**Codebusters B Open League – EXAM**

2021 Johns Hopkins Invitational

Team Number (on your wristband):

Team/School Name:

No abbreviations / PRINT LEGIBLY

Student Names (First & Last): PRINT LEGIBLY

1.

2.

3.

Total Points Possible: **2775**

Total Points Earned:

Team Number: School Name:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Question** | **Value** | **Incorrect letters** | **Deduction** | **Score** |
| Timed | 200 |  |  |  |
| 1 | 600 |  |  |  |
| 2 | 150 |  |  |  |
| 3 | 125 |  |  |  |
| 4 | 250 |  |  |  |
| 5 | 250 |  |  |  |
| 6 | 300 |  |  |  |
| 7 | 250 |  |  |  |
| 8 | 350 |  |  |  |
| 9 | 100 |  |  |  |
| 10 | 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 |
| **AAAAB** | B |
| **AAABA** | C |
| **AAABB** | D |
| **AABAA** | E |
| **AABAB** | F |

|  |  |
| --- | --- |
| **AABBA** | G |
| **AABBB** | H |
| **ABAAA** | I/J |
| **ABAAB** | K |
| **ABABA** | L |
| **ABABB** | M |

|  |  |
| --- | --- |
| **ABBAA** | N |
| **ABBAB** | O |
| **ABBBA** | P |
| **ABBBB** | Q |
| **BAAAA** | R |
| **BAAAB** | S |

|  |  |
| --- | --- |
| **BAABA** | T |
| **BAABB** | U/V |
| **BABAA** | W |
| **BABAB** | X |
| **BABBA** | Y |
| **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% | N | - | 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 fi as distinct letters, but a and a are the same letter. Likewise for e and e, and i and f. 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 fve letters: "b-u-r-r-o" and not as four letters "b-u-rr-o."

Team Number: School Name:

Codebusters B Open League JHSOI School:

Timed Question **[200 points]** Solve this aristocrat to reveal a quote from Mr. Krabs. When you have solved it, raise your hand so that the time

can be recorded and the solution checked.

## HU YSQNN OUFUB RUOZ Q PJUYC UFUO CSU AKYC BVRVWJNKJY

**BUIJUYC.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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 | 4 |  |  | 2 |  | 1 | 1 | 4 | 2 |  |  | 3 | 3 | 1 | 2 | 2 | 2 |  | 10 | 2 | 1 |  | 5 | 1 |
| **Replacement** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Team Number: School Name:

Codebusters B Open League JHSOI

1. **[600 points]** Solve this Xenocrypt which is a translation of a quote from George Washington into Spanish

## LVT ZFUBGVT NLF VLVNT NGEFSPG LV FUUGU VLVNT ZUGIG

**VTRT VLFHG.**

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

1. **[150 points]** Decode this message using the Affne Cipher with a = 5 and b = 9

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|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| J | A | A | J | T | H |
|  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| A | S | D |
|  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| I | B | Q | A |
|  |  |  |  |

|  |  |
| --- | --- |
| J | A |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Y | J | P | W |
|  |  |  |  |

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Team Number: School Name:

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1. **[125 points]** Encode this message using the Caesar Cipher with a shift of 12

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|  |  |
| --- | --- |
| W | E |
|  |  |

|  |  |  |
| --- | --- | --- |
| A | R | E |
|  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| U | N | D | E | R |
|  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | T | T | A | C | K |
|  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| R | E | T | R | E | A | T |
|  |  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| S | E | N | D |
|  |  |  |  |

|  |  |  |
| --- | --- | --- |
| A | L | L |
|  |  |  |

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|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| F | O | R | C | E | S |
|  |  |  |  |  |  |

|  |  |
| --- | --- |
| T | O |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| F | O | R | T |
|  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| C | H | E | S | A | P | E | A | K | E |
|  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| B | A | T | T | L | E |
|  |  |  |  |  |  |

|  |  |
| --- | --- |
| I | S |
|  |  |

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|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| I | M | M | I | N | E | N | T |
|  |  |  |  |  |  |  |  |

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1. **[250 points]** Solve this Baconian Cipher to reveal a quote from soccer player Cristiano Ronaldo

## ABAAAAAABBABBABABBAABAABAABABBABAAAABBAAAAABBAB

**BBAAABAAABBABABBBAABABAAABAAAABBBAAAAABAABAABAA**

**AABBAAAABBAABABBAABAAAAAABAABAAAAABAAAAAABAABBB**

**AAABAABAAABAAABAABAABBBABAABBBAAABAABBBAABAABAA**

**ABABABBAABAA**

Team Number: School Name:

Codebusters B Open League JHSOI

1. **[250 points]** Decode this quote from primatologist Jane Goodall using the Vigenere Cipher with a key of VERMONT

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V

|  |  |  |  |
| --- | --- | --- | --- |
| R | L | R | F |
|  |  |  |  |

|  |  |  |
| --- | --- | --- |
| M | B | N |
|  |  |  |

|  |  |
| --- | --- |
| Y | S |
|  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| D | M | Y | R | L |
|  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| H | Z | R | T | R | K | Z | R | T | Q |
|  |  |  |  |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| O | A | W |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| T | S | L |
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| --- | --- | --- | --- |
| T | O | I | X |
|  |  |  |  |

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| --- | --- |
| O | S |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| U | Q | Q | V | W | Z |
|  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| A | Y | M | H |
|  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| X | B | I | H |
|  |  |  |  |

|  |  |
| --- | --- |
| F | R |
|  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| R | V | Y | A | I | I | Q | B | P | X |
|  |  |  |  |  |  |  |  |  |  |

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|  |  |  |
| --- | --- | --- |
| T | S | L |
|  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| I | O | A | M |
|  |  |  |  |

|  |  |
| --- | --- |
| O | S |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| D | M | Y | R |
|  |  |  |  |

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1. **[300 points]** Decode this patristocrat to reveal a quote from theoretical physicist Stephen Hawking

## COFWK KLCWI KLJLH NDWGD SJXCZ ZTHGA CAJKL JWJYK

**KLFHT DWOMJ DGTHW ZJTTX JTQGJ DOCWK FTQDS J**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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 | 6 |  | 3 | 4 | 4 | 1 | 10 | 7 | 5 | 1 | 1 | 3 |  | 2 |  | 2 | 7 |  |  | 7 | 2 | 1 | 3 |
| **Replacement** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Team Number: School Name:

Codebusters B Open League JHSOI School:

1. **[250 points]** Encode the following quote using the Vigenere Cipher with the keyword CODE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| H | A | C | K | I | N | G |
|  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| I | N | V | O | L | V | E | S |
|  |  |  |  |  |  |  |  |

A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| D | I | F | F | E | R | E | N | T |
|  |  |  |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| W | A | Y |
|  |  |  |

|  |  |
| --- | --- |
| O | F |
|  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| L | O | O | K | I | N | G |
|  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| A | T |
|  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| P | R | O | B | L | E | M | S |
|  |  |  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| T | H | A | T |
|  |  |  |  |

|  |  |
| --- | --- |
| N | O |
|  |  |

|  |  |  |
| --- | --- | --- |
| O | N | E |
|  |  |  |

S

.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| T | H | O | U | G | H | T |
|  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| O | F |
|  |  |

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1. **[350 points]** Decode this quote from former US President Barack Obama using the Vigenere Cipher using the key of PREZ

|  |  |
| --- | --- |
| X | W |
|  |  |

|  |  |  |
| --- | --- | --- |
| C | N | J |
|  |  |  |

|  |  |
| --- | --- |
| I | I |
|  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| V | P | C | O | H | C | X |
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| A | H | A | C | M | M | V |
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Team Number: School Name:

Codebusters B Open League JHSOI

1. **[100 points]** Decode this lyric from a classic holiday song using the Atbash Cipher

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| Y | V | T | R | M | M | R | M | T |
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| X | S | I | R | H | G | N | Z | H |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| V | E | V | I | B | D | S | V | I | V |
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| B | L | F |
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| --- | --- |
| T | L |
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1. **[200 points]** Solve this aristocrat which is a quote by Albert Einstein which has the word **SIMPLE** in it

## KZKLDPMWAS BMIRVH XK TFHK FB BWTUVK FB UIBBWXVK, XRP

**AIP BWTUVKL.**

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|  | **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 |  | 1 |  | 3 |  | 2 | 3 |  | 7 | 2 | 2 |  |  | 3 |  | 2 | 1 | 3 | 3 | 4 | 4 | 3 |  | 1 |
| **Replacement** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |