Science Olympiad — Name's SSSS Submission CB

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	250			
1	350			
2	350			
3	275			
4	275			
5	200			
6	125			
7	200			
8	275			
9	375			
10	325			
11	400			
12	450			
13	300			
14	75			
15	125			
16	150			
17	200			
18	200			
19	175			
20	225			
21	100			

Question	Value	Incorrect letters	Deduction	Score
22	600			
23	575			
24	275			
25	50			
26	475			
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

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

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

Name's SSSS Submission CB School:_____

Timed Question **[250 points]** Solve this Aristocrat. No hints are provided. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

HDM HU EWM OHTE UPSTEPIEFDJ UMMZFDJT FD EWM BHPZX FT

QMFDJ TOIPE MDHSJW EH VDHB EWMPM'T I QMEEMP BIK EH

XH THOMEWFDJ, QSE DHE TOIPE MDHSJW EH FDGMDE I BIK

EH XH FE.

	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		12	19	8	1	15	7	6	2		14		4	7	3		4	8	3	1	6	3		2
Replacement																										

Name's SSSS Submission CB

1) **[350 points]** Solve this Aristocrat. The word drive appears at least once.

MJ ZQV ISMWG QWGS C BCDECFG MU OQQFT PQSG OMFG C

XCJJOG, MJ ZQV ISMWG QWGS C XCJJOG MU OQQFT PQSG

OMFG C BCDECFG.

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		2	10	2	2	6	12		2	6			8		6	2	10		6	2	2	2	4	2		2
Replacement																										

2) **[350 points]** Solve this Aristocrat. E is not the most common vowel.

HK ZLR HF WDA LYYLFHWA LK YUL, HF ZLREUAFF WDA

LYYLFHWA LK YULEUAFF?

	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	6			2	2	8		5			3	10						2			4		4		6	2
Replacement																										

Name's SSSS Submission CB School:_____

3) **[275 points]** Solve this Aristocrat regarding justice. It is supposed to be a joke.

OQMVNBG NM XGMV MGALGK BDHK. XGBPQMG NW NV ZPM

MGALGK ZPAR, NV ZDQHK XG OQMV-ZPVGA.

	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	3		2			10	2			4	2	8	5	2	4	4	1				6	1	3		4
Replacement																										

4) **[275 points]** Solve this joke regarding your eyes. It is an Aristocrat.

IBMZ AEL YHM, VBM FGDV QGWV EX AELW TEYA VE DVEQ

IEWRHZU GWM AELW QLQHFD. VBMA YHFGVM.

	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	5	3		3	8	3	4	4	2			4	6				4	1		1	1	7	5	1	3	2
Replacement																										

Name's SSSS Submission CB

5) **[200 points]** Solve this Aristocrat from Macbeth. It has been slightly altered. It was encoded with a K1 alphabet with the keyword Macbeth.

DAYU AJ R VRDU VFDX TO RE AXAFV, YKDD FY JFKEX REX

YKIO, JAZEAYOAEZ EFVWAEZ.

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	8			5	7	5			1	3	3				3			4		1	2	4	1	4	5	3
Replacement																										

6) **[125 points]** Solve this Aristocrat.

AWSSJAA BA QDV GQ DRVBDQ. BV BA GQ DHEBLGVBDQ.

K4	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	5	6		5	1		3	1		1		1					5	1	2			4	1			
Replacement																										

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7) **[200 points]** Solve this Aristocrat by Einstein. There is no frequency table.

N	Z	B	R	U	Z	R

X	B	W	S	D	F	W

E	R	C	B	J	B	D	U

B	N

C	H	L	R

,

,

E	R	C	B	J	B	D	U

X	B	W	S	D	F	W

N	Z	B	R	U	Z	R

B	N

Q	C	B	U	I

.

.

8) **[275 points]** Solve this Aristocrat with errors by Plato. All words are still real nglish words. Uds.

RUVNO NL EQPH UFOA NQ OVGVFRNQC FQ CPT RUNQC

	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		3		1	3	1	1				1		5	3	2	5	3		1	3	3				
Replacement																										

Name's SSSS Submission CB

9) **[375 points]** Solve this Xenocrypt.

ZFP UOD RXPYX AOK TKX RX MFPUKIMX, KR TGKUZPK JOKRJK

X WPGRRXP KIMPK RXT IOWKT.

	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	1			1		2	2		3	2	11		3			4	7		7		4	3		2	8	1	2
Replacement																											

10) **[325 points]** Solve this Xenocrypt about being a good person.

AM ÑLDNS AHJR MMADS NA QLADRH BAPHSDRH. HO DS MRH

ADTLADJPRH, HA LDR NA AMMRH.

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

Name's SSSS Submission CB School:_____

11) **[400 points]** Solve this Patristocrat about a specific instrument. Encrypted K1 with the keyword being the name of that instrument.

LIXXV JOWFH IJKLM NOAXW NOLWN AJMQL OTLMV LDXMQ

NKDTJ OASXL MSOXH XWNXB OXROT NKNOX MLSTO FXBMN

CNKVM XD

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	3	2	1	3		2		2	2	4	4	8	8	9	10		2	1	3	4		3	4	12		
Replacement																										

12) **[450 points]** Solve this Patristocrat. No hints.

KQSJV NQSVW JNUCU ZWKKW IRJVO QIRSU TDQTU CUWZF

JPNRD QWQKQ GJWTJ WDWDU JCOZX UCZRD QPU

	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	5		1	1		2	7	4			3	2	2	8	4	3	3	8	3	8	1		4
Replacement																										

Name's SSSS Submission CB

13) **[300 points]** Solve this Patristocrat based on the sound of the english language. Encoded K1 with a keyword of English.

TNTHY DWKYF CYKYK JKLMN OPOZJ QWJBO JKLMN OPOYD

KTOMN WJJKL MNOP

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

14) **[75 points]** Solve this. This is an atbash cipher.

W	R	W		B	L	F		P	M	L	D		G	S	Z	G		G	S	V	I	V		Z	I	V		Z	Y	L	F	G		G	V	M

J	F	R	M	G	R	O	O	R	L	M		R	M	W	R	E	R	W	F	Z	O		R	M	H	V	X	G	H		Z	O	R	E	V		Z	G

Z	M	B		T	R	E	V	M		N	L	N	V	M	G	?
																?

Name's SSSS Submission CB School:_____

15) **[125 points]**Decode this Caesar cipher. It is somebody's name.

E	P	I	G	X	R	Z

16) **[150 points]** Solve this quote by Dumbledore. This is an affine cipher, given BP=PB.

C	D	M		O	Q	D		D	M	V	M	Z		J	Q	V	M		M	D	C	W	K	J		Y	C	O	G	Y	.
																															.

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17) **[200 points]** Encode this Affine with A=7 and B=1.

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

D	O	G

18) **[200 points]** Encode this Vigenère given that the keyword is Homer.

S	H	U	T		U	P	,	B	R	A	I	N	,	O	R		I	'	L	L		S	T	A	B		Y	O	U		W	I	T	H		A
							,						,					,																				

Q	-	T	I	P	!
	-				!

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19) **[175 points]** Solve this Vigenère given that the first two words are I've been.

C	'	B	P
	,		

Z	Y	K	Y

A	U	R	W	C	X

A	R	J	S	,
				,

V	F	E

O	M	W	W	,
				,

Z	A	R	J	S	,
					,

V	F	E

Z	A	R	J	S	,
					,

H	F	R

H	K	G	C	L

A	R	J	S

A	R	J	S

20) **[225 points]** Solve this Bacon. First two words are how many.

MONTH UNDER HE TOO IN ALL GOOSE ALLEY FOLLY MAINE

AMIGO CLUBS UP FOR LEWIS CRIES MARIE PSYCH SUCKS

JAMIE KILOS IN USE OF HIM SAUCE SAILS POUND SWEET

IN WAY MAILS IRONY IN WAY MANDY WORLD BEADS FELLA

AM BOY GO SAY LUCKY STRAP COLOR WAIST POUND BY ITS

HOWLS I STAY HICKS

21) **[100 points]** Solve this Bacon.

BAAABAAABAABAAAABBABABABABABBABAAABBAABBABABBABABBAAB

AABAAAABAAABBAABABAABBAAABBBABBABAAABAABAABAAABBAAABA

BAAAABBABABBAA

22) **[600 points]** William has faithfully followed the steps of the RSA key-generation algorithm. Here are the results:

p = 193

q = 283

n = 54619

Φ = 54144

e = 25079

Unfortunately, William doesn't know how to compute the value of d and needs you to do that final step for them.

Enter the computed value of d, NOT the formula.

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23) **[575 points]** Jasmine and Hannah are accountants for a very large bank, and have started a friendship. They communicate via email, because they live thousands of miles apart. Hannah gets curious and asks Jasmine the year that they were born. Jasmine doesn't mind telling Hannah, but they know that the bank monitors all employee emails, and is afraid of being the victim of age discrimination. Therefore, Hannah suggests that they use RSA, and they provides their public key: (5963, 2665). Jasmine replies with the ciphertext 5490. Hannah's private key is 4921. In what year was Jasmine born?

Enter the answer:

24) **[275 points]** Encode this Hill cipher

$$\begin{pmatrix} H & I & J \\ K & C & B \\ V & D & P \end{pmatrix} \equiv \begin{pmatrix} 7 & 8 & 9 \\ 10 & 2 & 1 \\ 21 & 3 & 15 \end{pmatrix}$$

H	Y	D	R	O	X	Y	C	H	L	O	R	O	Q	U	I	N	E

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25) **[50 points]** Compute the decryption matrix.

$$\begin{pmatrix} F & Q \\ C & B \end{pmatrix} \equiv \begin{pmatrix} 5 & 16 \\ 2 & 1 \end{pmatrix}$$

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

26) **[475 points]** Given that HILL encodes to FBLA, find the decryption matrix.

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