Gravity Bounds
The acceleration due to gravity experienced by any mass close to the surface of the earth can be calculated using the following formula:

\[ g = \frac{GM}{r^2} \]

\( G \) is the gravitational constant, \( M \) is the mass of the earth and \( r \) is the radius of the earth.

The mass of the earth is 5.97 \( \times \) 10\(^{24} \) kg, to 3 significant figures.
The radius of the earth is 6371000 m, to the nearest 1000 m.
The gravitational constant, \( G \), is 6.67 \( \times \) 10\(^{-11} \) to 3 significant figures.

1. Using the values given above, calculate \( g \).

Taking the values given above, \( g \) is equal to: __________ \( ms^{-2} \)

2. By taking into account the precision of the measurements given, and considering upper and lower bounds, find the range of possible values \( g \) could take.

The greatest possible value of \( g \) is: __________ \( ms^{-2} \)

The least possible value of \( g \) is: __________ \( ms^{-2} \)

3. Using the upper and lower bounds you have now found for the value of \( g \), write down the value for \( g \), rounding to an appropriate degree of accuracy.

\( g \) is __________ \( ms^{-2} \) correct to __________ significant figures
The acceleration due to gravity experienced by any mass close to the surface of the earth can be calculated using the following formula:

\[
g = \frac{GM}{r^2}
\]

\(G\) is the gravitational constant, \(M\) is the mass of the earth and \(r\) is the radius of the earth.

The mass of the earth is \(5.97 \times 10^{24}\) kg, to 2 significant figures.
The radius of the earth is \(6371000\) m, to the nearest 1000 m.
The gravitational constant, \(G\), is \(6.67 \times 10^{-11}\) to 3 significant figures.

1. Using the values given above, calculate \(g\).

\[
g = \frac{(6.67 \times 10^{-11}) \times (5.97 \times 10^{24})}{6371000^2}
\]

Taking the values given above, \(g\) is equal to: \(9.81036023452388\) \(m/s^2\)

2. By taking into account the precision of the measurements given, and considering upper and lower bounds, find the range of possible values \(g\) could take.

\[5.965 \times 10^{24} \leq m < 5.975 \times 10^{24}\]
\[6370500 \leq r < 6371500\]
\[6.665 \times 10^{-11} \leq G < 6.675 \times 10^{-11}\]

\[
\frac{G_L m_L}{(r_U)^2} \leq g < \frac{G_U m_U}{(r_L)^2}
\]

The greatest possible value of \(g\) is: \(9.8274793416876\) \(m/s^2\)

The least possible value of \(g\) is: \(9.79325869624054\) \(m/s^2\)

3. Using the upper and lower bounds you have now found for the value of \(g\), write down the value for \(g\), rounding to an appropriate degree of accuracy.

\(9.7932\ldots \leq g < 9.8274\ldots\)

All values within this range round to 9.8 to 2 s.f., but to 3 s.f. they are no longer the same.

\(g\) is \(9.8\) \(m/s^2\) correct to 2 \textbf{significant figures}

Note: This gives an error interval of \(9.75 \leq g < 9.85\) which contains the calculated interval.