Science Olympiad — 2024 North Carolina Division C Regional 1

NORTH CAROLINA SCIENCE OLYMPIAD

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	200			
1	213			
2	296			
3	248			
4	271			
5	176			
6	535			
7	102			
8	538			
9★	259			★
10	327			
11	169			
12	242			
13	211			
14	319			
15★	124			★
16	588			
17	235			
18	227			
19★	244			★
20	193			
Bonuses	**Timed:**	**Special Bonus: ★ = 150; ★★ = 400; ★★★ = 750**		
Final Score				

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Timed Question **[200 points]** The following quote by Bertrand Russell has been encoded as an Aristocrat for you to solve. What did they say?
When you have solved it, raise your hand so that the time can be recorded and the solution checked.

ROG RA FMG JMSGA FHSVCNMX RA CRPGHO CBFMGCBFSJX

JROXSXFX SO MBWSOZ PSXJRWGHGP KMBF CBFMGCBFSJX

HGBYYD SX.

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

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1) **[213 points]** Some life learning has been encoded using a Complete Columnar cipher. You are told that the word **GROWN** appears somewhere in the cipher text. What does it decode to?

EAOES LWNEA CLSAX PTIYR NSODS LPWIU RSWVN IASMI

CBNOS PLNOO CTUEO YTHDL ANYWG IAYTD LEEAD AYGUW

ESIEC AAETT

Answer: _____

2) **[296 points]** A quote by Johnny Depp has been encoded using the K1 Aristocrat Cipher for you to decode. What did they say?

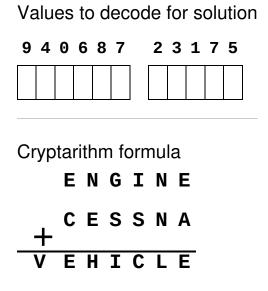**S ROL RF TRPL SE P QFETRPER TRPRU FX QFEXHTSFE AHTR**

WUQPHTU FX RZU UKNOUTTSFE SR CUPIUT FE DL XPQU.

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	1	7	8		3	1		1	3		1	2	7	4	10	5	9	9		1	4		1
Replacement																										

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3) **[248 points]** The following cryptarithm provides the key to decoding the values **940687 23175**. What do they decode to?

Values to decode for solution

9 4 0 6 8 7   2 3 1 7 5

	0	1	2	3	4	5	6	7	8	9
A										
C										
E										
G										
H										
I										
L										
N										
S										
V										

Cryptarithm formula

```
    E N G I N E

    C E S S N A
  +
  ─────────────
  V E H I C L E
```

4) **[271 points]** A quote by Samuel Taylor Coleridge has been encoded using the Aristocrat Cipher for you to decode. You are told that one of the words is **YOU** and that **THE** does not appear in the text.

PBHQR VSP PBMWENHIBM I YEQHWE'N QXBSEIBKW, JEWNPGW

VSPENWRT QXBSEIBH ST AQN PBMWENHIBMQBX.

	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	10			8		1	5	5	1	1		4	6		6	6	2	5	2		2	7	3	1	
Replacement																											

5) **[176 points]** Decode the following German Proverb which was encoded as a 2x2 Hill Cipher using a keyword of **DOWN**.

$$\begin{pmatrix} D & O \\ W & N \end{pmatrix} \equiv \begin{pmatrix} 3 & 14 \\ 22 & 13 \end{pmatrix}$$

R	A	K	S	U	G	E	H	O	I	V	A	J	C	W	T	M	K	F	X	O	T

6) **[535 points]** A friend of yours who can't spell very well has taken a very old quote from Goeth, typed it in (mistakes and all) and then encoded it as an Aristocrat using a K1 alphabet. What did they actually encode?

OCOIF UIQHO VOQYKB NQG KN BMOSJQX CZSQBNKY, QYP DONY

NO NQB TKXTJXXOP JH, NO JB YZ XZYUOI WYOO POQP.

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		5	2	1		1	1	2	3	4	4		1	7	13	4	8		2	2	2	1	1	5	7	3
Replacement																											

7) **[102 points]** The following quote by Martin Luther King Jr. needs to be decoded with the Porta Cipher with a keyword of **SWIM**

A	P	Q	T	C		S	R	C	N	Y		P	R	Y	D	Q		X	F	C	U	O		O	Q	V	L	N		C	C	M	Q	T

L	M	X	J	C		D	N	G	V	O		E	I	Y	X	J		Y	Q	X	X	D		R	A	E	D	F

8) **[538 points]** A quote by Alex A. Lluch has been encoded using the K1 Aristocrat Cipher for you to decode. You are told that the letter **D** decodes to be **E**.

HMLCM UQCUO TDHMF GCVVU HOBGD AZKLH MCBHX MXELC

MUXBG DWOBC BDOXE TDHMF OZAGC OEDDK HMFAC KLVKD

COZWD OCBHO ECABH XMCMY IXU

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	7	12	9	4	3	4	9	1		4	4	10		9		1			2	5	3	2	6	1	3
Replacement																										

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★(Special Bonus Question)   9) **[259 points]** A quote by Goldoni has been encoded using the Complete Columnar cipher. We are told that the word **LITTLE** appears somewhere in the text.

IITOL SWOTW AFBTT ORXHD UOFUM NIREL TLHAA XSSIK

IEHTX TLABO EINDO BUUTO CEX

Answer: _____

10) **[327 points]** A quote by George Savile has been encoded using the K3 Aristocrat Cipher using a key phrase. What was the key phrase used to encode the cipher?

Enter the Key Phrase here

Cipher:

CMUD CAQ CTNA OPDDOA MDJAE VUA MH DJAPE ULAAYJ DJTQ

DM RPWA AWPIAQYA TRTPQUD DJAPE MXQ VQIAEUDTQIPQR.

K3	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		3	10	4			1	3	5		1	5	1	2	7	8	3		5	5	2	2	1	2	
Replacement																											

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11) **[169 points]** The following quote by Paulo Coelho needs to be decoded with the Nihilist Substitition Cipher with a keyword of **HELP** and polybius key of **IMPORTANCE**.

87 60 67 36 89   39 87 65 57 48   63 57 49 37 67

	1	2	3	4	5
1					
2					
3					
4					
5					

34 70 36 65 47   57 67 84 34 70   50 87 36 46 76

67 28 79 50 66   27 58 69 55 24   50 50 86 24 58

60 67 55 48 36   65 47 89 39 87   34 49 47 66 48

46 50 93 38 46   46

12) **[242 points]** A quote by J.R.R. Tolkien has been encoded as an Aristocrat. The word **THE** appears twice in the quote. What does it decode to?

S XJR KJHGSTE JHNMV KN PDRQHU. J FJISK NU KFQ NHV:

KFQD WFNNRQ KFQ XSRQRK ZQLRNT ZLQRQTK KN RZQJG KN

	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	1	5	2	4	1	6	10	2	1	9		1	10	8	4	3	2	2	1	2		3
Replacement																											

13) **[211 points]** The following symbols are a Baconian Cipher encoding of a quote by Gustave Droz. What did they say?

o+t@+t+o@ot+@t+t+ot@o+t@o@+to+@t+o@ot+t+t+@t+to@o+@t+

t+to@+ot@+o@to+t+@t+to+t@+to+t+@to+t+@t+ot+@t+to+t+@o

t+@t+to@o+t@+t+o@ot@+t+t+to+t@+t+ot+@t+to@+to+t@+ot+@

t+to@o+t+t+@t+ot+@o@t+t+t+ot@o+@t+to

14) **[319 points]** An observation has been encoded as an Aristocrat using a K2 alphabet. What does it decode to?

IOK IEZAGVK TQIO AXKWSVZBWKXI QC IOFI IOK WQXAIK BZA

TFUK AS QX IOK WZEXQXN BZA'EK ZX IOK RZG.

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

★(Special Bonus Question)   15) **[124 points]** The following quote by Will Rogers needs to be decoded with the Nihilist Substitition Cipher with a keyword of **READ** and polybius key of **OBSERVING**.

40 55 66 54 50   37 36 84 37 27   47 83 28 59 77

	1	2	3	4	5
1					
2					
3					
4					
5					

66 40 59 47 47   29 39 57 54 38   59 59 46 58 39

68 46 30 27 50   55 47 59 59 57   60 27 50 55 40

55 47 44 37 47   36 47 57 68 47   56 38 25 40 57   38 45 39

16) **[588 points]** The following quote from Carlyle has been translated into Spanish and encoded as a Xenocrypt using a K1 Alphabet with an English Keyword. What does it decode to?

BA PTW ZTBFY STBIECAB E AYOEA HYF OE DBCIEI E DBHBA,

BAHTHLEC HYF GYIE AT ABDBCMIEI OY STB OB IMCE E TFY.

K1	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	12	5	3	11	4	1	5	7			1	2			4	1			2	7			1		7	1
Replacement																											

17) **[235 points]** A quote by David Bowie has been encoded as a Baconian cipher. What did they say?

Sṗéaḱ Ṡpeȧk Ṡpéak Ṡpeȧk Sṗéȧḱ Sṗéȧḱ Ṡpeȧk Sṗeȧḱ Sṗéȧk Sṗeȧḱ Ṡpéaḱ

Ṡpeȧk Ṡpeȧk Ṡpeak Sṗéȧk Sṗéaḱ Ṡpeak Sṗéaḱ Ṡpeak Ṡpeak Sṗéȧk Ṡpeȧḱ

Sṗeȧḱ Sṗeak Ṡpeȧk Sṗéaḱ Sṗéȧk Ṡpeak Ṡpeak Sṗeȧḱ Sṗéȧk Sṗéȧk Sṗéȧḱ

Sṗéaḱ Sṗéaḱ Ṡpeȧk Ṡpéak Sṗéȧk Ṡpeȧk Ṡpeaḱ

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18) **[227 points]** A quote by Buffon has been encoded using the Fractionated Morse Cipher for you to decode. You are told that the quote has **NOTHING** in it corresponding to the encoded text **T J K A N Q U Y**.

```
G   P   F   V   D   N   Y   V   A


Z   T   J   K   A   N   Q   U   Y   B   I   S   M   S


U   I   F   I   L   Z   E   O   O   F   S   C   I   T   Q   J


N   F   H   O   Y   R   I   L   N   P   F   C   I
```

Replacement																										
Morse fraction	•	•	•	•	•	•	•	•	•	—	—	—	—	—	—	—	—	—	×	×	×	×	×	×	×	×
	•	•	•	—	—	—	×	×	×	•	•	•	—	—	—	×	×	×	•	•	•	—	—	—	×	×
	•	—	×	•	—	×	•	—	×	•	—	×	•	—	×	•	—	×	•	—	×	•	—	×	•	—

★(Special Bonus Question)   19) **[244 points]** The following strange headlines encode a quote by Lou Holtz using a Baconian cipher. You are told that the deciphered text starts with **WHEN**

LADEN YACHT BY OUR ROGUE FERRY USED A NOISY ALARM.

GIANT GAMES NEVER BLUFF IF ITS BEEN A JOKER FAULT.

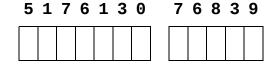**BY NOW, IT WAS A PLAN, RELAY A WISH IT DID LEARN.**

IVORY ROBIN GRABS GREAT QUEEN AGAIN, I MUST WRITE.

MY OLD MUMMY IS ONE I JUST UPSET AT OUR ENTRY.

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20) **[193 points]** The following cryptarithm provides the key to decoding the values **5176130 76839**. What do they decode to?

Values to decode for solution

5 1 7 6 1 3 0   7 6 8 3 9

Decoded answer: **WESTERN STORY**

Cryptarithm formula

```
    P O W E R
  + S P O R T
  -----------
    E N E R G Y
```

	0	1	2	3	4	5	6	7	8	9
E		X								
G					X					
N	X									
O									X	
P			X							
R				X						
S								X		
T							X			
W						X				
Y										X