1. (b).
2. (d).
3. (b), because $f = \dfrac{1}{T}$.
4. (a), because $U = \frac{1}{2}kx^2$.
5. (a) $E = \frac{1}{2}kA^2$, so $\boxed{\text{four times as large}}$.

   (b) $v_{max} = \sqrt{\dfrac{k}{m}}\,A$, so $\boxed{\text{twice as large}}$.
6. At the equilibrium position the elastic potential energy is zero, and so all the energy is kinetic. Therefore the speed $\boxed{\text{increases}}$ as it approaches the equilibrium position.

$\boxed{7}$. In one period T, the mass goes through a distance equal to $4A$. So the time is $\boxed{T/4}$ for distance A and $\boxed{T/2}$ for $2A$.

8. $\boxed{\text{No}}$, this is not a simple harmonic motion, because the $\boxed{\text{restoring force does not obey Hooke's law}}$. Once the ball is in the air, the gravitational force is always constant and downward.
9. In each T, it travels $A + A + A + A = \boxed{4A}$.
10. $f = \dfrac{1}{T} = \dfrac{1}{0.60\text{ s}} = \boxed{1.7\text{ Hz}}$.
12. $T = \dfrac{1}{f}$, ☞ $\Delta T = \dfrac{1}{f_2} - \dfrac{1}{f_1} = \dfrac{1}{0.50\text{ s}} - \dfrac{1}{0.25\text{ s}} = -2.0\text{ s} = \boxed{\text{decrease of 2.0 s}}$.
13. $k = \dfrac{F}{x} = \dfrac{mg}{x} = \dfrac{(0.25\text{ kg})(9.80\text{ m/s}^2)}{0.060\text{ m}} = \boxed{41\text{ N/m}}$.
14. $v_{max} = \sqrt{\dfrac{k}{m}}\,A = \sqrt{\dfrac{10\text{ N/m}}{0.50\text{ kg}}}\,(0.050\text{ m}) = \boxed{0.22\text{ m/s}}$.
20. The total initial mechanical energy is

   $E = \frac{1}{2}kx_o^2 + \frac{1}{2}mv_o^2 = \frac{1}{2}(35.2\text{ N/m})(0.0650\text{ m})^2 + \frac{1}{2}(0.150\text{ kg})(2.20\text{ m/s})^2 = 0.4374\text{ J}$.

   At the amplitude, the total energy is $E = \frac{1}{2}kA^2$. So $A = \sqrt{\dfrac{2E}{k}} = \sqrt{\dfrac{2(0.4374\text{ J})}{35.2\text{ N/m}}} = 0.1576\text{ m}$.

   Therefore the extra stretch is $0.1576\text{ m} - 0.0650\text{ m} = 0.0926\text{ m} = \boxed{9.26\text{ cm}}$.
21. From mechanical energy conservation (choose the initial position as $U_g = 0$),

   $E = \frac{1}{2}mv_o^2 = mgh + \frac{1}{2}kh^2 = (0.350\text{ kg})(9.80\text{ m/s}^2)(0.0450\text{ m}) + \frac{1}{2}(50.0\text{ N/m})(0.0450\text{ m})^2 = 0.2050\text{ J}$.

   So $v_o = \sqrt{\dfrac{2E}{m}} = \sqrt{\dfrac{2(0.2050\text{ J})}{0.350\text{ kg}}} = \boxed{1.08\text{ m/s}}$.
26. (a) From conservation of energy (choose the position of the object when the spring is compressed as $U_g = 0$): $E = \frac{1}{2}kA^2 = U = mgh$, ☞ $\frac{1}{2}(60.0\text{ N/m})A^2 = (0.250\text{ kg})(9.80\text{ m/s}^2)(0.100\text{ m} + A)$.

   Reducing to: $30.0A^2 - 2.45A - 0.245 = 0$. Solving for $A = \boxed{0.140\text{ m}}$ or -0.0580 m (discarded)

   (b) From energy conservation, the object will go to a height of $\boxed{\text{10.0 cm (original position)}}$.
27. (d).
28. (c), $y = A\sin(0) = 0$.
29. (b). $y = A\sin[2\pi(3T/4)/T] = A\sin(3\pi/2) = -A$.
37. (a) $T = 2\pi\sqrt{\dfrac{L}{g}} = 2\pi\sqrt{\dfrac{0.75\text{ m}}{9.80\text{ m/s}^2}} = 1.74\text{ s} = \boxed{1.7\text{ s}}$.

   (b) $f = \dfrac{1}{T} = \dfrac{1}{1.74\text{ s}} = \boxed{0.57\text{ Hz}}$.
38. $T = 2\pi\sqrt{\dfrac{L}{g}}$, ☞ $L = \dfrac{T^2 g}{4\pi^2} = \dfrac{(1.0\text{ s})^2(9.80\text{ m/s}^2)}{4\pi^2} = \boxed{0.25\text{ m}}$.

53. $\omega = \frac{2\pi}{T} = \frac{2\pi}{1.95 \text{ s}} = 3.221$ rad/s. $v_{max} = \omega A = (3.221 \text{ rad/s})(0.0865 \text{ m}) = 0.2796 \text{ m/s} = \boxed{0.279 \text{ m/s}}$.

$a_{max} = \omega^2 A = (3.221 \text{ rad/s})^2 (0.0865 \text{ m}) = \boxed{0.897 \text{ m/s}^2 = (0.0915)g}$. ($g = 9.80 \text{ m/s}^2$)

$\boxed{54}$. $f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$, ☞ $\frac{f_2}{f_1} = \sqrt{\frac{k_2}{k_1}} = \sqrt{2}$.

So the answer is $\boxed{\text{the second system, } f_2 = \sqrt{2}\, f_1}$.

60. (a) Since $T = 2\pi\sqrt{\frac{L}{g}}$, and the length is shorter, T is smaller.

So the clock runs faster or $\boxed{\text{gains time}}$.

(b) $\Delta T = 2\pi\sqrt{\frac{0.7500 \text{ m}}{9.80 \text{ m/s}^2}} - 2\pi\sqrt{\frac{0.7480 \text{ m}}{9.80 \text{ m/s}^2}} = 2.32 \times 10^{-3}$ s.

$T = 2\pi\sqrt{\frac{0.7500 \text{ m}}{9.80 \text{ m/s}^2}} = 1.7382$ s. In one day, there are 24 h = 86 400 s (or 4.9707×10^4 periods).

Therefore, the time difference is $(2.32 \times 10^{-3} \text{ s})(4.9707 \times 10^4) = 115 \text{ s} = \boxed{1.9 \text{ min}}$.

(c) $\boxed{\text{Yes, because of linear expansion}}$, the length depends on the temperature.

61. (d).
62. (a).
63. (c). A water wave is a combination of transverse and longitudinal.
64. (a) $\boxed{\text{Transverse and longitudinal}}$. (b) $\boxed{\text{Longitudinal}}$. (c) $\boxed{\text{Longitudinal}}$.

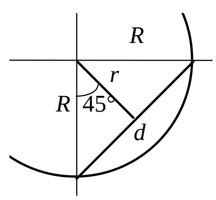
66. This is a $\boxed{\text{longitudinal}}$ wave, because the direction of the wave motion (horizontal across the field) is parallel to the direction of the wheat plant vibration.

$\boxed{69}$. $v = \frac{0.75 \text{ m}}{1.6 \text{ s}} = \boxed{0.47 \text{ m/s}}$

70. $\lambda = \frac{v}{f} = \frac{3.00 \times 10^8 \text{ m/s}}{5 \times 10^{14} \text{ Hz}} = \boxed{6 \times 10^{-7} \text{ m}}$.

77. (a) 90° in latitude covers one quarter of the Earth's circumference. The straight line distance between the locations is $d = \sqrt{R^2 + R^2} = \sqrt{2}\,R = \sqrt{2}\,(6.4 \times 10^3 \text{ km}) = 9.05 \times 10^3$ km.

$\Delta t = \frac{d}{v_S} - \frac{d}{v_P} = \frac{9.05 \times 10^3 \text{ km}}{6.0 \text{ km/s}} - \frac{9.05 \times 10^3 \text{ km}}{8.0 \text{ km/s}} = \boxed{3.8 \times 10^2 \text{ s}}$.



(b) $r = R \cos 45°$. So the depth under the surface is

$R - r = R(1 - \cos 45°) = (6.4 \times 10^3 \text{ km})(1 - \cos 45°) = 1.9 \times 10^3 \text{ km} > 30$ km.

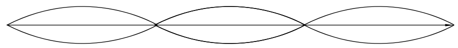
So the answer is $\boxed{\text{yes}}$.

81. (d).
82. (b).
83. (d).
84. $\boxed{\text{Only waveform}}$ is destroyed. $\boxed{\text{Energy is not destroyed, but redistributed}}$.

(c) $t = \frac{2(6.4 \times 10^3 \text{ km})}{8.0 \text{ km/s}} = \boxed{1.6 \times 10^3 \text{ s}}$. S waves do not go through the liquid core.

85. $\boxed{\text{Reflection (this is called echolocation)}}$, because the sound is reflected by the prey.

86. $\boxed{\text{Sound from different instruments would arrive at different times}}$.
87. (d).
88. (b).

89. (c). 

$\boxed{94}$. (a) $f_2 = 2f_1 = 2(150\text{ Hz}) = \boxed{300\text{ Hz}}$.

(b) $f_3 = 3f_1 = 3(150\text{ Hz}) = \boxed{450\text{ Hz}}$.

95. $f_3 = 3f_1$, ☞ $f_1 = \dfrac{f_3}{3} = \dfrac{450\text{ Hz}}{3} = \boxed{150\text{ Hz}}$.

99. $f = \dfrac{v}{\lambda} = \dfrac{250\text{ m/s}}{0.80\text{ m}} = 312.5\text{ Hz}$. $f_1 = \dfrac{v}{2L} = \dfrac{250\text{ m/s}}{2(2.0\text{ m})} = 62.5\text{ Hz}$.

So $n = \dfrac{f}{f_o} = \dfrac{312.5\text{ Hz}}{62.5\text{ Hz}} = \boxed{5}$.

100. $f_n = \dfrac{n}{2L}\sqrt{\dfrac{F_T}{\mu}}$, ☞ $\dfrac{F_T'}{F_T} = \dfrac{(f_1')^2}{(f_1)^2} = \dfrac{(440\text{ Hz})^2}{(450\text{ Hz})^2} = 0.956$.

So $F_T' = 0.956(500\text{ N}) = \boxed{478\text{ N}}$.