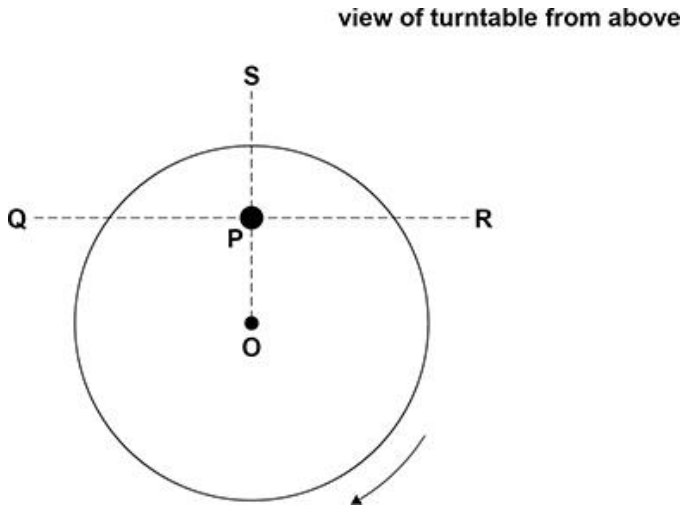
Q1.

A small mass is placed at **P** on a horizontal turntable. The turntable rotates clockwise with a constant angular speed about a vertical axis through its centre **O**.



The mass remains at rest relative to the turntable.

What is the direction of the frictional force on the mass at the instant shown?

A from **P** to **O** ⬭

B from **P** to **Q** ⬭

C from **P** to **R** ⬭

D from **P** to **S** ⬭

(Total 1 mark)

Q2.

A particle of mass m moves in a circle of radius r. The number of revolutions completed per second is f.

What is the kinetic energy of the particle?

A $4\pi^2 mf^2r^2$ ⬭

B $2\pi^2 mf^2r^2$ ⬭

C $\frac{mf^2r^2}{4\pi^2}$ ⬭

D $\frac{mf^2r^2}{2}$ ⬭

(Total 1 mark)

Q3.

A body is in simple harmonic motion of amplitude 0.60 m and period 2π seconds.

What is its speed when its displacement is 0.20 m?

A $0.32\ \text{m s}^{-1}$ ○

B $0.57\ \text{m s}^{-1}$ ○

C $0.63\ \text{m s}^{-1}$ ○

D $22\ \text{m s}^{-1}$ ○

(Total 1 mark)

Q4.

When a mass **M** is suspended from a spring, the spring extends by a distance x. **M** is displaced vertically and, when released, it oscillates with a period T.

M is removed and suspended from a different spring. The spring extends by a distance $\frac{x}{2}$

M is again displaced vertically and released.

What is the new period of oscillations of **M**?

A $\frac{T}{2}$ ○

B $\frac{T}{\sqrt{2}}$ ○

C $T\sqrt{2}$ ○

D $2T$ ○

(Total 1 mark)

Q5.

A mass–spring system and a simple pendulum have identical periods of oscillation T when at the surface of the Earth.

Both are taken to planet **X** where the acceleration due to gravity is $\frac{g}{2}$

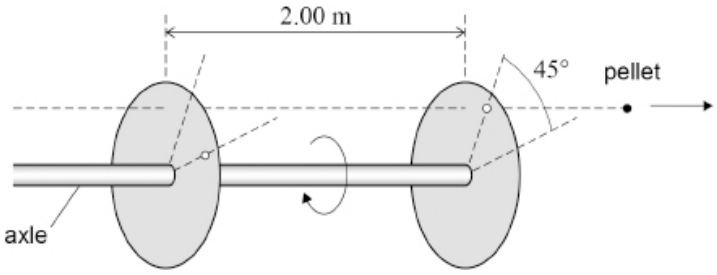
What are the periods of the mass–spring system and the simple pendulum on **X**?

	Period of mass–spring system	Period of simple pendulum	
A	$\frac{T}{2}$	$T\sqrt{2}$	⬭
B	T	$2T$	⬭
C	T	$T\sqrt{2}$	⬭
D	$T\sqrt{2}$	T	⬭

(Total 1 mark)

Q6.

Two circular discs made of card rotate at constant speed on a common axle.



The discs are 2.00 m apart.

An air-gun pellet is fired parallel to the axle. The pellet makes holes in the discs.
The holes are separated by an angle of 45°.
The speed of the pellet between the discs is 300 m s^{-1}.

How many revolutions does each disc complete in one second?

A 19 ⬭

B 118 ⬭

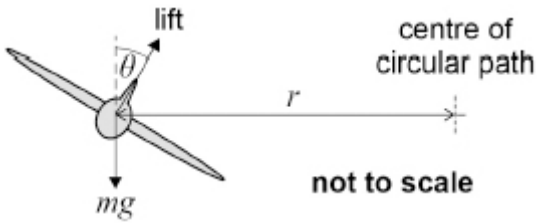
C 740 ⬭

D 1074 ⬭

(Total 1 mark)

Q7.

When an aircraft turns in a horizontal circular path, it banks at an angle θ.



The aircraft has mass m and travels at constant speed v in a horizontal circular path of radius r. The lift force acts at the angle θ.

What is tan θ?

A $\frac{gv^2}{r}$ ○

B $\frac{rv^2}{g}$ ○

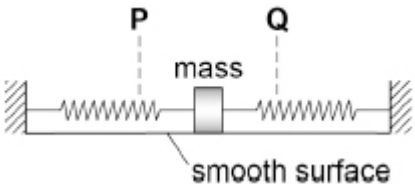
C $\frac{rg}{v^2}$ ○

D $\frac{v^2}{rg}$ ○

(Total 1 mark)

Q8.

A mass, attached to two springs, oscillates horizontally between **P** and **Q**. The motion of the system is simple harmonic.



Which quantity has its magnitude at a minimum value when the mass is at **Q**?

A the acceleration of the mass ○

B the kinetic energy of the mass ○

C the potential energy of the mass–spring system ○

D the resultant force of the springs on the mass ○

(Total 1 mark)

Q9.

A particle performs simple harmonic motion with a time period of $1.4\ \text{s}$ and an amplitude of $12\ \text{mm}$.

What is the maximum speed of the particle?

A $8.6\ \text{mm s}^{-1}$ ⬭

B $27\ \text{mm s}^{-1}$ ⬭

C $54\ \text{mm s}^{-1}$ ⬭

D $110\ \text{mm s}^{-1}$ ⬭

(Total 1 mark)

Q10.

A planet has a mass M and a radius R.
Loose material at the equator only just remains in contact with the surface of the planet.
This is because the speed at which the planet rotates is very large.

What is the period of rotation of the planet?

A $2\pi\sqrt{\frac{R^2}{GM}}$ ⬭

B $2\pi\sqrt{\frac{GM}{R^2}}$ ⬭

C $2\pi\sqrt{\frac{R^3}{GM}}$ ⬭

D $2\pi\sqrt{\frac{GM}{R^3}}$ ⬭

(Total 1 mark)