**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Marks: \_\_\_\_\_\_\_\_\_\_\_\_**

**Yr 12 Motion / Moments – Data Evaluation / Analysis Test**

The table below describes the orbital paths of a number of natural and man-made satellites orbiting the Earth.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Mass (kg)** | **Orbital Radius (x107 m)** | **Period (s)** | **Acceleration (m s-2)** | **Inverse of orbital radius squared**  **(Units: )** |
| Shuttle |  | 0.671 | 5410 |  |  |
| Tiros | 1405 | 0.722 | 6120 |  |  |
| Itos | 340 | 0.787 | 6670 |  |  |
| Lageos | 411 | 1.23 | 13500 |  |  |
| Nato | 310 | 4.22 | 86400 |  |  |
| Moon | 7.38 x 1022 | 38.2 | 2.42 x 106 |  |  |

1. Using your knowledge of **circular motion theory**, show working to illustrate that the **acceleration** of each satellite is related to its **orbital radius** and its **period** by the expression:

**a = 4π2r / T2**

**(4 marks)**

1. Using the expression from Question 1, calculate and **fill in the values for the 5th column** in the table above. Ensure you display the values to the correct number of **significant figures**.

**Show workings** for the calculation you performed to determine acceleration of **Tiros**.

**(5 marks)**

1. Fill in the values of **uncertainty** associated with Tiros in the table below.

Using this information **calculate** the **percentage uncertainty (%)** and **absolute uncertainty** for the acceleration of Tiros.

|  |  |  |  |
| --- | --- | --- | --- |
| **Quantity** |  | **Absolute Uncertainty** | **Percentage Uncertainty (%)** |
| Orbital Radius (x107 m) | 0.722 |  |  |
| Period (s) | 6120 |  |  |

**Ans:** % Uncertainty acceleration: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Ans:** Absolute Uncertainty acceleration: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(6 marks)**

1. Complete the **6th column of the table** on page 1, by calculating the values of **inverse of radius squared**. Clearly show the units by writing them at the top of that column.

**(4 marks)**

1. **Plot a graph** of gravitational field strength (g) against inverse of the radius squared (1/r2).

(Insert Graph Paper)

**(5 marks)**

1. It is known that gravitational field strength due to the Earth can be calculated using the formula

g = GMe / r2

**Use your graph**, determine the mass of the Earth.

(4 marks)