2023-Ph-H1-Q6

Section: Our Dynamic Universe
Topic: Gravitation

Summary:
A satellite of mass $m = 620\,\text{kg}$ orbits Earth at radius $r = 23,000\,\text{km} = 2.3 \times 10^7\,\text{m}$. The Earth's mass is $M = 6.0 \times 10^{24}\,\text{kg}$. We are asked for the gravitational force on the satellite.

Solution:
Gravitational force:

$$F = G\frac{Mm}{r^2} = 6.67 \times 10^{-11}\,\frac{6.0 \times 10^{24} \times 620}{(2.3 \times 10^7)^2}.$$

Step-by-step:

- $(2.3 \times 10^7)^2 = 5.29 \times 10^{14}$.
- Numerator: $6.67 \times 10^{-11} \times 6.0 \times 10^{24} \times 620 \approx 2.48 \times 10^{17}$.
- Divide: $2.48 \times 10^{17} / 5.29 \times 10^{14} \approx 4.7 \times 10^2\,\text{N}$.

Answer: A. $4.7 \times 10^2\,\text{N}$.

Guidance for Students:

- Always convert km to m.
- The gravitational force drops significantly with distance (inverse square).

Revision Tips:

- **Law of gravitation:** $F = G\frac{Mm}{r^2}$.
- Double-check units and exponents (km → m).
- Remember: $G = 6.67 \times 10^{-11}\,\text{Nm}^2/\text{kg}^2$.