



**2023**

## **Task 1: Data Analysis**

**Weighting: 20%**

# **Year 12 Physics**

*Place sticker with student number in this box.*

*Place a sticker on any writing booklets used.*

*DO NOT PUT A STICKER ON EVERY PAGE.*

### **General Instructions**

- Reading time - 5 minutes
- Working time - 40 minutes
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- A data sheet, formulae sheets and Periodic Table are provided at the back of this paper
- This paper **MUST NOT** be removed from the assessment room.

### **Subject Teachers:**

Ms Disney

Mr Fiander

Mr Sloan

Mr Smith

Mr Solomonides

### **Total marks – 25**

- Attempt all questions.

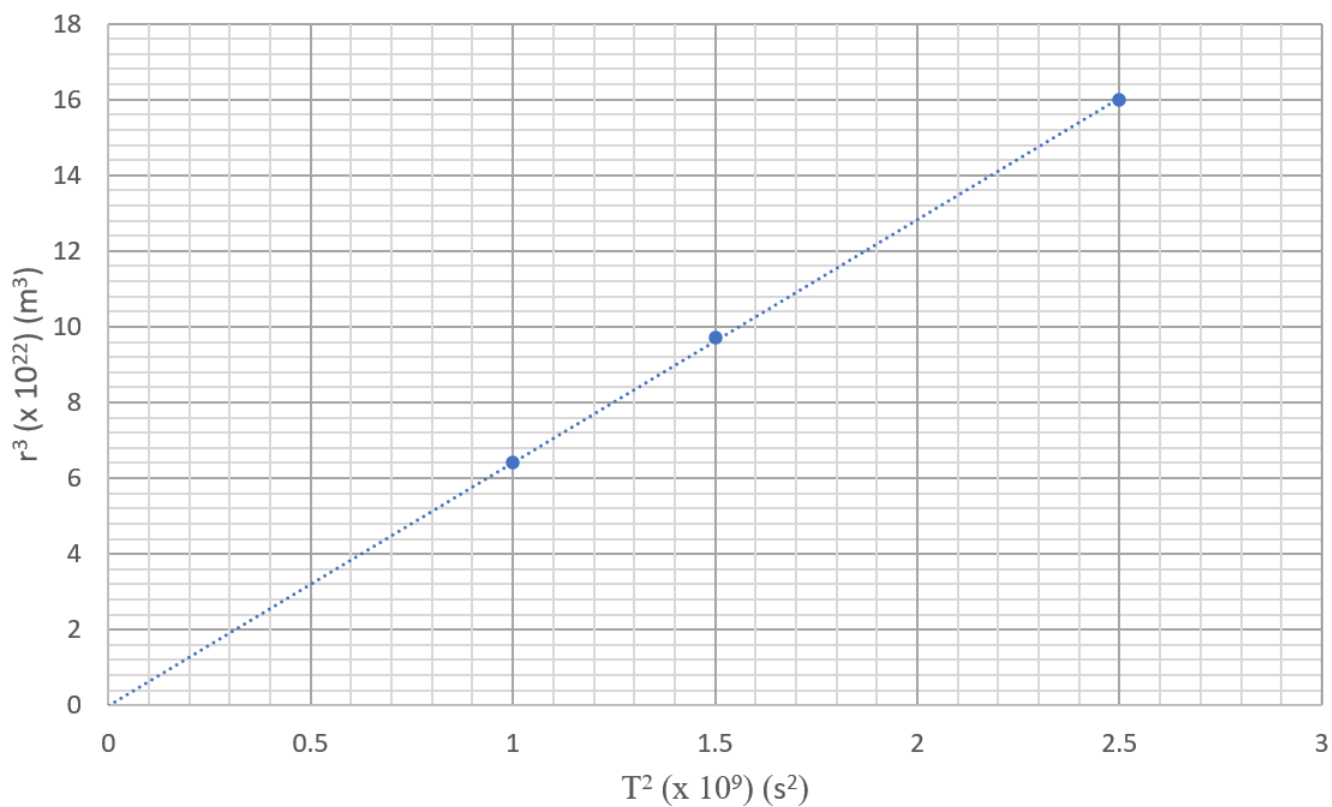
Extra writing booklets are available upon request. If used, place a sticker with your student number on EACH writing booklet. Clearly label the writing booklet with the question number.

Indicate in the main paper that you have used an extra booklet, or it may not be marked.

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**Question 1** (5 marks)

A student is analysing the graph below that shows the radius cubed and period squared for three satellites orbiting a planet.



- (a) Justify why the student should have expected a straight line relationship between  $r^3$  and  $T^2$ . 2

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- (b) Use the graph to calculate the orbital period of a satellite, with an orbital radius of  $5.2 \times 10^7$  m.

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**Question 2** (6 marks)

Three satellites (L, M and N) each of mass 550 kg, are in orbit around the Earth.

The graph below shows the total energy and orbital radius of satellites L and N.



- (a) Satellite M has an orbital radius exactly half of satellite N. Place an 'x' on the total energy curve above to represent satellite M and determine its total energy. 1

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- (b) On the graph above, sketch and label a curve representing the kinetic energy of the three satellites. Annotate L, M and N on the curve. 2

- (c) Justify, using appropriate mathematical derivations, the curve you have drawn for kinetic energy.

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**Question 3** (7 marks)

Two satellites R and S, orbit the same planet so that R has an orbital radius three times that of S.

- (a) Use proportionality to find the ratio of their periods  $T_R : T_S$ .

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- (b) Explain the role of the gravitational force in determining features of the orbit of satellites. Use appropriate mathematical justification as **part** of your answer.

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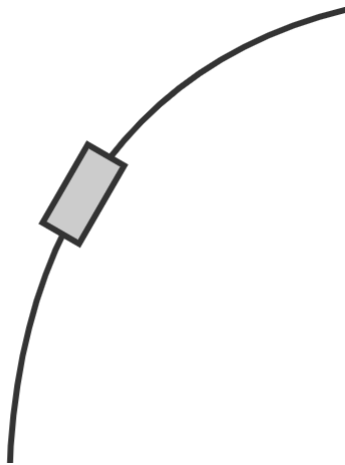
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**Question 4** (7 marks)

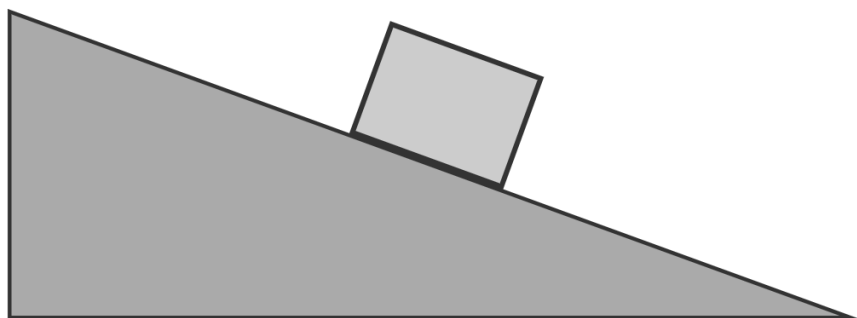
Two road curves have the same radius of 65 m. One road is flat and has a suggested maximum speed of 70 km h<sup>-1</sup>. One curve is banked at 12° and has a suggested maximum speed of 100 km h<sup>-1</sup>. 7

Explain, both qualitatively and quantitatively, the physics behind the difference in suggested maximum speeds on the two road curves for a 1000 kg car. Your answer must include appropriate annotations on the diagrams below.

FLAT NON-BANKED CURVE



BANKED CURVE





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**END OF ASSESSMENT**