Q1.

A synchronous orbit of the Earth has a radius R.
A planet has a mass twice the mass of the Earth. A day on the planet is one quarter of an Earth day.

What is the radius of a synchronous orbit for this planet?

A $\frac{R}{\sqrt[3]{2}}$ ⬭

B $\frac{R}{\sqrt[3]{16}}$ ⬭

C $\frac{R}{2}$ ⬭

D $\frac{\sqrt{2}R}{8}$ ⬭

(Total 1 mark)

Q2.

An asteroid has a mass of 2×10^{17} kg and an escape velocity of 40 m s^{-1}.

What is the order of magnitude of the radius of the asteroid?

A 10^3 m ⬭

B 10^4 m ⬭

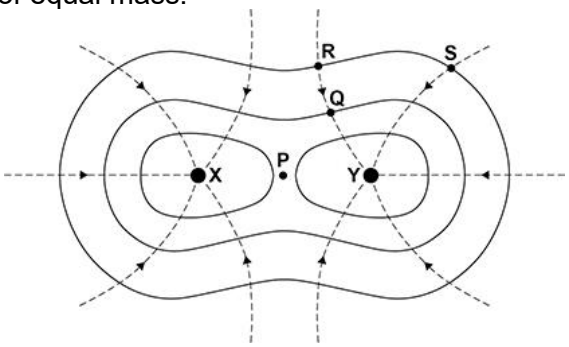
C 10^5 m ⬭

D 10^6 m ⬭

(Total 1 mark)

Q3.

The diagram shows the gravitational field for a binary star system consisting of two stars **X** and **Y** of equal mass.



Equipotential lines are shown as solid lines.
Gravitational field lines are shown as dashed lines.

Which statement is correct?

A More work is done moving from **Q** to **S** to **R** than moving directly from **Q** to **R**. ⬭

B No work is done moving from **Q** to **R**. ⬭

C The gravitational field strength is the same at **R** and **S**. ⬭

D The work done moving from **Q** to **R** and moving from **Q** to **S** is the same. ⬭

(Total 1 mark)

Q4.

Data are collected for the mass M, radius R and escape velocity u for each planet in the Solar System.

The data show that u is directly proportional to

A $\left(\frac{M}{R}\right)^{-\frac{1}{2}}$ ⬭

B $\left(\frac{M}{R}\right)^{\frac{1}{2}}$ ⬭

C $\frac{M}{R}$ ⬭

D $\left(\frac{M}{R}\right)^{2}$ ⬭

(Total 1 mark)

Q5.

A satellite is in a circular orbit at a height h above the surface of a planet of mass M and radius R.

What is the linear speed of the satellite?

A $\frac{\sqrt{GM}}{(R+h)}$ ⬭

B $\sqrt{\frac{GM}{(R+h)}}$ ⬭

C $\frac{GM}{\sqrt{R+h}}$ ⬭

D $\frac{GM}{(R+h)}$ ⬭

(Total 1 mark)

Q6.

Which statement is **not** true for a satellite in a geostationary orbit?

A The satellite orbits in the plane of the Earth's equator. ⬭

B The satellite has the same angular velocity as a point on the Earth's surface. ⬭

C The satellite takes 24 hours to orbit the Earth. ⬭

D Signals from the satellite can be sent to any point on the Earth's surface during one orbit. ⬭

(Total 1 mark)

Q7.

A planet of radius R and mass M has a gravitational field strength of g at its surface.

Which row describes a planet with a gravitational field strength of $4g$ at its surface?

	Radius of planet	Mass of planet	
A	$2R$	$2M$	⬭
B	$R\sqrt{2}$	$\frac{M}{2}$	⬭
C	$\frac{R}{\sqrt{2}}$	$\frac{M}{2}$	⬭
D	$\frac{R}{\sqrt{2}}$	$2M$	⬭

(Total 1 mark)

Q8.

The Moon orbits the Earth in 27 days.

What is the angular speed of the Moon's orbit?

A 4.3×10^{-7} rad s^{-1} ⬭

B 2.7×10^{-6} rad s^{-1} ⬭

C 3.7×10^{-2} rad s^{-1} ⬭

D 2.3×10^{-1} rad s^{-1} ⬭

(Total 1 mark)

Q9.

The radius of the Earth is R and the acceleration due to gravity at the surface of the Earth is g.

What is the escape velocity for a mass m at the surface of the Earth?

A $\sqrt{gR}$ ⬭

B $\sqrt{2gR}$ ⬭

C $\sqrt{2mgR}$ ⬭

D $\sqrt{\frac{2gR}{m}}$ ⬭

(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)

Q11.

Satellites **N** and **F** have the same mass and move in circular orbits about the same planet.
The orbital radius of **N** is less than that of **F**.

Which is smaller for **N** than for **F**?

A the gravitational force on the satellite ⬭

B the speed of the satellite ⬭

C the kinetic energy of the satellite ⬭

D the orbital period of the satellite ⬭

(Total 1 mark)