Essential Pre-Uni Physics F5.3

A Level

P P P

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

Part A Planet Mogg

The planet Mogg is completely spherical, with radius $2.3 \times 10^6\,\mathrm{m}$.

At a distance of $1.0 \times 10^7\,\mathrm{m}$ from the centre of planet Mogg, the gravitational field strength (g) due to Mogg is $2.1\,\mathrm{N\,kg^{-1}}$. Calculate the gravitational field strength at a distance of $5.0 \times 10^7\,\mathrm{m}$.

Part B $100\,\mathrm{km}$ above the surface

Calculate the gravitational field strength at a height of $100\,\mathrm{km}$ above the surface of the planet.

Part C $3.0 \times 10^6\,\mathrm{m}$ from the centre

Calculate the gravitational field strength due to planet Mogg at a distance of $3.0 \times 10^6\,\mathrm{m}$ from the centre.

Physics. You work it out.

Home Gameboard Physics Fields Electric Fields Essential Pre-Uni Physics H1.1

Essential Pre-Uni Physics H1.1

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 magnitude is the force if a $+6.0 \times 10^{-9}\,\mathrm{C}$ charge is put in a $50000\,\mathrm{N\,C^{-1}}$ field?

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Physics. You work it out.

Essential Pre-Uni Physics H1.4

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 strength of the electric field between two metal sheets held $5.0\,\mathrm{cm}$ apart, if one is connected to $-500\,\mathrm{V}$, and the other connected to $+2000\,\mathrm{V}$? Give your answer to 2 significant figures.

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Essential Pre-Uni Physics H1.5

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 field strength needed to cause a spark in air, if $240\ \mathrm{V}$ can only jump a distance of $8.0 \times 10^{-5}\ \mathrm{m}$?

Gameboard:

STEM SMART Physics 29 - Fields Overview

Physics. You work it out.

Essential Pre-Uni Physics H2.2

A Level
P P P

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

Calculate the electric field strength $1.0\,\mathrm{mm}$ away from a $+1.0\,\mathrm{pC}$ charge.

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Essential Pre-Uni Physics H4.2

A Level

P P P

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

Calculate the force on $3.0\,\mathrm{mm}$ of wire carrying a $4.0\,\mathrm{A}$ current in a $0.020\,\mathrm{T}$ field, if the current is perpendicular to the field.

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STEM SMART Physics 29 - Fields Overview

Physics. You work it out.

Essential Pre-Uni Physics H5.2

A Level

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 $3.5 \times 10^7 \, \mathrm{m\,s^{-1}}$ in a $3.4 \, \mathrm{mT}$ 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.

Gameboard:
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Essential Pre-Uni Physics H2.10

A Level

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

Two charges are stuck to a metre stick: a $+1.0\,\mathrm{pC}$ charge at the $0\,\mathrm{cm}$ mark, and a $-1.0\,\mathrm{pC}$ charge at the $10\,\mathrm{cm}$ mark. What is the strength of the electric field at the $20\,\mathrm{cm}$ mark? Assume that the wooden metre ruler is strong enough to hold the charges in place, but does not affect the electric field. Give your answer to 2 significant figures.

Gameboard:
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Liquid Pool

A Level

C C C

The inner wall of a glass dish was lined with a copper ring R, and a copper rod Q was placed exactly in the middle. Rod Q was connected, via a switch, to the positive plate and ring R was connected to the negative plate, of a battery. The arrangement was placed between the poles of a strong magnet. The dish was then filled with copper(II) sulphate solution and a small float F added to indicate any motion of the liquid (see the figure). Which of the following sketches, in which the pool is viewed from above, indicates the possible motion of the float?

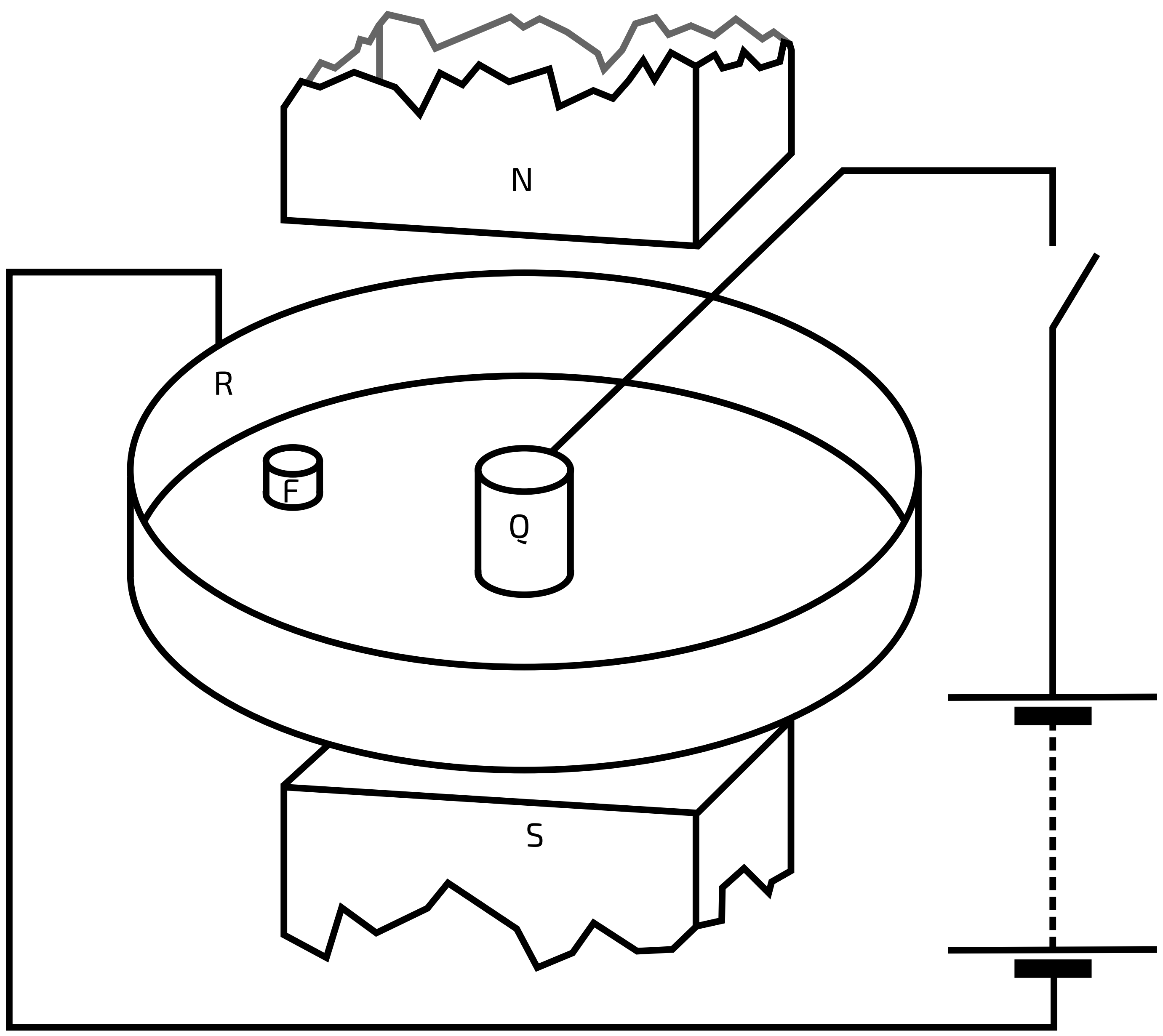

Figure 1: The liquid pool placed between the poles of a strong magnet

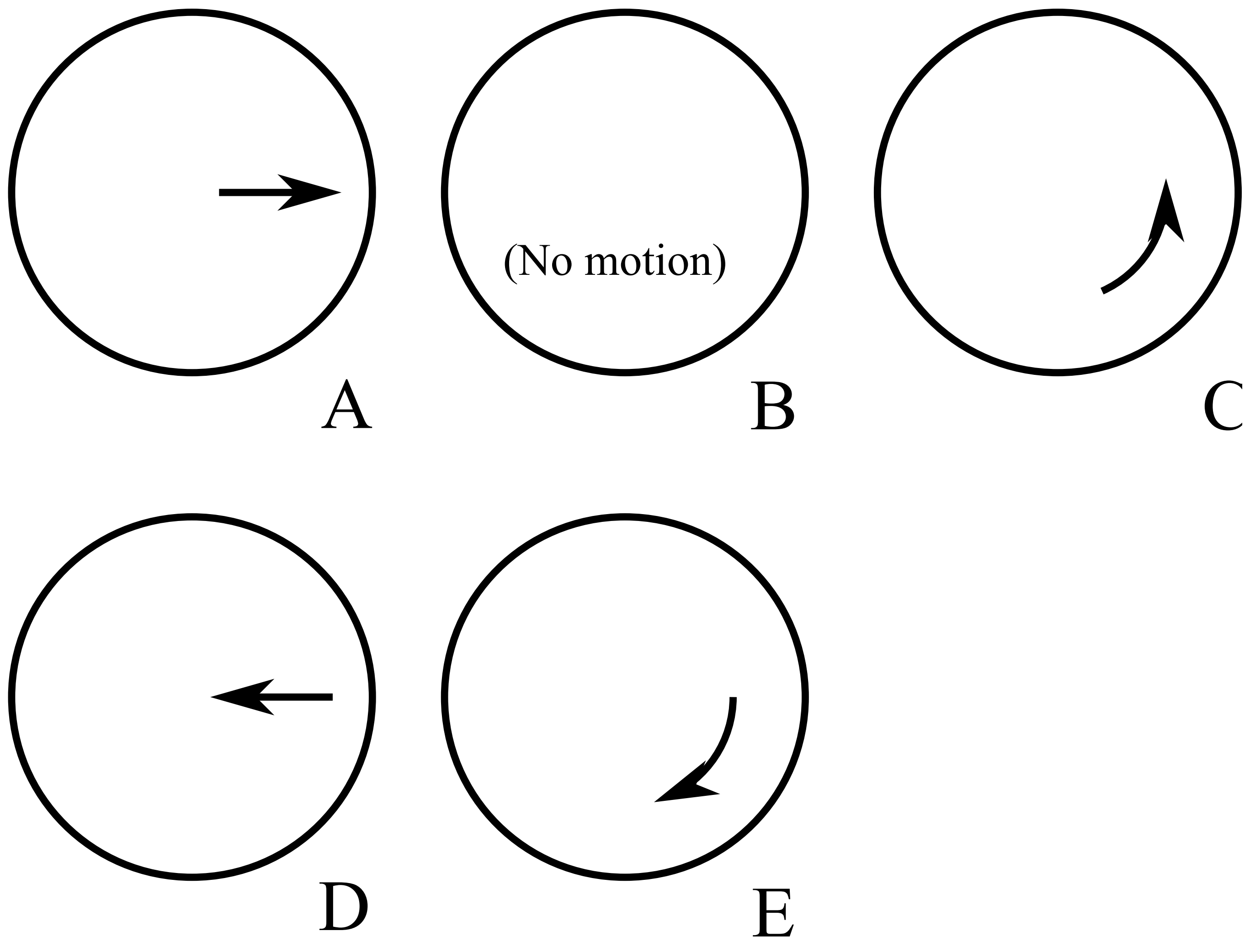

Figure 2: Choices of motion

- A
- B
- C
- E
- D

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isaac Physics. You work it out.

Home Gameboard Physics Fields Combined Fields Geometry and Inverse Square Laws

Geometry and Inverse Square Laws

A Level
C C C

Many different situations result in an inverse square law, because of the geometry of 3D space.

Part A Electric Field

An electric charge can be thought of as the source of a number of electrical field lines which are proportional to the charge; twice the charge will give twice the number of field lines. In the absence of any other charge, these lines will be equally spaced around the charge, in a radial direction.

The electric field at any distance from the charge is proportional to the number of electric field lines per unit area at that distance.

As the number of field lines is proportional to the charge, this means that the electric field is proportional to the charge divided by the surface area of a sphere at that distance, or $E = k\frac{q}{A}$.

By comparing the electric field strength a distance r away from a charge $+q$ to the surface area of a sphere of radius r, find an expression for the constant of proportionality k.

The following symbols may be useful: `epsilon_0, k, pi, q, r`

Part B Gravitational Fields

In a similar fashion, a mass can be thought of as a source of gravitational field lines. The gravitational field at a distance r away from the mass is proportional to the mass divided by the surface area of a sphere of radius r.

By analogy with the previous question find the constant of proportionality k assuming all values are given in SI base units. Don't forget to include the gravitational constant, G.

The following symbols may be useful: `G, M, epsilon_0, k, m, pi, r`

Part C Fluid around a bubble

A similar situation can be observed when thinking about an air bubble being inflated inside water. As the spherical bubble increases in size, it pushes water out of the way. To keep the pressure through the water constant, at any given radius r measured from the centre of the bubble, the total amount of water being pushed outwards must be the same. This is an incompressible fluid.

For a spherically symmetric system the amount of fluid being pushed through a surface of area A is proportional to the area multiplied by the radial velocity at that radius.

At a distance of r_1 from the point of formation of a bubble, water is moving radially away with a speed of v_1. What is the speed of the water, v_2, at a distance of r_2 from the centre of the bubble?

The following symbols may be useful: `G, epsilon_0, r_1, r_2, v_1, v_2`

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