SHM Problems from 11.1:

Speed, Amplitude, and Position:
1. An SHO has a period of 0.234 s and amplitude of 0.470 m. What is its speed and acceleration when it is at x = +0.118 m? (12.2 m/s, -85.1 m/s/s)
2. An SHO has a period of 3.45 s, and amplitude of 0.676 m. What is its distance from equilibrium when it has a speed of 0.645 m/s? (0.576 m)
3. An SHO has a speed of 0.627 m/s when it is 0.870 m from equilibrium. What is its period if its amplitude is 1.08 m? (6.41 s)
4. An SHO has a speed of 3.34 m/s when it is 0.540 m from equilibrium. What is its amplitude if its angular velocity is 7.50 rad/s? (0.700 m)
5. An SHO with an amplitude of 2.12 m has a speed of 5.86 m/s when it is at x = -1.80 m. What is its acceleration at this point? (+49.3 m/s/s)

Simple equations of motion:
6. An SHO has an equation of position (in m) of $x = 14.0sin(6.50t)$ What is its <u>acceleration</u> at x = -8.00 m? (338 m/s/s) What is its position, velocity and acceleration at t = 3.20 s? (+13.0 m, -33.7 m/s, -549 m/s/s)
7. An SHO has an equation of position (in m) of $x = 43.2sin(12.0t)$ What is its **amplitude** and **angular velocity**? (two questions) (43.2 m, 12.0 rad/s)
8. An SHO has an equation of position (in m) of $x = 8.50sin(4.00t)$ What is its amplitude and maximum velocity? (8.50 m, 34.0 m/s)
9. An SHO has an equation of position (in m) of $x = 9.50sin(1.62t)$ What is its <u>position</u>, velocity and acceleration at t = 9.25 s? (+6.29 m, -11.5 m/s, -16.5 m/s/s)
10. An SHO has an equation of velocity (in m/s) of $v = 1.25cos(5.60t)$ What is its <u>period</u>? (1.12 s) What is its position, velocity, and acceleration at t = 4.60 s (+0.131 m , +1.01 m/s, -4.11 m/s/s)

Advanced Equations of motion:
11. An SHO has an equation of position (in m) of $x = 5.10sin(6.35t)$. What is its acceleration when it is at x = +3.40 m? (-137 m/s/s)
12. An SHO has an equation of position (in m) of $x = 3.50sin(11.0t)$ What is its **velocity** at t = 2.32 seconds? (+35.6 m/s)
13. An SHO that has an equation of position (in m) of $x = 6.50sin(5.00t)$. What is its speed when it is 2.13 m from equilibrium? (30.7 m/s)
14. An SHO with a mass of 3.91 kg and an equation of velocity (in m/s) of $v = 12.0cos(17.0t)$. What is its kinetic energy at t = 16.3 s? (181 J) What is its amplitude, and what is its acceleration at x = +0.600 m? (0.706 m, -173 m/s/s)
15. What is the amplitude of an SHO that has an equation of velocity (in m/s) of $v = 14.0cos(5.70t)$. (2.46 m) What is the position at t = 16.9 s? (+2.14 m)

Energy
16. An SHO has a mass of 3.14 kg, a period of 4.32 s, and amplitude of 0.521 m. What is its total energy? (0.902 J)
17. An SHO has a mass of 2.61 kg, a period of 0.657 s, and a total energy of 843 J. What is its amplitude? (2.66 m)
18. An SHO has a mass of 6.67 kg, amplitude of 0.870 m, and a total energy of 18.3 J. What is its period? (2.33 s)
19. An SHO has a period of 3.41 s, and a total energy of 32.7 J, and amplitude of 5.43 m. What is its mass? (0.653 kg)
20. What is the period of a SHO that has a total energy of 24.2 J, a mass of 3.23 kg, and amplitude of 0.312 m? (0.506 s)
21. An SHO has a mass of 1.63 kg, a total energy of 45.7 J, amplitude of 0.148 m. What is its kinetic energy when it is 0.115 m from equilibrium? (18.1 J)
22. An SHO has a mass of 2.93 kg, a frequency of 12.0 Hz, and amplitude of 0.194 m. What is its **potential energy** when it is 0.120 m from equilibrium? (120. J)
23. An SHO has a mass of 4.20 kg, a total energy of 16.8 J, and amplitude of 0.840 m. What distance is it from equilibrium when it has a **potential** energy of 11.3 J? (0.689 m)
24. An SHO has a total energy of 436 J, a mass of 0.895 kg, and amplitude of 2.42 m. What is its speed when it is 1.21 m from equilibrium? (27.0 m/s)
25. An SHO has a total energy of 10.2 J, amplitude of 0.830 m, and a mass of 1.81 kg. What is its potential energy when its velocity is 2.28 m/s? (5.50 J)