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Essential Pre-Uni Physics F6.4



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

Mass of Earth = $5.98\times10^{24}\,\mathrm{kg}$

Radius of Earth = $6400\,\mathrm{km}$

The Moon's orbit round the Earth has a radius of $3.8 \times 10^8\,\mathrm{m}$. Calculate the Moon's speed in its orbit.



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Essential Pre-Uni Physics F6.5



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.
Mass of Earth = $5.98 imes 10^{24}\mathrm{kg}$

Radius of Earth = $6400 \, \mathrm{km}$

Part A Orbiting the Earth

If you want something to orbit the Earth at a height of $200\,\mathrm{km}$ above the surface, at what speed must it travel? Give your answer to 3 significant figures.

Part B Time period

What is the time period of the orbit in Part A? Give your answer to 3 significant figures.

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Essential Pre-Uni Physics F6.6



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

Mass of Earth = $5.98 \times 10^{24} \, \mathrm{kg}$

Radius of Earth = $6400 \, \mathrm{km}$

Part A Kepler's Third Law

Starting from $F=rac{GMm}{r^2}$ and $F=rac{mv^2}{r}$, derive Kepler's 3rd Law relating the radius of an orbit r to the mass of the planet M and the orbital speed v.

Give your answer in a form where r is on the left hand side of the equation and all other terms are on the right hand side.

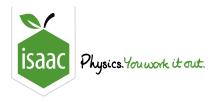
The following symbols may be useful: G, M, pi, r, v

Part B Time period

Repeat the question, but this time to relate r and M to the time period T.

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Orbits 26.5



Calculate the orbital period of Jupiter in units of Earth years given that the mass of the Sun, $M=2.0\times 10^{30}\,\mathrm{kg}$, the mass of Jupiter, $m=1.9\times 10^{27}\,\mathrm{kg}$ and the average radius of Jupiter's orbit around the sun is $R=7.8\times 10^8\,\mathrm{km}$.

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Orbits 26.7

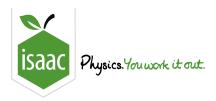


61 Cygni is a wide binary star system. It contains two stars of nearly equal mass which orbit once around their mid point every $659~{
m years}$. They are $1.26\times10^{13}~{
m m}$ apart. Assuming that the two stars have equal mass, calculate:

Part A Speed	
the speed of the stars.	
Part B Total mass	
the total mass of the system.	

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Orbits 26.2



A positron of charge $+q$ and mass m enters a magnetic field B travelling at a speed v perpendicular to the direction of the magnetic field.
Part A Radius of orbit
Derive an expression for r in terms of q , B , m and v .
The following symbols may be useful: B, m, q, r, v
Part B From positron to proton
If we now change the particle from a positron to a proton, keeping the magnetic field and the velocity of the particle the same, what would happen? Complete the sentence below.
The proton will move in a with
Items:
circular non-circular straight orbit line a smaller a larger the same varying no radius curvature

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Orbits 26.9



In a particle accelerator protons are accelerated in the +x-direction until they have a velocity of $v=6.5\times 10^6\,\mathrm{m\,s^{-1}}$. They then pass into a magnetic field of strength $0.10\,\mathrm{T}$ that is oriented in the +y-direction.

Part A	Direction of motion	
In which direction do the protons accelerate when they first enter the magnetic field?		
	-+x direction	
	$igcup_{-x}$ direction	
	-y direction	
	$igcup_{-y}$ direction	
	-+z direction	
	-z direction	
Part B	Radius	
\ \ /h	nat is the radius of the orbital path that the protons take?	
VVI	iat is the radius of the orbital path that the protons take:	

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Gameboard Physics Fields Magnetic Fields Essential Pre-Uni Physics H6.4

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Part A Momentum of a muon

Work out the momentum of a muon (same charge as an electron, but mass $=207 imes \, \mathrm{electron \; mass}$) taking a curved path with a $90 \, \mathrm{cm}$ radius perpendicular to a $0.0076\,\mathrm{T}$ magnetic field.

Part B Momentum of an electron

Work out the momentum of an electron which would take the same path in the same field as in Part A.

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