Physics. You work it out.

Essential Pre-Uni Physics F3.1

A Level

How big is $3\,\mathrm{rad}$, when expressed in degrees to the nearest whole number?

Physics. You work it out.

Essential Pre-Uni Physics F3.8

A Level

A car travels $10\,\mathrm{km}$. One of its wheels has a radius of $30\,\mathrm{cm}$. Calculate the angle the wheel turns as the car travels this distance (answer in $\mathrm{radians}$ to 2 significant figures).

Gameboard:

STEM SMART Physics 23 - Circular motion

Physics. You work it out.

Essential Pre-Uni Physics F3.3

A Level

Complete the questions in the table by converting the units.

Time period / s	Frequency / Hz	Angular velocity / $\mathrm{rad\,s^{-1}}$	Revolutions per minute (rpm)
0.50	(a)	(b)	(c)

Part A Frequency

a) Frequency?

Part B Angular velocity

b) Angular velocity?

Part C Revolutions per minute

c) Revolutions per minute?

Gameboard:

STEM SMART Physics 23 - Circular motion

Physics. You work it out.

Essential Pre-Uni Physics F3.10

A Level

My washing machine has a spin speed of $1200\,\text{rpm}$, and a drum radius of $20\,\text{cm}$. Calculate how fast clothes go when up against the side of the drum when the machine is spinning. Give your answer to 2 significant figures.

Gameboard:

STEM SMART Physics 23 - Circular motion

Essential Pre-Uni Physics F4.1

A Level

You must give the correct unit for each answer.

Complete the questions in the table.

Speed / $\mathrm{m\,s^{-1}}$	Radius / m	Angular velocity / $\mathrm{rad\,s^{-1}}$	Centripetal acceleration / $\mathrm{m\,s^{-2}}$
	0.32	5.2	(a)
2.1	0.070		(b)
(c)	30.0		9.8
	(d)	0.20	9.8
60	1200		(e)

Part A Centripetal acceleration (a)

Speed / $\mathrm{m\,s^{-1}}$	Radius / m	Angular velocity / $\mathrm{rad\,s^{-1}}$	Centripetal acceleration / $\mathrm{m\,s^{-2}}$
	0.32	5.2	(a)

a) What is the centripetal acceleration in $\mathrm{m\,s^{-2}}$?

Part B Centripetal acceleration (b)

Speed / $\mathrm{m\,s^{-1}}$	Radius / m	Angular velocity / $\mathrm{rad\,s^{-1}}$	Centripetal acceleration / $\mathrm{m\,s^{-2}}$
2.1	0.070		(b)

b) What is the centripetal acceleration in $\mathrm{m\,s^{-2}}$?

Part C Speed (c)

Speed / $\mathrm{m\,s^{-1}}$	Radius / m	Angular velocity / $\mathrm{rad\,s^{-1}}$	Centripetal acceleration / $\mathrm{m\,s^{-2}}$
(c)	30.0		9.8

c) What is the speed in $\mathrm{m\,s^{-1}}$?

Part D Radius (d)

Speed / $\mathrm{m\,s^{-1}}$	Radius / m	Angular velocity / $\mathrm{rad\,s^{-1}}$	Centripetal acceleration / $\mathrm{m\,s^{-2}}$
	(d)	0.20	9.8

d) What is the radius in m?

Part E Centripetal acceleration (e)

Speed / $\mathrm{m\,s^{-1}}$	Radius / m	Angular velocity / $\mathrm{rad\,s^{-1}}$	Centripetal acceleration / $\mathrm{m\,s^{-2}}$
60	1200		(e)

e) What is the centripetal acceleration in $\mathrm{m\,s^{-2}}$? Give your answer to 2 significant figures.

Gameboard:

STEM SMART Physics 23 - Circular motion

Physics. You work it out.

Essential Pre-Uni Physics F4.2

A Level

A car goes round a roundabout at $30.0\,\text{mph}$ ($13.4\,\text{m}\,\text{s}^{-1}$) on a circular path with a radius of $8.0\,\text{m}$. Calculate the centripetal acceleration.

Gameboard:

STEM SMART Physics 23 - Circular motion

Essential Pre-Uni Physics F4.5

A Level

C C C

A space station with an $8.0\,\mathrm{m}$ radius is spun to give the astronauts something which feels like gravity. If the centripetal acceleration is $9.8\,\mathrm{m\,s^{-2}}$, calculate the speed at which the walls rotate (in $\mathrm{m\,s^{-1}}$).

Gameboard:

STEM SMART Physics 23 - Circular motion

Physics. You work it out.

Essential Pre-Uni Physics F4.6

A Level

C C C

Calculate the centripetal force experienced by a $500\,\mathrm{g}$ pair of wet trousers when in the spin cycle of a washing machine with a $20\,\mathrm{cm}$ drum radius if it rotates at $1200\,\mathrm{rpm}$. Give your answer to 2 significant figures.

Gameboard:

STEM SMART Physics 23 - Circular motion

Cornering on a Smooth Surface

A Level

C C C

A car of mass $m = 1000\,\mathrm{kg}$ is driven round a smooth circular track of radius $r = 250\,\mathrm{m}$ and takes a time $T = 30\,\mathrm{s}$ to complete one lap.

At what angle θ must the track be banked to counteract the tendency of the car to slip sideways?

Adapted with permission from UCLES, Higher School Certificate Physics, June 1928, Paper 2, Question 3.

Gameboard:

STEM SMART Physics 23 - Circular motion

Geostationary Orbit

A Level

C C C

A satellite is to be placed in a circular orbit around the Earth.

The gravitational force F_A between the satellite and the Earth is in the inward radial direction and its magnitude is given by the equation

$$F_A = \frac{GMm}{R^2}$$

where $G = 6.67 \times 10^{-11}\,\mathrm{m^3\,kg^{-1}\,s^{-2}}$ is the gravitational constant; $M = 5.97 \times 10^{24}\,\mathrm{kg}$ and m are the masses of the Earth and the satellite respectively; and R is the radius of the orbit.

Use the information and data above to calculate the required radius of the orbit if the satellite is in a geostationary orbit (remains above the same point on the equator).

Used with permission from UCLES, A Level Physical Science, June 1989, Paper 2, Question 3.