



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Science

PHYSICS UBC DEPARTMENT OF
ASTRONOMY



Défi Scientifique Michael Smith Science Challenge

Wednesday, February 14th 2018

9-10 Pacific, 10-11 Mountain, 11-12 Central, 12-1 Eastern, 1-2 Atlantic, 1:30-2:30 Newfoundland

PLEASE PRINT DOUBLE-SIDED (BLACK AND WHITE OK)

Instructions

1. Do not open this contest booklet until you are told to do so.
2. Be certain that you understand all of the instructions. If not, ask your teacher.
3. Do not ask your teacher for any help with the content of the contest.
4. This contest is closed-book. No notes of any kind (printed or electronic) are allowed.
5. You may use a calculator (graphing or scientific) and a ruler.
6. No computers, tablets, cellphones, or other wireless devices are allowed.
7. Write your answers in this booklet and hand it back to your teacher at the end.
8. This booklet consists of 4 questions on 8 pages, including this page of instruction.
9. Print your name and other information clearly. Only those who do so can be counted as official contestants.
10. When your teacher instructs you to begin, you will have **60 minutes** to finish the contest.

Scoring

Full marks will be given to a student who demonstrates clear understanding of the science required by the question. Partial marks will be given for partial understanding. There are no penalties for incorrect answers. The questions are not of equal difficulty. We are challenging the strongest science students in Canada; it is possible that highest overall score will be less than 80%. This is meant to be tough!

Teachers

Please mail the following **two items** to Michael Smith Challenge, Department of Physics & Astronomy, 6224 Agricultural Road, UBC, Vancouver, BC, V6T 1Z1 by the end of **Wednesday, February 14th, 2018**:

1. Students' contest booklets
2. A cheque payable to "UBC Physics & Astronomy", for \$6.00 per script returned (if paying by cheque) **OR** a printed receipt of your payment (if paid by credit card).

Please do not send by email.

Contest Named in Honour of Dr. Michael Smith (1932-2000)

UBC's 1993 Nobel Prize Winner

Contest Committee

Nikita Bernier (translator), Yas Oloumi Yazdi, Theresa Liao, and Chris Waltham, UBC Department of Physics & Astronomy

TEAR OFF THIS PAGE

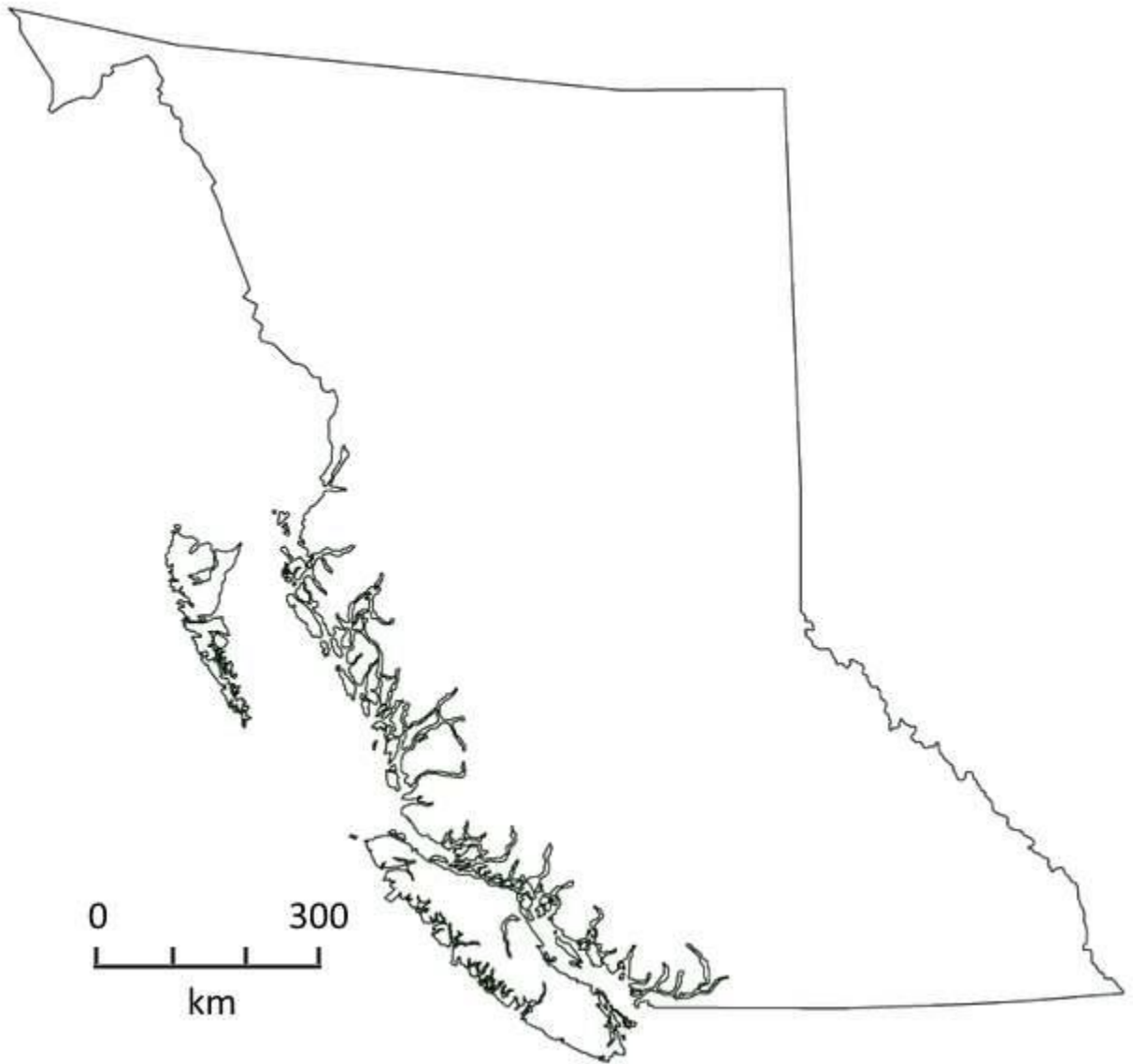
Useful Information

Element	Symbol	Atomic Mass
Hydrogen	H	1
Carbon	C	12
Oxygen	O	16
Sodium	Na	23
Chlorine	Cl	35.5

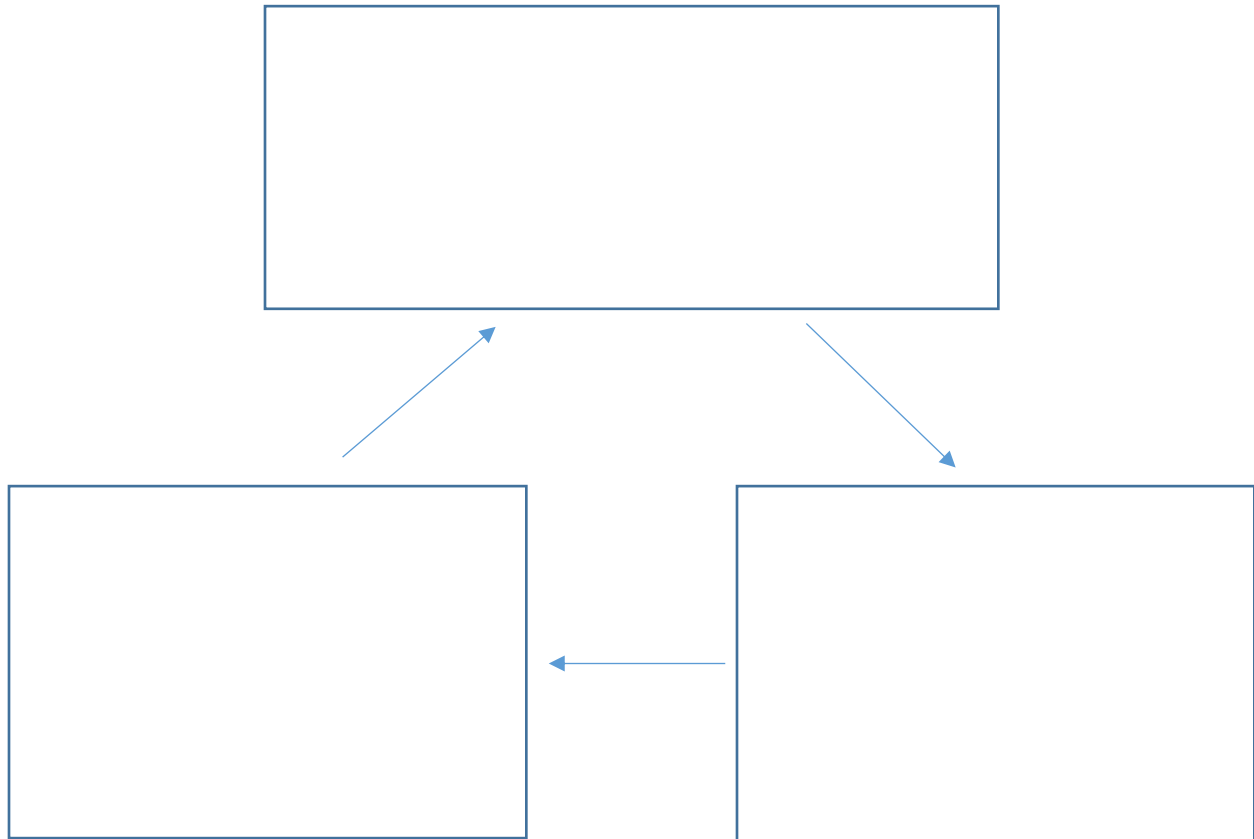
NAME _____ SCHOOL _____

Q1	Q2	Q3	Q4	Total
/20	/20	/20	/20	/80

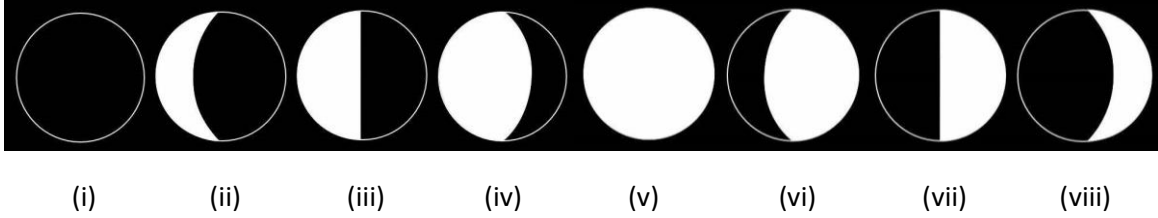
1. Last summer, fires burnt a million hectares in the heart of British Columbia. A square of side 100 m has an area of one hectare.
(a) Draw a square on the map below that is a million hectares in area. Use a ruler for accuracy.



(b) Positive feedback is a process in which the effects of a disturbance on a system increase the magnitude of the original disturbance. That is, A produces more of B, which in turn produces more of A. Put some words in the boxes below to demonstrate that massive forest fires are an example of positive feedback.



2. You are standing somewhere in Canada and the Moon appears like one of the images (i-viii) below:



(a) How would the Earth appear if you were standing near the North Pole of the Moon?

Moon appears like this from Earth	Earth appears like this from Moon
(ii)	
(iv)	
(vii)	

(b) How would the Moon appear from Earth immediately before entering the Earth's shadow in a Lunar Eclipse event? (Please answer i-viii).

(c) The orbit of Mars lies outside that of Earth. In which of the configurations (i-viii) can Mars appear from Earth?

3. The word “recyclable” should refer to an object that can be processed for reuse. However, the word has come to mean “can be put in the recycling bin”, which is not the same thing. Consider single-use coffee cups, which are a mix of plastic and paper that is hard to recycle:

(a) Estimate how many single-use coffee cups are thrown away every year in Canada. Show how you arrived at your answer. Marks will only be given for your reasoning.

(b) Re-usable (“Eco”) coffee cups, especially those made of plastic, may or may not be environmentally better than single-use cups. The appearance of plastics through the biosphere means it is crucial to figure out which is better. Government legislators have asked you, a scientist, to help them decide. What critical pieces of data would you collect? List up to six.

1.
2.
3.
4.
5.
6.

4. You are training for a marathon and need a lot of energy. On the other hand, you are trying to reduce the salt in your diet.

Nutrition Facts Valeur nutritive	
Per 2 slices (71 g) / pour 2 tranches (71 g)	
Amount Teneur	% Daily Value % valeur quotidienne
Calories / Calories 180	
Fat / Lipides 2.5 g	4 %
Saturated / saturés 1 g + Trans / trans 0 g	5 %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 230 mg	10 %
Carbohydrate / Glucides 32 g	11 %
Fibre / Fibres 4 g	16 %
Sugars / Sucres 3 g	
Protein / Protéines 6 g	

Brand 1

Nutrition Facts Valeur nutritive	
Per 1 slice (50g) / pour 1 tranche (50 g)	
Amount Teneur	% Daily Value % valeur quotidienne
Calories / Calories 110	
Fat / Lipides 1.5 g	2 %
Saturated / saturés 0.2 g + Trans / trans 0 g	1 %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 170 mg	7 %
Carbohydrate / Glucides 20 g	7 %
Fibre / Fibres 2 g	7 %
Sugars / Sucres 1 g	
Protein / Protéines 4 g	

Brand 2

- (a) Which of these brands of bread would you choose? Marks will only be given for your reasoning.

(b) How many grams of salt (sodium chloride, NaCl) go into each 1 kg loaf of brand 1?