Gravitational Fields

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Warm up problems

1. Use Newton's Law to calculate the force on a 1 kg object held 1 m above the Earth's surface, if the Earth's radius is 6400 km and its mass is 6.0×10^{24} kg.
2. Use $F = mg$ to calculate the force on a 1 kg object held 1 m above the surface of the Earth, if $g = 9.81\,\text{m s}^{-2}$.
3. Use Newton's Law to calculate the force on a 1 kg object held 6400 km above the Earth's surface, if the Earth's radius is 6400 km and its mass is 6.0×10^{24} kg.

Lesson Objectives

1. To learn what a field is.
2. To be able to draw G field lines in simple cases.
3. To calculate gravitational field strength g

REMINDER: Office hours are week 1 Tuesdays 3.45–5.0 p.m. in room 19.
Next office hours: Tuesday 25 September 2012

Specification Requirement

Gravitational field strength
Concept of a force field as a region in which a body experiences a force. Representation by gravitational field lines.

[AQA GCE AS and A Level Specification Physics A, 2009/10 onwards]

2 Two satellites A and B of the same mass are going around Earth in concentric orbits. The distance of satellite B from Earth's center is twice that of satellite A. What is the ratio of the centripetal force acting on B to that acting on A?

(a) $\frac{1}{8}$
(b) $\frac{1}{4}$
(c) $\frac{1}{2}$
(d) $\sqrt{\frac{1}{2}}$
(e) 1

1 The Moon does not fall to Earth because

(a) It is in Earth's gravitational field.
(b) The net force on it is zero.
(c) It is beyond the main pull of Earth's gravity.
(d) It is being pulled by the Sun and planets as well as by Earth.
(e) all of the above
(f) none of the above

3 Two satellites A and B of the same mass are going around Earth in concentric orbits. The distance of satellite B from Earth's center is twice that of satellite A. What is the ratio of the tangential speed of B to that of A?

(a) $\frac{1}{2}$
(b) $\sqrt{\frac{1}{2}}$
(c) 1
(d) $\sqrt{2}$
(e) 2

3 Two heavy spheres of radius R and mass M are just touching each other, and each feels an attractive force F towards the other sphere. If two spheres of the same material but radius $2R$ are now placed next to each other, what will the force between them be?

(a) $\frac{F}{2}$
(b) F
(c) $2F$
(d) $4F$
(e) $16F$