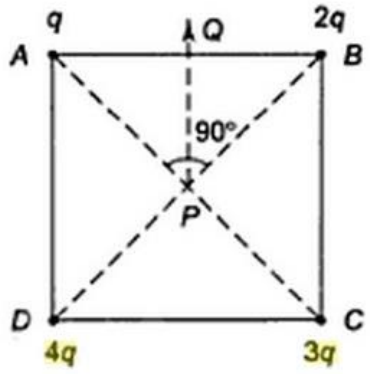
Answer on Question#40104, Physics, Electrodynamics

Q,2Q,3Q AND 4Q CHARGES ARE PLACED AT THE FOUR CORNERS OF A SQUARE.THE FIELD AT THE CENTRE P OF THE SQUARE HAS THE DIRECTION ALONG -

1. AB 2. CB 3. AC 4. BD.

Solution:



The electric field at a distance r from a point charge Q is given by

$$E = \frac{1}{4\pi\varepsilon_0} = \frac{Q}{r^2}$$

If Q is positive, the field is directed radially away from Q. Let $PA = PB = PC = PD = r$. Then the electric field at P due to charge $2q$ at B is

$E_1 = \frac{1}{4\pi\varepsilon_0}\frac{2q}{r^2}$ along PD

The electric field at P due to charge $4q$ at D is

$E_2 = \frac{1}{4\pi\varepsilon_0}\frac{4q}{r^2}$ along PB

Net field along PB is $E = E_2 - E_1 = \frac{1}{4\pi\varepsilon_0}\frac{2q}{r^2}$

Similarly, the net electric field at P due to charges q and $3q$ at A and C will be

$E' = \frac{1}{4\pi\varepsilon_0}\frac{2q}{r^2}$ directed along PA.

Thus $E = E'$, but they are mutually perpendicular to each other, therefore, their resultant will be along PQ which is parallel to CB. Hence the correct choice is (b)

Answer: (b)