

## Practice with electric fields

## Objectives:

**Objectives:**  
Solve problems relating to uniform and non-uniform electric fields by applying your understanding of the physics within this unit.

## Starter:

**Check your HW answers:**

- 2.3 x 10<sup>-28</sup> N
  - 5.5 x 10<sup>-71</sup> N
  - 4 x 10<sup>42</sup> !!!

2. Electrical force is same as with 2 electrons (they have the same magnitude of charge).  
Gravitational force = 1.9 x 10<sup>64</sup> N  
Electrical force/gravitational force = 1.2 x 10<sup>36</sup>

3. Because even though the Earth has a very large mass, providing a strong gravitational field, both it and you are electrically neutral overall.

4. Number of molecules = (60/0.018) x 6.02 x 10<sup>23</sup> = 2.0 x 10<sup>27</sup>  
There are 10 electrons in a water molecule (8 from the O atom and one each from H)  
Thus total number of electrons in student = 2.0 x 10<sup>28</sup>  
1% of electrons is 2.0 x 10<sup>26</sup> which have a charge of 2.0 x 10<sup>-18</sup> x 1.6 x 10<sup>-19</sup> = 32 MC (i.e. 32 million coulombs!!!)  
 $F = kQ_1Q_2/r^2 = 9.0 \times 10^9 \times 32 \times 10^{26} \times 32 \times 10^{26} / 1^2 = 9.3 \times 10^{54}$  N  
This is a huge force on each student - it is almost the weight of our entire planet!!!

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## Practice with electric fields

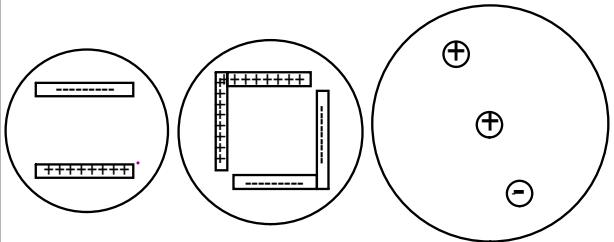
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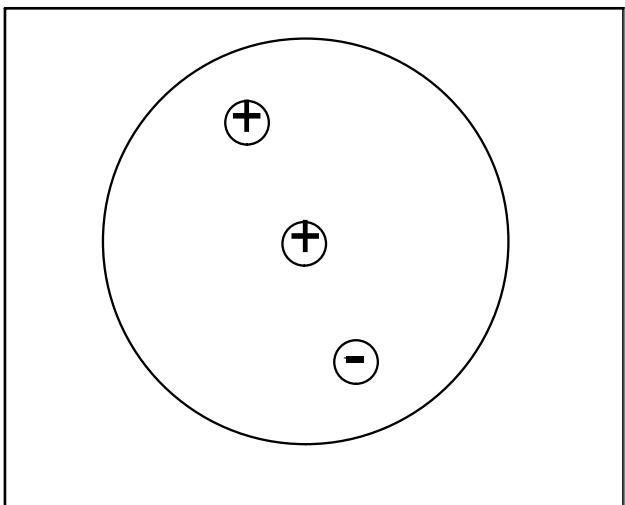
### Problem 1:

## Problem 1:

**Field shapes and circles:**  
Draw the field lines for each situation. Continue the field lines to the edge of the circle. Map the whole circle.



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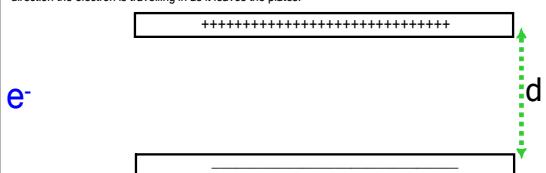
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### Problem 2:

#### Uniform fields

An electron is accelerated from rest by an anode of 400V over a distance of 0.02m. It enters a parallel plate set up horizontally. The plates have a length of 10cm and are separated by a distance 0.15m. Calculate the velocity and the direction the electron is travelling in as it leaves the plates.



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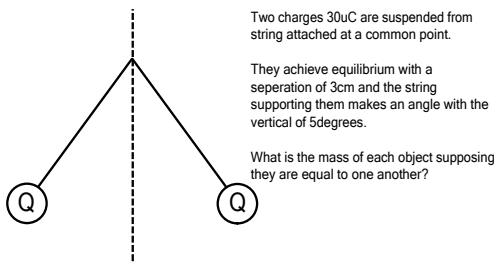
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### Problem 3:

#### Radial fields



Two charges  $30\mu C$  are suspended from string attached at a common point.

They achieve equilibrium with a separation of 3cm and the string supporting them makes an angle with the vertical of 5degrees.

What is the mass of each object supposing they are equal to one another?

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### Task: HW

Complete the questions and self-mark.

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## Attachments

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Radial fields problems.doc