

# Science Olympiad — Codebusters Test

## 2019

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	200			
1	150			
2	250			
3	275			
4	250			
5	325			
6	350			
7	300			
8	300			
9	450			
10	400			
11	300			
12	250			
13	100			
14	300			
15	450			
16	275			
17	550			
18	650			
<b>Bonus</b>				
<b>Final Score</b>				



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

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

1	3	5	7	9	11	15	17	19	21	23	25
1	9	21	15	3	19	7	23	11	5	17	25

<b>AAAAA</b>	A	<b>AABBA</b>	G	<b>ABBAA</b>	N	<b>BAABA</b>	T
<b>AAAAB</b>	B	<b>AABBB</b>	H	<b>ABBAB</b>	O	<b>BAABB</b>	U/V
<b>AAABA</b>	C	<b>ABAAA</b>	I/J	<b>ABBBA</b>	P	<b>BABAA</b>	W
<b>AAABB</b>	D	<b>ABAAB</b>	K	<b>ABBBB</b>	Q	<b>BABAB</b>	X
<b>AABAA</b>	E	<b>ABABA</b>	L	<b>BAAAA</b>	R	<b>BABBA</b>	Y
<b>AABAB</b>	F	<b>ABABB</b>	M	<b>BAAAB</b>	S	<b>BABBB</b>	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.”

Timed Question [200 points] Decode this aristocrat. The message probably contains the phrase "United States". When you have solved it, raise your hand so that the time can be recorded and the solution checked.

HVEQGUB INV XUGIVC HIMIVH SGPGIMEZ DASVH FGIN SMUZ

EVHJAUHGYGPGIGVH MH FVPP MH JEVHHXEV MUC

MDDAXUIMYGPZIZ. NAFVQVE, INV SGPGIMEZ GHU'I OAE

VQVEZAUV, YXI GI AOOVEH HA SXDN OAE INAHV FNA HVEQV.

AUV INGUB INMI SXHI YV LUAFU MUC CVMPI FGIN GH INMI

INGH DMEVVE DAXPC YV M PGOV INEVMIVUGUB AUV, MUC

INVEV MEV SMUZ AYHIMDPVH AUV SXHI BA INEAXBN

YVOAEVNMUC.

	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	20	5	7	7	19	6	21	22	30	2		1	21	17	6	10	4		8		20	37		9	7	6
Replacement																										

Codebusters Test

1) [150 points] Decode this Atbash cipher.

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

2) [250 points] Encrypt the following plaintext using the Affine cipher where A is 23 and B is 7.

C	I	P	H	E	R	T	E	X	T	I	S	B	E	L	O	W	T	H	I	S	P	H	R	A	S	E

3) [275 points] Decrypt the Vigenère cipher below using "Bruce" as the key.

U	Y	Y	U	Y	D	T	Y	U	W	G	L	F	Y	E	S	I	C	Q	V	J	J	N	J	I	B	M	Y	T	E	H	V

G	C	R	X	Z	N	J	P	B	J	Y	T	-	P	J	B	Y	H	S	D	L	M	.
												-										.

4) [250 points] Solve this aristocrat. As a little hint, the second last word is "three".

ITGQ L SLM L WTFP, LMR PQ YLM QLZ WJE L RLV. CDZ

ZQLYP L SLM PJN ZJ WTFP, LMR PQ'AA CQ RQLR JW

SQEYDEV HJTFJMTMI TMFTRQ JW ZPEQQ VQLEF.

	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	2	5	5	1	1	2	7		14	8	1		7	12	6	3	7		3	5		3	5
Replacement																										

Codebusters Test

5) [325 points] Encrypt the message using the Hill cipher. The key is "Nerd".

$$\begin{pmatrix} N & E \\ R & D \end{pmatrix} \equiv \begin{pmatrix} 13 & 4 \\ 17 & 3 \end{pmatrix}$$

S	C	I	E	N	C	E	R	U	L	E	S

6) [350 points] Decrypt the following Baconian cipher to see a famous quote from Albert Einstein.

\*-----\*-----\*\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*

--\*\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*

\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*

\*\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*

\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*-----\*



7) [300 points] Solve this aristocrat to read an interesting message.

LWSYS RJ DILWRDN QIYS DILZVUS RD JIEYZLSJ LWZD LWZL

WS BIHDF LRQS, XWSD WS XZJ ZD IUF QZD, LI USZYD

QHJRE ZDF FZDERDN, ZDF LWIHNWL RL LRQS XSUU JMSDL.

	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		15	3	5		3	8	6		14	1	3			5	8	13		5	1	9	3	4	11
Replacement																										

8) [300 points] Encode the phrase with the Vigenère cipher using "Truth" as the key. Some good advice I suppose...

Y	O	U	H	A	V	E	P	O	W	E	R	O	V	E	R	Y	O	U	R	M	I	N	D	-	N	O	T
																							-				

O	U	T	S	I	D	E	E	V	E	N	T	S	R	E	A	L	I	Z	E	T	H	I	S	A	N	D	Y	O	U

W	I	L	L	F	I	N	D	S	T	R	E	N	G	T	H

Codebusters Test

9) [450 points] Solve this patristocrat.

HSDPL CIQHM OIXLD WIYHX TLU DP UXTPD PFEQT ELCTL

UGUIR ULTQL CIBDQ LUBSD NLTP L QHMOI XLRCU XCRIT

QSIDS FIXTP MIIPV TVIYU P

	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	5	7	2	2	1	4	12			11	3	1	2	8	6	3	4	9	8	2	1	6	2	
Replacement																										

10) [400 points] Decrypt the goofy message below using the Hill cipher where the encryption keyword is "Bruh".

$$\begin{pmatrix} B & R \\ U & H \end{pmatrix} \equiv \begin{pmatrix} 1 & 17 \\ 20 & 7 \end{pmatrix}$$

L	V	R	P	V	S	A	M	K	V	H	F

11) [300 points] Decode this Affine cipher to show a terrible joke where A = 19 and B = 6

U	E	K	D	E	R	L	G	U	C	K	G	I	G	Q	W	U	K	F	C	H	H	G	H	H	J	C	K			
K	S	R	G	Z	Z	H	E	H	E	D	D	E	R	K	M	T	D	J	E	R	M	G	L	.	C	G	K	O	E	L
J	C	A	,	"	I	J	G	D	,	K	D	J	E	I	M	R	L	M	T	D	J	E	K	D	R	E	E	D	? "	
																												? "		

12) [250 points] Decode this aristocrat.

JOMMAYCS, ALAWSNRKYQ TZJ IAZONKEOC. NRA TZS JRA

LKATAM NRA TUWCM TZJ YUNRKYQ BUWA ION Z WAECAGNKUY

UE RAWJACE.

	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	14	1	5		4		1		2	5	5	2	4	7	4		2	6	3	5	5		5		5	5
Replacement																										

Codebusters Test

13) [100 points] Solve this Caesar cipher.

V	Y	B	I	R	Q	B	V	A	T	P	N	R	F	N	E	P	V	C	U	R	E	F	J	U	R	A	G	U	R	E	R

  

V	F	N	B	A	R	Y	R	G	G	R	E	J	B	E	Q	.
																.

14) [300 points] Find the decryption matrix for a hill cipher encryption matrix where the keyword is "Help".

$$\begin{pmatrix} H & E \\ L & P \end{pmatrix} \equiv \begin{pmatrix} 7 & 4 \\ 11 & 15 \end{pmatrix}$$

$$\left( \begin{array}{|c|c|} \hline & \\ \hline & \\ \hline \end{array} \right)$$

15) [450 points] Solve this patristocrat. Good luck!

RTJJZ IFBBY MFBIM EYFJF IYMIA RTERT JJFIB MNEBZ

YFMHU MNKNE MIART ERTJJ FIBZI BZYFM HUMN

	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	7			5	8		2	8	7	1		9	4				5		5	2				5	4
Replacement																										

16) [275 points] Using the Affine cipher, encrypt the following plaintext where A is 5 and B is 11.

S	O	M	E	W	H	E	R	E	,	S	O	M	E	T	H	I	N	G	I	N	C	R	E	D	I	B	L	E	I	S
W	A	I	T	I	N	G	T	O	B	E	K	N	O	W	N	.	.													

Codebusters Test

---

17) [550 points] Solve this Baconian cipher

++==+ +=++++=+++++++=+++++++=+=+==+==++==+=+=+++=+++=  
  
==+++++=+++=++++=+++++=+++++=+++++=+++++=+++++=+++++=+++++=  
  
++++++++=+=++++=+++++=+++++++=+++++=+++++=+++++=+++++=+++++=  
  
=+++++=+++++=+=+++++=+++++=+++++=+++++=+++++=+++++=+++++=  
  
=+++++=+=++++=+++++=+++++=+++++=+++++=+++++=+++++=+++++=  
  
+++++=+++++=+++++=++++=+++++=

18) [650 points] Solve this xenocrypt.

MJQP JMLPFP MJQPLGJ GVEPFBIPFOG MA QPAAMV DSM

JBMLHVM DSBJBQM. SFG DSM MJ SFBNG HMVG PSF LSR

HVPÑQBÑG R XSFÑBGFPA. MFQGFÑMJ, RP JMP DSM MJQM

ÑVMPFOG SF QPAAMV OMJOM ÑMVG G JBLHAMLMFQM KSJÑPFOG

BOMPJ HPVP LMWGVV MA DSM QBMFM, DSMVVP DSMOPVJM

HPVP CMV ÑGLG QGOG JM SFM.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Ñ	O	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	8	10	1	7	1	16	18	6	1	17	1	8	38		9	8	23	11	3	15			16	1	1		
Replacement																											