

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

☐

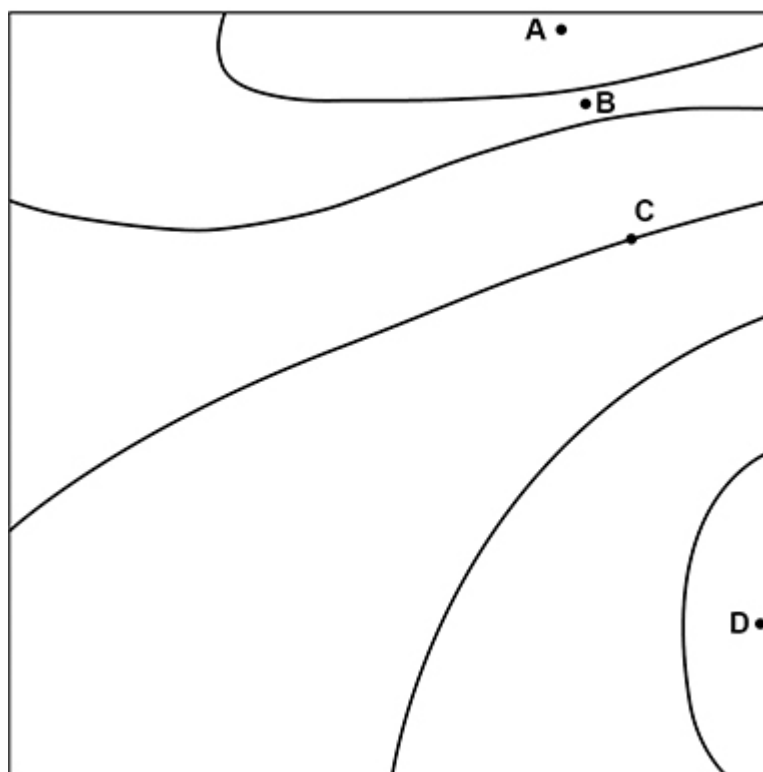
D 8.9×10^{50} N

☐

(Total 1 mark)

2.

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



Gravitational Fields MCQ

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 $2g$ ☐

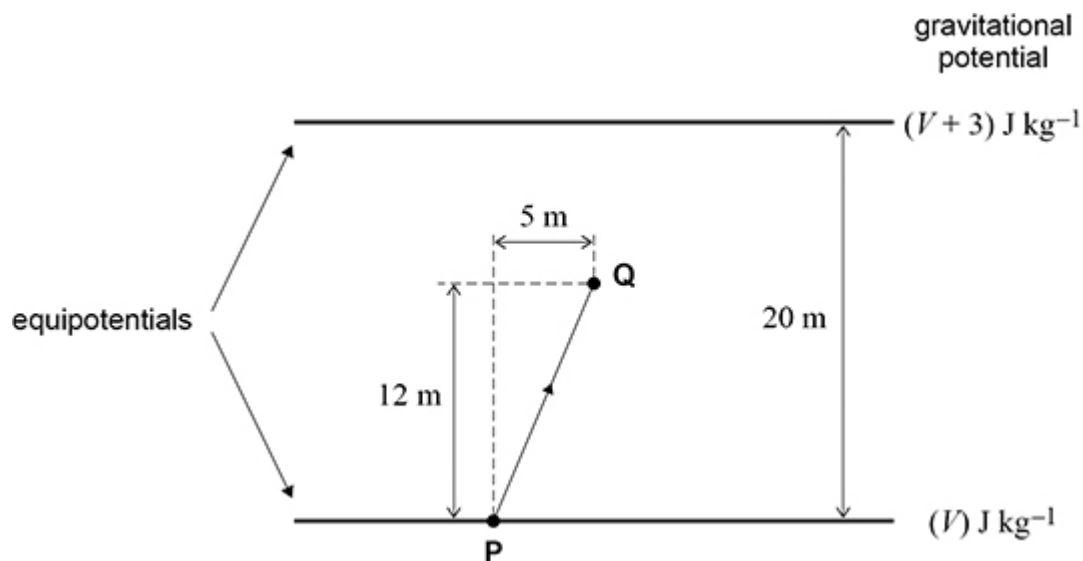
B $4g$ ☐

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.



Gravitational Fields MCQ

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

☐

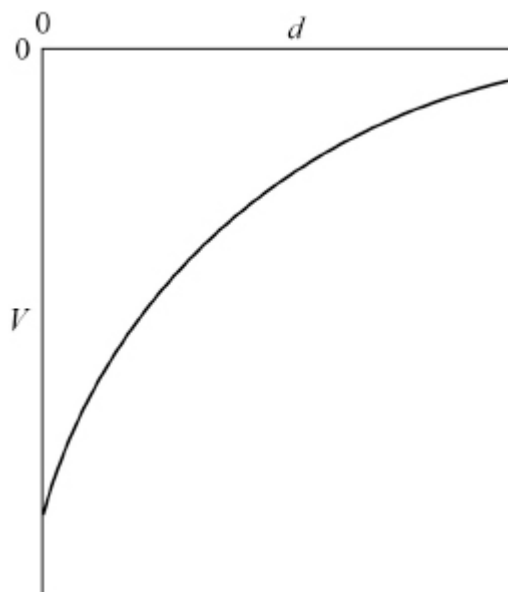
D 36 J

☐

(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 $1.2 \times 10^{-5} \text{ rad s}^{-1}$

☐

B $7.3 \times 10^{-5} \text{ rad s}^{-1}$

☐

C $4.4 \times 10^{-3} \text{ rad s}^{-1}$

☐

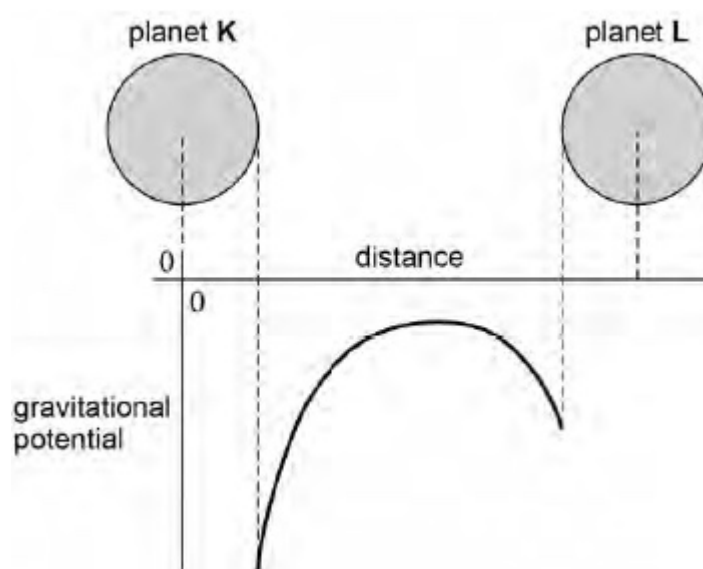
D $2.6 \times 10^{-1} \text{ rad s}^{-1}$

☐

(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.

☐

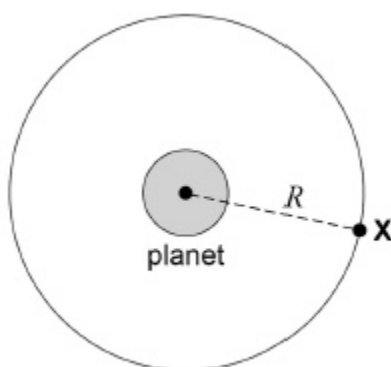
D More work must be done to move a mass of 1 kg from the surface of K to a distant point, than 1 kg from the surface of L.

☐

(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 $1.4F$

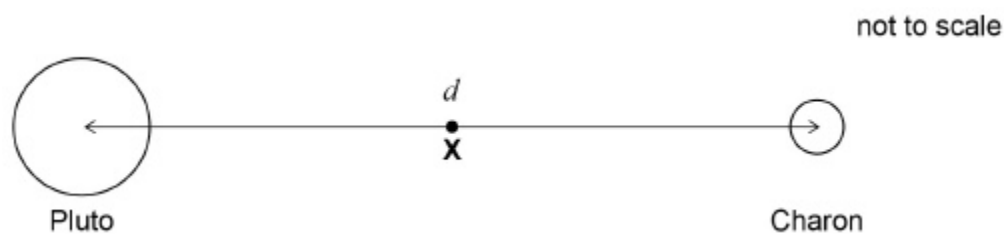
☐

(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.

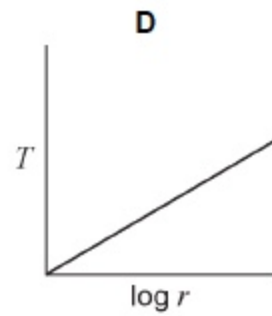
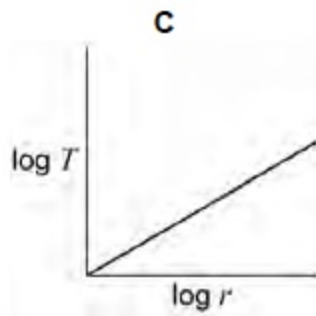
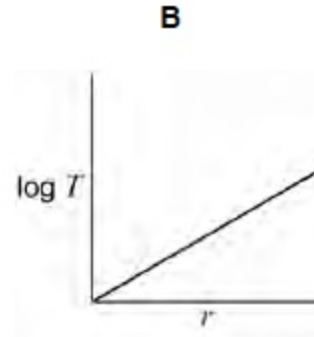
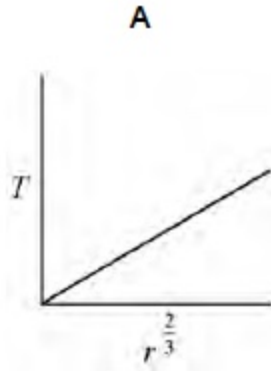


What is the distance of **X** from the centre of Pluto?

- | | | |
|----------|----------------|--------------------------|
| 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?

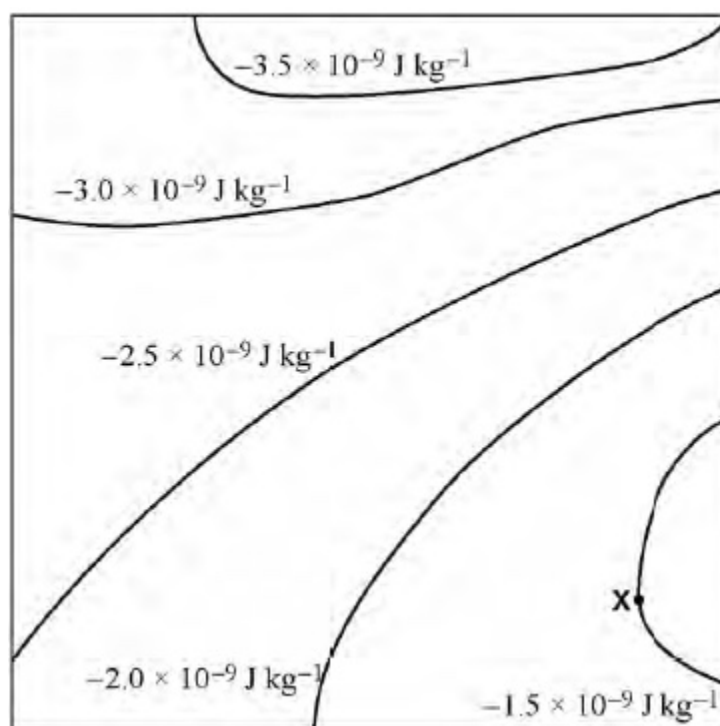


- A ☐
- B ☐
- C ☐
- D ☐

(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 $\uparrow$
☐
B $\downarrow$
☐
C $\leftarrow$
☐
D $\rightarrow$
☐

(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 $1.2 \times 10^{-5} \text{ rad s}^{-1}$

☐

B $7.3 \times 10^{-5} \text{ rad s}^{-1}$

☐

C $4.2 \times 10^{-3} \text{ rad s}^{-1}$

☐

D $2.6 \times 10^{-1} \text{ rad s}^{-1}$

☐

(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)