool.qc.ca):

- ***Alcohol and Health: Alcohol and the Human Body***
- ***Alcohol and Health: The Effects of Early Alcohol Use***
- ***Alcohol and Energy Drinks : Don't Get Your Kicks from this Mix!***

Note scientific data on drinking for the following:

	SCIENTIFIC INFORMATION
1. Differences according to age, sex and weight (body mass) **Source :**	
2. The effects of alcohol on the brain **Source :**	
3. High-risk behaviours **Source :**	

3 **Rationale:** Using your new-found knowledge, explain why Fred's parents had reason to be concerned about there being alcohol at the party and why they didn't want him to drink.

Provides or justifies explanations related to the issue. *Justifies decisions (or opinions) based on scientific knowledge.* *Uses the correct terminology, rules and conventions.*	

Activity 2 How does being 18 change things?

Fred's parents are OK with him going to the party because a responsible adult will be present to keep an eye on things. Now they have to have to discuss the same subject with their older son!

Steve, Fred's older brother, is 18 and he's also going to spend the evening out with friends. His parents would like to make a few suggestions: they want to recommend a limit and an acceptable way to drink.

The following documents will help you in your research:

- ***Drinking games can be deadly***
- ***Alcohol and Health - Alcohol and the Human Body:*** Find information about how alcohol is digested and eliminated, and about the recommended drinking limits.

2.1 Fred's older brother and their parents

1 Considering the messages you have already seen about alcohol on TV, posters and online:

List two things Steve could say to his parents:

List two things Steve's parents could recommend for him:

2 **Research:** Look up scientific information that can help you better understand what happens when you drink alcohol, and allow you to help Steve make an enlightened decision. Make note of scientific data for the following:

	SCIENTIFIC INFORMATION
Digestion and elimination of alcohol Look for this information in "Alcohol and Health: Alcohol and the Human Body."	
Binge drinking/Drinking games	
Drinking limits to avoid intoxication Look for this information in the report on drinking games.	

3 **Rationale:** Use your new-found knowledge to come up with some advice that Steve's parents could offer him.

Provides sufficient explanation. *Provides or justifies explanations related to the issue.* *Justifies decisions (or opinions) based on scientific knowledge.*	

2.2 Blood alcohol content (BAC) and calculations

To help Steve stick to the limit and avoid becoming intoxicated, calculate the concentration of alcohol in his blood (his blood alcohol content, or BAC) after drinking different amounts.

To calculate BAC, you will need the following information:

- the number of drinks consumed
- the volume of each drink
- the alcohol content of each drink
- Steve's body weight (mass)

The following formulas will also help you with your calculations.

A = BAC (g/l) C = Alcohol content of the drink (% v/v)	$\mathbf{V}_{\text{alcohol}} = \mathbf{V}_{\text{all drinks}} \cdot \mathbf{C}$
$V_{alcohol}$ = Total volume of alcohol present (ml) Q = Quantity of alcohol in grams (g)	$\mathbf{Q} = \mathbf{V}_{\text{alcohol}} \cdot \boldsymbol{\rho}$
ρ = Density of alcohol (g/ml), **i.e. 0.8 g/ml** M = Mass (weight) of the person (kg) K = Diffusion coefficient (varies according to amount of water in the body) **i.e. 0.6 l/kg for a woman and 0.7 l/kg for a man**	$\mathbf{A} = \frac{\mathbf{Q}}{\mathbf{M} \cdot \mathbf{K}}$

Here's an example of how to use the information and formulas to calculate BAC:

EXAMPLE

Tony (180 cm, 70 kg) drinks two beers (355 ml, 6% alcohol). Calculate his BAC.

1. **Calculate the total volume of drinks consumed:**

   Two drinks X 355 ml = 710 ml

2. **Calculate the volume of alcohol (V alcohol) in the drinks, knowing that the alcohol content of each drink is 6% v/v:**

   Isolate the unknown variable using fractions:

$$\frac{6 \text{ ml of alcohol}}{100 \text{ ml}} = \frac{x}{710 \text{ ml}} = 42.6 \text{ ml of alcohol}$$

   Or calculate the volume using the formula:

$$V_{alcohol} = V_{all\ drinks} \cdot C\ (\%\ v/v)$$

$$V_{alcohol} = \frac{710 \text{ ml} \cdot 6 \text{ ml alcohol}}{100 \text{ ml}} = 42.6 \text{ ml alcohol}$$

3. **Calculate the quantity of alcohol in grams (Q) in the total volume of drinks consumed, knowing that the density of alcohol is 0.8 g/ml:**

$Q = ?$

$V_{alcohol} = 42.6\ ml$

$\rho = \frac{0.8\ g}{ml}$

$\boxed{Q = V_{alcohol} \cdot \rho}$

$Q = 42.6\ ml \cdot \frac{0.8\ g}{ml} = 34.08\ g_{alcohol}$

4. **Calculate the blood alcohol content (BAC) (g/l):**

$A = ?$

$M = 70\ kg$

$K = \frac{0.7\ l}{kg}$

$\boxed{A = \frac{Q}{M \cdot K}}$

$A = \frac{34.08\ g}{70\ kg \cdot \frac{0.7\ l}{kg}} = \frac{0.7\ g}{l}$ or $\frac{0.07\ g}{100\ ml}$

ANSWER: **Tony has a blood alcohol content (BAC) of 0.07% (m/v).**

5. **Now calculate Steve's BAC under the following conditions:**

BAC CALCULATIONS	ANSWERS
a) He weighs 50 kg and drinks three beers (355 ml each, 5% alcohol)	
b) He weighs 75 kg and drinks two shooters (45 ml each, 40% alcohol)	
c) He weighs 60 kg and drinks two beers (355 ml each, 6.1% alcohol)	
d) He weighs 50 kg and drinks two beers (355 ml each, 5% alcohol)	
e) He weighs 60 kg and drinks two beers (355 ml each, 4% alcohol)	

✦ **Remember: BAC calculations are approximate.** To determine a person's exact BAC, you need a blood or breath sample.

Identifies the relevant elements of the issue and the common aspects *Comes up with an initial solution.* *Provides or justifies explanations related to the issue* *Justifies decisions (or opinions) based on scientific knowledge*	

Activity 3 Mixes to avoid

THE SET-UP

Steve is a little tired the night of the party and he doesn't really like the taste of alcohol, so he wants to mix it with an energy drink to solve both problems at once and be part of the gang.

1 Using what you have already read, complete the following exercise. Answer these two questions:

What are the first recommendations you could give Steve about mixing alcohol and energy drinks?

If Steve decides to mix alcohol and energy drinks, what are some of the things you think he might feel the next morning when he goes to work (at a dep, grocery store or municipal pool)?

2 **Research:** Read official publications containing scientific data about mixing alcohol and energy drinks that can help you better understand the effects of such mixes, and allow you to help Steve make an enlightened decision.

	SCIENTIFIC INFORMATION
Number of drinks:	
Effects when you drink the mix:	
Consequences and effects of alcohol abuse on the human body the next day:	

3 **Rationale:** Using your new-found knowledge, how would you advise Steve?

Provides or justifies explanations related to the issue *Justifies decisions (or opinions) based on scientific knowledge*	

Review

When science tests alcohol, does it help convince people to adopt healthy drinking habits? Explain your answer.

DID YOU KNOW?

Éduc'alcool has developed a number of useful tools: some can be found on its website, while others are mobile apps.

Blood Alcohol Calculator
Calcoholator
Drink Dashboard

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SCIENCE ACTIVITIES – EVALUATION CHART

TO BE COMPLETED BY THE TEACHER

SC

EVALUATION CRITERIA	DEMONSTRATIONS OF STUDENT'S COMPETENCY			
	A	B	C	D
Activity 1 A party at Isabelle's **a) My opinion** Criterion 1: Identifies the relevant aspects of the issue. Comes up with an initial solution.	Provides **plausible** arguments that take into account the volume, concentration, dilution and quantity of alcohol consumed: - Physical aspects - Psychological aspects - Social aspects	Provides **plausible** arguments that take into account **two aspects of the issue**.	Provides questionable arguments that involve **only one** aspect of the issue.	Provides disorganized arguments that have nothing to do with the issue.
b) Formulates hypotheses **c) Rationale** Criterion 3: Provides or justifies explanations related to the issue. Justifies decisions (or opinions) based on scientific knowledge Uses the correct terminology, rules and conventions.	Considers **all pertinent details** of the issue (effects of alcohol, differences according to age, and risky behaviour) in the rationale.	Considers **a number of pertinent details** of the issue in the rationale	**Fails to consider at least two details** of the issue in the rationale.	**Fails to consider at least three details** of the issue in the rationale.
Activity 2 How does being 18 change things? **2.1 Fred's older brother and their parents** Criterion 3: Provides or justifies explanations related to the issue. Justifies decisions (or opinions) based on scientific knowledge	Considers **all pertinent details** of the issue (effects of alcohol, differences according to age, and risky behaviour) in the rationale (digestion and elimination, binge drinking and intoxication).	Considers **a number of pertinent details** of the issue in the rationale regarding the parents' advice.	**Fails to consider at least two details** of the issue in the rationale regarding the parents' advice.	**Fails to consider at least three details** of the issue in the rationale regarding the parents' advice.
2.2 Blood alcohol content and calculations Criterion 1: Identifies the relevant aspects of the issue. Comes up with an initial solution. Criterion 3: Provides or justifies explanations related to the issue. Justifies decisions (or opinions) based on scientific knowledge	Provides **plausible** arguments that take into account the volume, concentration, dilution and quantity of alcohol consumed.	Provides **plausible** arguments without justifying them using the concepts of, dilution and volume	Provides questionable arguments without justifying them.	Provides disorganized arguments that have nothing to do with the issue.
Activity 3 Mixes to avoid Criterion 3: Provides or justifies explanations related to the issue. Justifies decisions (or opinions) based on scientific knowledge	Considers **all pertinent details** of the issue (effects of alcohol, differences according to age, and risky behaviour) in the rationale (alcohol + energy drinks).	Considers **a number of pertinent details** of the issue in the rationale regarding (alcohol + energy drinks).	**Fails to consider at least two details** of the issue in the rationale regarding (alcohol + energy drinks).	**Fails to consider at least three details** of the issue in the rationale regarding (alcohol + energy drinks).
For the whole module Criterion 3: Provides or justifies explanations related	Uses scientific terminology, rules and conventions **judiciously**	Uses scientific terminology	Uses scientific terminology	Uses **inadequate** terminology.