



UNIVERSITY OF BRITISH
COLUMBIA
Faculty of Science



**NSERC
CRSNG**

promo
Science

Michael Smith National Science Challenge 2013

Tuesday, February 26th, 2013

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 examination 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 examination.
4. This examination 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 exam booklet and hand it back to your teacher at the end.
8. This exam booklet consists of 6 questions on 8 pages, including this page of instruction. Check to make sure you have all the pages.
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 examination.

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. Remember we are challenging the best science students in Canada; it is possible that even the best papers may not achieve an overall score of 80%. This is meant to be tough!

Teachers

Please mail* the following **2 items** to Michael Smith Challenge, Department of Physics & Astronomy, 6224 Agricultural Road, UBC, Vancouver, BC, V6T 1Z1 by the end of **Tuesday, February 26th, 2013**:

1. Students' exam booklets
2. A cheque payable to University of British Columbia, for \$5.00 per script returned (if paying by cheque) **OR** a printed receipt of your payment (if paid by credit card).

* Canada Post regular mail; express/couriers *not* necessary.

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

UBC's 1993 Nobel Prize Winner

Examination Committee

Theresa Liao, Alex Toews, and Chris Waltham, UBC Department of Physics & Astronomy

Tamara Kunz, UBC Department of Chemistry

David Ng, Michael Smith Laboratories, UBC

Translator

Laurent Charette, Louis Deslauriers, Philippe Sabella Garnier and Alex Toews, UBC Department of Physics & Astronomy

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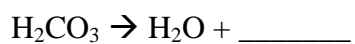
NAME (PRINT) _____ SCHOOL _____

1	2	3	4	5	6	TOTAL
/10	/10	/10	/10	/10	/10	/60

1. H_2CO_3 is an ingredient in pop that makes it carbonated, or 'fizzy'. It undergoes a decomposition reaction to produce the desired carbonation, or 'fizziness'.

a) Is H_2CO_3 an acid or a base?

b) Fill in the missing product in the following decomposition reaction, and indicate the phase of each product.



c) Explain why this reaction makes the drink 'fizzy' (50 words maximum).

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2. We all know that ice floats in water. Imagine if ice were denser than water. Consider how this would impact life on Earth. List up to five ways, no more than 30 words each.

3. There are two competing hypotheses (A and B) that attempt to explain the same phenomenon. A scientist performs an experiment to see which, if any, is right, and makes a series of measurements shown below. Hypothesis A predicts an outcome of 100, while hypothesis B predicts 200. What would you conclude about the validity of these two hypotheses?

95.5

93.7

116.9

89.4

195.3

209.3

202.4

97.9

191.4

185.0

214.0

190.9

200.7

198.0

91.5

119.5

80.2

213.8

99.8

104.8

4. It was once believed that the planets, the Sun, and other stars all revolved around the Earth. This was a generally accepted 'fact' based on the observation that these bodies do appear to move around the Earth every 24 hours. However, we now recognize that the Earth rotates about its own axis. How do we know? List up to three reasons, no more than 30 words each.

6. It has been observed in the last few decades in China that the decline in the stork population is correlated with the decline in the human birth rate.

a) Can you think of possible reasons for this correlation? Give your answers only in the space below.

b) What further observations would you make to test your hypotheses? Give your answers only in the space below.