

Eton College King's Scholarship Examination 2023

SCIENCE 2 (Data Analysis)

(30 minutes)

Candidate Number: _____

Remember to write your candidate number on every sheet in the space provided.

You should attempt ALL the questions. Write your answers in the spaces provided.

The maximum mark for each question or part of a question is shown in square brackets.

Calculators are allowed. In questions involving calculations, all your working must be shown.

For examiners' use only.

Total [30]	
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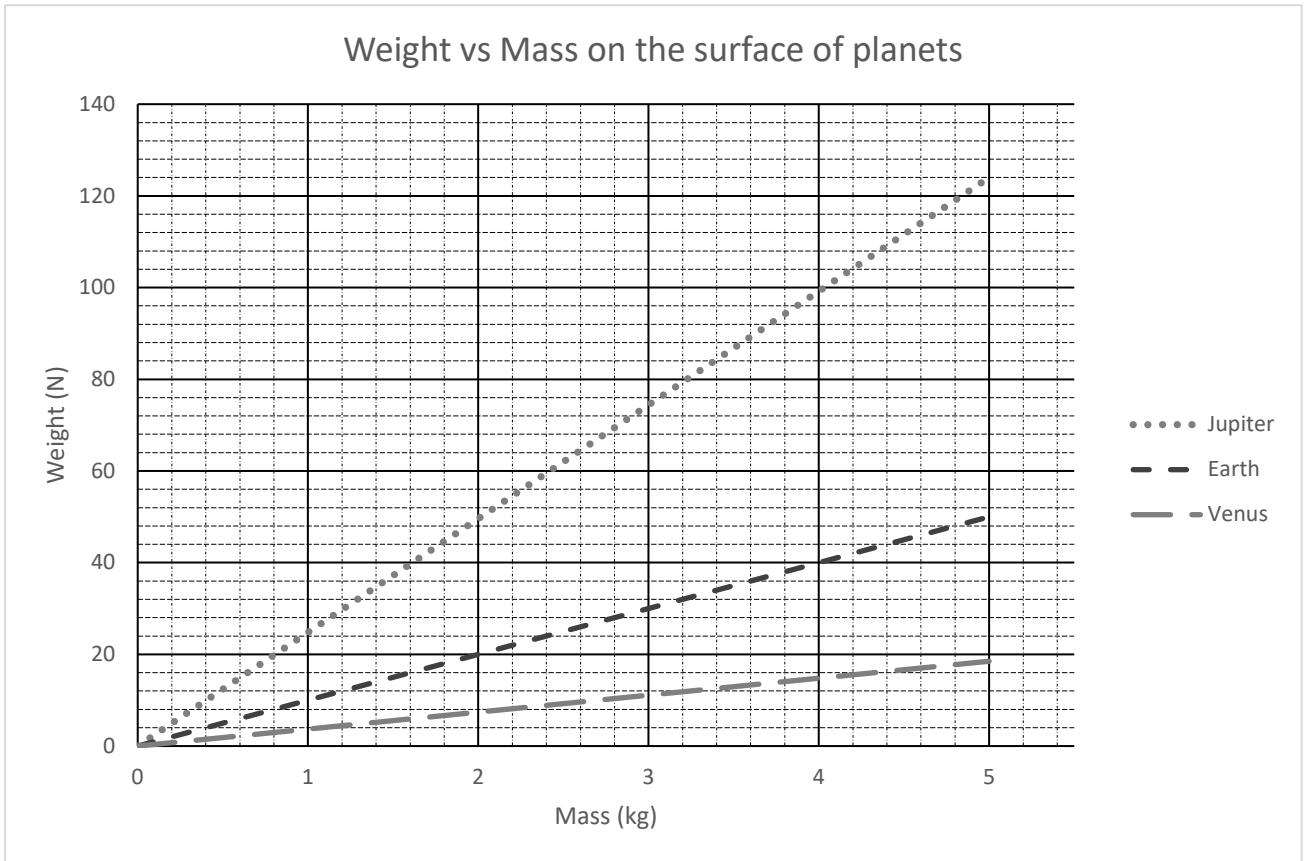
Do not turn over until told to do so.

1. This question is about mass and weight and requires the use of:

$$W = mg$$

Here, W is the weight of an object, m is the mass of an object and g is the gravitational field strength.

Mr Spock wants to investigate gravity on the surface of three planets in our solar system. He collects data and draws the graph below.



(a) What feature of the lines allows Spock to calculate the gravitational field strength for each planet?

[1]

(b) Spock has a mass of 80 kg. Using the graph, complete the table.

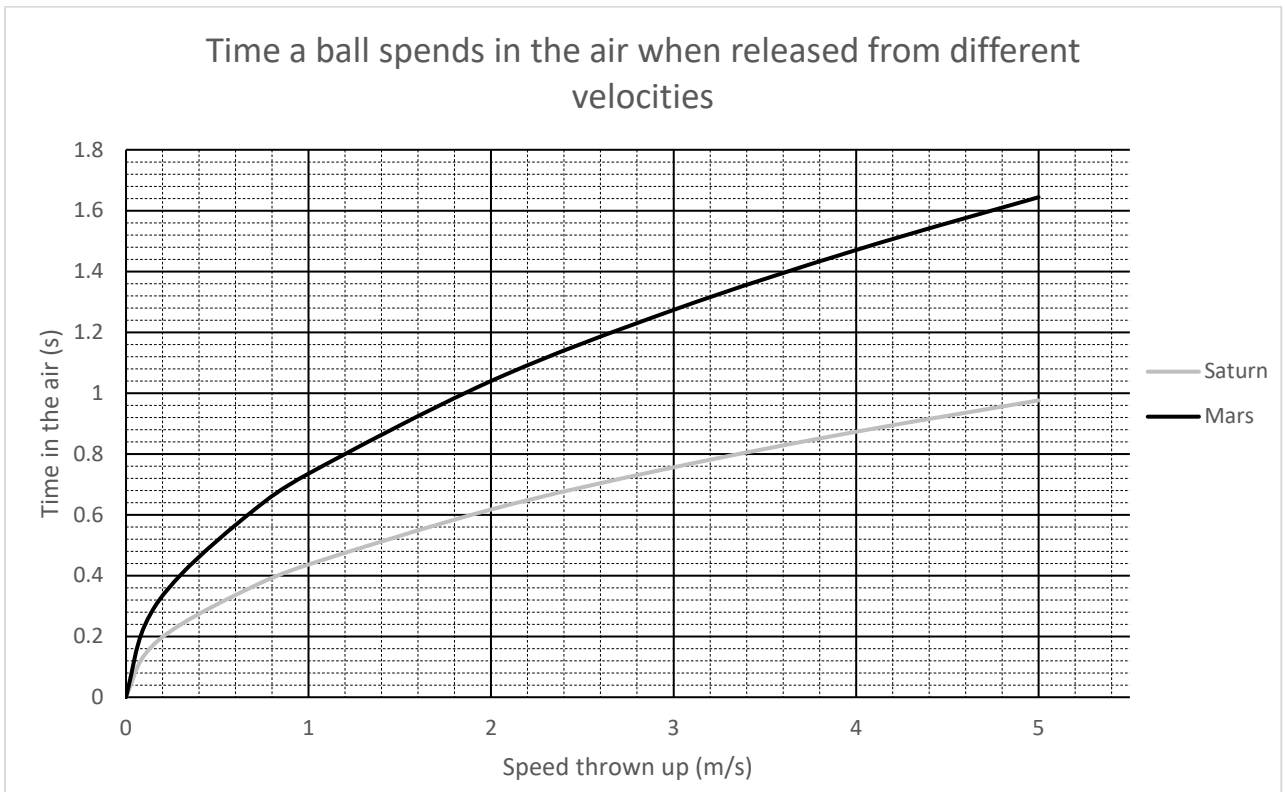
Planet	Gravitational Field Strength, g (N/kg)	Spock's Weight (N)
Venus		
Earth		
Jupiter		

[6]

- (c) Describe two differences in the flight of the ball that Spock would observe when throwing a ball up on Earth and throwing a ball up on Venus (assuming the balls are thrown up at the same speed).

[2]

Spock travels to Saturn and Mars to examine how long his ball stays in the air having been thrown up at different speeds. His findings are shown by the graph below.



- (d) Circle the correct relationship between time spent in the air, T , and the speed thrown up, u . g is the gravitational field strength of the planet in question. Justify your choice using data from the graph.

$$T = \sqrt{\frac{2g}{u}}$$

$$T = \sqrt{\frac{2u}{g}}$$

$$T = \frac{2u}{g}$$

$$T = \sqrt[3]{\frac{2u}{g}}$$

[4]

(e) Using the graph, determine the value of g on Saturn.

[3]

(f) How does the mass of the ball thrown affect the time it spends in the air?

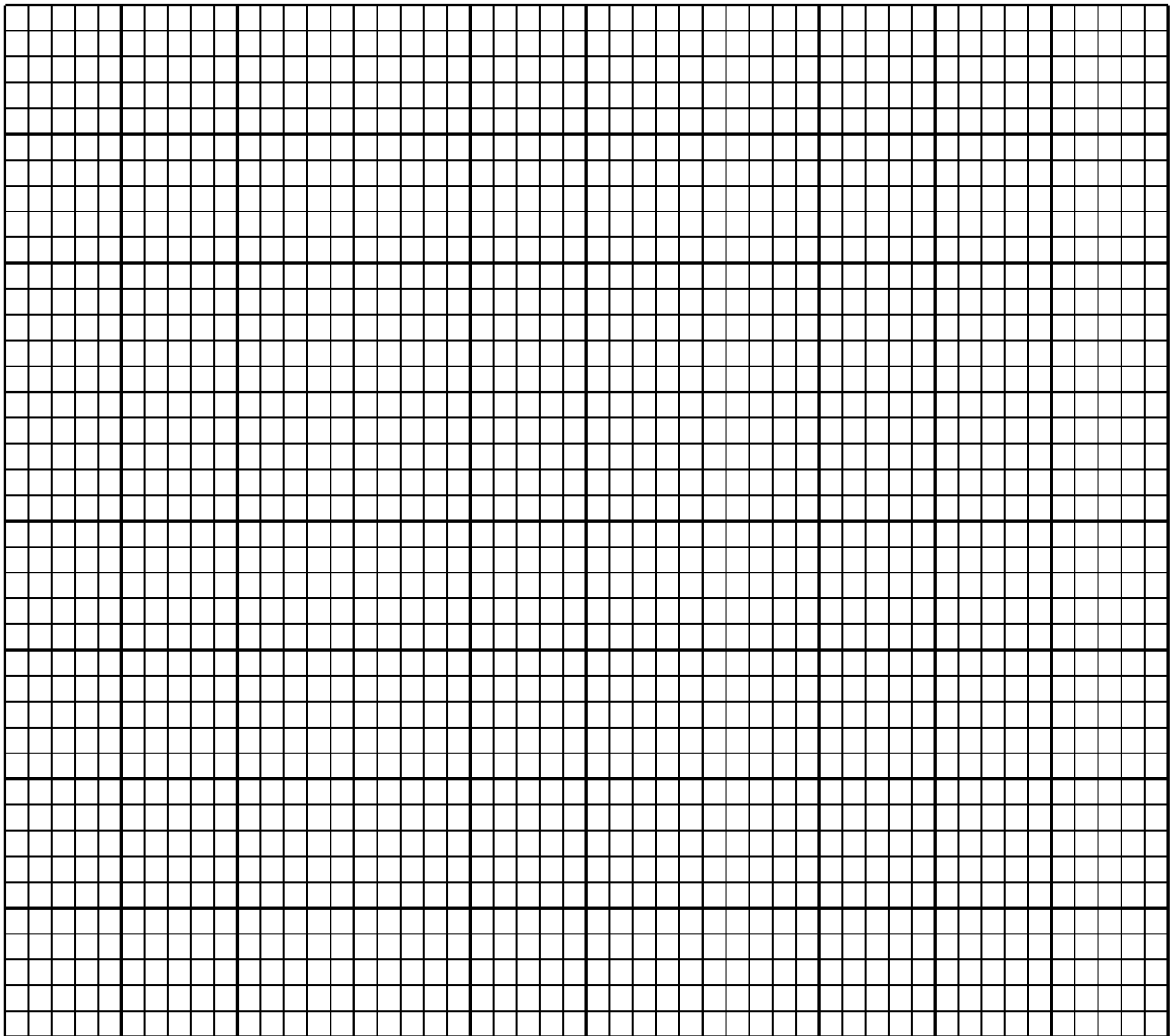
[1]

Spock conducts some further research around Earth regarding how gravitational field strength varies with height above the Earth's surface.

Height above Earth's surface (km)	Gravitational Field Strength, g (N/kg)
1000	7.3
2000	5.7
3000	4.5
4000	3.7

(g) Plot a graph of Spock’s data, including a suitable line of best fit.

[5]



(h) What does the y-intercept of your graph represent? (Note that the y-intercept may not be visible with your choice of scale.)

_____ [2]

(i) Mount Everest is 9 km tall. Comment on the value of the gravitational field strength at the summit of Mount Everest.

_____ [2]

- (j) The Moon is 400,000 km away from the Earth. Comment on the value of the Earth’s gravitational field strength at the location of the Moon.

[1]

- (k) Spock makes a journey in his spaceship, leaving from the surface of the Earth and travelling to the Moon in a straight line. Describe the forces acting on Spock throughout the journey.

[3]

[End of paper]