

North Carolina Science Olympiad — Code Busters Test 3

2018

Names of participants: (Please print neatly)

School Name: _____

V JV1 JV2 JV3

Warning: Do not open this packet until given permission to do so.

Note: There are useful notes after this page.

Scoring:

Time to solve first problem: _____ (use to calculate Bonus below)

Question	Value	Incorrect letters	Deduction	Score
Timed	100			
1	250			
2	100			
3	120			
4	300			
5	75			
6	50			
7	350			
8	50			
9	350			
10	120			
11	125			
12	125			
13	75			
14	140			
15	120			
16	60			
17	300			
18	120			
19	100			
Bonus				
Final Score				

The following tables might be useful during the event.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A
C	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B
D	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C
E	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D
F	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E
G	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F
H	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G
I	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H
J	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I
K	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
L	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K
M	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L
N	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M
O	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
P	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Q	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
R	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
S	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
T	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
U	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
V	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
W	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
X	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Y	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Z	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

AAAAA	A
AAAAB	B
AAABA	C
AAABB	D
AABAA	E
AABAB	F
AABBA	G
AABBB	H
ABAAA	I/J
ABAAB	K
ABABA	L
ABABB	M

ABBAA	N
ABBAB	O
ABBBA	P
ABBBB	Q
BAAAA	R
BAAAB	S
BAABA	T
BAABB	U/V
BABAA	W
BABAB	X
BABBA	Y
BABBB	Z

Frequency Table of English letters:

E	12.51%	S	6.54%	C	3.06%	G	1.96%	K	0.67%
T	9.25%	R	6.12%	U	2.71%	W	1.92%	X	0.19%
A	8.04%	H	5.49%	M	2.53%	Y	1.73%	J	0.16%
O	7.60%	L	4.14%	F	2.30%	B	1.54%	Q	0.11%
I	7.26%	D	3.99%	P	2.00%	V	0.99%	Z	0.09%
N	7.09%								

Frequency Table of Spanish letters:

E	14.08%	I	5.98%	M	3.08%	Y	1.09%	Z	0.47%
A	12.16%	L	5.24%	P	2.89%	V	1.05%	Ñ	0.17%
O	9.20%	D	4.67%	B	1.49%	G	1.00%	X	0.14%
S	7.20%	T	4.60%	H	1.18%	F	0.69%	K	0.11%
N	6.83%	U	4.69%	Q	1.11%	J	0.52%	W	0.04%
R	6.41%	C	3.87%						

For the purposes of cryptograms it is customary to treat n and ñ as distinct letters, but a and á are the same letter. Likewise for e and é, and i and í. In other words, all the accent marks get amputated when working with cryptograms. Also, while some older Spanish dictionaries consider ch, ll, and rr, to be their own letters—this has fallen out of modern usage. Accordingly, “burro” is considered as five letters: “b-u-r-r-o” and not as four letters “b-u-rr-o.”

Famous Phrases

Gettysburg address:

FOUR SCORE AND SEVEN YEARS AGO OUR FATHERS BROUGHT FORTH ON THIS CONTINENT, A NEW NATION, CONCEIVED IN LIBERTY, AND DEDICATED TO THE PROPOSITION THAT ALL MEN ARE CREATED EQUAL.

Declaration of Independence:

WHEN IN THE COURSE OF HUMAN EVENTS IT BECOMES NECESSARY FOR ONE PEOPLE TO DISSOLVE THE POLITICAL BANDS WHICH HAVE CONNECTED THEM WITH ANOTHER AND TO ASSUME AMONG THE POWERS OF THE EARTH, THE SEPARATE AND EQUAL STATION TO WHICH THE LAWS OF NATURE AND OF NATURE'S GOD ENTITLE THEM, A DECENT RESPECT TO THE OPINIONS OF MANKIND REQUIRES THAT THEY SHOULD DECLARE THE CAUSES WHICH IMPEL THEM TO THE SEPARATION.

Constitution of United States of America:

WE THE PEOPLE OF THE UNITED STATES, IN ORDER TO FORM A MORE PERFECT UNION, ESTABLISH JUSTICE, INSURE DOMESTIC TRANQUILITY, PROVIDE FOR THE COMMON DEFENSE, PROMOTE THE GENERAL WELFARE, AND SECURE THE BLESSINGS OF LIBERTY TO OURSELVES AND OUR POSTERITY, DO ORDAIN AND ESTABLISH THIS CONSTITUTION FOR THE UNITED STATES OF AMERICA.

MAGNA CARTA (In Latin):

JOHANNES DEI GRACIA REX ANGLIE, DOMINUS HIBERNIE, DUX NORMANNIE, AQUITANNIE ET COMES ANDEGAVIE, ARCHIEPISCOPI, EPISCOPI, ABBATIBUS, COMITIBUS, BARONIBUS, JUSTICIARIIS, FORESTARIIS, VICECOMITIBUS, PREPOSITIS, MINISTRIS ET OMNIBUS BALLIVIS ET FIDELIBUS SUIS SALUTEM.

5) [75 Points] Using a key of **SPRY** encode the string **CERTIFICATE** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} S & P \\ R & Y \end{pmatrix} \equiv \begin{pmatrix} 18 & 15 \\ 17 & 24 \end{pmatrix}$$

C	E	R	T	I	F	I	C	A	T	E	

6) [50 Points] Bruno Mars' observation has been encoded using a Caesar Cipher. What does it say?

Q	Y	W	M	G	M	W	R	S	X	Q	E	X	L	.	M	X	'	W	W	G	M	I	R	G	I	.
														.			'									.

C	S	Y	O	I	I	T	Q	M	B	M	R	K	X	L	I	W	X	Y	J	J	Y	T

Y	R	X	M	P	M	X	F	P	S	A	W	Y	T	S	R	C	S	Y	,	S	V	M	X
																		,					

F	I	G	S	Q	I	W	X	L	M	W	M	R	G	V	I	H	M	F	P	I	T	S	X	M	S	R	.
																											.

7) [350 Points] Solve this Patristocrat of what Stephen Hawking wrote in a Brief History of Time and is encoded using a K1 key. The word **THAT** appears at least twice.

ORYFT VOBFG TIOPU OGTBU OORPO ORYJU BKYIV YBVAT

KYIU Y XWSPV YOTZI POBTU PEEPL VORPO LYQPU XBVQT

KYIPU XJUXY IVOPU X

K1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	1	6			2	2	2		6	2	3	2			13	10	2	4	1	7	9	7	1	5	10	1
Replacement																										

8) [50 Points] Using a code word of **MIGHT**, encode the following quote from Mark Twain using the Vigenère cipher.

A L L Y O U N E E D I N T H I S L I F E I S I G N O R A N C E

A N D C O N F I D E N C E , A N D T H E N S U C C E S S I S S U R E .

9) [350 Points] Solve this K1 Key encoded Patristocrat which is a quote by Frederick Maurice Powicke in “History, Freedom & Religion” and ends with the word **FORCE**.

XQPFC LJQPN OAACN FXMWM TWHMQ SXFCN FXQRS PHXQV

XXTGM MPVTD MWFXM VCRFL CACNF XMBQR WJMFV LQGMB

TRCRH QFXTU AQRWN CLVM

K1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	4	2	8	1		9	2	3		2		4	11	5	1	4	9	6	2	5	1	4	6	10		
Replacement																										

10) [120 Points] The following quote from Abraham Lincoln has been encoded using a running key cipher against a famous document. What does it say?

E K S A , B X G V A Y V I D Q K F F U X R A G L Z V

J T K ; Q T N Q W Q T Q G E I E S F U E I L J R K C

X R D A K W L X A W V O J S B O N S G D M A Z M M .

18) [120 Points] Solve this Aristocrat which is a quote from the British Comedy series “A bit of Fry and Laurie” which has the word **GIVE** in it.

L OILMU ZMLNZD OUYOLMJ LY Z OVGGLRDV LBVZ; OIVH JVO

ZDD MVGPEWY ZMB JLPV OIV CGEMJ ZMYCVGY.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency		2	2	4	2		5	1	3	4		8	7	1	7	2		1			1	10	1		5	7
Replacement																										

19) [100 Points] Edgar Ramirez once said this about what to look for. It has been encoded using the Vigenère cipher using a very common five letter word. You have been told that the 23rd through the 28th letters in the code (**UMBPSA**) actually is the word **HIDDEN**. What does the message decode to?

U O Y A Y	K G G V W	F C Y S M	W T B V R	T S U M B
P S A J Y	O S B J R	T S P L Y	D O P X C	D H U I F
U R Q I L	R O P I R	T O G A C	M Z Y L Y	H S