

Science Olympiad — Jhahria Cødebusters

Exam I

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	100			
2	500			
3	300			
4	350			
5	400			
6	900			
7	500			
8	600			
9	100			
10	300			
11	120			
12	100			
13	500			
14	400			
15	100			
16	160			
17	250			
18	249			
19	200			
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%				

Morse Code:

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

0 -----	2 ••---	4 ••••-	6 -••••	8 ----••
1 •-----	3 •••---	5 •••••	7 --•••	9 -----•

• E	- T	•- A	-• N	-- M	-•• D	-•- K	--• G	--- O
•• I	•-• U	•-• R	•-• W	•-•• L	•-•• P	•--- J		
••• S	•••- V	••-• F	•-•- Y	-••• Z	-•-• Q			
•••• H	-••- X	-•-• C	•••- 3	••••- 4				
-••• B	•---- 1	••--- 2	---•• 8	-----• 9				
----- 0	-•••• 6	--••• 7						
••••• 5								

Timed Question [200 points] Solve this aristocrat which is a line from a famous song by twenty øne piløts song. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

J PWY FMBO PILV J HLF MBOLU WBB SX KLWUY PMCBO

YIUJVR ZCF VMP J'S JVYLECUL, WVO J EWUL PIWF QLMQBL

FIJVR.

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

1) [100 points] Decode this phrase from a twenty øne piløts song using a Caesar Cipher.

H	V	S	M	G	O	M	"	G	H	O	M	W	B	M	C	I	F	Z	O	B	S	P	C	M	Z	O	B	S		
							"																							
P	C	M	"	P	I	H	K	S	U	C	K	V	S	F	S	K	S	K	O	B	H	H	C	H	V	S	M			
			"																											
H	V	W	B	Y	H	V	W	G	H	V	W	B	U	W	G	O	V	W	U	V	K	O	M	V	W	U	V	K	O	M
P	I	H	K	W	Z	Z	H	V	S	M	P	S	O	Z	W	J	S	H	C	A	C	F	F	C	K	?				
																										?				

2) [500 points] Solve this aristocrat which encodes the opening lines of a song from the twenty øne piløts album "Trench".

FPKBMYMKB F M WBBJ NPJX, BHBR UGOGJZDBX. KZ MRYBOMPO

TPOJX RBBXF YP FGRMYMDB. M'HB QPY YP FYBU YSOPVQS PO

M'JJ XMFFMUGYB. M'JJ OBNPOX KZ FYBU YSOPVQS WPO KZ

IGFBKBRY YGUBF.

	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		19		2		10	6	2	1	8	6		11	2	10	12	3	5	4	1	5	2	2	6	13	4
Replacement																										

3) [300 points] Solve this aristocrat which encodes the opening verse of the twenty øne piløts song "Johnny Boy".

QZ FEMIF QAKZ NOAK VAQY EQRF ERKZ, QZ SZDZO OZMHHI

EAHB QRF VRNZ, QZ SZDZO OZMHHI EAHB M HRZ, GXE EQRF

ERKZ QZ BZPRBZF EQME RE'F MHORJQE.

	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	4		2	12	7	1	8	3	1	4		6	2	7	1	10	10	2			2		1	1	17
Replacement																										

4) [350 points] Solve this aristocrat which encodes lines from a twenty øne piløts song.

NBFCYX EF JPY ZBLXEQ SZ JPEG JPEFC E UBNY. E

IXSLBLMV GPSWMNF'J GPST VSW, LWJ EJ'G TBV JSS MBJY.

UV PYBXJ EG TEJP VSW PENEFC, LWJ UV UEFN'G FSJ UBNY.

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

5) [400 points] Solve these twenty øne piløts song lyrics misheard by a smart speaker and encoded as a K1 aristocrat.

NGN OY QAOKNR, QOZ GAJ UNMN. V EN'KK SKG, EVLU XZAE

UABN, XZAE SNOM. OZR LUN TMAJZR, LOJZLD YG EUVZTD.

BKJY YNL OD NGN DVZTU, BKJY YNL OD NGN DVZTU.

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	6	3		6	5		6			5	6	6	3	15	8		2	3	2	4	7	5		2	6	9
Replacement																										

6) [900 points] Solve these twenty øne piløts song lyrics misheard by a smart speaker and encoded as a K2 aristocrat.

JCJ OTC ONPH YTE00 UJJ OSX TMW ONTJS ONJ HEWI. EH

JCJ XUI ONJ SE0JT PW ONJ YXV XK VC EWI. 'GEMHJ POH

XPU ONE0 JCJ NEUAJ EWI POH EUU ONE0 JCJ RWJEI EWI

ONJ SEPAJH XK ONJ SE0JT VJEW WXONPWL OSX VJ.

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	2		6		16		1	7	6	24	2	1	2	11	21	7		1	6	6	6	4	10	8	2	

7) [500 points] Solve this K2 patristocrat that encodes lines from a twenty øne piløts song that begins with **PETR**.

BUF DY VYUTH VKXHN HGPDU PITKX HNHGX PJUQU RHLUN

HGKYA AXYTU VDHLU JUDNH IUTUI NYIWN HGIUU TEHLU

HIUFH UMFUD LYIPF UNHGD QHIUE

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	2	1		6	2	4	5	15	8	2	3	4	1	7		4	2	1		5	19	3	1	4	6			

8) [600 points] Solve this patristocrat which encodes lines from a twenty øne piløts song.

EWTDT OPLNT OAUNM ZSLZU DAZE A UFOMZ SGTDT SILZV

GLEWT KTDIO ETBGT EMTG TDTSI LZVGL EWTKT DIQDT

MEWGT PMYTM ZSMNN UMNNL ZNLZT

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	1		7	7	1	6		4		2	8	8	7	4	2	1		5	18	4	2	4		2	9
Replacement																										

9) [100 points] This famous line from a hit twenty øne piløts song needs to be encoded with the Affine Cipher using $a=23$ and $b=10$.

M	Y	N	A	M	E	'	S	B	L	U	R	R	Y	F	A	C	E	,	A	N	D	I	C	A	R	E	W	H	A	T	

Y	O	U	T	H	I	N	K	.

10) [300 points] The following well-known line from a twenty øne piløts song beginning with **WH** needs to be decoded with the Affine Cipher.

S	H	A	O	,	G	'	C	J	O	D	D	G	B	I	,	W	A	G	'	C	V	O	E	G	B	I	C	Q

V	G	C	K	A	B	C	Q	X	G	L	K	.

11) [120 points] Encode this phrase heard in the twenty øne piløts song "Migraine" using Vigenere with a keyword of "SKELETON".

I	V	E	G	O	T	A	M	I	G	R	A	I	N	E	A	N	D	M	Y	P	A	I	N	W	I	L	L	R	A

N	G	E	F	R	O	M	U	P	D	O	W	N	A	N	D	S	I	D	E	W	A	Y	S

12) [100 points] Decode these lines from the twenty øne piløts song "Message Man" which were encoded with the keyword "CLIQUE".

C	W	W	I	Y	V	J	T	L	U	M	F	G	S	Q	D	X	E	O	L	A	A	I	J	O	J	L	Y	M	K

W	T	A	U	U	R	F	H	P	E	C	E	O	E	W	T	U	C	K	D	E	E	L	W	G	E	P	Q	H	S

V	S	M	H	N	M	O	P	A

13) [500 points] Decode this baconian which encodes yet more lines from "Message Man", by twenty øne piløts.

ψϕϑ⊳*|/ψ-⊳ϕ*⊳/ψ|-ϕ⊳⊳/ψ|ϕ-ϕ/ϕ*⊳ψ|-ϕϕ*⊳ϕ|-/ϕψϕ*⊳|-ϕ/ϕψϕ*⊳ϕ

|-ϕ/⊳ψ⊳|/ψ-ϕ*⊳|-⊳ϕ*⊳|-ϕ*⊳|-ϕ*⊳/|-ϕ*⊳ψϕ|-ϕϕ*⊳/|-ϕψ⊳⊳|/-ϕψ

ϕ|-ϕ⊳|-ϕϕ*⊳/ψ|ϕ-ϕ/ϕ*⊳ψϕ|ϕ/-ϕψϕ*⊳ϕ|-/ϕψϕ*⊳|-ϕ/ϕψϕ*⊳ϕ|-ϕ/⊳ψ

⊳|/ψ-ϕ⊳⊳|-ϕ*⊳|-ϕ/⊳ψϕ|-ϕϕ*⊳/|ψϕ-ϕϕ/⊳ψϕ|-ϕ/ϕ*⊳|ψϕ-ϕ/ϕψ*⊳ϕ

ϕ|-/ϕ*⊳ψ|-ϕϕ*⊳ϕ|/ψ-ϕ*⊳⊳|/ψ-ϕϕ*⊳|ϕ-ψϕϕϕ/⊳|-ψ⊳ϕ*⊳/|-ϕ*⊳|-ϕ

ψ*⊳|-ϕϕ*⊳ϕ|-/ϕ*⊳ψ|-ϕ⊳⊳/⊳|ψ-ϕϕ*⊳ϕ|-ϕ*⊳|-ϕ/⊳ψϕ|ϕ-ψϕ*⊳⊳|/ψ-ϕ

⊳⊳/|-ψϕ⊳⊳|-/ψϕ⊳⊳/|-ϕψ*⊳⊳|ψϕ-ϕ*⊳ϕ|-/ϕ*⊳|-ϕ*⊳|ψ-ϕ*⊳ϕ|-

14) [400 points] Figure out what these strange headlines encoded using a Baconian alphabet mean. It encodes some lines from a twenty øne piløts song that begins with the word "YOU'RE".

BADLY A PLAN BE OLD BACK A ACRES BE ITS EARTH ACRES

A BOOK BE OLD A CALL AMPLE ACRES A PLAN EARTH ABBEY

A PLAN BACON ACRES BE ITS A HAND ACRES A SHOT BACK A

ACRES ACRES A BOOK A BEAT ABBEY A PLAN BABES A HAND

BADLY BACON A PLAN BE OLD A BABY BACON A SHOT BACK A

ACRES ACRES BIRTH A BOOK ABBEY AMPLE EARTH ACRES

A BABY A BABY BACON EARTH A PLAN BE ITS A SHOT A PLAN

BACK A AMPLE A PLAN A PLAN A CALL BACK A ACRES A CASE

BACON A PLAN ABBEY BACON A PLAN ALPHA A BABY ACRES

A CASE BACON ACRES BE ITS A CASE A BEAT ACRES A HAND

ACRES

15) [100 points] Using a key of **NICONINER**, encode the following phrase heard repeatedly in the twenty øne piløts song "Nico and the Niners".

$$\begin{pmatrix} N & I & C \\ O & N & I \\ N & E & R \end{pmatrix} \equiv \begin{pmatrix} 13 & 8 & 2 \\ 14 & 13 & 8 \\ 13 & 4 & 17 \end{pmatrix}$$

E	A	S	T	I	S	U	P	

16) [160 points] Decode this phrase heard in the twenty øne piløts song "Car Radio" with a keyword of **VSSL**.

$$\begin{pmatrix} V & S \\ S & L \end{pmatrix} \equiv \begin{pmatrix} 21 & 18 \\ 18 & 11 \end{pmatrix}$$

G	K	M	A	X	O	M	A	Q	G	S	G	K	V	Y	E	N	Y	Y	J	G	H	R	T

17) [250 points] The opening lines from "Isle of Flightless Birds", by twenty øne piløts, have been encoded using the Pollux Cipher for you to decode. You are told that 6=-, 3=-, 8=-, 2=x, 5=x, 9=x.

84933897630541547759801174042281342734794198897308113

0269383253911442492741569868073108138523044475765652887

94101713979114208514410122377215839368964971195765875847

991653408640127311947720766191785731976670683911127226

21141212816602478421317561330243973408689178084564750738

9741151157677570518307227327310150733976076742346577581

5864

18) [249 points] We'll end with the beginning. The opening lines from "Implicit Demand for Proof", twenty øne piløts's first song, have been encoded using the Morbit CIPHER for you to decode. You are told that 1=xx, 6=•x, 2=-x, 3=x•, 7=••, 5=•-.

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

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

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

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

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

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

3 1 9 6 4 2 5 2 9

19) [200 points] Compute the decryption matrix for this hill cipher key which is the name of the drummer of a band that you might have heard of. Take a guess as to which band it is.

$$\begin{pmatrix} J & O \\ S & H \end{pmatrix} \equiv \begin{pmatrix} 9 & 14 \\ 18 & 7 \end{pmatrix}$$



