

A Level Physics A
H556/01 Modelling physics

Question Set 13

- 1 (a) Phobos is one of the two moons orbiting Mars. Fig. 17.1 shows Phobos and Mars.

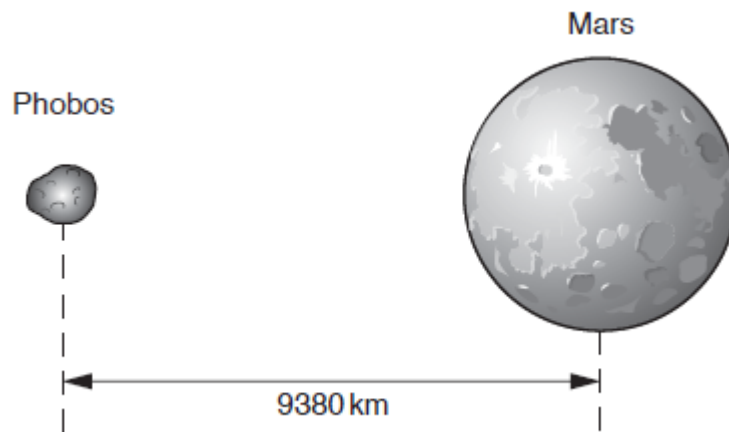


Fig. 17.1

The orbit of Phobos may be assumed to be a circle. The centre of Phobos is at a distance 9380 km from the centre of Mars and it has an orbital speed $2.14 \times 10^3 \text{ m s}^{-1}$.

- (i) On Fig. 17.1, draw an arrow to show the direction of the force which keeps Phobos in its orbit. [1]

- (ii) Calculate the orbital period T of Phobos.

$T = \dots\dots\dots \text{ s}$ [2]

- (iii) Calculate the mass M of Mars.

$M = \dots\dots\dots \text{ kg}$ [3]

- (b) The gravitational field strength at a distance r from the centre of Mars is g .

The table below shows some data on Mars.

$g/\text{N kg}^{-1}$	r/km	$\lg (g/\text{N kg}^{-1})$	$\lg (r/\text{km})$
1.19	6000	0.076	3.78
0.87	7000		
0.67	8000	-0.174	3.90
0.53	9000	-0.276	3.95
0.43	10000	-0.367	4.00

- (i) Complete the table by calculating the missing values. [1]

(ii) Fig. 17.2 shows the graph of $\lg (g/\text{N kg}^{-1})$ against $\lg (r/\text{km})$.

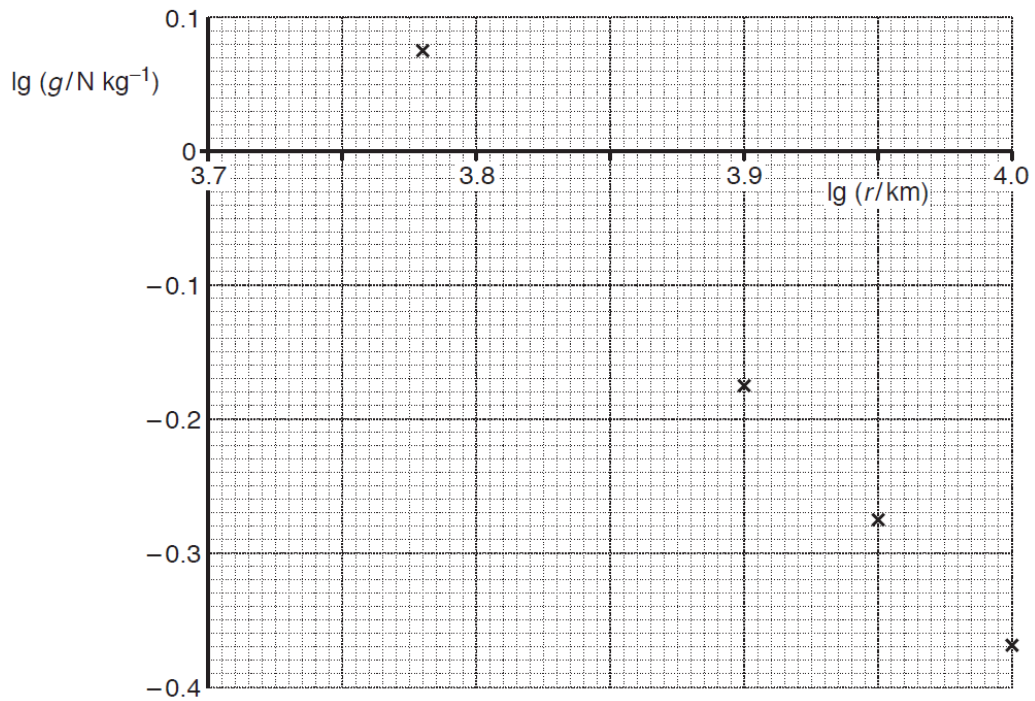


Fig. 17.2

- 1 Plot the missing data point on the graph and draw the straight line of best fit. [2]
- 2 Use Fig. 17.2 to show that the gradient of the straight line of best fit is -2 . [1]
- 3 Explain why the gradient of the straight line of best fit is -2 . [2]

(c) In July 2018, the closest distance between the centre of Mars and the centre of Earth will be 5.8×10^{10} m.
 Fig. 17.3 shows the variation of the **resultant** gravitational field strength g between the two planets with distance r from the centre of the **Earth**.

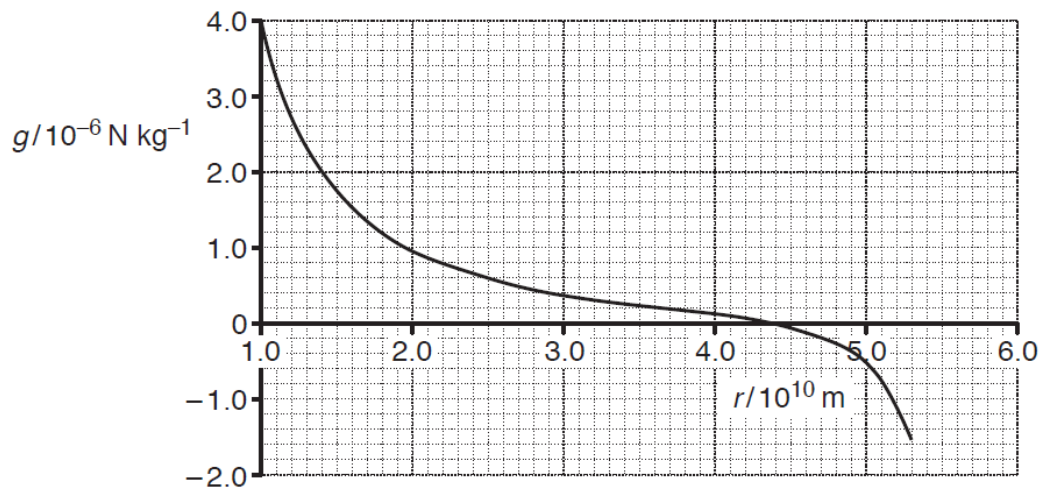


Fig. 17.3

(i) Explain briefly the overall shape of the graph in Fig. 17.3. [2]

(ii) Use the value of r when $g = 0$ from Fig. 17.3 to determine the ratio

$$\frac{\text{mass of Earth}}{\text{mass of Mars}}$$

$$\frac{\text{mass of Earth}}{\text{mass of Mars}} = \dots\dots\dots [2]$$

Total Marks for Question Set 13: 16

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