Simple Harmonic Motion 1

(Where necessary take g = 9.8 ms^{-2})

1. What is meant by simple harmonic motion?

2. What is meant by:
(a) the amplitude of a body performing simple harmonic motion
(b) the displacement of a body performing simple harmonic motion

3. At what points of the oscillation shown in the diagram is:
(a) the displacement of the mass greatest?
(b) the velocity of the mass greatest?
(c) the velocity of the mass least?
(d) the acceleration of the mass least?
(e) the acceleration of the mass greatest?

4. Draw graphs that show the variation with time of the following:
(a) the acceleration of the mass
(b) the velocity of the mass
(c) the displacement of the mass

5. Which of the following are simple harmonic motion? Explain your answers:
(a) the vibration of a tuning fork
(b) an elastic superb all bouncing on the ground
(c) a large rectangular box resting on the floor that is slightly tilted and then released
(d) a trampolinist bouncing up and down on a trampoline
(e) a simple pendulum
(f) a mass fixed to a helical spring oscillating up and down
(g) a ball being swung round in a horizontal orbit on the end of a piece of string

6. If a pendulum clock is taken to the top of the mountain does it gain or lose? Explain your answer.

7. A mass of 0.4 kg oscillates with simple harmonic motion with an amplitude of 5 cm and a frequency of 100 Hz.
Calculate:
(a) the maximum acceleration of the mass
(b) the maximum velocity of the mass
(b) the maximum kinetic energy of the mass

8. A small coin rests on a horizontal table that performs oscillations in the vertical plane. If the amplitude of these oscillations is 10 cm calculate the maximum frequency of oscillation such that the coin remains in contact with the table surface.

9. A pendulum and a helical metal spring are both suspended from the ceiling of a lift. If the lift now accelerates upwards, what happens to the period of oscillation of both systems?

10. An elastic string extends by 1 cm when a small mass is attached at the lower end. If the weight is pulled down by 0.25 cm, calculate the period of the resulting motion.