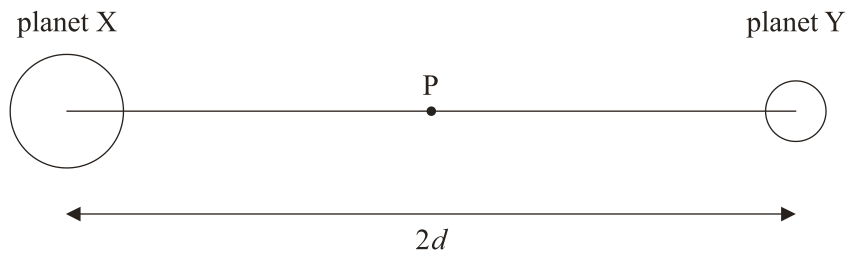


6. The diagram below shows two planets X and Y of masses $2M$ and M respectively. The centres of the two planets are separated by a distance $2d$. Point P is midway between planets X and Y. The mass of each planet may be assumed to be concentrated at its centre.



The magnitude of the gravitational field strength at point P due to the two planets is

- A. zero.
- B. $\frac{GM}{d^2}$.
- C. $\frac{2GM}{d^2}$.
- D. $\frac{3GM}{d^2}$.
8. Gravitational field strength at a point may be defined as
- A. the force on a small mass placed at the point.
- B. the force per unit mass on a small mass placed at the point.
- C. the work done to move unit mass from infinity to the point.
- D. the work done per unit mass to move a small mass from infinity to the point.

(1)

9. Planet X has radius R and mass M . Planet Y has radius $2R$ and mass $8M$.

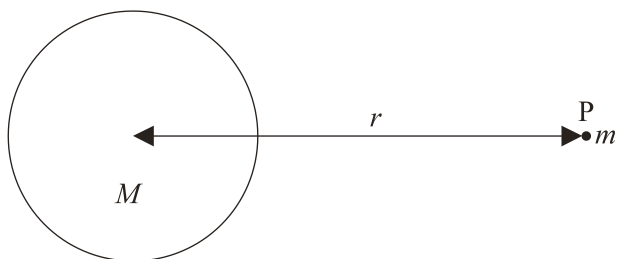
Which **one** of the following is the correct value of the ratio

$$\frac{\text{gravitational field strength at surface of planet X}}{\text{gravitational field strength at surface of planet Y}}?$$

- A. 4
- B. 2
- C. $\frac{1}{2}$
- D. $\frac{1}{4}$

(1)

10. A point object of mass m is brought from infinity to the point P, a distance r from the centre of an isolated sphere of mass M .



The work done by the gravitational force in bringing the point object from infinity to point P is

- A. $G \frac{M}{r}$.
- B. $G \frac{Mm}{r}$.
- C. $-G \frac{M}{r}$.
- D. $-G \frac{Mm}{r}$.

(1)

12. This question is about gravitational fields.

(a) Define *gravitational field strength*.

(2)

(b) The gravitational field strength at the surface of Jupiter is 25 N kg^{-1} and the radius of Jupiter is $7.1 \times 10^7 \text{ m}$.

(i) Derive an expression for the gravitational field strength at the surface of a planet in terms of its mass M , its radius R and the gravitational constant G .

(2)

(ii) Use your expression in (b)(i) above to estimate the mass of Jupiter.

(2)

(Total 6 marks)