



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

NAVY SCREEN EDITION

**SECTION A** · Warm-up

**A1** Define a force field. [2]

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**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]

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**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]

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

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**SECTION B** · Standard

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

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- 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]

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