Year 12 Physics Assessment Task I.D. Number: _____

Practical and Processes

Teacher: ☐ Mr Coombes ☐ Mr Robson TOTAL MARKS _____/ 30

Task Weighting: 15% Time Allowed: 45 minutes

- Attempt all questions
- Show all working
- For question 2 watch the movie on the screen. You will require a stopwatch to carry out question 2. This may be shared between two students. Check that the stopwatch is working before the task commences and notify your teacher if there is a problem.

Data and Equations

$g = 9.8 \text{ m s}^{-2}$

Mass of Earth = 6×10^{24} kg

Radius of Earth = 6400 km

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$E_p = -G\frac{m_1 m_2}{r}$$

$$F = mg$$

$$v_x^2 = u_x^2$$

$$v = u + at$$

$$v_y^2 = u_y^2 + 2a_y\Delta y$$

$$\Delta x = u_x t$$

$$\Delta y = u_y t + \frac{1}{2}a_y t^2$$

Question 1

Complete the following table that describes the mass and weight of an astronaut in different locations. [2M]

Planet	Mass of astronaut (kg)	Acceleration due to gravity (ms^{-2})	Weight of astronaut (N)
Earth			980
Mars	100		380
Venus		8.9	

Question 2

(a) Determine the length of the pendulum shown in the movie.
Record your measurements in a table and present your calculations clearly. [6M]

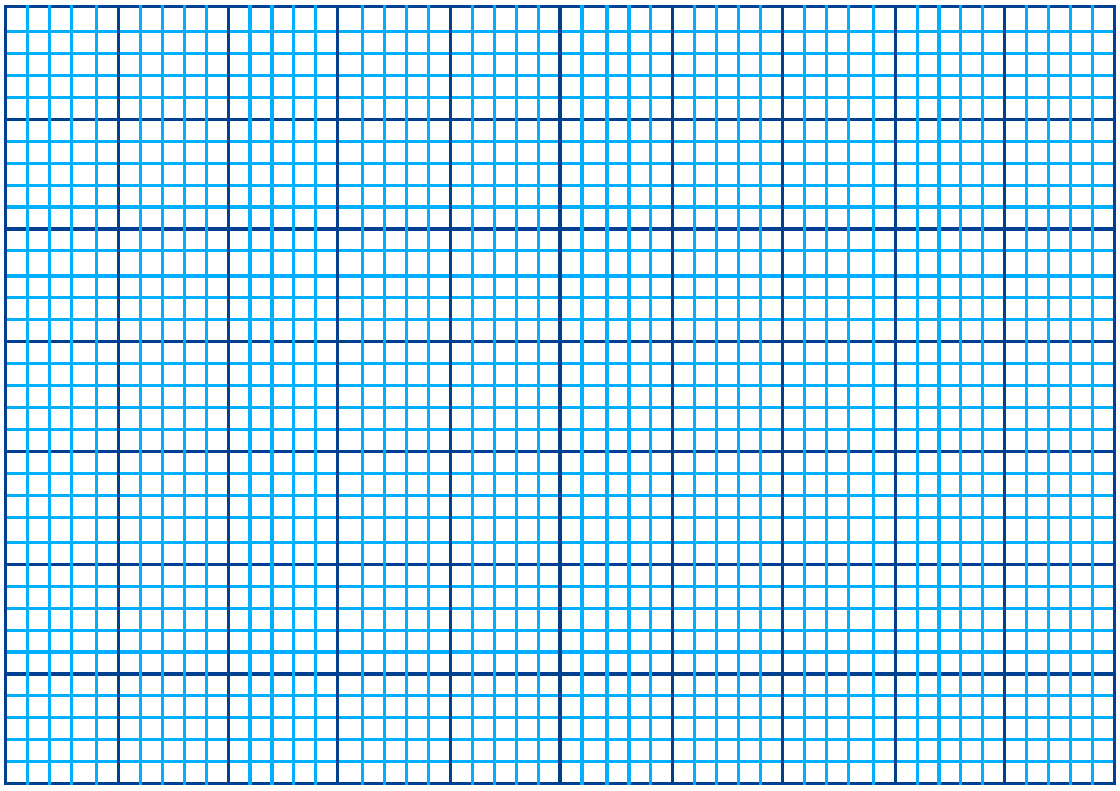
(b) For the measurements collected in part (a), explain one strategy that you used to ensure that the measurements were reliable. [2M]

Question 3

The table shows measurements taken of the gravitational potential energy of a 100 kg satellite as it is moved away from the earth's surface

Distance from the centre of the Earth (x 10^6 m)	Gravitational Potential Energy (x10^9 J)	
6.4	-6.3	
13.1	-3.1	
18.4	-2.1	
26.2	-1.6	
31.2	-1.3	

(a) On the grid, draw a graph that tests the hypothesis that the gravitational potential energy of the satellite is inversely proportional to the distance from the centre of the earth. Any additional data required for the graph should be tabulated in the blank column. [4M]



(b) **Using the graph**, determine the value of G, the universal gravitational constant [3M]

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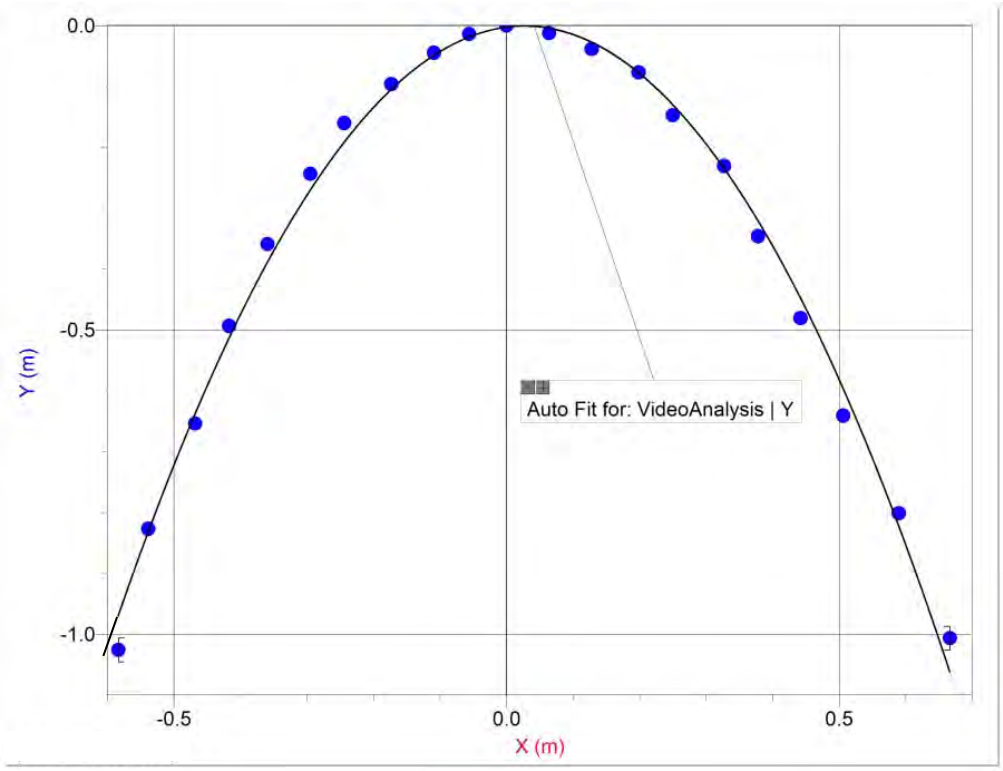
Question 4

The graphs in this question were generated using video of a projectile on planet Nindra. Please note that the acceleration due to gravity on this planet is not $9.8ms^{-2}$.

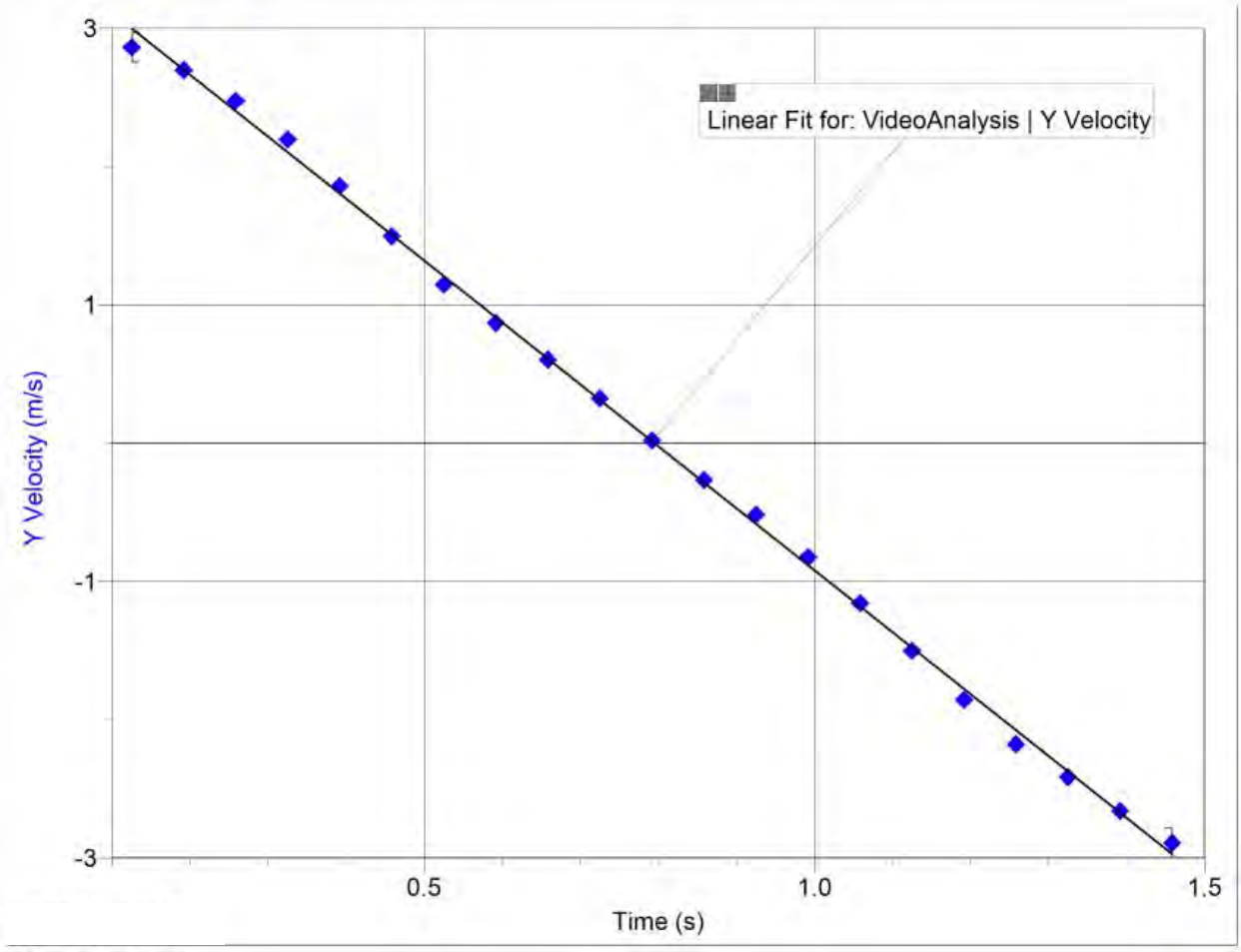
(a) Using the graph below identify the following. [1M]

(i) Maximum height _____

(ii) Range _____



(b) Use the following graph to calculate the acceleration due to gravity on planet Nindra. [2M]



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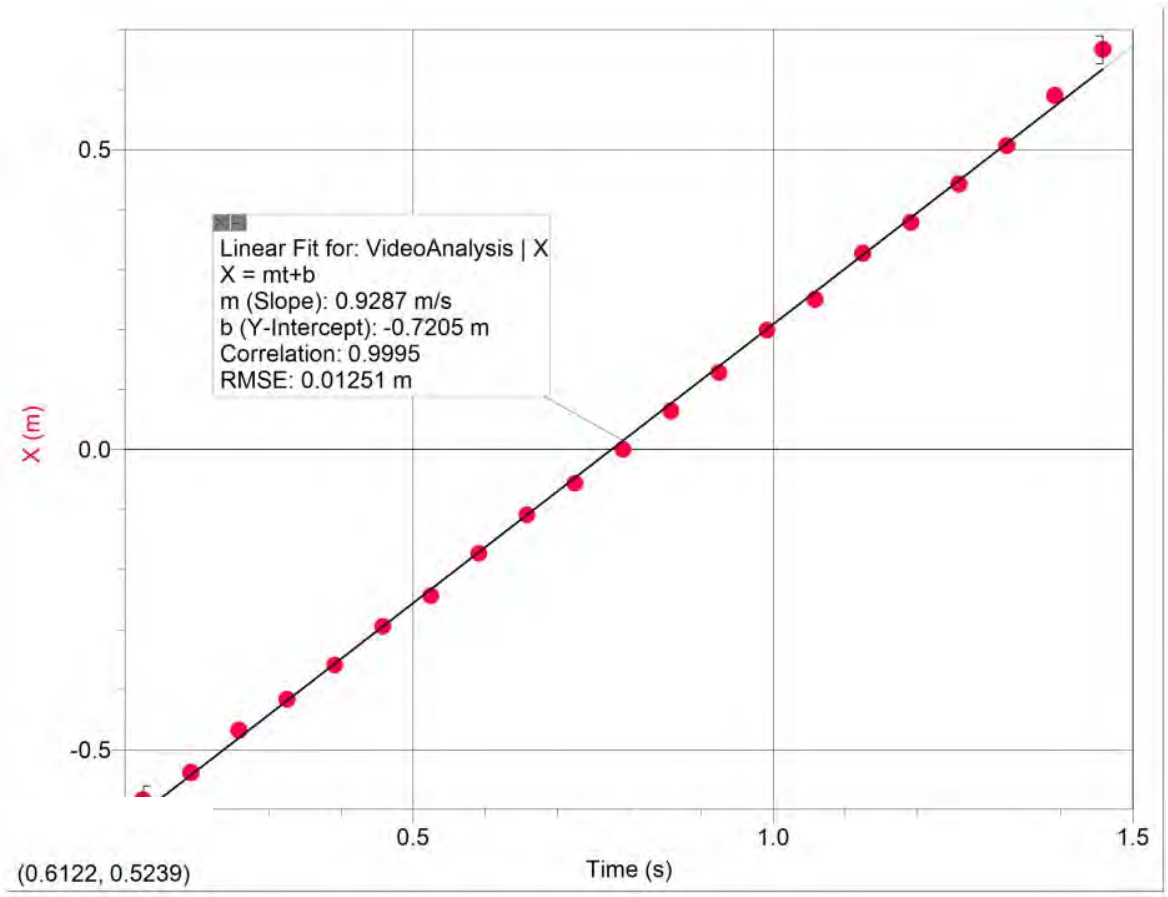
(c) Using the following graph and any previous graphs calculate the total velocity of the projectile at time t=1s. [3M]



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(d) Poor little Johnny can't afford a computer. Explain how Johnny could validate the model that a projectile travels in a parabolic motion using the following photograph. [2M]

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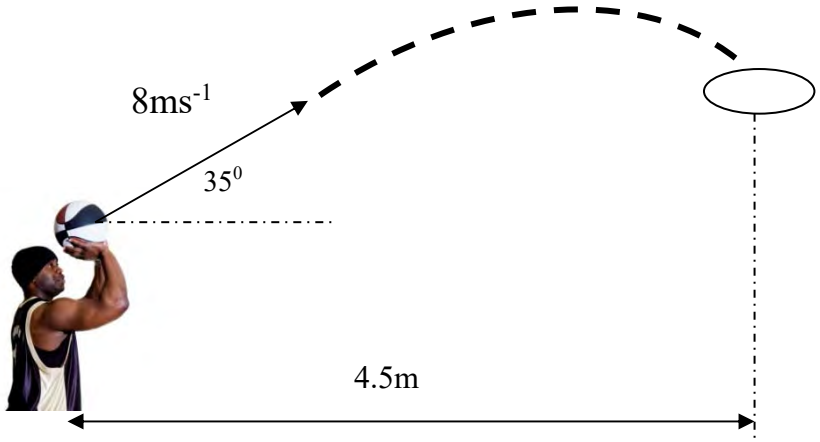
Question 5

A basketball player launches a ball from a height 2.1m above the ground as shown below. The hoop is located 4.5m away horizontally and is 3.0m above the ground. Using calculations show whether the basketball hits its target. [5M]



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END OF EXAM

Criteria Q1	Mark
Correctly states the 5 relevant quantities (-0.5 for each error)	2

Criteria Q2a	Mark
Response must contain Reasonable results(8.15 -8.3 s for 10 oscillations) Multiple results (at least 3) An indication that more than one oscillation was used Results which are displayed using a table with relevant headings/units Calculation of and substitution of the correct average period into the appropriate formula A reasonable final answer including units (0.16m – 0.17 m)	6
Missing one of the above	5
Missing two of the above	4
Missing three of the above	3
Missing four of the above	2
Missing five of the above	1

Criteria Q2b Outcome H6, H12	Mark
Response clearly outlines the strategy (repetition of measurements) AND states that this is done to check the consistency of the measurements – if consistent, they are reliable	2
Response clearly outlines the strategy	1

Criteria Q3a	Mark
Correct data recorded in blank column (1/r) including scientific notation AND Appropriate graph drawn (E_p v 1/r) AND Graph has axes labelled correctly with quantity and unit, points plotted clearly and correctly and a reasonable line of best fit.	4
Correct graph drawn but with one significant error (eg data used incorrectly calculated)	3
Correct graph drawn but with two significant errors OR Incorrect graph (eg E_p v r) drawn well	2
Correct data recorded OR Incorrect graph drawn with one significant error	1

Criteria Q3b Outcome H7, H12, H14	Mark
Calculation includes • A correct calculation of the gradient of the E_p v 1/r graph (including scientific notation) • A clear link between the gradient and the formula for E_p (slope = $-Gm_1 m_2$) – note that the gradient MUST be negative. • A clear substitution and reasonable calculation of G (-G = gradient/ $m_1 m_2$)	3
Method used as above but with one significant error (eg gradient not calculated correctly) OR Uses a point on the line of best fit and substitutes correctly into the formula to determine a reasonable value of G	2
Correctly calculates the gradient of the graph OR Clearly shows the link between the formula and the gradient.	1

Criteria Q4a Outcome H9, H14	Mark
Correctly identifies the range (1.2-1.35m) and the maximum height (1-1.1m)	1
Identifies one of the above	0.5

Criteria Q4b Outcome H12, H14	Mark
Correctly calculates the gradient in the range (4.4-4.8ms^{-2})	2
Calculates a gradient that in close to the correct range	1.5
Recognises that a gradient represents the acceleration.	1

Criteria Q4c Outcome H7, H12, H14	Mark
Uses a vector diagram to correctly calculate the total velocity including the angle below horizontal.	3
Calculates the final velocity correctly without an angle.	2
Correctly identifies the vertical and horizontal velocities using the graphs provided.	1

Criteria Q4d Outcome H11, H12	Mark
Describes an appropriate method of plotting a graph of y-displacement vs. x-displacement squared and recognises that a parabolic motion is validated by a straight line on this graph.	2
Describes an appropriate method of plotting a graph of y-displacement vs. x-displacement squared	1

Criteria Q5	Mark
Correct calculations that show that the ball will either fall short or below the hoop and a statement that the ball misses the target.	5
Correct calculations that show that the time to reach to target horizontally does not correspond to the time to reach target vertically.	4
Calculates the time to travel to the target (either using vertical or horizontal component) but incorrectly calculates the corresponding displacement of the ball at that time.	3
Uses the calculated initial velocities to calculate either a time or final velocity correctly.	2
Calculates the initial horizontal and vertical velocities.	1