

# Gravitational fields

## Question Paper 3

Level	A Level
Subject	Physics
Exam Board	OCR
Topic	Newtonian world and astrophysics
Sub-Topic	Gravitational fields
Booklet	Question Paper 3

**Time Allowed:** 18 minutes

**Score:** / 15

**Percentage:** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1 Fig. 3.1 represents the planet Jupiter. The centre of the planet is labelled as O.

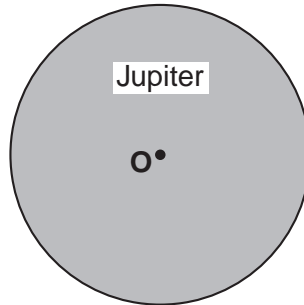


Fig. 3.1

(a) Draw gravitational field lines on Fig. 3.1 to represent Jupiter's gravitational field. [2]

(b) Jupiter has a radius of  $7.14 \times 10^7 \text{ m}$  and the gravitational field strength at its surface is  $24.9 \text{ N kg}^{-1}$ .

(i) Show that the mass of Jupiter is about  $2 \times 10^{27} \text{ kg}$ .

[3]

(ii) Calculate the average density of Jupiter.

density = .....  $\text{kg m}^{-3}$  [2]

[Total: 7]

- 2 (a) The molar mass of hydrogen gas is  $2.02 \times 10^{-3} \text{ kg mol}^{-1}$ . Calculate the mass of a hydrogen molecule.

mass = ..... kg [2]

- (b) The temperature of the Earth's upper atmosphere is about 1100K. Show that at this temperature the mean kinetic energy of an air molecule is about  $2 \times 10^{-20} \text{ J}$ .

[2]

- (c) Show that the speed of a helium atom of mass  $6.6 \times 10^{-27} \text{ kg}$  at a temperature of 1100K is about  $2.5 \text{ km s}^{-1}$ .

[2]

- (d) The *escape velocity* from the Earth is  $11 \text{ km s}^{-1}$ . The escape velocity is the minimum vertical velocity a particle must have in order to escape from the Earth's gravitational field. Explain why helium atoms still escape from the Earth's atmosphere.

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.....  
..... [2]

[Total: 8]