Answer on Question #42908 – Physics – Other

39. The measured value of the length of a simple pendulum is 20 cm known with 2 mm accuracy. The time for 50 oscillations was measured to be 40 s with 1 s resolution. Calculate the percentage accuracy in the determination of acceleration due to gravity g from the above measurements.

Solution.

The formula for pendulum period calculation is

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

Therefore

$$g = \left(\frac{2\pi}{T}\right)^2 l$$

So error in calculation g is:

$$\frac{\Delta g}{g} = 2\frac{\Delta T}{T} + \frac{\Delta l}{l}$$

From condition:

$$\frac{\Delta l}{l} = \frac{2mm}{20cm} = 0.01$$

$$\frac{\Delta T}{T} = \frac{1s}{40s} = 0.025$$

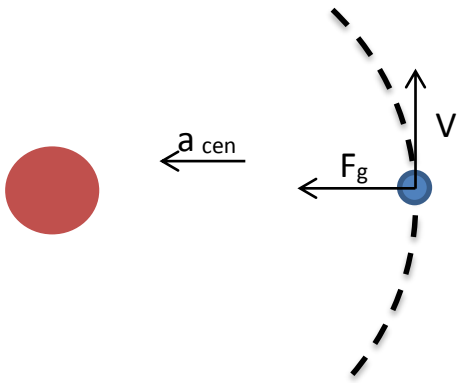
So

$$\frac{\Delta g}{g} = 2 * 0.025 + 0.01 = 0.06 = 6\%$$

Answer: (a) 6%

40. Which of the following curve represents the variation of total energy with radius r for satellite in a circular orbit?

Solution.



Total energy:

$$E_{tot} = E_K + E_{pot}$$

$Potential\ energy$:

$$E_{pot} = -\frac{GMm}{r}$$

Kinetic energy with 2nd Newton's law:

$$E_K = \frac{mV^2}{2}$$

$$F_g = ma_{cen} \Rightarrow \frac{GMm}{r^2} = \frac{mV^2}{r}$$

Thus:

$$E_K = \frac{GMm}{2r}$$

Then total energy:

$$E_{tot} = \frac{GMm}{2r} - \frac{GMm}{r} = -\frac{GMm}{2r}$$

This situation corresponds to curve R or S – they are similar

Answer: (c) R, (d) S