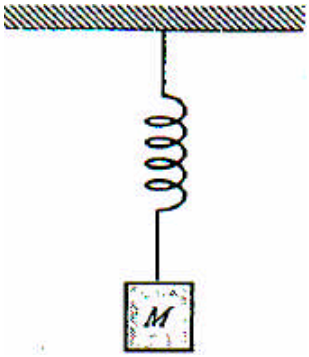
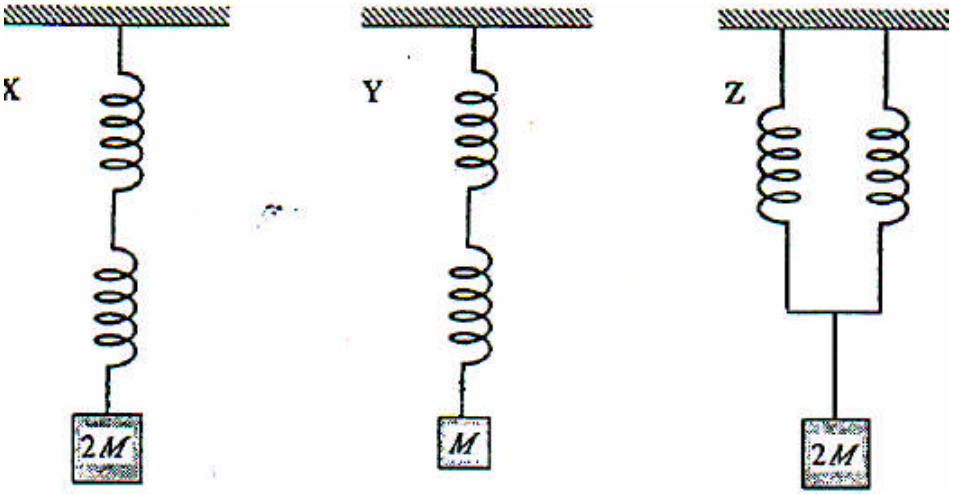
Chapter 10
Multiple choice and quick questions

1. The first mass spring system shown below has a period of *T* when the mass oscillates vertically.



The spring systems below use identical springs to the system above.



Which of the statements below is/are correct?

1: System X has a time period of *2T*.

2: System Y has a time period of *2T*.

3: System Z has a time period of *2T*.

A 1 only **B** 2 only **C** 1 and 3 only ✓ **D** 2 and 3 only

E 1, 2 and 3

2. This question is about a simple pendulum performing simple harmonic oscillations (Fig. 1*)*

The graph *(*Fig. 2*)* shows the period *T* of a simple pendulum varies with its length *l.*

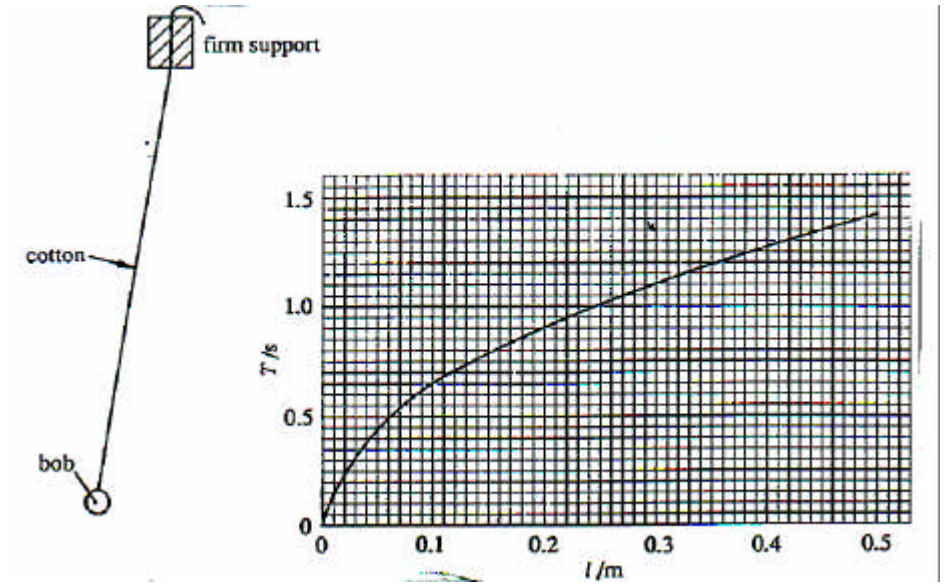


Fig. 1 Fig. 2

A student claims that the graph shows that:

$$T = k\sqrt{l}$$

Take measurements from the graph to:

(i) check this claim by calculation;

$$k = \frac{T}{\sqrt{L}}$$

$$T = 0.5s\,,\ L = 0.06\ m \Rightarrow k = 2.01$$

$$T = 1.4s\,,\ L = 0.48\ m \Rightarrow k = 2.02$$

$$\therefore T \propto \sqrt{L}$$

(ii) find the length of the pendulum which has a period of 1.60 s.

$$k \approx 2.0 \Rightarrow L = \frac{T^2}{k^2} = \frac{(1.60)^2}{2^2} = 0.64\,m$$

3. Which of the following is/are simple harmonic oscillations to a good approximation?

1: a heavy bar swinging gently from a pivot near one end

2: a molecule rebounding to and fro inside a box

3: a mass moving gently up and down on the end of a spring

A 1 only **B** 2 only **C** 1 and 3 only ✓ **D** 2 and 3 only

E 1, 2 and 3

4. Which of the following is/are exponential in form?

1: The variation of electric field strength with distance from the centre of a charged sphere.

2: The variation of the activity of a radioactive source with time.

3: The variation of the intensity of light with distance from a star.

A 1 only **B** 2 only ✓ **C** 1 and 3 only **D** 2 and 3 only

E 1, 2 and 3

5. An experimenter records the value of a current *I* in a thermistor at various temperatures *T*. The experimenter wishes to test the relationship:

$l\mu$ P e –AT where *A* and *P* are constants.

$e^{-A/T}$

If the relationship is correct, which quantities should be plotted to obtain a straight line?

A *I* against 1/*T*

B 1/*I* against 1/*T*

C *I* against 1n*T*

D 1n*I* against *T*

E 1n*I* against 1/*T* ✓

6. A crane carries a load which swings with a natural frequency *f*. With suspension of length *l*, the period *T* of the motion is $2\pi\sqrt{l}/g$.

The load is lifted until the suspension is half its original length. Which one of A to E below gives the frequency of the oscillating load?

A *f* **B** 2*f* **C** *f*/2 **D** $f\sqrt{2}$ ✓ **E** $f/\sqrt{2}$

7. Which one of **A** to **E** below gives the frequency when the suspension is its original length but the load is doubled?

A *f* ✓ **B** 2*f* **C** *f*/2 **D** $f\sqrt{2}$ **E** $f/\sqrt{2}$

8. This question is about the oscillation observed when a student stands on bathroom scales.

The pointer on the scale oscillates before reaching a steady reading, as shown in fig.4.

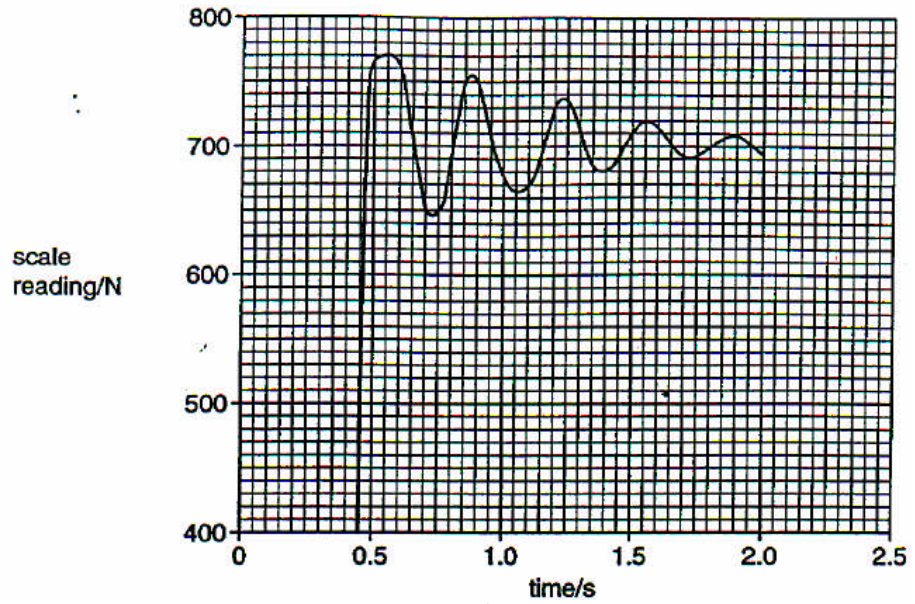


Fig.4

(a) The student comments that the oscillation appears to be harmonic. What evidence from the graph supports this statement?

Constant t ime period T ≈ 0.35s

(b) Use the information on the graph to determine

(i) the mass of the student;
g = 9.8N kg -1

$$\therefore m = \frac{700\ N}{9.8\ N\ kg^{-1}} = 71\,kg$$

W = mg

(ii) the frequency of the oscillation;

$$f = \frac{1}{T} = \frac{1}{0.35} = 3\,H_z$$