1. e (There are a couple ways to do this. The simplest way is to recognize that the maximum velocity is equal to $2\pi A/T$, where A is the amplitude and T is the period. The period is is independent of the amplitude so if the amplitude doubles then so does the maximum velocity)

2. e (when the object has reached its greatest speed, it is no longer speeding up and it has not yet started to slow down)

3. (a) Since it is released 2 cm from the equilibrium position, it won't get more than 2 cm away from equilibrium. The amplitude of the motion is 2 cm.

   (b) The net force on the object at equilibrium is zero. That is why it is called the equilibrium position – an object placed there at rest will stay at rest at that location.

   (c) Assuming an ideal spring, where the force of the spring is proportional to the displacement, the net force on the object at its maxium displacement is equal to kx, where k is the spring constant (spring strength) and x is the displacement (2 cm in this case). Since hanging a 20-g weight (with gravitational force equal to 0.02 kg times 9.8 N/kg) stretches the spring 3 cm, we have that

   $$\begin{aligned} k &= F/x \\ &= (0.02 \text{ kg}) \times (9.8 \text{ N/kg})/(0.03 \text{ m}) \end{aligned}$$

   which gives a spring constant of 6.53 N/m.

   When stretched an additional 2 cm (which the spring is when the object is 2 cm below the equilibrium position), the spring force is (6.53 N/m)×(0.02 m) more. This means the net force there is 0.13 N.

   (d) There are several ways to find the acceleration. The easiest, perhaps, is to use Newton's second law. Since we already know the net force at the lowest point (see part c), divide by the mass to find the acceleration. I get an acceleration of 6.53 m/s^2.

   (e) There are a couple of ways to find the period. One way is to combine the expressions for $a_{\max}$ and $v_{\max}$. In the expression for $a_{\max}$, replace the $v_{\max}$ with $(2\pi/T)A$, where A is the amplitude. That means the maximum acceleration must equal $(2\pi/T)^2 A$. Solving for T, I get a period of 0.358 s.

(f) The maximum speed (which occurs when the object is passing the equilibrium point) is equal to $2\pi A/T$. Plug in to get 0.361 m/s.