Science Olympiad — BirdSO C

Names of participants: (Please print neatly)

School Name:

Check your team: □ Varsity □ 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	200			
2	300			
3	250			
4	300			
5	300			
6	350			
7	350			
8	550			
9	600			
10	550			
11	650			
12	650			
13	200			
14	200			
15	200			
16	250			
17	200			
18	300			
19	300			
20	350			
21	300			
22	250			
23	300			
24	450			
25	150			
26	200			
27	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

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.”

Morse Code:

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	−−−−●

●	E
●●	I
●●●	S
●●●●	H
−●●●	B
−−−−−	0
●●●●●	5

−	T
●−	A
●●−	U
●●●−	V
−●●−	X
●−−−−	1
−●●●●	6

−●	N
●−●	R
●●−●	F
−●−●	C
●●−−−	2
−−●●●	7

−−	M
●−−	W
●−●●	L
−●−−	Y
●●●−−	3
−−−●●	8

−●●	D
●−−●	P
−−●●	Z
●●●●−	4
−−−−●	9

−●−	K
●−−−	J
−−●−	Q

−−●	G

−−−	O

BirdSO C School:_____

Timed Question **[250 points]** Solve this timed aristocrat. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

B ZCBA FQDPCK NSGJ ADP FDHJMQSVN MD MQSVE BXDPM.

OQJV S FJJ DVJ BVK PVKJUFMBVK SM MQJ LSUFM MSHJ,

MQJV S EVDO SM TBV'M XJ HPTQ NDDK.

	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	6	2	9	2	5	1	3		11	5	1	12	3	2	5	7		9	2	2	10		2		1
Replacement																										

BirdSO C

1) **[200 points]** Solve this uplifting Aristocrat.

KTHTHNTK, VT MGG AECHNGT, TITKO JZT JS CA. ERME'A

VRO UE'A M LJHSJKE EJ PJ RMZX UZ RMZX.

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

2) **[300 points]** Solve this Aristocrat.

NXG FNNGACN NY HJMGLUG F AFL JH NXG VKGFNGHN XYLYK

PYI UFL RGHNYE YL XJA. JN AGFLH NXFN PYI KGUYVLJDG

XJH HICGKJYKJNP NY PYIKHGMZ.

	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	1	1	7	13	8	4	8	6	7	2	14		4		1			3	2		6	11	1
Replacement																										

BirdSO C School:_____

3) **[250 points]** Solve this Aristocrat.

UMHG ISPNQFMIPLR SNKILIUI LK XKNDLKB KNU DPFU UPLKBI

GALIU, CHU DPFU UPGJ ZGFK; LU LI KNU ZGZNMJ CHU

VHTBZGKU.

	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	2	3		4	6	4	8	2	9	8	3	6		6	1	1	2	1	13	1		1		4
Replacement																										

4) **[300 points]** Solve this Aristocrat.

FR LIGTFRD YNLIKU, QI ULOGG LIGT YCKUIGHIU, XYK

QLONIHIK DYYE QI DFHI YCN PYBTGINIU NLI PFKPGI ORE

PYBIU VOPW NY CU.

	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	3	3	2	4	7	3	15		5	6		6	4	5	3	3		3	7	1	1	1	9	
Replacement																										

5) **[300 points]** Solve this Aristocrat with errors.

YVOP'AO XEO YZ QO RJL, EKDDP, MAKEEP MOZMDO UVZ XEO

YZ EJP EUJP AKIS UJE J EKIO ZC J MZAO HZWJQXDJAP.

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

6) **[350 points]** Solve this Aristocrat with errors.

QNDK ECCA TX ITLBL CS FTRA QNLR UCVM YMDTR TX

XBDKKLMLA TR KTRU ITXBLX?

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

7) **[350 points]** Solve this Aristocrat.

VBRRXKB EA VENB KHWPBTAOREHW; ER UXAR IB YTBAF OWS

KTEAD, AH ADOTNVEWJ RFOR ZHX AKOTKBVZ WHREKB RFB

IERRBT EW ER.

	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	10		2	10	3		5	2	1	6			2	5	1		12	1	6	1	4	6	3	1	2
Replacement																										

8) **[550 points]** Solve this unhinted Patristocrat.

XKJRA KGGBE PJRYE WYWEB QAJYR ZNYGM SWYRV IKAJR

YRRBQ CSYEB ABZZW GBAPJ AYAYW RSANB AAPBQ BJZAP YRV

	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	11	9	1		4		4		1	6	3		1	2		4	3	9	3			2	5	1	10	4
Replacement																										

9) **[600 points]** Solve this Patristocrat in which W maps to G.

AQWWP KWPIC RZUMR KRSPH PXTPE IWQQJ SQZUQ DZTRW

IXKJU QDZSR REPEI XTIQC RZUWQ QJSQZ EFRWZ QDKJP

EBXYR IPESR RTKRR JRJ

	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	3	6	1		1	6	6	5		1			8	11	14	5	4	4		7	4	1	7
Replacement																										

10) **[550 points]** Solve this unhinted Patristocrat.

QFBBX KWNNX NKULN UOIDQ XKQFS XKVFN NQFYX KVTWO

FCWFE XSXKV ZHTQF LTWVW LZILT WOFCW FEXJW ZHTQF

LTWVX SW

	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	1	2	10		2	2	1	6	5		6	3		6		3	6	2	5	10	9	1	3
Replacement																										

BirdSO C School:_____

11) **[650 points]** Solve this K2 Xenocrypt with keyword OINK.

MSNIN QNHRCPQN INONMOCLHYIL QC KYFFY, MNPL NQRY

OLHINHYIL QC HL FL CHRNHRY.

Replacement																									
K2	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			5			3		7	5		1	7	3	10		3	2	5	4	1						6	

12) **[650 points]** Solve this Xenocrypt.

MX TJYLSW ÑGWXFW C JDOGFCS KMW WX WNÑW YMXFJ XJ

IMWFW ÑWXWSDJ ÑJFJ. MXC WDWHHGJX WN ÑJFJ DJ KMW DW

KMWFC.

	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			4	5		7	3	2	1	11	3	1	7	2	5	1				3	1			17	8	2	
Replacement																											

13) **[200 points]** Encode these words of wisdom utilizing the Affine cipher (a = 3, b = 18).

D	O	N	'	T
			'	

W	O	R	R	Y

A	B	O	U	T

T	H	E

W	O	R	L	D

C	O	M	I	N	G

T	O

A	N

E	N	D

T	O	D	A	Y	.
					.

I	T	'	S
		'	

A	L	R	E	A	D	Y

T	O	M	O	R	R	O	W

I	N

A	U	S	T	R	A	L	I	A	.
									.

14) **[200 points]** Encode this message using the Affine cipher (a = 3, b = 16)

I	N	F	O	R	M	A	T	I	O	N

I	S

T	H	E

O	X	Y	G	E	N

O	F

T	H	E

M	O	D	E	R	N

A	G	E	.
			.

BirdSO C School:_____

15) **[200 points]** Solve this Affine cipher that ends in SM.

O	G	P	J	R

D	G	P

A	P	Y	R

G	X	Y	R

U	X	D	K	R	M

X

U	X	E	O

P	W

O	G	R	L	E

K	X	E	H	L	J	J	L	J	F

.

.

16) **[250 points]** Encode this quote using a Vigenere cipher - keyword THANKS.

P	L	A	N	T

S	C	R	Y	T

H	E	I	R	G

R	A	T	I	T

U	D	E	F	O

R	T	H	E	S

U	N	I	N	G

R	E	E	N	J

O	Y

17) **[200 points]** Decode this Vigenere cipher given the keyword MONKAS.

I	S	E	K	R	W	X	M	G	R	I	F	W	D	R	Y	P	D	Q	V	N	F	E	Y	A	C	Q	C	E	F

E	S	H	X	L	W	E	G	G	R	E	Q	M	U	E	O	E	O	U	H	U	E	S

18) **[300 points]** Solve this Vigenere cipher given that it ends in HUMOR.

X	I	Z	R	R	N	G	R	F	R	M	Y	B	A	J	D	M	R	A	Q	J	Q	R	P	Y	S	G	N	X	C

T	O	G	B	D	Q	C	S	R	G	X	U	F	R	L	X	Y	B	S	F	Z	G	B	E

BirdSO C School:_____

19) **[300 points]** Solve this Baconian cipher.

23145672357235728935723015476829031457623589072135472

35672385723597235720357123547268935701234572357268359

72035172354689072143567238597203571234567283597023517

2354672835792357203154723 6

20) **[350 points]** Solve this Baconian cipher of a Homer Simpson quote that ends in LY.

12481324851264781248912481248102483124812564871902435

86179248102483125467812904358612748190234812548612481

27481248129048135267481249803124812546812749812481023

5468124789102354

21) **[300 points]** Solve this Hill cipher given a decryption matrix of LUBRICANT.

$$\begin{pmatrix} O & R & S \\ T & D & L \\ N & N & Y \end{pmatrix} \equiv \begin{pmatrix} 14 & 17 & 18 \\ 19 & 3 & 11 \\ 13 & 13 & 24 \end{pmatrix} \qquad Decode \begin{pmatrix} O & R & S \\ T & D & L \\ N & N & Y \end{pmatrix}^{-1} \equiv \begin{pmatrix} 11 & 20 & 1 \\ 17 & 8 & 2 \\ 0 & 13 & 19 \end{pmatrix}$$

W	K	A	L	U	S	L	P	M	D	Q	L	E	C	Y	O	W	Q	B	L	F	N	V	J	Q	O

Q	C	B	O	O	K	Y	C	L	F	N	K	M	J	Q	P

22) **[250 points]** Encode this message using the Hill cipher. The given decryption matrix is JINX.

$$\begin{pmatrix} D & I \\ N & R \end{pmatrix} \equiv \begin{pmatrix} 3 & 8 \\ 13 & 17 \end{pmatrix}$$

F	R	E	E	D	O	M	I	S	T	H	E	W	I	L	L	T	O	B	E	R	E	S	P	O	N

S	I	B	L	E	T	O	O	U	R	S	E	L	V	E	S

23) **[300 points]** Special Agent, Haileigh, has the following RSA public key:

n = 287809 e = 270077

Unfortunately for them, A quantum computer has successfully factored their n

```
287809 = 449 * 641
```

Compute the value of their private key:

Enter the computed private key:

24) **[450 points]** Daniel and Alexander are accountants for a very large bank, and have started a friendship. They communicate via email, because they live thousands of miles apart. Alexander gets curious and asks Daniel the year that they were born. Daniel doesn't mind telling Alexander, but they know that the bank monitors all employee emails, and is afraid of being the victim of age discrimination. Therefore, Alexander suggests that they use RSA, and they provides their public key: (52537, 23321). Daniel replies with the ciphertext 24967. Alexander's private key is 42401. In what year was Daniel born?

Enter the answer:

25) **[150 points]** Solve this Pollux cipher given that it begins with THOS.

2411114300411141441304111143204411141111411421414411401

4424111141441114140131422242140114412141243140104412410 1

4144140121412114114133141114142114431114010244341111 41

44112141141014114 0

26) **[200 points]** A quote has been encoded using the Morbit Cipher for you to decode. You are told that 3=●×, 1=×−, 2=●−, 5=×●, 8=−×, 9=●●.

8 9 9 5 4 9 9 5 2 1 8 2 1 3 5 9 5 7 3 9 5 6 5 3 8

1 3 3 3 6 3 9 3 1 1 7 4 2 1 2 3 6 6 1 7 1 8 2 6 5 6 3

9 5 9 5 9 3 1 1 7 4 8 2 3 9 5 2 1 8 2 6 5 9 3 1 1 7

4 6 9 5 4 9 9 5 8 2 6 5 7 3 6 7

BirdSO C School:_____

27) **[100 points]** Encode this quote using a Caesar shift of 5.

O	T	H	E	R		T	H	A	N		T	H	E		L	A	W	S		O	F		P	H	Y	S	I	C	S	,		R	U	L	E	S
																															,							

H	A	V	E		N	E	V	E	R		R	E	A	L	L	Y		W	O	R	K	E	D		O	U	T		F	O	R		M	E