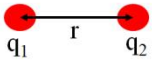
Noteguide for Coulomb's Law - Videos 16AB **Name**_____

- Charge is in Coulombs (C) (1C = 1 A·s)
  - Signed quantity (+/-)
  - e = 1.602×10^{-19} C
  - Protons are +, electrons are -
  - 1 C = 6.25×10^{18} electrons or protons
  - 1μC = 10^{-6} C
- Charge is conserved
- Likes repel, opposites attract

Just like gravity:

$$F_E = k\frac{q_1 q_2}{r^2}$$



F_E = force of attraction or repulsion (N)
k = "Coulomb constant" (8.99×10^9 Nm^2C^{-2})
q_1 = charge 1 (C)
q_2 = charge 2 (C)
r = center to center distance (m)

Example 1- What is the force of attraction between a helium electron and its nucleus if the electron is 1.7×10^{-10} m away?)

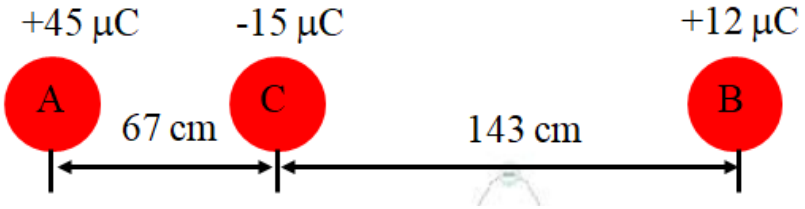
Example 2 – Two charged spheres have a force of repulsion of 5.40 N when their centers are 0.120 m apart. What is the force of repulsion when their centers are 0.360 m apart?

Whiteboards - Work these out - if you don't get the right answer, watch the video to see how to do it.

1. Jess Uwaite places a +3.0 μC charge 3.5 m from a +5.0 μC charge. What is the force of repulsion? ($1\ \mu C = 10^{-6}$ C) (0.011N)	2. Noah Verkreinatlaad places a 5.0 C charge how far from a 3.0 C charge to make the force between them exactly 4.00 N? (1.8×10^5 m or 180 km)
3. Cally Seniks measures a force of attraction of 4.50 N between two charges when their centers are separated by 1.20 m. What is the force of attraction when their centers are separated by 0.950 m? (7.18 N)	4. Rita Book measures a force of attraction of 12.0 N between two charges when their centers are separated by 2.50 m. At what separation is the force of attraction 7.00 N? (3.27 m)

Noteguide for Linear Arrays - Videos 16D1 **Name**_____

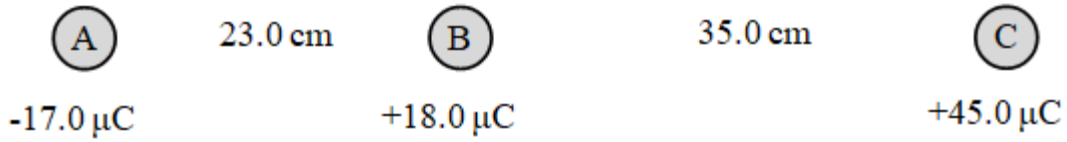
Find the net force on B:



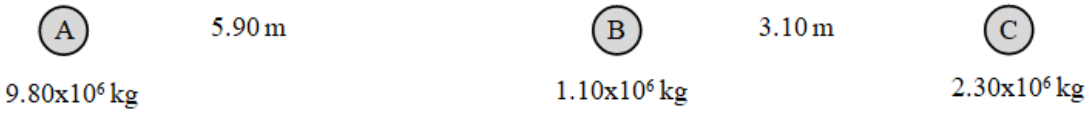
Write down the three steps:

Whiteboards - Work these out - if you don't get the right answer, watch the video to see how to do it.

Find the force on A:

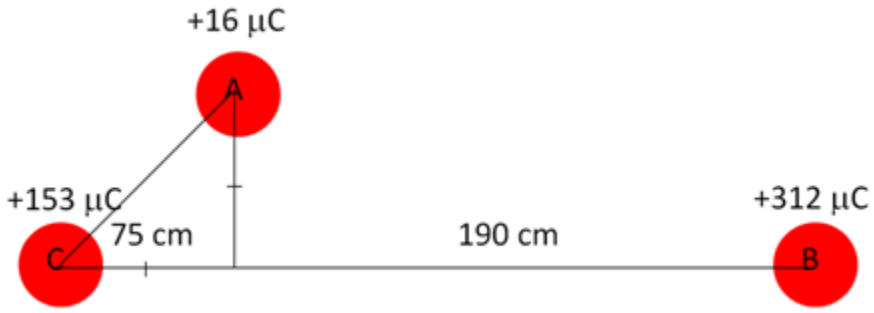


Find the force on B: (Use the force of gravity formula - $F = \frac{Gm_1m_2}{r^2}$, G = 6.67×10^{-11} N m^2 kg^{-2}



Noteguide for Non-Linear Arrays - Videos 16D2 **Name**_____

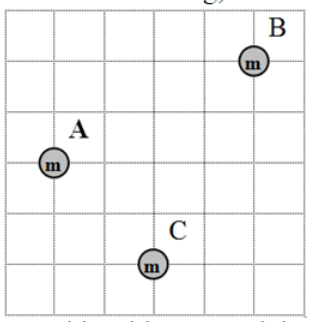
Find the net force on A:



Write down the three steps:

Try this one:

B. A is 1.60×10^6 kg, and B is 2.10×10^6 kg, and C is 6.30×10^6 kg.



(88.2 N right and down at 38.1° below the x-axis)

Use the force of gravity formula -

$$F = \frac{Gm_1m_2}{r^2}$$

$G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}

Noteguide for Field Theory - Videos 16E **Name**_____

Gravitational	Electrical

Field: $g = \frac{F}{m}$ g - gravitational field strength (N/kg) F - force exerted by field on the mass (N) m - the mass (kg) $g = G\frac{M}{r^2}$ g - g near a point mass toward mass (N/kg) G - 6.67×10^{-11} Nm^2kg^{-2} M - the mass (kg) r - distance from the point mass (m)	Field: $E = \frac{F}{q}$ E - electric field strength (N/C) F - force exerted by field on charge (N) q - the charge (C) $E = k\frac{q}{r^2}$ (not in data packet) E - E near a point charge away from charge (N/C) k - 8.99×10^9 Nm^2C^{-2} q - the charge (C) r - distance from the point charge (m)

Example 1 - A +125 μC charge experiences a force to the right of 0.0175 N. What is the Electric field, and its direction?

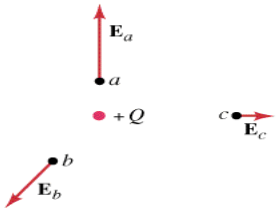
Example 2 - An electron travels through a region where there is a downward electric field of 325 N/C. What force in what direction acts on the electron, and what is its acceleration?

Whiteboards - Work these out - if you don't get the right answer, watch the video to see how to do it.

1.Ishunta Dunnit notices that a charge of -125 μC experiences a force of 0.15 N to the right. What is the electric field and its direction? (1200 N/C left)	2. Doan Botherme places a +12 mC charge into an upward 160 N/C electric field. What force in what direction does it experience? (1.9 N up)
3.Alfred O. Dadark is on a planet where a mass of 0.12 kg experiences a downward force of 7.80 N. What is the gravitational field on the surface of this planet? (65 N/kg down)	4. Telly Vishun places an unknown charge into a known upward electric field of 612 N/C, and the charge experiences a downward force of .851 N. What is the charge? (-1.39 mC)
5. Sal F. Hone levitates a 0.00125 kg ball with an upward electric field of 590 N/C. What is the charge on the ball? (Hint gravity = electrical force) (+20.8 μC) Eq = mg	

Noteguide for Point Charges and Masses - Videos 16F **Name**_____

Field: $g = G\frac{M}{r^2}$ g - g near a point mass <u>toward</u> mass (N/kg) G - 6.67×10^{-11} Nm^2kg^{-2} M - the mass (kg) r - distance from the point mass (m)	Field: $E = k\frac{q}{r^2}$ (not in data packet) E - E near a point charge <u>away</u> from charge (N/C) k - 8.99×10^9 Nm^2C^{-2} q - the charge (C) r - distance from the point charge (m)



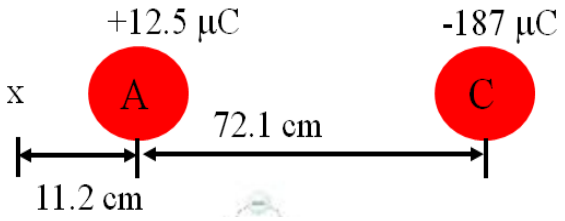
Example: What is the electric field 2.0 m to the right of a -21 μC charge?

Whiteboards - Work these out - if you don't get the right answer, watch the video to see how to do it.

1.Vera Similitude measures the electric field 13.5 m to the right of a -1.45 μC charge. What electric field in what direction? (71.5 N/C to the left)	2. Vesta Buhl measures an electric field of 2,120 N/C, 67 cm from a charge of unknown value. The electric field is away from the charge. What is the charge? (+0.11 μC)
3.Amelia Rate measures a gravitational field of 3.4 N/kg. What distance is she from the center of the earth? (Me = 5.98 x 1024 kg.) (1.1×10^7 m)	4. Tara Bull measures an electric field of 10. N/C what distance from an electron? (12 μm)

Noteguide for Fields in Linear Arrays - Videos 16G1 **Name**_____

Field: $g = G\frac{M}{r^2}$ g - g near a point mass <u>toward</u> mass (N/kg) G - $6.67\text{x}10^{-11}$ Nm^2kg^{-2} M - the mass (kg) r - distance from the point mass (m)	Field: $E = k\frac{q}{r^2}$ (not in data packet) E - E near a point charge <u>away</u> from charge (N/C) k - $8.99\text{x}10^{9}$ Nm^2C^{-2} q - the charge (C) r - distance from the point charge (m)



Example: What is the electric field at the x ?

Whiteboards - Work these out - if you don't get the right answer, watch the video to see how to do it.

1. Find the gravitational field at p: (49.0 N/kg to the left)

m 1.80x10^6 m (p) 9.10x10^6 m m

2.70x10^24 kg 8.20x10^24 kg

2. Find the electrical field at p: (51.6 N/C to the right)

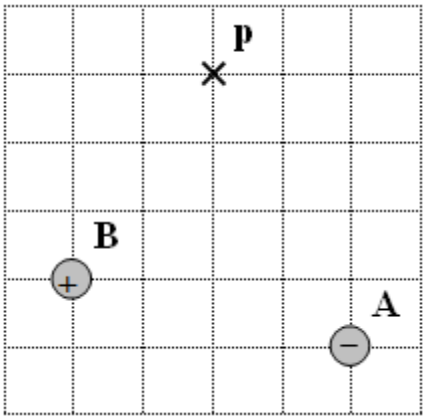
(p) 13.0 m - 21.0 m +

-2.30 µC +9.10 µC

Noteguide for Fields in Non Linear Arrays - Videos 16G2 **Name**_____

I think you will be OK if you pick only one of these. They are a lot like the vector force ones. If you do both that would be better - but I will leave that up to you.

Find the electric field at point p. Charge A is -3.20 µC, B is +4.40 µC, and each grid line is a meter.
(2640 N/C right and up at 28.1° with the x axis)



Find the gravitational field at point p. Mass A is 1.60×10^{12} kg, B is 3.9×10^{12} kg, and each grid line is a meter.
(21.5 N/kg right and down at 18.6° with the x axis)