The Complete character table for the Point group C_{2v} is as follows:—

C_{2v}	E	$C_{2(z)}$	σ_{xz}	σ_{yz}		
A_1	1	1	1	1	z	x^2, y^2, z^2
A_2	1	1	-1	-1	R_z	xy
B_1	1	-1	1	-1	x, R_y	xz
B_2	1	-1	-1	1	y, R_x	yz
I	II				III	IV

In the upper left corner is the Schonflies notations for the group and the upper row of the table consists of the symmetry operators grouped into classes.

Area I: Area I represents the symbol for irreducible representation according to Mulliken.
All these irreducible representation are uni dimentional and hence A or B symbol hasbeen used.
Because upper two irreducible representations are symmetrical with respect to the principal axis and hence A's are written and lower two representations are anti-symmetric with respect to the principal axis and hence B's are written.
Subscript 1 or 2 are written for the symmetrical and antisymmetrical respectively with respect to σ_{xz}.

Area II:- Area II of the character table has the characters of the irreducible representations of the Point group C_{2v}.

Area III:- Area III represents the Cartesian Co-ordinates or rotational axis corresponding to irreducible representation. In order to assign the Cartesian Co-ordinate or rotational axis, we must perform the operations on them and enquire the character.

Let us consider a vector along Z axis. The operations E, $C_{2(z)}$, σ_{xz}, σ_{yz} do not change the direction of the head of vector. Hence its character are 1, 1, 1, 1.
Thus the vector z transforms under the symmetry operations into A_1. Similarly x and y vector transform in to B_1 and B_2 representations respectively. Rotation axis R_x, R_y and R_z represents rotation about x, y and z axis.

To under-stand the transformation by rotational axis, we should mark a Curved arrow and Symmetry operation. If the direction of the head of arrow does not change operation, the Character is +1 and −1 for the chang head of arrow.

	E	C_2	σ_{xz}	σ_{yz},	Tranformation i
R_z z R_z	1	1	1	−1	A_2
R_y R_y	1	−1	1	−1	B_1
R_x x R_x	1	1	−1	−1	B_2

Area IV :- Area IV represents Square and binary Poducts to the irreducible representation.

For assignment of the square and binar of vectors, the characters are squared or direct p are obtained ; x^2, y^2 and z^2 belongs to A_1 irredu representation.

The product of Character of x and y b to A_2, the products of x and z belongs to B_1 product of y and z belongs to B_2 representatio

—x—

Construction of Character Table for C_{3v} Point group.

There ar six symmetry operations present in C_{3v} point group i.e $E, C_3^1, C_3^2, \sigma_a, \sigma_b, \sigma_c$.
these operations are derive in the three classes i.e ($E, 2C_3, 3\sigma_v$) and hence there are three irreducible representations.

let they are Γ_1, Γ_2 & Γ_3.

The sum of the squares of dimensions (i.e character of the identity - operation) should be equal to six (or 6).

$$\sum l_i^2 = l_1^2 + l_2^2 + l_3^2 = 6$$

The values of l_i that will satisfy this requirement are 1, 1, and 2.

C_{3v}	E	$2C_3$	$3\sigma_v$
Γ_1	1		
Γ_2	1		
Γ_3	2		

i) Every point group posesses one representation which is totally symmetric.

In this representations, all the operations have the character value one (1)

Thus we have

C_{3v}	E	$2C_3$	$3\sigma_v$
Γ_1	1	1	1

It can be seen that the summation of the square, of the character of the operations is equal to 6

$$1^2 + 2\times1^2 + 3\times1^2 = 6$$

ii) Γ_2 (Second irreducible representation), must be orthogonal to Γ_1.
since $\chi_2(E)$ must always be positive and hence Γ_2 must consist of three +1 and three -1. This is only possible if Γ_2 has 1, 1, and -1.

C_{3v}	E	$2C_3$	$3\sigma_v$
Γ_1	1	1	1

One third representations will be of two dimension and hence $\chi_3(E)$ is 2.

In order to find out the values of $\chi_3(C_3)$ and $\chi_3(\sigma_v)$. we make the use of the orthogonality relationship.

Γ_1 and Γ_3 are orthogonal to each other and Γ_2 and Γ_3 are also

C_{3v}	E	$2C_3$	$3\sigma_v$
Γ_1	1	1	1
Γ_2	1	1	-1
Γ_3	2	$\chi_3(C_3)$	$\chi_3(\sigma_v)$

$$\sum_R \chi_1(R)\cdot\chi_3(R) = (1)\cdot(2) + 2(1)\cdot\chi_3(C_3) + 3\cdot(1)\chi_3(\sigma_v) = 0 \quad \text{—(i)}$$

$$\sum_R \chi_2(R)\cdot\chi_3(R) = (1)\cdot(2) + 2(1)\cdot\chi_3(C_3) + 3\cdot(-1)\chi_3(\sigma_v) = 0 \quad \text{—(ii)}$$

Solving equation (i) and (ii) we get

$$2\chi_3(C_3) + 3\chi_3(\sigma_v) = -2 \quad \text{—(iii)}$$

$$2\chi_3(C_3) - 3\chi_3(\sigma_v) = -2 \quad \text{—(iv)}$$

On adding eq^n (iii) and (iv) we get

$$4\chi_3(C_3) = -4$$

$$\therefore \chi_3(C_3) = -1$$

This value is substituted in equation (iii) to get

$$2(-1) + 3\chi_3(\sigma_v) = -2$$

$$3\chi_3(\sigma_v) = 0$$

$$\therefore \chi_3(\sigma_v) = 0$$

Thus, the complete set of character of irreducible representations of C_{3v} point group is:

C_{3v}	E	$2C_3$	$3\sigma_v$
Γ_1	1	1	1
Γ_2	1	1	-1
Γ_3	2	-1	0