A Level · OCR · Physics

6 mins 6 questions

Multiple Choice Questions

Gravitational Fields

Gravitational Fields / Gravitational Field Lines / Gravitational Field Strength / Newton's Law of Gravitation

Easy (1 question)	/1
Medium (1 question)	/1
Hard (4 questions)	/4
Total Marks	**/6**

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Easy Questions

1 The Earth is surrounded by a gravitational field.

Which of the following statements is/are correct about the gravitational field lines near the **surface** of the Earth.

1. They are parallel.
2. They show the direction of the force on a small mass.
3. They are equally spaced.

A. Only 1

B. Only 1 and 2

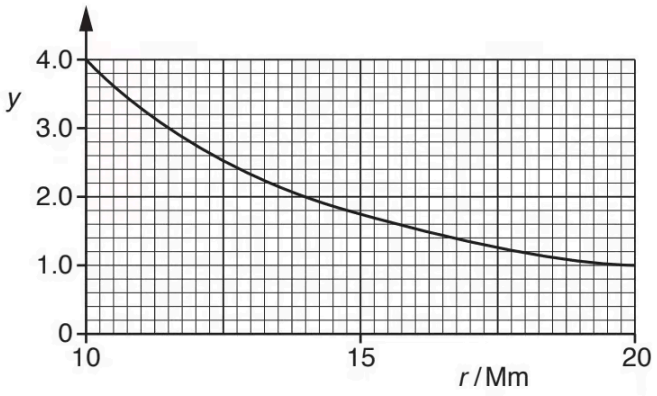
C. Only 2 and 3

D. 1, 2 and 3

(1 mark)

Medium Questions

1 A graph of y against distance r from the centre of a planet is shown below.



The graph shows that y is inversely proportional to r^2.

Which quantity is best represented on the y-axis of the graph?

A. Period of a satellite orbiting the planet.

B. Gravitational potential of the planet.

C. Gravitational field strength of the planet.

D. Kinetic energy of a satellite orbiting the planet.

(1 mark)

Hard Questions

1 The gravitational force between two point-mass objects **X** and **Y** is F_1.

The mass of **X** increases and the distance between **X** and **Y** is halved.

Which statement about the new gravitational force F_2 between these two objects is correct?

A. $0 < F_2 < 0.25F_1$

B. $F_2 > 4F_1$

C. $F_2 = F_1$

D. $2F_1 < F_2 < 4F_1$

(1 mark)

2 A space probe travels from the Earth to the Moon, where the distance between the centre of the Earth and the Moon is r. When the probe is halfway to the Moon, it has a driving force of F, and is travelling at a constant velocity.

What is the forward force F_A equivalent to?

A. $\frac{2Gm_{Probe}}{r^2}(M_{Earth} - M_{Moon})$

B. $\frac{4Gm_{Probe}}{r^2}(M_{Earth} - M_{Moon})$

C. $\frac{2GM_{Moon}M_{Earth}m_{Probe}}{r^2}$

D. $\frac{4GM_{Earth}}{r^2}(M_{Moon} - m_{Probe})$

(1 mark)

3 Satellite **X** orbits the Earth at distance h above its surface and experiences gravitational field strength g_X. Satellite **Y** has half the mass of Satellite **X** but orbits the Earth at double the distance and experiences gravitational field strength g_Y.

Given that the radius of the Earth is *r*, what is the ratio of $\frac{g_X}{g_Y}$ equivalent to?

A. $\frac{r+2h}{r+h}$

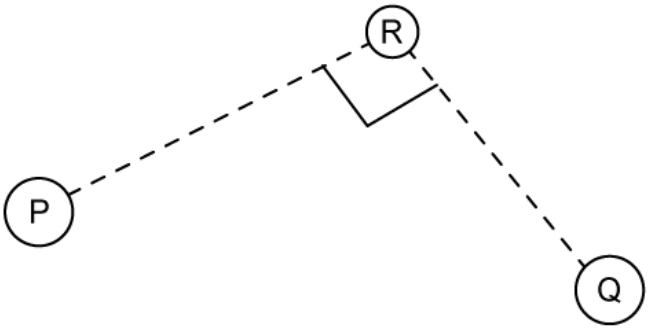
B. $\frac{(r+h)^2}{(r+2h)^2}$

C. $\frac{(r+2h)^2}{(r+h)2}$

D. 4

(1 mark)

4 Below is a diagram of two asteroids, **P** and **Q**, that are equidistant from Asteroid **R**. The mass of Asteroid **R** is *m*, and the masses of **P** and **Q** are both 3*m*. The gravitational force of **P** on **Q** is perpendicular to the gravitational force of **R** on **Q**.



By modelling the asteroids as spheres, what is the resultant force on Asteroid **R**?

A. $\frac{3\sqrt{2}Gm^2}{r^2}$

B. $\frac{6Gm^2}{r^2}$

C. $\frac{4\sqrt{2}Gm}{r^2}$

D. $\frac{3Gm^2}{r^2}$

(1 mark)