



QUESTION WORKBOOK

The field concept

Gravitational fields · Year 13

AQA 3.7.1 · CIE 13.1.2, 13.3.3 · OCR A 5.4.1(a), 5.4.1(c), 5.4.1(e), 6.2.2(d)

14 questions · 36 marks

PRINT EDITION

SECTION A · Warm-up

A1 Define a force field. [2]

A2 State the property of a body that gives rise to each of the following: a gravitational field, an electric field, a magnetic field. [2]

A3 A mass of 2.0 kg experiences a gravitational force of 19.6 N. Calculate the gravitational field strength at this point. [2]

A4 A diagram shows the gravitational field lines of a planet. State what is indicated by the direction of the arrow on a field line, and by the spacing of the lines. [2]

A5 Explain why two field lines can never cross. [2]

SECTION B · Standard

- B1** Compare the gravitational force and the electric force between two point objects. State one similarity and two differences. [3]

- B2** A rock of mass 5.0 kg on the surface of a planet experiences a gravitational force of 40 N. Calculate the gravitational field strength at the surface of the planet. [2]

- B3** Define gravitational field strength and state an appropriate unit for it. [2]

- B4** The table gives the gravitational field strength at the surface of three moons of a large planet.
moon P: 1.3 N kg^{-1}
moon Q: 0.90 N kg^{-1}
moon R: 2.2 N kg^{-1}
A lander of mass 350 kg is damaged on touchdown if its weight exceeds 600 N .
Deduce on which of the moons the lander can touch down safely. [3]

- B5** Explain why the Earth's gravitational field can be treated as uniform in a laboratory experiment, but must be treated as radial when analysing the motion of a distant satellite. [3]

SECTION C · Stretch

- C1** Describe the gravitational field line pattern around an isolated point mass, and the pattern in a uniform field close to the Earth's surface. [4]

- C2** A space probe of mass 10 kg experiences a gravitational force of 82 N at a point above a planet. Calculate the gravitational field strength at that point and state the direction of the field. [3]

- C3** Explain why gravitational forces are always attractive, whereas electric forces can be either attractive or repulsive. [3]

- C4** A planet and its smaller moon are separated by a fixed distance. Explain why there is a point on the line joining their centres at which the resultant gravitational field strength is zero, and state, with a reason, whether this point lies closer to the planet or to the moon. [3]