



Physics. *You work it out.*

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Essential Pre-Uni Physics H1.8

A Level



Please give your answers to the lowest number of significant figures provided in the question. In these questions ignore the effects of non-electrical forces.

What is the force on a $+6.0 \times 10^{-13} \text{ C}$ charge between two metal surfaces if the surfaces are $5.0 \times 10^{-5} \text{ m}$ apart, and the voltage difference across the plates is 9.0 V ?

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Essential Pre-Uni Physics H3.7



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

For electrons moving at a speed greater than 10% of the speed of light, you should only claim that your answer is approximate (unless you have used relativistic equations). If you reckon that the electron is travelling at a speed greater than 80% of the speed of light, you should decline to give your answer unless using relativity

It is desired to produce protons with a kinetic energy of 5.0 MeV. What accelerating voltage is needed?

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Essential Pre-Uni Physics H4.5

A Level



Ignore the effect of the Earth's magnetic field unless specifically asked to include it.

Assume that the horizontal component of the Earth's magnetic field points North, and the vertical component points down.

The horizontal component of the Earth's magnetic field in Britain is $6.91 \times 10^{-5} \text{ T}$, while the vertical component is $1.55 \times 10^{-4} \text{ T}$.

Part A Force on a wire

There is a bad electrical fault in a house. A 6.0 m wire running North-South carries a current of 6000 A for a short time. Calculate the magnitude of the force on it given that it is exposed to the Earth's magnetic field.

Part B Direction of the force

At an instant when the current in the wire is running from North to South, what is the direction of the force?

- ☐ East
- ☐ North
- ☐ West
- ☐ South

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Essential Pre-Uni Physics H4.6

A Level

Ignore the effect of the Earth's magnetic field unless specifically asked to include it.

A student wants to make a rail gun. This consists of two metal rails 8.0 cm apart in a magnetic field. A projectile (shell) is placed to bridge the rails. A large current is passed from one rail to the other through the projectile, which then experiences a force and shoots off the end of the rails. To do this, she needs a 100 N force to act on the projectile (shell) which bridges the 'rails'. Assuming she has permanent magnets to provide a 0.16 T magnetic field, how much current does she need to pass through the projectile?

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Essential Pre-Uni Physics H5.2



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Part A Perpendicular to the field

Calculate the force on an electron going at $3.5 \times 10^7 \text{ m s}^{-1}$ in a 3.4 mT magnetic field if the electron is travelling perpendicular to the magnetic field.

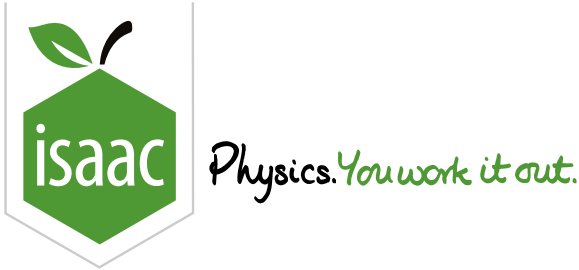
Part B Parallel to the field

Repeat the question if the electron is travelling parallel to the magnetic field.

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Orbits 26.8

A Level
P P P

Find an expression for the the ratio of the gravitational field to the electric field, g/E , for an electron that is in orbit at a radius r around the central proton of a hydrogen atom. Take m_p and m_e to be the masses of the proton and electron respectively, and e to be the electronic charge.

The following symbols may be useful: E , G , e , ϵ_0 , g , m_e , m_p , π , r

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Physics. *You work it out.*

Vectors and Fields - Between a Planet and a Moon 27.5

A Level

C

C

C

For the Earth - Moon system, $M_P = 81M_M$ (the mass of the Earth is 81 times the mass of the Moon) and the distance between them $R = 3.85 \times 10^8 \text{ m}$.

r_M is the distance to the Moon and r_P is the distance to the Earth.

Part A r_M/r_P

Calculate r_M/r_P for the place where $g = 0$.

Part B r_M as a fraction of R

Evaluate r_M (for the same place) as a fraction of R .

Part C r_P

Evaluate r_P at this place.

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Vectors and Fields - Electric Deflection 28.8

A Level



In an oscilloscope, a deflector applies up to 1 kV between two 3.0 mm-long plates separated by 2.0 mm. Electrons with initial kinetic energy 1500 eV pass through the deflector.

Part A Deflection angle

By what angle are electrons deflected at the maximum voltage?

Part B Screen position

A phosphorescent screen is placed 10 cm away so that undeflected electrons hit the centre of the screen. How far from the centre of the screen can deflected electrons land?

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Physics. You work it out.

Vectors and Fields - Helix in Magnetic Field 29.2

A Level
P P P

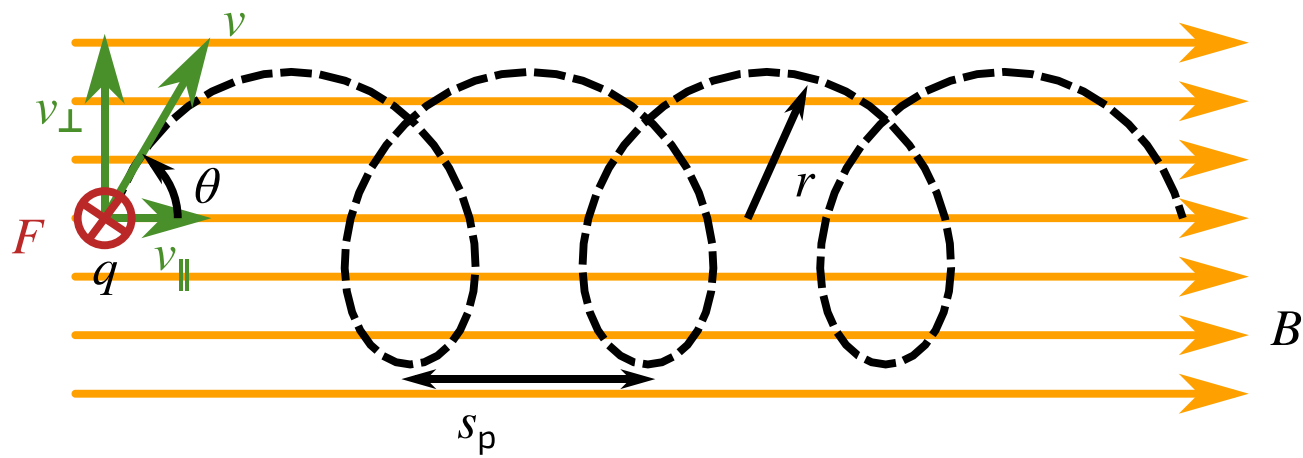


Figure 1: The helical path of a charged particle in a magnetic field.

A charged particle of mass $1.05 \times 10^{-25} \text{ kg}$ and charge $3.2 \times 10^{-19} \text{ C}$ enters a 1.45 T magnetic field with a speed of $3.2 \times 10^6 \text{ m s}^{-1}$. The velocity of the particle is at an angle of 30° to the magnetic field. What is the radius and the pitch of the helix that the particle now follows?

Part A Radius

What is the radius of the helix?

Part B Pitch

What is the pitch of the helix?

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Energy and Fields - Closest Approach 25.2

A Level



Calculate the distance of closest approach of a proton travelling at $2.0 \times 10^6 \text{ m s}^{-1}$ to a copper nucleus with 29 protons. Assume that the copper nucleus remains stationary.

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