1. The distance between the Sun and the Earth is 1.5×10^{11} m

What is the gravitational force exerted on the Sun by the Earth?

A 3.5×10^{22} N ⬭

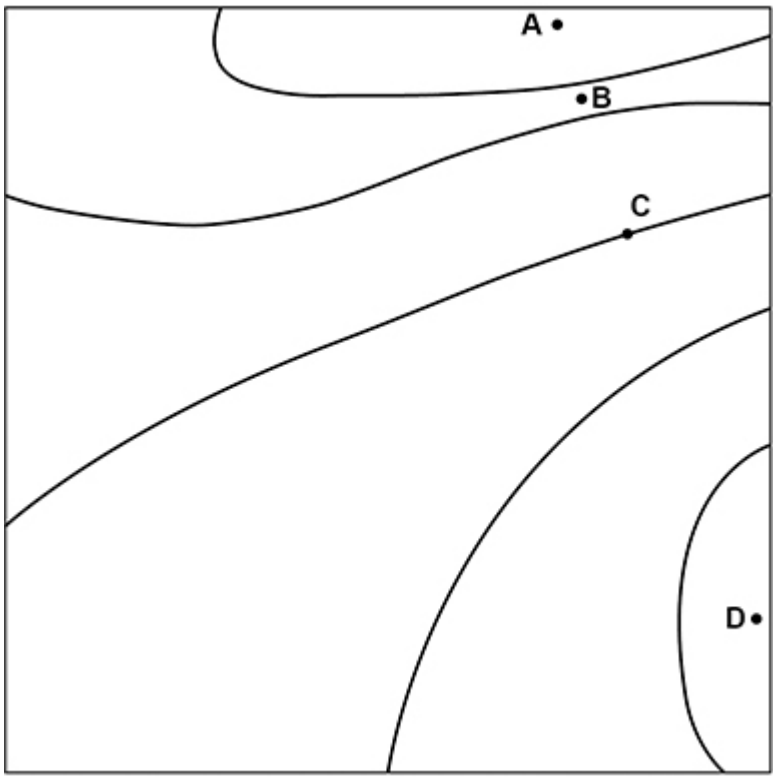
B 1.7×10^{26} N ⬭

C 5.3×10^{33} N ⬭

D 8.9×10^{50} N ⬭

(Total 1 mark)

2. The diagram shows gravitational equipotentials. Adjacent equipotentials are separated by an equal gravitational potential difference V.



Which point has the greatest gravitational field strength?

A ⬭

B ⬭

C ⬭

D ⬭

(Total 1 mark)

3. A planet has radius R and density ρ. The gravitational field strength at the surface is g.

What is the gravitational field strength at the surface of a planet of radius $2R$ and density 2ρ?

A $2g$ ⬭

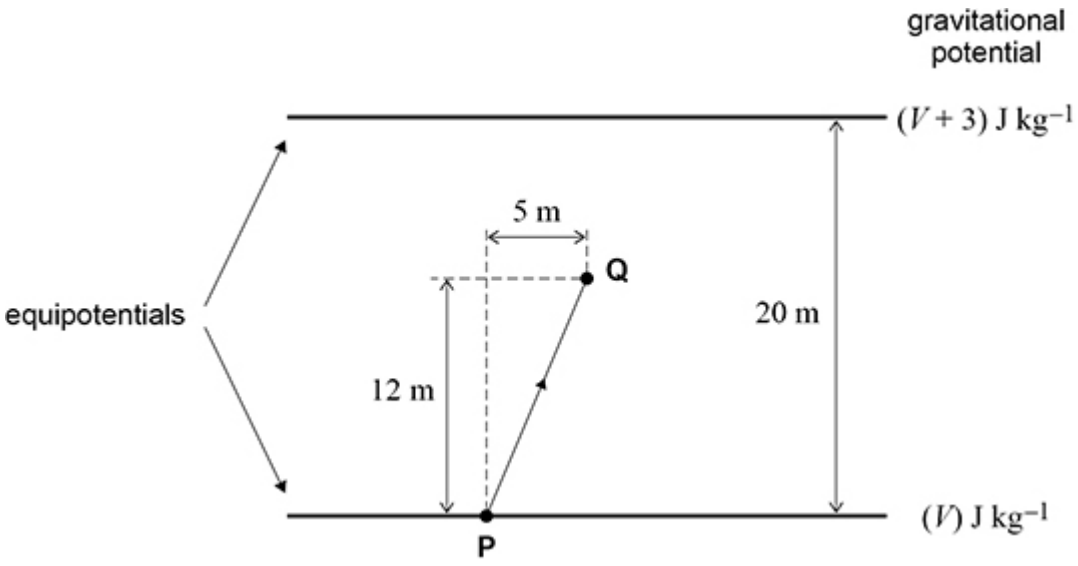
B $4g$ ⬭

C $8g$ ⬭

D $16g$ ⬭

(Total 1 mark)

4. The diagram shows equipotential lines for a uniform gravitational field. The lines are separated by 20 m.



An object of mass 4 kg is moved from **P** to **Q**.

What is the work done against gravity to move the object?

A 7.2 J ⬭

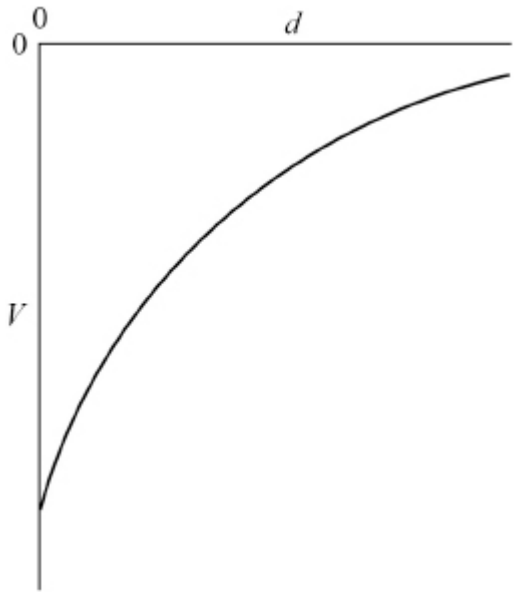
B 7.8 J ⬭

C 10.2 J ⬭

D 36 J ⬭

(Total 1 mark)

5. The graph shows how the gravitational potential V varies with the vertical distance d from the surface of the Earth.



What does the gradient of the graph represent at the surface of the Earth?

A potential energy ⬭

B mass of the Earth ⬭

C magnitude of the gravitational constant ⬭

D magnitude of the gravitational field strength ⬭

(Total 1 mark)

6. What is the angular speed of a satellite in a geostationary orbit around the Earth?

A 1.2×10^{-5} rad s^{-1} ⬭

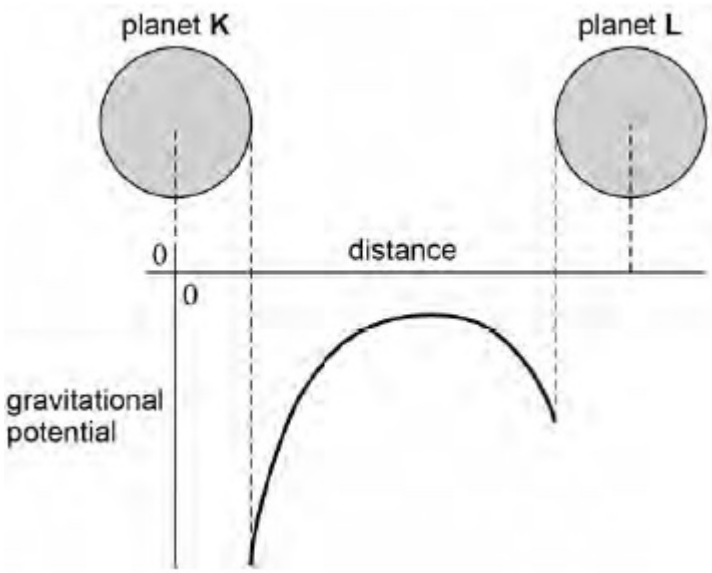
B 7.3×10^{-5} rad s^{-1} ⬭

C 4.4×10^{-3} rad s^{-1} ⬭

D 2.6×10^{-1} rad s^{-1} ⬭

(Total 1 mark)

7. The graph shows how the gravitational potential varies with distance between two planets, **K** and **L**, that have the same radius.



Which statement is correct?

A The mass of **L** is greater than the mass of **K**. ⬭

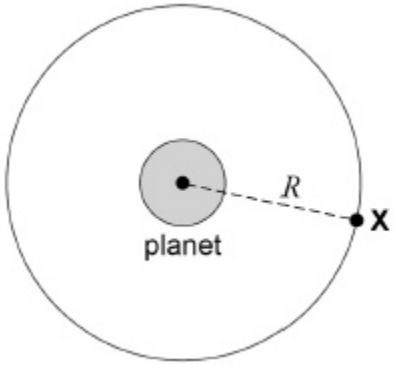
B The gravitational field strength at the surface of **L** is greater than that at the surface of **K**. ⬭

C The escape velocity from planet **L** is greater than that from planet **K**. ⬭

D More work must be done to move a mass of 1 kg from the surface of **K** to a distant point, than 1 kg from the surface of **L**. ⬭

(Total 1 mark)

8. A satellite **X** of mass m is in a concentric circular orbit of radius R about a planet of mass M.



What is the kinetic energy of **X**?

A $\frac{GMm}{2R}$ ⬭

B $\frac{GMm}{R}$ ⬭

C $\frac{2GMm}{R}$ ⬭

D $\frac{4GMm}{R}$ ⬭

(Total 1 mark)

9. The distance between the Sun and Mars varies from 2.1×10^{11} m to 2.5×10^{11} m.
When Mars is closest to the Sun, the force of gravitational attraction between them is F.

What is the force of gravitational attraction between them when they are furthest apart?

A $0.71F$ ⬭

B $0.84F$ ⬭

C $1.2F$ ⬭

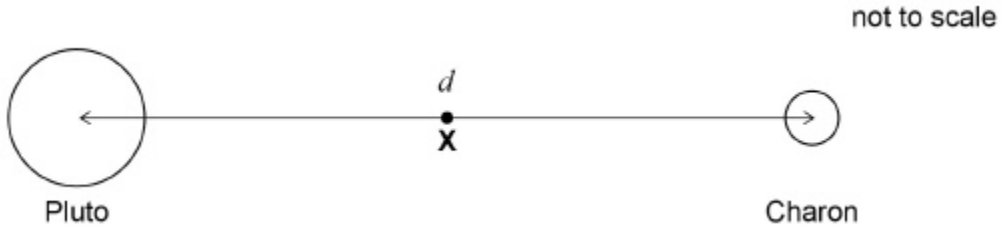
D $1.4F$ ⬭

(Total 1 mark)

10. Charon is a moon of Pluto that has a mass equal to $\frac{1}{9}$ that of Pluto.

The distance between the centre of Pluto and the centre of Charon is *d*.

X is the point at which the resultant gravitational field due to Pluto and Charon is zero.



What is the distance of **X** from the centre of Pluto?

A $\frac{2}{9}d$ ⬭

B $\frac{2}{3}d$ ⬭

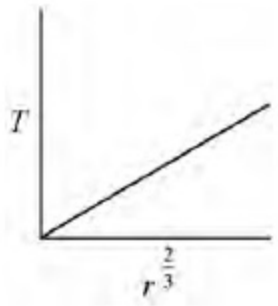
C $\frac{3}{4}d$ ⬭

D $\frac{8}{9}d$ ⬭

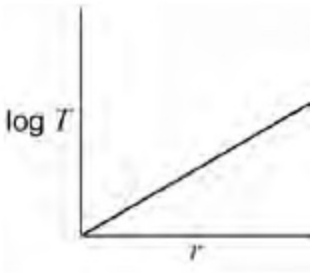
(Total 1 mark)

11. Which graph shows the relationship between the time period T and the orbital radius r of a planet in orbit around the Sun?

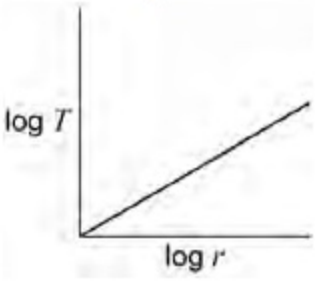
A



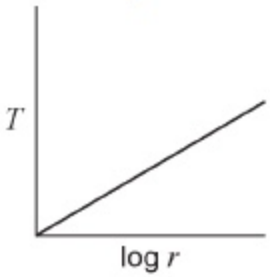
B



C



D



A ⬭

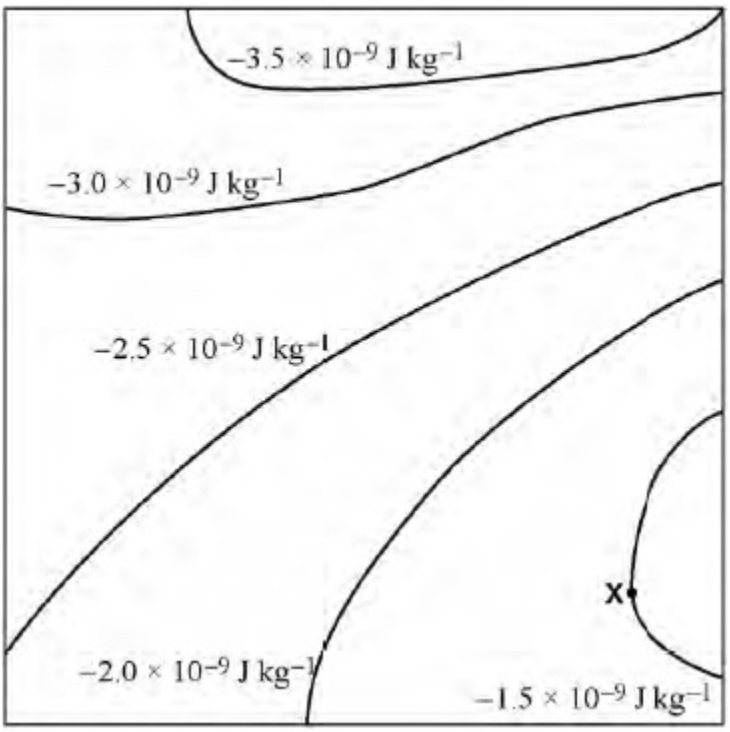
B ⬭

C ⬭

D ⬭

(Total 1 mark)

12. The diagram shows equipotential lines near a group of asteroids.



Which arrow shows the direction of the gravitational field at **X**?

A ↑ ⬭

B ↓ ⬭

C ← ⬭

D → ⬭

(Total 1 mark)

13. Planet **N** has a gravitational potential $-V$ at its surface. Planet **M** has double the density and double the radius of planet **N**. Both planets are spherical and have uniform density.

What is the gravitational potential at the surface of planet **M**?

A $-16V$ ⬭

B $-8V$ ⬭

C $-4V$ ⬭

D $-0.2V$ ⬭

(Total

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

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

A gravitational force on the satellite ⬭

B angular speed ⬭

C kinetic energy ⬭

D orbital period ⬭

(Total 1 mark)

15. A planet of mass M and radius R rotates so quickly that material at its equator only just remains on its surface.

What is the period of rotation of the planet?

A $2\pi\sqrt{\frac{R}{GM}}$ ⬭

B $2\pi\sqrt{\frac{GM}{R}}$ ⬭

C $2\pi\sqrt{\frac{R^3}{GM}}$ ⬭

D $2\pi\sqrt{\frac{GM}{R^3}}$ ⬭

(Total 1 mark)

16. What is the angular speed of a satellite in a geostationary orbit around the Earth?

A 1.2×10^{-5} rad s^{-1} ⬭

B 7.3×10^{-5} rad s^{-1} ⬭

C 4.2×10^{-3} rad s^{-1} ⬭

D 2.6×10^{-1} rad s^{-1} ⬭

(Total 1 mark)

17. Which row shows two scalar quantities?

A	gravitational potential	gravitational field strength	⬭
B	mass	gravitational potential	⬭
C	gravitational field strength	weight	⬭
D	weight	gravitational potential	⬭

(Total 1 mark)

18. An object moves freely at 90° to the direction of a gravitational field.

The acceleration of the object is

A zero. ⬭

B opposite to the direction of the gravitational field. ⬭

C in the direction of the gravitational field. ⬭

D at 90° to the direction of the gravitational field. ⬭

(Total 1 mark)

19. A spacecraft of mass 1.0×10^6 kg is in orbit around the Sun at a radius of 1.1×10^{11} m
The spacecraft moves into a new orbit of radius 2.5×10^{11} m around the Sun.

What is the total change in gravitational potential energy of the spacecraft?

A -6.76×10^{14} J ⬭

B -3.38×10^{14} J ⬭

C 3.38×10^{14} J ⬭

D 6.76×10^{14} J ⬭

(Total 1 mark)