Oxford Cambridge and RSA

A Level Physics A

H556/01 Modelling physics

Question Set 7

1 This question is about a simple pendulum made from a length of string attached to a mass (bob). For oscillations of small amplitude, the acceleration *a* of the pendulum bob is related to its displacement *x* by the expression

$$a = -\left(\frac{g}{L}\right)x$$

where *g* is the acceleration of free fall and *L* is the length of the pendulum. The pendulum bob oscillates with simple harmonic motion.

(a) **(i)** Show that the period *T* of the oscillations is given by the expression

$$T^2 = \frac{4\pi^2}{g}L.$$

[3]

(ii) A student notices that the amplitude of each oscillation decreases over time. Explain this observation and state what effect this may have on *T*. **[2]**

(b)* Describe with the aid of a labelled diagram how an experiment can be conducted and how the data can be analysed to test the validity of the equation

$$T^2 = \frac{4\pi^2}{g}L$$

for oscillations of small amplitude. **[6]**

(c) Another student conducts a similar experiment in the laboratory to investigate the small amplitude oscillations of a pendulum of a mechanical clock. Each 'tick' of the clock corresponds to **half** a period.

(i) Show that the length of the pendulum required for a tick of 1.0 s is about 1 m. **[2]**

(ii) If the pendulum clock were to be used on the Moon, explain whether this clock would run on time compared with an identical clock on the Earth. **[2]**

Total Marks for Question Set 7: 15