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6.2 Newton's Law of Gravitation

Medium

PHYSICS

IB HL

EXAM PAPERS PRACTICE

6.2 Newton's Law of Gravitation

Question Paper

Course	DP IB Physics
Section	6. Circular Motion & Gravitation
Topic	6.2 Newton's Law of Gravitation
Difficulty	Medium

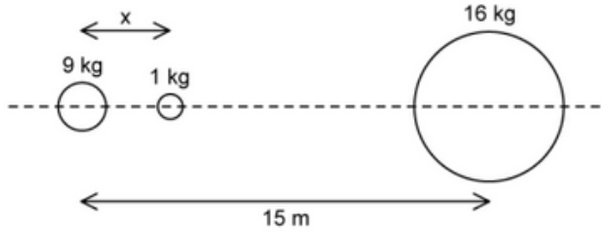
Time allowed: 20

Score: /10

Percentage: /100

Question 1

The diagram below shows three uniform masses in a straight line.



The resultant gravitational force on the 1 kg mass is zero if the distance *x* is:

A. $\frac{45}{7}$ m

B. 45 m

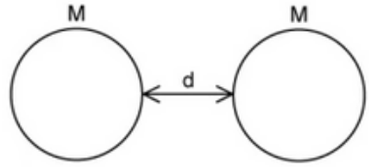
C. $\frac{27}{5}$ m

D. 35 m

[1 mark]

Question 2

The gravitational force between two identical uniform spheres of mass *M* is *F* when the distance between them *d*.



If the radius of each sphere is *x*, what is the correct expression for mass, *M*?

A. $\frac{F(d+2x)^2}{G}$

B. $\sqrt{\frac{Fd^2}{G}}$

C. $\sqrt{\frac{F(d+2x)}{G}}$

D. $\sqrt{\frac{F(d+2x)^2}{G}}$

[1 mark]

Question 3

The mass of a potential landing module heading for Jupiter is 4000 kg. The gravitational field strength on Jupiter is roughly 2.5 times that on Earth. What is the weight of the landing module on Earth?

A. 4000 N

B. 100 000 N

C. 10 000 N

D. 40 000 N

[1 mark]

Question 4

A planet has triple the mass of Earth and a third of its radius. What is the gravitational field strength on the surface of the planet?

A. 10 N kg^{-1}

B. 270 N kg^{-1}

C. 90 N kg^{-1}

D. 240 N kg^{-1}

[1 mark]

Question 5

A satellite of mass m is placed in a geostationary orbit. If the Earth's angular velocity is ω rad s^{-1}, what is the circumference of the satellite's orbit?

A. $\left(\frac{GM}{\omega^2}\right)^{\frac{1}{3}}$

B. $2\pi\sqrt{\frac{GMm}{\omega^2}}$

C. $2\pi\left(\frac{GM}{\omega^2}\right)$

D. $2\pi\left(\frac{GM}{\omega^2}\right)^{\frac{1}{3}}$

[1 mark]

Question 6

A spherical planet of uniform density has two times the mass of the Earth and three times the average radius. The magnitude of the gravitational field strength at the surface of the Earth is g. What is the gravitational field strength at the surface of the planet?

A. $\frac{3}{4}g$

B. $\frac{2}{3}g$

C. $\frac{2}{9}g$

D. 18g

[1 mark]

Question 7

The inverse square law means that halving the radius of a planet results in quadrupling the gravitational field strength at its surface.

The centres of two planets are separated by a distance *R*. The gravitational force between the two planets is *F*. What will the force between the planets be when their separation increases to 4*R*?

A. $\frac{F}{16}$

B. 4*F*

C. $\frac{F}{4}$

D. *F*

[1 mark]

Question 8

A mass at point *P* gives rise to a gravitational field strength *g* at point *X* as shown.

An identical mass is placed at point Q as shown.

What is the resultant gravitational field strength at *X* in this new situation?

A. zero

B. between *g* and zero

C. between 2*g* and *g*

D. greater than 2*g*

[1 mark]

Question 9

A spacecraft travels away from Earth in a straight line with its motors shut down. At one instant, the speed of the spacecraft is 5.7 km s^{-1}. After a time of 1000 s, the speed is 5.2 km s^{-1}. The gravitational field strength acting on the spacecraft during this time interval is:

A. -5×10^{-4} N kg^{-1}

B. 5×10^{1} N kg^{-1}

C. -5×10^{-1} N kg^{-1}

D. -1×10^{1} N kg^{-1}

[1 mark]

Question 10

Which of the following statements about uniform gravitational fields is **incorrect**?

A. The field strength is equal at every point in a uniform gravitational field

B. The acceleration of freefalling bodies is dependent on their mass

C. The field lines in a uniform gravitational field are parallel to each other

D. There is a uniform gravitational field near the Earth's surface

[1 mark]