NAME: _____

DATE: _____

DSA

Alternate Base Systems for Cross-Curricular Fun & Engineering Applications

HANDOUT FOR INDIVIDUAL WORK
Level 3 – Counting, Numbers, Conversions

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We use the Decimal system for counting. We say 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
There are other ways of counting which can be useful under different circumstances.

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Binary: The first computers only had an OFF and an ON switch. There were only two possibilities which we call Binary because the prefix "bi" means two. The Binary base only contains 1 and 10. When we count in Binary we say: 1, 10, 11, 100, 101, 110, 111, 1,000…

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Octal: In the Octal system we count by eights and we say: 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16 17 20, 21, 22, 23, 24, 25, 26, 27, 30, ___, ___, ___, ___, ___, ___, ___, 40…

In each base under 10 we can use the same numbers we already use. But what happens when we have a base like the Dozenal system wherein we need to add two new numbers? In the last century everyone agreed to call the two extra dozenal letters "dec" and "el".

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How do we count in the Dozenal system? We say: 1, 2, 3, 4, 5, 6, 7, 8, 9, dec, el, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, one dozen dec, one dozen el, 20, 21, 22, 23, 24, 25, 26, 27,28. 29, two dozen dec, two dozen el, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, _____, _____, 40…

INTERESTING FACTS: You can use your mind or the information above to answer the question.
There are only 2 digits in the binary base: 0 and 1.
There are 8 digits in the Octal Base: _____

CONVERTING AMONG BASES: It is fun to convert among the bases. The Decimal, Octal, and Binary Bases are easy to convert because we do not have to invent any new numbers. The Dozenal base is fun and more interesting to convert because there are two extra numbers! Note that every base has a 10. However, also note that 10 in one base is not equal to 10 in another base. Some bases contain more pieces than others before you get to the number 10.

CONVERSION QUESTION:
What does 11 in the Decimal Base convert to in the Dozenal Base? _____(write it as a word)

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CONVERSION QUESTIONS: Write examples of conversions between different bases using stick-lines to represent quantity. Use the empty space on this page for more conversions.

Example: | | | | | | | |

In Decimal Base = _____

In Binary Base = _____

In Octal Base = _____

In Dozenal Base = _____

YOUR CONVERSION:

In Decimal Base = _____

In Binary Base = _____

In Octal Base = _____

In Dozenal Base = _____

YOUR CONVERSION:

In Decimal Base = _____

In Binary Base = _____

In Octal Base = _____

In Dozenal Base = _____

REFLECTION:
Do you understand how to count & convert different bases? YES A LITTLE BIT NO

When you and your neighbor are both done with the work, explain alternate-bases and counting in alternate-bases to him or her; then let your neighbor explain alternate bases and counting in different bases to you.

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Think about the Dozenal-base system:
One, two, three, four, five, six, seven, eight, nine, dec, el, ten.
Notice that in order to count up to 10 in dozenals, we must include two extra numbers,
Dec and El. Mathematicians have agreed to call the two extra Dozenal numbers Dec and El.

Nobody has ever decided which symbols we should use for Dec and El. Maybe you can help.
Below, please make up your own shapes for the two extra dozenal numbers, Dec and El.
Draw them next to their names: DEC and EL and circle your best efforts for each number.

DEC

EL