Year 13 Science: Simple harmonic motion

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Find the period of a simple pendulum 0.800 m long.

2. A 0.500 kg mass hangs on a spring of stiffness 20.0 N m^{-1}. Find the period.

3. An object oscillates in SHM with amplitude 5.00 cm and period 0.400 s. Find its maximum speed and maximum acceleration.

4. A 0.300 kg mass on a spring of stiffness 120 N m^{-1} oscillates with amplitude 0.0500 m. Find the total energy and the speed when y = 0.0300 m.

Exam-style question: a mass on a spring

A 0.250 kg mass hangs at rest on a spring of stiffness 40.0 N m^{-1}. It is pulled 6.00 cm below its equilibrium position and released.

5. Show that the angular frequency of the motion is 12.6 rad s^{-1}.

6. Calculate the maximum speed and the maximum acceleration of the mass.

7. Calculate the time after release when the mass first reaches 2.00 cm above equilibrium. A reference circle may help.

8. The top of the spring is then moved up and down by a hand at a frequency of 2.0 Hz. Explain, using forces and energy, why the mass oscillates with a very large amplitude.

Fix the mistake

9. Correct this statement: "$\cos^{-1}(-0.500)$ in degree mode gives 120, so t = 120 ÷ 3.927 = 30.6 s."

10. Correct this statement: "The acceleration is zero at the extremes because the object stops there."

11. Correct this statement: "Using $y = A \sin \omega t$ for a mass released from rest at the top."

12. Correct this statement: "A pendulum with a heavier bob or a bigger swing has a longer period."